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The Oaks, Wrexham Industrial Estate

Phase 2 Site Investigation Report

Carried Out For: Cefn Park Developments Ltd

Planning Consultant: J10 Planning Ltd



THE OAKS, WREXHAM INDUSTRIAL ESTATE

PHASE 2 SITE INVESTIGATION REPORT

Date: 21/05/2019

Report No 4292/01 Issue 2

Prepared for: Cefn Park Developments Ltd

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DISCLAIMER

This report should be read with the Service Constraints Report Limitations & Planning Requirements set out in Appendix A.



THE OAKS, WREXHAM INDUSTRIAL ESTATE

PHASE 2 SITE INVESTIGATION REPORT

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THE OAKS, WREXHAM INDUSTRIAL ESTATE

PHASE 2 SITE INVESTIGATION REPORT

1. INTRODUCTION

1.1 Background Information

1.1.1 TerraConsult Limited (TCL) was commissioned by Cefn Park Developments Ltd to carry out an intrusive site investigation for an area of land off Oak Road in Wrexham Industrial Estate. J10 Planning are the client's planning consultants. The purpose of the report is to provide information on conditions for a proposed commercial development at the site.

1.1.2 This report has been devised to generally comply with the relevant principles and requirements of a range of guidance including:

- Part IIA of the Environment Protection Act, 1990;
- Contaminated Land (Wales) (Amendment) Regulations 2012 and Contaminated Land Statutory Guidance (Welsh Government, April 2012);
- Planning Policy Wales (Ed 10, November 2018);
- BS5930:2015: "Code of practice for site investigations";
- BS10175: 2011 +A2:2017 "Investigation of Potentially Contaminated Sites - Code of Practice";
- The Building Regulations 2010. Part C (HM Government 2013); and
- DEFRA/Environment Agency (2004) Report CLR11 "Model Procedures for the Management of Land Contamination".

1.1.3 TerraConsult's service constraints and report limitations are presented in Appendix A and a description of environmental risk assessment methodology and terminology is presented in Appendix B.

1.2. Development Proposals

1.2.1 The proposed development of the site is understood to comprise:

- the demolition of a number of historic buildings on the site, whilst others are to be retained;
- the removal from site or the treatment of any contaminated material encountered during demolition and ground works phases;
- the construction of both single storey and two storey light industrial units including access roads, parking areas and service provision; and
- the creation of „Ecology Mitigation Zone“ at the west and south of the site and a „Heritage Zone“ along the east of the site.

1.2.2 The findings and conclusions of the risk assessments have been set out and recommendations given for the proposed light industrial units. The proposed development plan at the time of the design of the ground investigation is shown in Figure 1.



Figure 1: Proposed Development Plan. Taken from The Oaks Business Park Development Masterplan Prospectus, J10 Planning, April 2018-LS/DMP/version 002

1.2.3 After completion of the ground investigation, TCL was informed of a change in the proposed development. The development plan is presented in Figure 2.



Figure 2: Updated Proposed Development Plan. Taken from 'Proposed site parameters plan', Land Studio, February 2019.

- 1.2.4 Since the issue of the Site Investigation Report by TerraConsult in April 2019 (Report 4292R01-01) the client informed TCL of an updated proposed development plan. The updated development plan is presented in Figure 3 below.

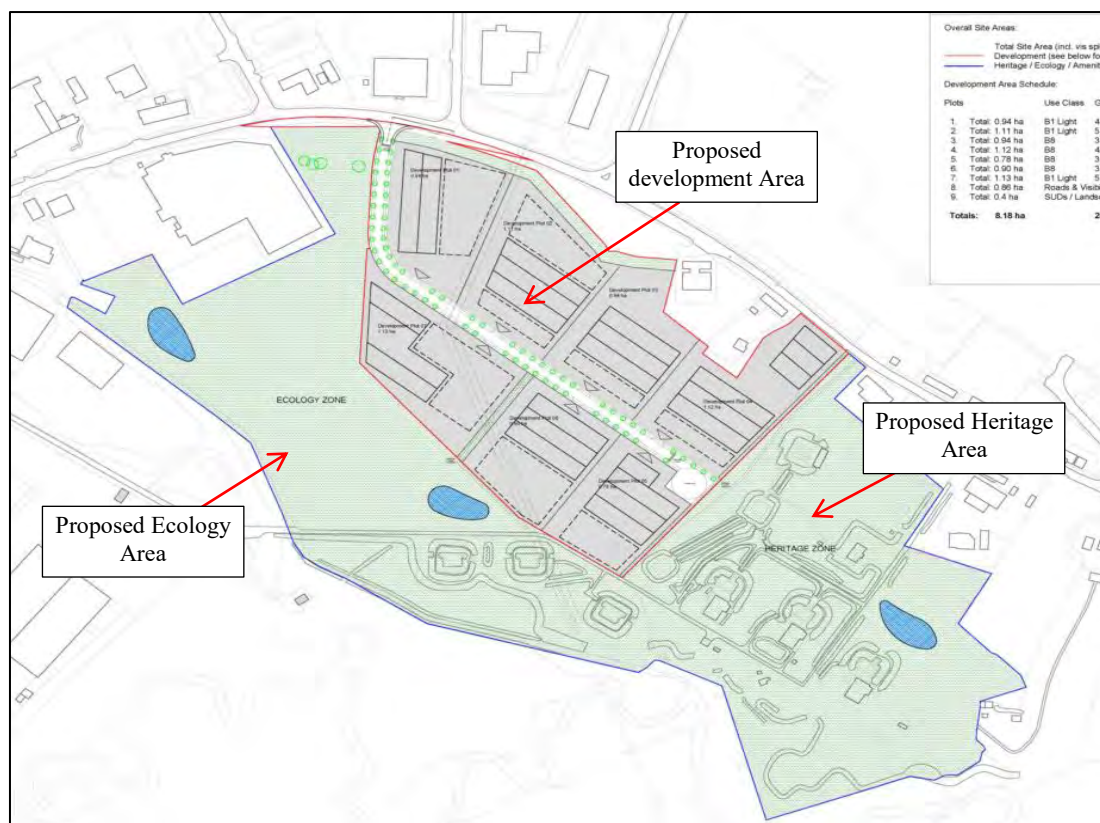


Figure 3: Updated Proposed Development Plan. Taken from 'Proposed site parameters plan', Land Studio, February 2019 version 003 F.

1.3. Planning Status & Requirements

- 1.3.1 This report is designed to comply with the requirements of The Planning Policy Wales (2018) and is intended to be used by the developer as part of the submission to gain planning for the works.

1.4. Scope of the Investigation

- 1.4.1 The investigation was designed to meet the requirements to provide information for planning purposes and for design of the development. The specific activities carried out were as follows:

- review existing desk study information (prepared by a Third Party) and other available reports and summarise existing reports, history of the site and geo-environmental data;
- carry out a site walk over;
- confirm preliminary conceptual site model;
- carry out an intrusive investigation comprising cable percussive boreholes/dynamic sampling/trial pitting with associated sampling;
- undertake ground gas and groundwater monitoring;

- perform laboratory testing for potential contaminants and geotechnical purposes;
- assess the general nature and extent of contamination at the site and carry out a contamination risk assessment to determine if the site poses a risk to potential receptors;
- undertake a ground gas risk assessment;
- provide recommendations of feasible remedial measures to facilitate development of the site for residential end use (*should the investigation indicate that remediation of contaminants be required*); and
- provide preliminary geotechnical information on the ground conditions for foundation and floor slab design.

1.5. Previous Investigations

- 1.5.1 A number of reports on previous investigations and other relevant information have been provided by the Client for the site. These reports are discussed in Section 3 of this report and the information used to verify the existing preliminary Site Conceptual Model.

2. SITE LOCATION AND DESCRIPTION

2.1 Site Location

2.1.1 The site is indicated in Figure 4 below and the site location is summarised in Table 1.



Figure 4: Site Location Plan. Taken from The Oaks Business Park Development Masterplan Prospectus, J10 Planning, April 2018-LS/DMP/version 002.

Table 1: Summary of Site Location	
Location	The site is located on the southeastern side of Wrexham Industrial Estate off Oak Road, approximately 4.7km to the east of Wrexham town centre
Grid Reference	338707, 349407
Post Code	LL13 9RG (nearest postcode)
Site Area	22 ha approx.
Site Shape	The site is irregular in shape.
Topography	The elevation varies between approximately 24 m Ordnance Datum (OD) and 34m OD. The site has many embankments and raised areas across the site predominantly across the central, eastern and southern areas. The site slopes downwards to the River Clywedog on the south western boundary.

2.2 Site Description

2.2.1 A site visit was undertaken on 8th February 2019. A summary of the site features is presented in Table 2. The locations of various features are detailed on Figure 5 below. Photographs of the site are presented in Appendix C.

Table 2: Summary of Description of the Site and its Environs	
Current Use	Unoccupied largely wooded/vegetated area freely accessed by the public. Tyre tracks suggest the area is used for off road vehicles such as quad bikes.
Access	There are two access roadways onto site directly off Oak Road. One is by the north western area of the site opposite Abbey Road. The other access is near the north eastern corner
Existing Buildings & Structures	Several brick buildings are across the site primarily in the south and south eastern areas. These buildings vary in shape and size with some possibly containing basements. There are tunnels and bunker like structures also on site.
Site Surface	The site is mainly heavily vegetated and wooded over the largely soft landscaped surface with a series of paths, roadways and tracks which cross the site, some of which are of concrete construction (particularly in the southern area forming access routes between the buildings and structures). A compacted gravel area is in the northwest of the site which is used as a parking area. Some pooled water in localised depressions.
Vegetation	The site is densely vegetated with bushes, scrub, immature and semi-mature trees in the north and western areas of the site. The southern and eastern areas are predominantly semi mature and mature trees.
Storage Tanks	Below Ground Tanks: No evidence/none suspected. Above Ground Tanks: None present.
Services	Water services were noted next to the access track in the north eastern area of the site in the form of manhole chambers and a service marker post was present in the north western area of the site. A number of pylons carrying overhead electricity lines are present on site. Several infilled/ disused manhole chambers were noted in the southern and eastern areas.
Asbestos	Potential Asbestos Containing Materials (ACMs) were noted by the north eastern entrance in the form of fly tipped corrugated cement sheets
Waste Disposal/ Materials Storage	None.
Surrounding Area	Oak Road forms the northern boundary with commercial and industrial units beyond. Residential development to the north, east and west and fields to the south. Commercial areas are also to the west and south west of the site. The River Clywedog and Redwither Brook run parallel to the southern boundary with undeveloped field beyond and to the east.
Local / Background Knowledge	The site is known to have been part of the Royal Ordnance Factory during the Second World War. The disused buildings and roadways are associated with this historical use. Recently, the wooded area is also known to have been used for paintballing and airsoft recreational games.

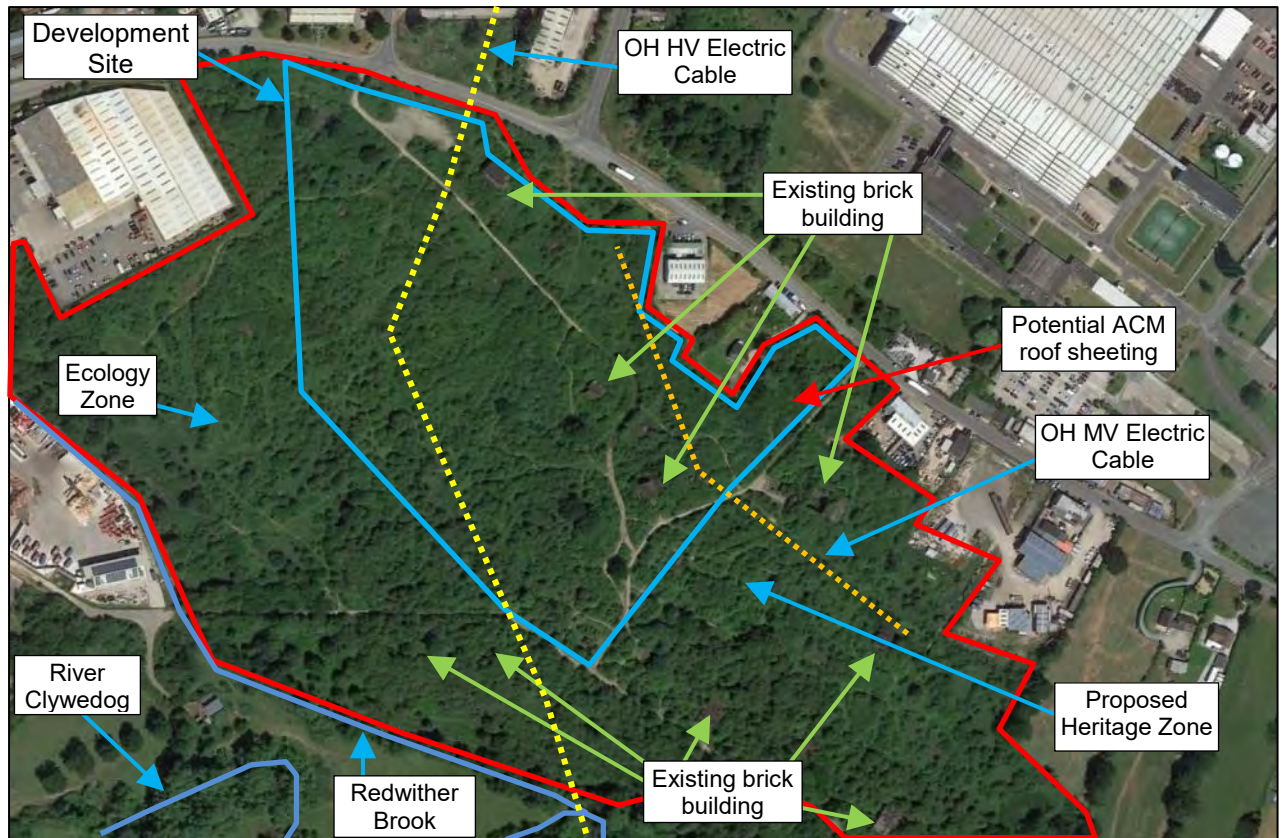


Figure 5: Google Earth © aerial image.

2.3 Site Ownership

2.3.1 It is understood that the site is currently owned by Cefn Park Developments Ltd.

3. PREVIOUS INVESTIGATIONS/REPORTS

3.1 Preliminary Risk Assessment/ Phase 2 Contaminated Land Investigation for North Wales Prison (400m to the east of the development site)

*Former Firestone Site, Wrexham Industrial Estate, ESI Limited, December 2012
Report refs 60895R1 and 60895R2.*

- 3.1.1 The report was presented to TerraConsult but it is part of a larger report by Environ for a Ministry of Justice report for North Wales Prison, Wrexham, Report Ref. UK18-19102. The prison site is approximately 500 m to the south west of the proposed development; whilst the findings and conclusions are specific to the prison site, some data are relevant to The Oaks development. The relevant information to The Oaks is summarised below.
- 3.1.2 The Preliminary Risk Assessment (Phase 1) detailed the environmental setting of the site and its historic uses. After the decommissioning of Royal Ordnance Factory, the site was used as a tyre factory until 1994, when the land was remediated.
- 3.1.3 Three licensed groundwater abstractions were noted to be located immediately to the east of the site (i.e. between the prison and the proposed development at The Oaks). The abstractions are noted to be drawn from the Kinnerton Sandstone and used for process water. In association with this, the site is located within a Source Protection Zone and Groundwater Drinking Water Protected Area.
- 3.1.4 The Phase 2 report detailed the intrusive investigation in November 2012. Thirty-eight mechanically excavated trial pits were completed, with soil and groundwater samples recovered for laboratory analysis. From assessment of the laboratory data, ESI Ltd determined that there was a low risk to human health at the proposed development.
- 3.1.5 Whilst no ground gas monitoring was carried out, based on the history of the site and the description of soil on site, ESI judged that there was a low risk of ground gas issues at the site.
- 3.1.6 With only localised bodies of perched groundwater recorded during the investigation, the preliminary risk assessment stated that there was no risk to potential Controlled Water receptors including the Redwither Brook and River Clywedog.

3.2 Historical Scoping Report

*Townscape: Chartered Town Planning and Heritage Consultant Ltd, March 2017
Royal Ordnance, Marchwiel, (34), Wrexham. Historical Scoping Report.*

- 3.2.1 Townscape completed an historical analysis of the site, focussing on the former Royal Ordnance Factory, part of which was located in the area of the proposed development.
- 3.2.2 The report details the construction and use of Royal Ordnance Factory (ROF) Marchwiel, a 700ha site developed during World War 2 (WWII). The extent of the ROF compared with The Oaks can be seen in Figure 6, below.

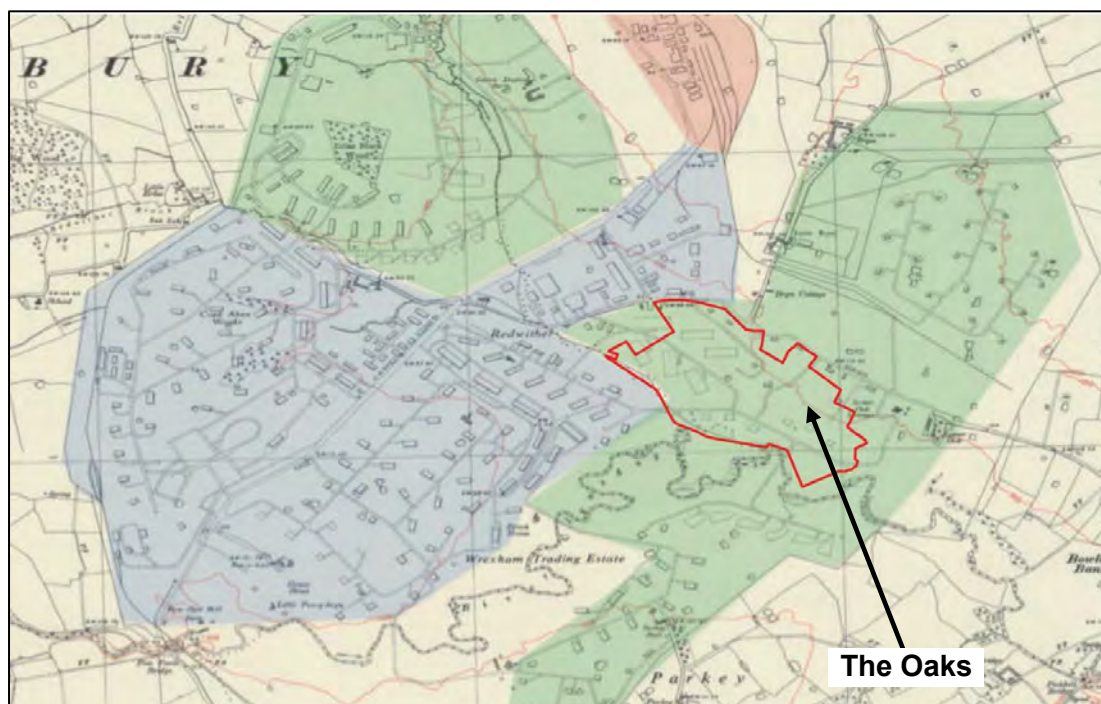


Figure 6: Area for Royal Ordnance Factory Marchwiell.

- 3.2.3 In Figure 6, the ROF footprint is shown in green, blue and red. Blue shading corresponds to the main production site, green shading corresponds to storage and depot facilities and red shading is the transport/railway connection¹.
- 3.2.4 As detailed in the report and shown in Figure 6, the site was not part of the main production area. Earth mound blast walls were constructed on site around ordnance storage buildings though it is assessed by Townscape to be likely that these were either used for storage or simply as a decoy in the case of bombing.
- 3.2.5 Townscape concludes their report stating that the area of the ROF within the site boundary was *„never fully completed nor operational’*.
- 3.2.6 Personal statements from local residents appended to the report further state that no bombs were believed to have been dropped on the area.
- 3.2.7 A personal statement from the site owner has also provided information on the site post WWII. Relevant extracts from this testimony is given below:

“In 1974 The Secretary of State for Industry (Mr A Wedgewood Benn) through his agents The Welsh Development Agency had a requirement to acquire 160 acres of the former ROF to provide industrial land for unemployed former miners in Wrexham. I was the owner of that land and before the purchase was completed, I transferred the land into a company called Elfosark Investment Developments Ltd and the directors subsequently changed the name to Cefn Park Developments Ltd. (The Company). The Company then sold 160 acres of the former ROF land to the Secretary of State for Industry. The Oaks site was transferred into the Company but it was not included in the sale to the Secretary of State. It was retained by The Company.

¹ Mapping and Information is taken from Townscape Historical Scoping Report.

The directors of The Company were of the opinion that The Oaks site may also sell if the ex ROF buildings were demolished and some of the money arising from the sale was utilised to this effect. Planning permission was obtained to demolish the partly sunken magazines which were surrounded by blast banks and a contract was drawn up by some consulting engineers in Liverpool and after tenders were received the contract was awarded to Jones Bros of Ruthin, Civil Engineers.

At the same time in 1974, the factory for Kelloggs was being constructed nearby and the builders had large amounts of clean clay that they were digging out of the foundations for disposal.

The magazines were blasted, the reinforcement then cut with oxyacetylene and removed in large sections and towed and pushed with very large machines to form a bank alongside the Redwither Brook. The magazines were about 12ft below ground level, were made of reinforced concrete and had floors that were 12" to 18" thick. The blast banks were pushed back into the holes left by the magazines. One of the magazines was only partially constructed and another had had the hole prepared and the blast banks formed but construction had not begun. This is clearly shown on the Ordnance Survey maps prepared at the time.

It follows that The Oaks site was probably one of the last areas of the ROF to be developed and was never completed. During the clearance of the site (I was there every day) there was no indication of any unexploded ordnance or ordnance of any kind whatsoever. It may be that this part of the ROF never came into production at all. I remember getting an insurance policy to cover the contractors from unexploded ordnance for £50 which would indicate that the risk was assessed as very low.

The original site sloped gently down towards the Redwither Brook. The wall made of the reinforced concrete demolished magazines formed a good buttress and the clay from the Kellogg's site was used to raise the level of the whole site up to the top of the buttress and make it more level. There was also a bund near the house and the contractors brought a scraper to remove the bund and further level the site.

The Company sold part of the site to their neighbours Brake Engineering and that sale covered the cost of recovering the site to date. Brake Engineering have built part of their factory over one of the recovered magazines. They found some lumps of concrete but nothing unmanageable."

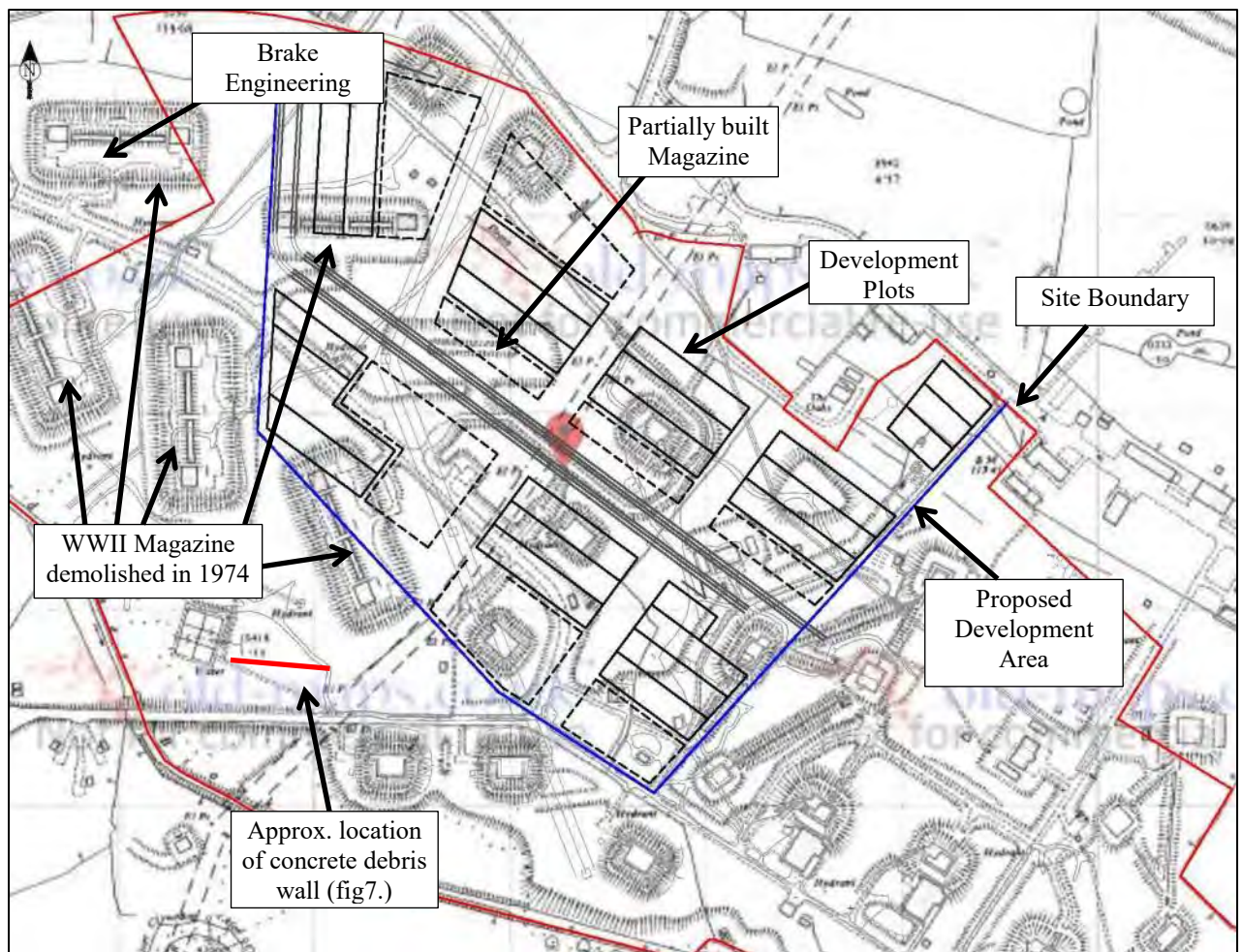


Figure 7: Extract of OS Historical mapping – 1962 with Development Plan overlay.



Figure 8: Photo from SW boundary showing wall made from concrete material of the demolished magazine buildings. Natural Glacial Clay from Kellogg's was placed behind.

3.3 Preliminary Flood Risk & Drainage Assessment

Opus International Consultants (UK) Ltd, October 2016

- 3.3.1 The report details the fluvial flood risk and shows that the site occupies land with Flood Zone A, Flood Zone B and Flood Zone C2 as detailed by TAN15. With part of the site located in Flood Zone B and C2, Opus stated that modelling would be required.
- 3.3.2 Furthermore, Opus suggested that attenuation ponds are likely to be required due to the increase in impermeable areas through the construction of rooves and hardstanding.
- 3.3.3 Further details of flood risk and drainage design are provided in TerraConsult report 4292R03-1.

3.4 Phase 1 (Desk Study) Investigation Report, The Oaks

Opus International Consultants (UK) Ltd, March 2017. Report ref V-R6399.00 The Oaks, Oak Road, Wrexham Industrial Estate, Wrexham.

- 3.4.1 The Phase 1 Report completed by Opus details the environmental setting of the site and its historic uses from 1879 to 2016.

Historical Mapping Review

- 3.4.2 Before 1938, the site was undeveloped. A small brook ran along the southern boundary of the site and a number of ponds were present.
- 3.4.3 During the Second World War, the site was used as part of Royal Ordnance Factory (ROF) Wrexham. The ROF site is understood to have been used for the production of nitro-glycerine and nitrocellulose as part of the larger process of cordite production. No historical mapping is available between 1938 and 1954. By 1954, a number of buildings with mounded blast walls and associated tracks were present. The buildings are understood to have been magazines. The ponds were drained and built over. The brook at the southern boundary is named as Redwither Brook.
- 3.4.4 By 1979, many of the ROF buildings were removed from the site. A large electricity pylon runs through the centre of the site. The historical mapping indicates that there has been little change to the present day.

Geology

- 3.4.5 Through review of Technical Report WA/91/4, „Applied geological mapping in the Wrexham area: geology and land-use planning” and online BGS borehole data, the underlying superficial geology beneath the site was deemed to include the following strata:

- Made Ground;
- Alluvium – south eastern corner of site;
- River Terrace Deposits – along Redwither Brook;
- Glacial Till – whole site; and
- Basal Sand and Gravel.

The solid geology beneath the site was deemed to consist of:

- Salop Formation – Mudstone and Sandstone; and,
- Kinnerton Sandstone Formation – Sandstone.

- 3.4.6 The superficial deposits were assessed to be a Secondary Aquifer A, whilst the bedrock formations are listed as Principal Aquifers.
- 3.4.7 The risk of coal mining was assessed to be low by Opus due to the Kinnerton Sandstone Formation not having any coal seams, removing the risk of shallow workings. Deep workings associated with the former Bersham Colliery pose no risk as the colliery closed in 1986, over 30 years ago. No recorded shafts were noted within 5 kilometres of the site.

Environment

- 3.4.8 A review of an environmental database report (not appended as part of Opus's report therefore not seen by TCL) yielded the following observations on the environmental setting.
- 3.4.9 The Redwither Brook is the nearest surface water body to the site, located 3 m to the south west. The River Clywedog is designated as a primary river and is located 15 m to the south east of the site.
- 3.4.10 The site has been assumed to lie within an intermediate probability radon area (5-10% of properties at or above the action level). This is due to the radon section of the environmental database report being incomplete. As such, basic protective measures to protect against radon will be required within all new buildings and radon measures will need to be retrofitted within any existing buildings to be retained as part of the development which have not had appropriate radon protection measures installed.
- 3.4.11 There are three registered radioactive substances entries within 250 m of the site, the nearest being 175 m to the north.
- 3.4.12 There are no COMAH, NIHS or Contaminated Land Register entries within 1 km of the site.
- 3.4.13 There are no integrated pollution controls within 250 m or local integrated pollution prevention sites within 500 m.
- 3.4.14 There is one recorded pollution incident on site. This smoke related incident of July 2002 caused minor water impact and no land impact, though significant air impact was recorded.
- 3.4.15 There are two recorded controlled water pollution incidents on site. Both occurred in Water Company Sewage, Pickhill Bridge.
- 3.4.16 There are six discharge consents located within 250 m of the site. The nearest of these is 4 m south west of the site regarding trade discharges into a freshwater stream or river.
- 3.4.17 There are no historical, local authorities or registered landfill sites located within 250 m of the site. Eight waste management facilities were noted within 250 metres of the site, with the nearest being 86 metres northwest. One registered waste transfer site is located 191 m northwest.
- 3.4.18 The site is not located within a Nitrate Vulnerable Zone and there are no environmentally sensitive sites within 500 m of the site.
- 3.4.19 Based on the site history and the environmental setting, Opus identified the following potential on site contaminant sources:

- demolition of previous buildings: heavy metals, Polycyclic Aromatic Hydrocarbons (PAHs), asbestos;
- the use of the site for storage as part of the ROF: PAHs, Semi Volatile and Volatile Organic Compounds (SVOCs and VOCs), Total Petroleum Hydrocarbons (TPH), sulphates, acidic soil;
- the electricity generation on site: Poly Chlorinated Biphenyls (PCBs);
- possible buried explosives or waste products; and
- infilled ground on site: ground gases.

3.4.20 Opus assessed there to be a low to moderate risk from on-site contaminants associated with the site's history.

3.5 Minerals Assessment Report

3.5.1 A minerals assessment report has been prepared for the development and this is provided in TerraConsult report 4292R02-1.

4. HAZARD ASSESSMENT & PRELIMINARY CONCEPTUAL SITE MODEL

4.1 Hazards Identified with the Proposed Development

4.1.1 Through review of the reports published in Section 4, hazards to human health can be identified. The hazard identification is based on the assumptions presented below:

- the site will be an industrial/ commercial development; and
- drinking water will be from mains supply.

4.2 Potential Sources of Contamination

4.2.1 For the purpose of this assessment the potential contaminants of concern have been considered according to whether they are likely to have originated from on-site or off-site sources.

Potential On-site Sources of Contamination

- Made Ground: Sulphates, metals, metalloids, asbestos, PAH and petroleum hydrocarbons, VOCs and SVOCs;
- Previous buildings: possible asbestos;
- Deposition of reworked natural clay: possible low levels of metals, asbestos, PAH and petroleum hydrocarbons, depending on handling and transport mechanisms; and
- Ground gases (carbon dioxide and methane): from Made Ground.

Potential Off-site Sources of Contamination

- Industrial estate: A number of uses across the estate will have potential contaminative effects. It is unlikely that there will be any additional contaminants that have not been discussed above.

4.3 Potential Receptors of Contamination

4.3.1 Based on the data previously discussed, the following potential receptors to contamination have been identified as shown in Table 3, below.

Table 3: Identified Potential Sensitive Receptors	
A	Humans – Pre development completion, i.e. working on site during demolition and construction.
B	Humans working on the site post construction.
C	Off-site Human Health receptors.
D	Surface Waters -Redwither Brook and River Clywedog.
E	Groundwater – Perched groundwater in Made Ground and groundwater within drift deposits (Secondary A Aquifer) and sandstone bedrock (Principal Aquifer).
F	Local flora and fauna during and post demolition and construction.
G	Building structure and services.

4.3.2 The possible contaminant linkages are discussed below. It should be noted not all may be formed between all sources and receptors.

4.3.3 The preliminary assessment of risks undertaken for the development considers potential risks to receptors A to G in Table 3 above. The receptors A to F incorporate each of the receptors normally required by the Local Authority to be considered in their planning conditions relating to land contamination:

- Human health of current and future site users (A & B);
- Human health of current and future off site visitors and residents on adjacent site areas (C);
- Groundwater and surface water (D & E);
- Adjoining land (C, F & G);
- Property, current and future (including buildings, crops, livestock, pets, woodland, service lines) (F & G);
- Ecological systems (F); and
- Buildings and structures (G).

4.3.4 It should be noted that there are no archaeological sites or ancient monuments considered to be within the zone of influence of the site. They are therefore not considered in the risk assessment.

4.3.5 The closest of each of the above receptor categories to the site are considered to be:

On-site

- Site users;
- Buildings;
- Flora and fauna; and
- Principal bedrock aquifer.

Off-site

- River Clywedog and Redwither Brook (<5m south);
- Industrial/Commercial
 - Wrexham Industrial estate to north and west; and
- Residential
 - Oak Road (<10m north).

4.3.6 The possible contaminant linkages are discussed below. It should be noted not all may be formed between all sources and receptors.

4.4 Identification of Pathways

Pathways to Human Health

4.4.1 There are various routes by which a potential contaminant may reach a receptor. For example, in areas where contaminated material is exposed, dermal contact with the material, inhalation or ingestion of dust may occur.

4.4.2 The majority of the site is currently not covered in hard standing. Due to the numerous mounds on site, it is anticipated that a large earthworks operation is required to modify ground levels.

4.4.3 Inhalation or ingestion of dust and water could occur during the construction and development phase at the site. Pathways from dermal contact with soil and groundwater may also arise. It is considered that the risk of short term exposure for ground workers and other construction workers is low unless there are asbestos fibres in the Made Ground.

- 4.4.4 Post construction, the surface of the development area will be occupied with buildings and hardstanding, however extensive landscaped areas may still be present. This is significant in that a number of potential pathways comprise direct contact and ingestion/inhalation.

Ground Gas

- 4.4.5 Gas and vapour entry into buildings is considered to be a possible pathway for the proposed development due to the possibility of advection and diffusion into buildings, which may occur regardless of the presence of hard standing across the site.

Pathways to Controlled Waters

- 4.4.6 The Redwither Brook and River Clywedog are controlled waters receptors. The brook forms part of the southern boundary of the site, whilst the river is located 3 m to the south east of the site.

- 4.4.7 Groundwater levels at the site are unknown. As with the 2012 investigation at the adjacent site, the presence of perched groundwater within the Made Ground is likely, though this may not be continuous across the site. Lateral migration of potentially contaminated groundwater off-site (either via permeable Made Ground, the underlying aquifer or subsurface drainage) must be considered.

- 4.4.8 The vertical leaching of contaminants from the Made Ground into the groundwater is a potential pathway for contaminants to impact upon groundwater within the underlying Secondary A and Principal Aquifers. The anticipated presence of significant thickness of Glacial clays may mitigate against this but this is not proven.

- 4.4.9 Surface runoff from contaminated areas into surface watercourses must also be considered. Due to a lack of a hard standing site surface, this will be uncontrolled prior to and during the groundworks phase when this must be carefully managed. Post construction the majority of the site and surface runoff will be limited and controlled through drains. A separate Flood Consequence Assessment and Drainage Strategy has been carried out separate to this report.

Other Pathways

- 4.4.10 Other potential pathways that are possibly less significant to the site but still require consideration are: potential phytotoxic effects on sensitive landscaping plants; chemical attack on foundations and services; and permeation of contaminants through domestic sub surface water pipes.

4.5 Contaminant Linkages

4.5.1 For each contamination source there are potential contaminant linkages with all receptors. However, in the context of this site, not all of the contaminant linkages are plausible. The likelihood of the various pathways linking the contaminants to the receptors is presented in Table 4, below.

Table 4: Matrix of Contaminant Linkages								
Source/ Contaminated Medium	Pathway	Receptor						
		A - Humans using the site pre-development completion	B - Humans working on the site post construction	C - Off-site human health receptors	D - Surface Water	E - Groundwater	F - Flora & fauna	G - Building & Services
Soil/Made Ground	Ingestion	S	P	P	-	-	P	-
	Dermal Contact/Direct Contact	S	P	P	-	-	P	P
	Inhalation	S	P	U	-	-	U	-
	Infrastructure/Drainage	P	P	U	P	P	P	P
	Groundwater	U	U	U	P	P	U	P
	Surface water	P	P	U	U	P	U	P
Groundwater	Ingestion	U	U	U	-	-	U	-
	Inhalation	U	U	U	-	-	U	-
	Dermal Contact	U	U	U	-	-	U	-
	Groundwater	U	U	U	P	-	U	P
	Surface Water	U	U	U	U	P	P	P
Gas (Radon)	Migration	S	S	P	-	-	P	-
Gas (CH ₄ CO ₂)	Migration	U	P	U	-	-	P	P
Key to significance of contaminant linkages S = Significant Pathway P = Possible Pathway U = Unlikely Pathway - =Not Applicable Only Significant and Possible contaminant linkages are taken forwards to the next part of the risk assessment.								

4.5.2 Based on TerraConsult's assessment of the data and the other reports discussed previously, it is considered that Opus may have over-stated the risk from contaminants because:

- the fill material on site is likely to be mainly natural „inert“ soils free of contaminants with the most likely contaminant being asbestos from building demolition;
- the site appears not to have been used for either production or storage of explosives; and
- the level of risk from permanent ground gases (methane, carbon dioxide, etc.) is very low.

4.5.3 Note that site has been assumed to lie within an intermediate probability radon area (5-10% of properties at or above the action level). As such, basic protective measures against radon will be required.

4.6 Conceptual Site Model

4.6.1 In accordance with BS 10175, a schematic section has been developed for the site based on the previously presented data and contaminant linkage assessment:

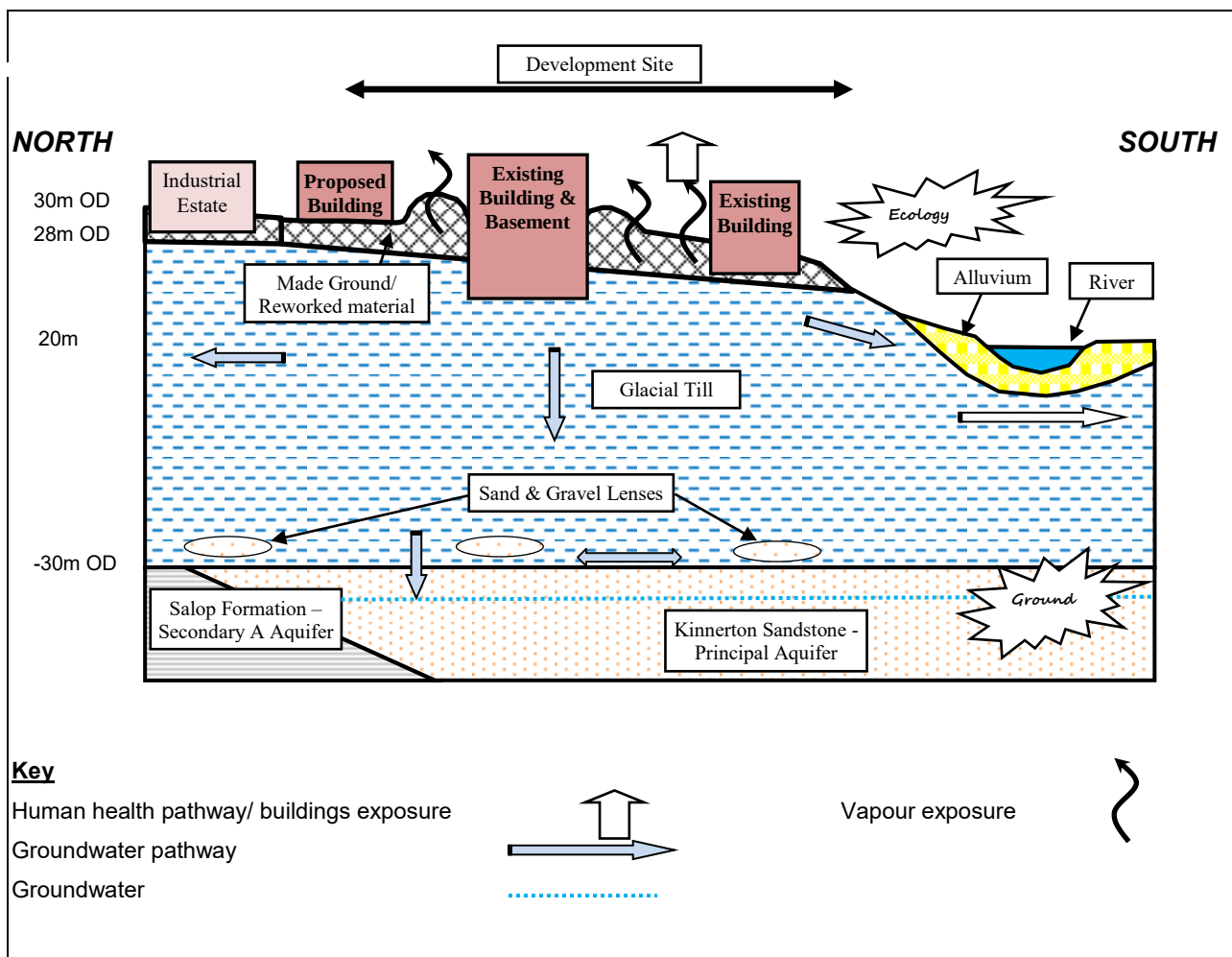


Figure 9: Preliminary Conceptual Ground Model - Schematic Section (not to scale).

4.6.2 The model shows the predicted geology and topography, the major on site potential contamination sources and vulnerable receptors. The drawing may not be considered to scale. The information presented above represents the preliminary conceptual ground model that may need to be revised based on information obtained as part of any future intrusive investigation. A number of sensitive receptors and potential pathways and sources (in association with a list of likely contaminants) have been identified.

4.6.3 The ground model and proposed end use described above should be considered broadly representative of the standard industrial land-use as defined in SR3 "Updated Technical Model to the CLEA Model" (SC050021/SR3, 2011) for the purpose of this report.

4.7 Geotechnical Hazards Associated with the Development

- 4.7.1 In addition to the environmental hazards, there are also geotechnical hazards associated with the stability of the ground (including load bearing capacity, slope stability and effects of ground (mining) cavities). Local Authorities follow NPPF (2019) which requires that *“site is suitable for its new use taking account of ground conditions and land instability, including from natural hazards or former activities such as mining.”* A summary of the geotechnical considerations is provided in Table 5, below.

Table 5: Summary of Geotechnical Hazards	
Geohazards	
Highly Compressible Ground	Alluvium may be present towards the southern area of the site. The compaction of the reworked clay imported from the Kellogg's factory is unknown.
Collapsible Soils	No
Swelling Clay	Glacial clay likely to be of low volume change potential.
Running Sand	No
Ground Dissolution	No
Landslip	No
Mining & Quarrying	There is no evidence of mining or mineral extraction or quarrying at the site.
Geotechnical Design Considerations	
Site Clearance	Predominantly vegetated with discrete areas of hardstanding and buildings/basements. Presence of old foundations and basements very likely.
Trees	Mature and semi-mature trees present across site. No information at present whether any Tree Preservation Orders are present on the site.
Existing Buildings / Obstructions	Historic buildings from use as Royal Ordnance Factory present on site. Basements, Pill boxes and tunnels present.
Foundations	Anticipated that shallow spread foundations will be suitable at this site designed following NHBC Standards (2018) to take into account of the presence of the trees. Need to confirm the volume change potential of the formation material. In areas of deep Made Ground/Alluvium deep foundations will be appropriate (vibro (stone) columns or piles).
Floor Slabs	Suspended floor slabs envisaged.
Groundwater	Likely to be at river level at south of site, therefore at more than 5 m below ground level across the majority of the development.
Earthworks	Bulk earthworks considered necessary in order to remove embankments and fill in basements.
Slopes	Slope down to river at southern area of site is beyond development proposal.
Retaining Walls	Not considered to be relevant to the proposed development.
Chemically aggressive ground conditions	Possibility for low pH and high sulphate concentrations which could be detrimental to below ground concrete.

5. INVESTIGATION METHODOLOGY

5.1 Investigation Strategy

- 5.1.1 Exploratory holes were located across site, where access permitted, to gain lateral and vertical coverage of the ground conditions with the site investigation locations shown on Drawing No. 4292/002. It should be noted that the exploratory hole locations were based on the development plan in Figure 1 which has subsequently been amended. The purpose of the exploratory holes is summarised in Table 6, below.

Table 6: Purpose of Exploratory Holes	
Exploratory Holes	Target Area
Boreholes formed by cable percussion methods. (BH)	To assess deeper ground conditions and allow Standard Penetration Testing (SPTs) and samples for geotechnical characterisation. Located to gain a spread across the site. To install deep monitoring installations.
Dynamic Percussive (Window sampler) boreholes. (WS)	To assess shallow ground conditions and allow SPTs to be undertaken. To allow collection of samples for contamination and geotechnical testing. To install shallow monitoring installations.
Trial pits formed by mechanical excavator. (TP)	To assess shallow ground conditions both laterally and vertically. To allow collection of samples for contamination and geotechnical testing. Located to gain a spread across the site, avoiding underground services and inaccessible areas.
Hand dug trial pits (HD)	To assess shallow ground conditions in areas that could not readily be accessed by plant.

- 5.1.2 The site is highly vegetated and the topography is undulating. Gaining access, particularly for the cable percussion boreholes was not possible in some area and was limited to areas adjacent to the access routes.

5.2 Chemical and Geotechnical Testing Strategy

- 5.2.1 Based on the conceptual phase model, there is a low likelihood of significant contamination being present but chemical analysis of soil samples to target a wide range of potential contaminants of concern which could historically have been used on the Wrexham Industrial Estate. These include asbestos, heavy metals, petroleum hydrocarbons, PAHs, SVOCs and VOCs.
- 5.2.2 Samples were recovered from all strata encountered for geotechnical analysis in order to provide as much detail as possible about the ground conditions both laterally and with depth.

5.3 Monitoring Strategy

- 5.3.1 The ground gas monitoring is in accordance with BS 8576: 2013 and comprised six visits over six weeks. This monitoring period is in general accordance with Table 5.5 of CIRIA

C665 (2007) for the generational potential of the source and the sensitivity of the development but it is a shorter period of monitoring than suggested in CIRIA C665 (2007). This is applicable because the table is only a guide and the investigation completed by ESI Ltd in 2012 suggested a low risk of ground gas generation; there is a low risk of significant ground gas being present on this site.

6. FIELDWORK

6.1 General Observations

6.1.1 The intrusive fieldwork was carried out between 11th and 20th February 2019 with gas and groundwater monitoring performed at weekly intervals thereafter until 5th April 2019. TerraConsult personnel were present to supervise all work, describe the ground encountered, carry out in situ testing and decide on the depths and response zones of monitoring wells. A services search was carried out prior to the site work and a Cable Avoidance Tool (CAT) scan performed at the location of each exploratory hole location. Fieldwork procedures were undertaken in accordance with the relevant sections of:

- British Drilling Association "Guidance for Safe Intrusive Activities on contaminated or Potentially Contaminated Land" (2008);
- BS5930:2015 "Code of Practice for Site Investigations"; and
- BS10175:2011 + A2:2017 "Investigation of potentially contaminated sites – Code of practice."

6.1.2 The investigation comprised the following fieldwork scope:

- 8 cable percussive boreholes using 150 mm diameter casing and tools;
- 10 dynamic (window) sample holes with plastic liners;
- 24 trial pits using a tracked excavator or hand tools;
- Installation of 14 gas and groundwater monitoring wells (all 51 mm internal diameter HDPE with slotted sections having a 250 µm geotextile filter wrap);
- Sampling and testing of soils and groundwater;
- Description of the ground encountered in accordance with BS5930:2015 "Code of Practice for Site Investigations;" and
- Gas and groundwater monitoring spread over a period of 6 weeks.

6.2 Trial Pits

6.2.1 Nine trial pits (TP01 to TP09) were excavated using a tracked twelve tonne excavator, where access permitted, across the site to depths of between 1.50m bgl (TP03) and 3.20m bgl (TP04). Following the re-issue of development plan, TP01, TP02 and TP03 are not assessed to be relevant to the development and will not be considered further.

6.2.2 Thirteen hand-dug trial pits (HD01 to HD13) were completed across the site in areas that could not be accessed by plant.

6.2.3 The trial pit logs and photographs are presented in Appendix D.

6.3 Dynamic (Window) Sample Boreholes

6.3.1 Ten dynamic sampling boreholes (WS01 to WS10) were carried out using a tracked Dando Competitor rig. These holes were excavated to 4.45 m bgl except for WS01 and WS07, which were excavated to 5.45 m bgl.

6.3.2 Standard Penetration Tests (SPTs) were carried out at metre intervals in the holes in

general accordance with BS EN ISO 22476-3:2005. The dynamic sample logs and the SPT Calibration Certificate are presented in Appendix D. Following the re-issue of development plan, WS09 and WS10 are not assessed to be relevant to the development and will not be considered further.

6.4 Cable Percussion Boreholes

- 6.4.1 Eight cable percussion boreholes were completed across the site to a general depth of 15.00 mbgl. BH06 was terminated at 2.00 m bgl on a concrete obstruction, before being re drilled in an adjacent location to depth as BH06A. The boreholes were drilled in 150 mm diameter. SPTs were carried out in both granular and cohesive strata in the holes in general accordance with BS EN ISO 22476-3:2005+A1 2011. Undisturbed driven U100 samples were taken from cohesive strata for laboratory analysis.
- 6.4.2 The logs from the cable percussion boreholes and the SPT Calibration Certificate are presented in Appendix D. Following the re-issue of development plan, BH05 is not assessed to be relevant to the development and will not be considered further.

6.5 Soakaway Tests

- 6.5.1 Two soil infiltration (soakaway) tests were carried out in accordance with BRE Digest 365 (2016). Due to the relatively slow infiltration rate each test was carried out a single time. The tests were completed without the use of granular backfill as the test pits were assessed to be stable. The results of the infiltration tests are presented in Appendix E.

6.6 CBR Tests

- 6.6.1 Eleven California Bearing Ratio (CBR) tests were carried out using the Transport & Road Research Lab (TRRL) Dynamic Cone Penetration (DCP) method to provide design parameters for road/pavement design. The tests were carried out directly from the ground surface. The results are presented and discussed within Section 11.7.

6.7 Samples and Sample Containers

- 6.7.1 Soil samples for chemical analysis each comprised: a plastic tub for metals and inorganics, an amber glass jar for organics and an amber glass vial for volatiles.
- 6.7.2 Prior to taking any water samples, the wells were developed and three well volumes of water were purged from the wells using dedicated disposable bailers (also called a grab sampler). If recharge was relatively slow and not sufficient to allow a purged sample from being taken then a sample was taken of the water during the purging and the volume of purged water was noted.
- 6.7.3 The water samples were tested on site in accordance with EA recommendations for pH, conductivity, redox potential, temperature and dissolved oxygen. A range of different sample containers were used for sampling groundwater:
- 1 litre plastic bottles metals and inorganics;
 - 1 litre glass bottles for SVOC's; and
 - Amber glass vial for VOC's.

- 6.7.4 Water samples and soil samples for organic analysis were stored in a cool box, with plastic tubs stored in a plastic crate directly to the testing laboratory.

6.8 Monitoring

- 6.8.1 After completion of the fieldwork, six visits were made to the site to carry out monitoring of groundwater levels and ground gas concentrations. Ground gas monitoring was carried out in accordance with BS8576:2013 and comprised measurement of landfill gases using a GasData GFM435 infra-red meter to measure gas flow rate, methane, carbon dioxide, oxygen, carbon monoxide and hydrogen sulphide.
- 6.8.2 The results of this monitoring are presented in Appendix F, together with details of the instrumentation specifications.
- 6.8.3 It should be noted that no free phase hydrocarbons were encountered in any of the monitoring wells or during intrusive works.

6.9 Topographical Survey

- 6.9.1 The location and level of each exploratory position was surveyed to National Grid Co-ordinates and Ordnance Datum. The plan also shows the locations of important features such as building outlines and infrastructure.

7. LABORATORY TESTING

7.1 Chemical Laboratory Testing

- 7.1.1 The samples were submitted to The Environmental Laboratory Ltd in St Leonards on Sea, East Sussex who are UKAS accredited in accordance with ISO17025 and are also MCERTS accredited for soil analysis in accordance with the Environment Agency's scheme. The laboratory carries out Quality Assurance and Quality Control in accordance with BS ISO 17025 and participates in external laboratory comparison and quality control schemes. Details of the accreditation and the methods of analysis are provided on the relevant test reports.
- 7.1.2 The selection of samples for laboratory testing and analytes to be determined were made based on the review of Phase 1 assessment, the excavation records and other observations during the investigations. The sample selection rationale was as follows:
- to gain a good coverage across the site and of the various material types and strata encountered;
 - to characterise samples which had visual or olfactory evidence of contamination;
 - to characterise samples from the interface of permeable and less permeable horizons within the ground;
 - to characterise soils samples located at groundwater level; and
 - to characterise the groundwater.
- 7.1.3 The selected soil and groundwater samples were tested for a range of typical contamination indicators including specific tests for contaminants suspected as being present from the desk study and from observations made on site. Tests were also performed which were used to support the modelling of contaminant transport and impacts (e.g. TOC) and for waste classification purposes.
- 7.1.4 Each of the soil samples were analysed for the „total“ concentration of a suite of potential contaminants. A number of leachate samples were also prepared from selected soil samples in accordance with BS EN 12457: Part 4 : 2002 with a 10:1 water:soil extract prepared. The results of the leaching are presented in terms of µg/l and also in mg/kg.
- 7.1.5 The results of the laboratory analysis are presented in Appendix G. The various suites of analysis for the soil, leachate and water were as follows:

Table 7: Suites of Analysis for Soil and Water Samples					
Determinand	Soil Suite 1	Soil Suite 2	Soil Suite 3	Landfill WAC Suite	Water Suite
Number of Samples	23	11	23	4	7
Asbestos Screen	Total 50No.			-	-
pH	✓	✓	✓	✓ (L)	✓
Dissolved Solids	-	-	-	✓ (L)	✓
Alkalinity	-	-	-	-	✓
Metals					
As, Cd, Cr, Cu, Pb, Hg, Ni, Se, Zn (all totals)	✓	✓	✓	✓ (L)	✓
Ba, Mo, Sb	-	-	-	✓ (L)	-
Boron (water soluble on soil samples)	✓	✓	✓	-	✓
Ca, Fe, K, Mg, Mn, Na	-	-	-	-	✓
Inorganics					
Ammonium	-	✓	✓	-	✓
Cyanide - Total	✓	✓	✓	-	✓
Chloride (2:1 extract on soil samples)	✓	✓	✓	✓ (L)	✓
Fluoride (2:1 extract on soil samples)	-	✓	✓	✓ (L)	✓
Nitrate (2:1 extract on soil samples)	-	✓	✓	✓ (L)	✓
Sulfate (2:1 extract on soil samples)	✓	✓	✓	✓ (L)	✓
Organics					
Phenols - Total (monohydric)	✓	✓	✓	✓ (L)	✓
Total Organic Carbon (TOC)	✓	✓	✓	DOC & TOC	-
PAH (Speciated USEPA 16)	✓	✓	✓	✓ (S)	✓
TPH (C ₈ to C ₃₆)	✓	✓	✓	-	✓
TPH (C ₈ to C ₃₆) TPH CWG Speciation	-	✓	✓	-	✓
Mineral Oil (C ₁₀ to C ₄₀)	-	✓	✓	✓ (S)	-
Benzene, Toluene, Ethyl Benzene, Xylenes (BTEX);	-	✓	✓	✓ (S)	✓
Volatile Organic Compounds (VOCs) and Chlorinated Solvents	-	**	✓	-	✓
Semi Volatile Organic Compounds (SVOCs)	-	**	✓	-	✓
Poly Chlorinated Biphenyls (PCBs)	-	**	✓	✓ (S)	-
✓ = Test carried out on all samples **= Test required on selected samples only 2. All soil samples to be tested and reported in accordance with EA MCERTS for Soils Scheme 3. WAC Leachate preparation and reporting in accordance with ISO/EN/BS12457:Part 4 with results reported in terms of both mg/kg and mg/l for a 10:1 extract. 4. (S) test carried out on soil sample, (L) test on leachate prepared from soil sample in accordance					

7.2 Geotechnical Laboratory Testing

7.2.1 Samples were submitted to Professional Soils Laboratory Limited in Doncaster who is UKAS accredited in accordance with ISO17025. The following geotechnical testing was undertaken with the results of this testing presented in Appendix H:

- 17 natural moisture contents;
- 19 liquid and plastic (Atterberg) limits;
- 10 analyses on soils for sulfate and aggressive chemical environment classification for buried concrete (the full BRE SD1 suite, Building Research Establishment 2005); and
- 27 quick undrained triaxial shear strength tests (100 mm dia specimens).

8. GROUND CONDITIONS

8.1 General

- 8.1.1 The site investigations have allowed the site specific ground conditions to be described and this information was used to provide an improved conceptual ground model. The geology encountered during the site investigations was generally consistent with that anticipated from the desk study. A summary of the general strata encountered across the site is provided in the Table 8 below, with more detailed description given in the following subsections.

Table 8: Summary of Strata Encountered		
Geological Strata	Maximum Depth Below Ground Level to Base of Strata (m)	Strata Thickness (m)
Topsoil	0.60	0.60
Made Ground	3.00	0.00 – 3.00
Glacial Till	15.00 (Base not proven)	At least 14.60

8.2 Ground Surface

- 8.2.1 The site is heavily vegetated with discrete asphalt roadways and gravel tracks. There are a number of large mounds and derelict old WWII buildings across the site. This made accessing areas away from the access roads / path very difficult.
- 8.2.2 Where topsoil was encountered, it was generally described as a firm brown sandy clay with rootlets. In HD01, HD02, HD03 and HD04, the topsoil was a granular material. The topsoil ranged in thickness from 0.10 m to 0.60 m, with the thickest occurrence at BH02.

8.3 Anthropogenic Materials

- 8.3.1 Made Ground was encountered in all exploratory holes across the site. Two types of material were encountered.

Made Ground: Clay

- 8.3.2 Cohesive Made Ground was recorded at all locations and was generally described as soft dark brown slightly sandy slightly gravelly clay with gravel of shale and concrete. The material was encountered from ground level at a number of locations and proved to depths of between 0.40 m bgl at BH01 and 2.70 m bgl at TP04. The maximum proven thickness of the material ranged from 0.15 m at TP07 to 2.70 m at TP04.

- 8.3.3 It was often not possible for the site engineer to ascertain the difference between reworked natural material that is understood to have imported from the area of the Kellogg's factory and „true“ Made Ground.

Made Ground: Gravel

- 8.3.4 Granular Made Ground was recorded locally at BH01, WS04, TP04, TP0, TP07, HD02, HD06 and HD11. The material was generally described as angular to subrounded fine to coarse slightly silty sandy gravel of burnt oil shale. The material was encountered at depth ranging from: BH01: 0.0 to 0.10 m to TP04: 2.70 to 3.00 m. The proven thickness of the material ranged from 0.10 m at BH01 to 0.70 m at HD02.

- 8.3.5 No visual or olfactory evidence of contamination was noted during the fieldwork other than the presence of burnt oil shale (which can be a source of heavy metals, sulphates, etc.).
- 8.3.6 Concrete obstructions were encountered at 1.78 m bgl at TP08 and 1.98 m bgl at BH06. These are believed to be representative of historic slabs. A brick obstruction encountered at 0.30 m bgl at HD13 is believed to be representative of an historic wall.

8.4 Drift Deposits

- 8.4.1 Glacial Till was encountered at all locations that reached their target depth with the exception of the hand-dug trial pits all of which terminated within the made ground overlying the till. The Glacial Till was described at all locations as stiff slightly sandy slightly gravelly clay. Laminations were noted in all BH locations at depths ranging from 4.00 m bgl to 12.00 m bgl.

8.5 Solid Geology

- 8.5.1 Bedrock was not encountered during the investigation.

8.6 Groundwater

- 8.6.1 Perched groundwater was recorded during site works in three exploratory holes, as summarised in Table 9, below.

Table 9: Groundwater strike information			
Location	Depth of strike (m bgl)	Rise after 20 minutes	Strata
BH03	2.20	1.90	Base of MG / Glacial Till
BH03	7.30	No rise	Glacial Till
BH05	1.70	No rise	Base of MG / Glacial Till
TP02	1.40	Small seepage	Glacial Till

- 8.6.2 Groundwater has been recorded in the monitoring wells and a summary is provided in Table 10 below.
- 8.6.3 There is a large variation in the recorded groundwater. A number of the wells have recorded very high perched groundwater >1.0m. This is considered likely the surface water recharging through the deeper Made Ground.
- 8.6.4 The dual monitoring wells (shallow & deep) installed in the cable percussion boreholes have shown separate water bodies. The installed wells are not likely to be hydraulically connected, and no groundwater direction can be inferred. A summary of groundwater monitoring is presented in Table 10, below.

Table 10: Groundwater Monitoring Records			
Borehole	Response Zone (mbgl)	Water Level Highest (mbgl)	Water Level Lowest (mbgl)
BH01 -S	1.00 – 4.00	3.38	3.76
BH01 -D	12.0 – 15.0	4.41	4.56
BH05 S	1.00 – 4.00	3.12	3.34
BH05 D	12.0 – 15.0	13.12	14.6
BH06A S	1.00 – 4.00	3.20	3.37
BH06A D	12.0 – 15.0	12.78	14.66
BH07 S	1.00 – 4.00	3.96	Dry
BH07 D	12.0 – 15.0	5.12	5.49
WS01	1.00 – 4.00	2.29	4.91
WS02	1.00 – 4.00	0.47	0.85
WS03	1.00 – 4.00	2.41	2.57
WS04	1.00 – 4.00	0.20	0.32
WS05	1.00 – 4.00	0.55	0.86
WS06	1.00 – 4.00	3.87	Dry
WS07	1.00 – 5.00	3.63	4.36
WS08	1.00 – 4.00	3.85	Dry
WS09	1.00 – 4.00	0.30	0.74
WS10	1.00 – 4.00	0.20	0.63

9. GENERIC QUANTITATIVE RISK ASSESSMENT

9.1 Introduction

9.1.1 The assessment of contamination has been carried out in accordance with the overall guidance presented in CLR11 Model Procedures for the Management of Land Contamination using the procedures as indicated in Appendix B.

9.1.2 Generic risk assessment is a two stage process. Firstly, in the Risk Estimation stage, the measured contaminant concentrations are compared to the relevant generic assessment criteria (GACs) or C4SLs²/S4ULs where they have been published. Where there is a suitable dataset, this is done after carrying out statistical analysis to determine the upper confidence limit on the true mean. Otherwise, maximum or specific data points are compared directly. The second stage, Risk Evaluation, comprises an authoritative review of the findings with other pertinent information, in cases where the C4SLs or GACs are exceeded, in order to consider if exceedance may be acceptable in the particular circumstances.

9.1.3 The aspects of risk from substances in the ground considered below are as follows:

- human health;
- plant life;
- pollution of Controlled Waters;
- water supply pipes
- below ground concrete; and
- ground gases.

9.2 Assessment for the Protection of Human Health

9.2.1 The Generic Qualitative Risk Assessment (GQRA) is based on a soil with a Soil Organic Matter of 1% was carried in accordance with the methodology for assessing soil samples set out in Appendix B based on a commercial/industrial end use. A full summary of the chemical test results is presented in Appendix G. No exceedances of applicable Generic Assessment Criteria (GAC) threshold concentrations were recorded.

Metals

9.2.2 Sixty one samples were tested for metal concentrations across the site, with none containing concentrations higher than the applicable GAC for the planned commercial development other than a single concentration of lead recorded in soils sampled from BH3 at 0.3m bgl where a concentration of 4,010 mg/kg was recorded.

PAH

9.2.3 The majority of the samples tested for PAH (70%) were below the detection limit (0.4 mg/kg). No exceedances of the applicable PAH GACs were encountered within the development area. The PAH concentrations within the development area do not represent a significant increased risk to long term human health and give no cause for concern. The maximum total PAH concentration is 2,100 mg/kg from HD13, which was taken from the wall/bund created from demolition material from the magazine buildings and located outside the proposed development area. The next highest PAH concentration is 157 mg/kg, indicating this result is an outlier. The C4SL for

² C4SLs Category 4 Screening Levels. S4UL: Suitable for Use levels

Benzo(a)pyrene was exceeded within HD13. The material encountered in HD13 is proposed to remain the „Ecological“ Zone. If the development proposals change then further investigation may be required.

Petroleum Hydrocarbons

- 9.2.4 No hydrocarbon impacted soils were noted during the site investigation. Thirty of the forty seven samples (64%) analysed for TPH were below the detection limit. From the remaining samples, none of the applicable GAC for the proposed commercial development were exceeded. No BTEX samples were recorded above the laboratory detection limit.

VOCs and SVOCs

- 9.2.5 A number of SVOCs were reported above the laboratory detection limit, however they are at very low concentrations. GAC are available for dibenzofuran and pentachlorophenol. There are no exceedances of the relevant GACs.

Asbestos

- 9.2.6 Asbestos can be present in soil as fragments of bulk Asbestos Containing Materials (ACMs) (e.g. asbestos cement sheeting) and also as discrete asbestos fibres within the soil matrix. This investigation has carried out sampling of soils at discrete locations to determine whether both bulk fragments of asbestos and discrete fibres are present in the soil at the site. The asbestos assessment commenced on site with inspection of the Made Ground by our site staff for the presence of bulk ACMs.
- 9.2.7 Two different types of laboratory assessments were carried out in order to confirm the site assessment that ACMs were absent:
- 50 samples underwent laboratory assessment to determine whether asbestos fibres or ACMs were present (note that the laboratory quantification limit for these samples is 0.001%); and
 - where asbestos was found to be present in a sample then full asbestos quantification and composition analysis was conducted.
- 9.2.8 No ACMs were found in the laboratory asbestos analysis. However, asbestos fibres were detected in one of the 50 samples and were recorded as containing chrysotile. The quantity present was below the analytical limit of quantification of 0.001 % by weight. Finding asbestos at such concentrations is very common in Made Ground and does not signify that any remediation is required due to the presence. However it does highlight the risk that could be present from asbestos if any localised “hotspots” are encountered during groundworks.
- 9.2.9 During the fieldwork no suspected ACMs were identified within the soil matrix. However, corrugated roof sheeting was noted near the northern boundary, which appears to have been fly-tipped. The roof material has the potential for containing asbestos and should be tested before removal from site.

Risks to Human Health (Construction Phase)

- 9.2.10 During the construction works there will be a risk from dust to on site workers and people occupying adjacent properties. Appropriate risk assessments should be carried out by the contractor to allow appropriate controls for the mitigation of risk to health of construction workers to be put in place. This risk can be controlled to within acceptable limits by:
- control of dust generation (see below);

- workers wear suitable Personal Protective Equipment (PPE);
- having adequate site hygiene facilities allowing staff to keep a good level of personal hygiene;
- all groundworkers should have been trained in asbestos awareness and should keep a look out for this being encountered during excavations. The earthworks contractor should have a contingency plan in place before any works commence in case the presence of asbestos is suspected in groundworks; and
- only permitting smoking or eating on site in appropriate pre-designated areas.

9.3 Risk to Plant Life

- 9.3.1 Concentrations of the phytotoxic metals zinc, copper and nickel have been recorded in Made Ground in excess of the guideline values for the protection of plants as presented in the MAFF document "Code of Good agricultural practice for the protection of soil" (1998). The results of the phytotoxic screening are presented in Table 11, below. It is acknowledged that the MAFF guidelines are based on the averaging area pH value.

Table 11: Phytotoxic Risk of Natural Ground				
Determinand	Number of Samples	Trigger Value (mg/kg)	Results Exceeding Trigger Concentration (mg/kg)	Exceeds Tier 1 Screening (Y/N)
Arsenic	62	250	-	N
Copper	62	200*	-	N
Chromium	62	400	-	N
Nickel	62	110*	-	N
Zinc	62	300*	360, 606, 582	Y
* Soil average pH >7.0				

- 9.3.2 Within the Made Ground, zinc is elevated when compared to the GAC (see Table 11). This is based on three samples with a high concentration; Tier 1 screening for commercial/ industrial end use was not exceeded by any of these samples. Detriment to plant life is hard to quantify as many of the GACs are based on agricultural crop yields rather than serious harm of death of a species. Two of the three results are located within what will be the „Heritage Zone“ and are therefore unlikely to be of concern. As the vegetation present on site appears to be in good condition, TerraConsult does not consider any additional consideration is required with regards to risk to plants.
- 9.3.3 In landscaped areas the marginally elevated levels of contamination may not be acceptable for the proposed end use, and these will require either replacement with appropriate clean inert materials or provision of a suitable capping system to protect end-users. The possibility of hazards to local flora and fauna arising from some of the levels of contamination cannot be precluded. Appropriate advice should be sought from the Local Authority Ecological Consultant.

9.4 Assessment for the Protection of Controlled Waters

- 9.4.1 The risks to Controlled Waters (groundwater and surface waters) from contaminants on-site have been assessed in accordance with the EA documents "The Environment Agency's Approach to Groundwater Protection" (2017) and Remedial Targets Methodology (RTM, 2006). Pollutant inputs from contaminated land sites are considered as passive inputs under the European Water Framework Directive (2000/60/EC) (WFD) and its daughter Directives, and as such are regulated under the Agency's "limit" pollution objective. Acceptable water quality targets (WQT) are defined for protection of human health (based on Drinking Water Standards (DWS)) and for protection of aquatic ecosystems (Environmental Quality Standards (EQS)).
- 9.4.2 The results of the remedial targets methodology assessment are presented in Appendix J and exceedances are summarised in the following table.

Table 12: Summary of Exceedances of Generic Assessment Criteria for Controlled Waters						
Chemical of Potential Concern	Water Quality Target (µg/l)	Basis for Water Quality Target	No. Samples Tested	Min. (µg/l)	Max. (µg/l)	No. Samples Exceeding Target
Chloride	250,000	EQS	9	12,000	770,000	3
Sulphate as SO ₄	250,000	DWS	9	107,000	3,740,000	6
Ammonium as NH ₄	500,000	DWS	9	15,000	1,300,000	3
Aromatic C7-C8	1	DWS	9	1	30	3
Toluene	50	EQS	9	1	30	0

- 9.4.3 The results from the groundwater analysis have indicated that relevant water quality targets are exceeded with respect to chloride, sulphate, ammonium and C7-C8 aromatic TPH carbon fractions.
- 9.4.4 Toluene was recorded above the laboratory detection limit but below the EQS threshold. Therefore the presence of toluene at these concentrations is unlikely to pose risk to Controlled Waters or end user receptors.
- 9.4.5 No visual or odorous hydrocarbon / chemical evidence was noted during the water sampling. It is likely that the exceedance of aromatic TPH can be attributed to the presence of toluene.
- 9.4.6 The concentrations of sulphate are elevated across the site and five out of the nine samples exceed the EQS threshold. There are a number of potential sources including the elements within the Made Ground for example mudstone, burnt oil shale, gypsum plaster etc. However, the analysis from the soil has shown no elevated concentrations of Sulphates (including the granular Made Ground which is mainly burnt oil shale). Another possible source could be the use of fertilizers as ammonium sulphate.

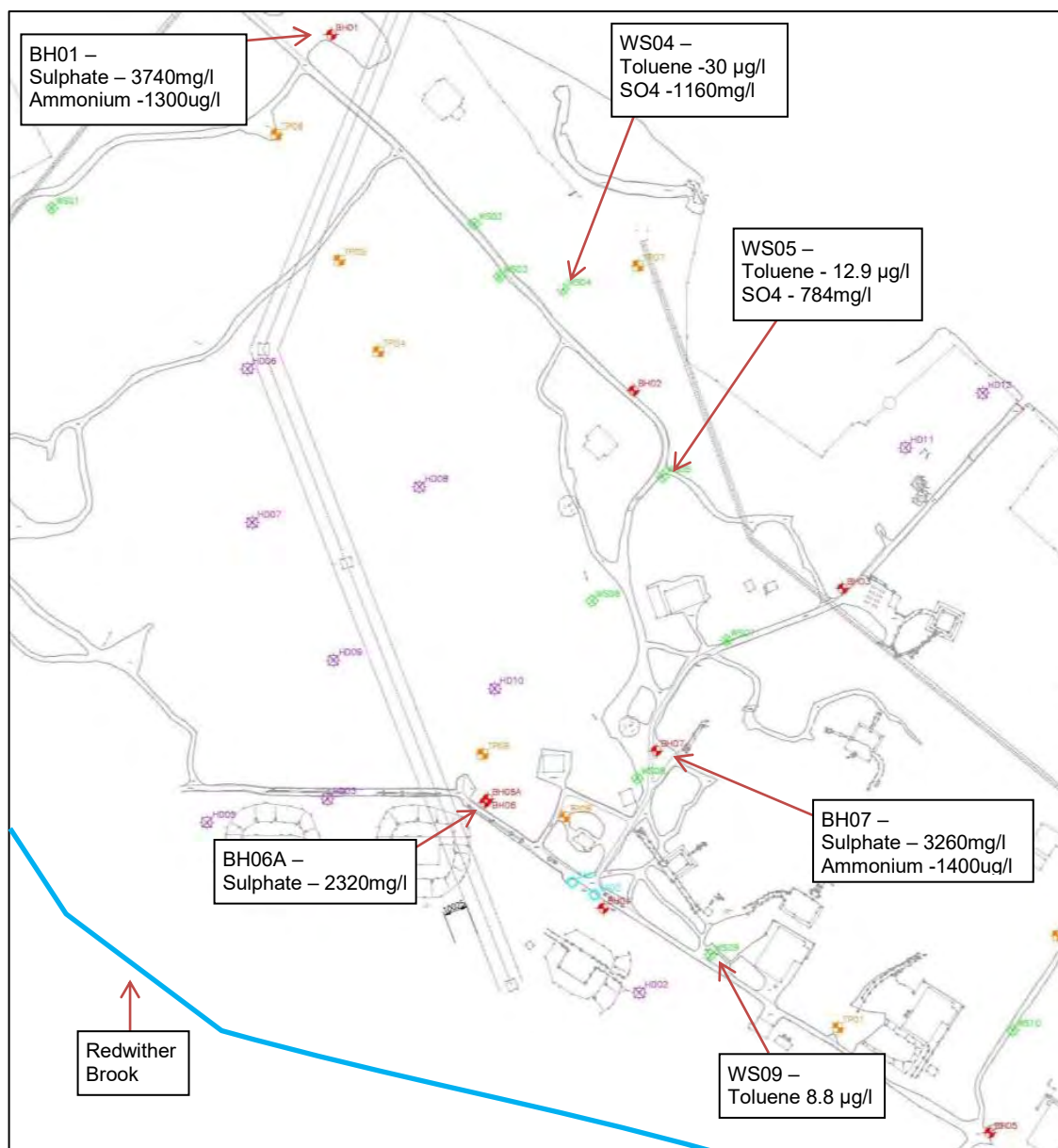


Figure 10: Exploratory hole location plan showing groundwater results exceeding EQS / DWS thresholds.

9.4.7 The concentrations of chloride and ammonium are also elevated across the site. Three samples exceed the EQS threshold for chloride and three samples exceed the EQS for Ammonium and a further sample exceeded the DWS. For ammonia, there are many potential sources including natural degradation of organic matter as well as the use of fertilizers as ammonium sulphate. It is unlikely that the source of ammonia is from degradation of ammonia based explosives / propellants (e.g. ammonium nitrate, nitroglycerine) as it is understood that the study site was still under development at the end of WWII and was never operational for storage of explosives but it is possible that the site was used for a period for storage of ammonium sulphate used in explosive production elsewhere on the ordnance factory site.

Discussion

9.4.8 The groundwater testing has shown elevated concentrations of certain chemicals within the perched Groundwater located within the Made Ground and/or upper horizons of the

cohesive glacial superficial deposits. Subject to agreement with the NRW, TerraConsult does not believe the site poses a significant risk to Controlled Waters because:

- there is no evidence to suggest the presence of a continuous shallow groundwater body and it is unlikely that there is a significant lateral migration of contamination;
- the perched groundwater at and in the vicinity of the site are not abstracted for human consumption;
- the proposed development will be predominantly hard landscaped. Post construction the majority of the development area and surface run-off will be limited and controlled through drains and drainage ditches so the development will reduce infiltration; and
- there are three licensed groundwater abstractions from the Kinnerton Sandstone located to the east of the site used for process water. The Glacial Clay deposits are understood to be >60m thick and any potential shallow contaminants in the perched groundwater will not be in hydraulic continuity with the water in the bedrock.

9.4.9 TerraConsult recommends that discussion with NRW is entered into at the earliest opportunity.

9.5 Water Supply Pipe Material Assessment

9.5.1 Plastic pipe materials are potentially vulnerable to attack from elevated levels of hydrocarbons, which can potentially lead to contamination of potable water supplies and water supply companies also require the risk to their workers from other contaminants in the ground to be assessed. The assessment has been completed in accordance with the current UK Guidance for the Specification of Water Supply Pipes to be used in Brownfield Sites (UK Water Industry Research Ltd. UKWIR, 2014) together with guidance from Welsh Water. This guidance provides threshold concentrations for different pipe material for various chemical groups.

9.5.2 The pipeline materials considered by the guidance are PE, PVC, wrapped steel, wrapped ductile iron or copper pipe and barrier pipe. PE are assessed using threshold concentrations for various chemical groups including volatile organic compounds (VOC) with tentatively identified compounds (TICs), semi-volatile organic compounds (SVOC) with TICs, mineral oils, aldehydes, ketones, etc. Wrapped steel, wrapped ductile iron and copper pipe are assessed using corrosive properties. The default recommendation for water supply pipes is to use PE with other types of pipework only used if the limits for PE pipes are exceeded. When assessing the ground for water supply pipes the suite of potential contaminants to be tested only needs to be those contaminants that are potentially present on site based on the desk study.

9.5.3 The available data indicates no exceedances for the PE water supply pipe are present and as such the use of PE pipe is deemed permissible with the following caveats:

- should areas of unexpected contamination be found during construction and any water supply pipes are routed through those areas, additional sampling and testing will be required; and
- following confirmation of the water supply pipe route and associated proposed pipe invert level, the water supplier for the area should be contacted and written approval sought. They may require additional chemical data along any

proposed potable water supply pipe routes. This should also be checked against the proposed cut and fill proposals for the site to achieve finished levels.

9.6 Chemical Attack on Below Ground Concrete

9.6.1 Below ground concrete structures are potentially at risk in areas of elevated sulphates and where there is low pH. An assessment of the soil and groundwater data (following the protocol established in BRE Special Digest 1, 2005) indicates that ACEC Class AC-4 conditions prevail. Therefore concrete at the site must be designed in accordance with this design of concrete in terms of the durability and structural performance. The origin of the elevated Sulphates is not clear. It may be prudent to carry out further groundwater analysis to confirm this assessment.

9.7 Permanent Ground Gases

Measured Gas Concentrations

9.7.1 Six rounds of gas monitoring carried were out by TerraConsult in the gas monitoring wells with atmospheric conditions varying from 988 to 1,036 mbar during March and April 2019. Two of the monitoring visits were carried out with atmospheric pressures less than 1,000 mbar (pressures 988 and 999 mbar on the 7th and 12th March 2019) with the other four sets of readings were all taken with air pressured greater than 1,000 mbar. The highest flow rates, methane and carbon dioxide concentrations, together with the lowest oxygen levels (i.e. a combination of the worst case temporal conditions recorded) from the monitoring visits are summarised in the table below:

Table 13: Worst case measured gas concentrations											
Borehole	Response Zone m bgl	No. of Visits	Steady State Flow (l/hr)	Methane (%v/v)	Carbon Dioxide (%v/v)	Oxygen (% v/v)	Carbon Monoxide (ppm)	Hydrogen sulphide (ppm)	Water Level (m bgl)		Atmospheric pressure readings (mb)
									WL Highest m bgl	WL Lowest m bgl	
WS01	1.00 – 4.00	6	<0.1	<0.1	0.7	17.8	<1	<1	2.29	4.91	988
WS02	1.00 – 4.00	6	<0.1	<0.1	0.7	17.6	<1	<1	0.47	0.85	989
WS03	1.00 – 4.00	6	3.0	<0.1	4.8	12.2	<1	<1	2.41	2.57	989
WS04	1.00 – 4.00	6	<0.1	<0.1	2.2	17.9	<1	<1	0.20	0.32	989
WS05	1.00 – 4.00	6	12.2	<0.1	0.7	18.0	<1	<1	0.55	0.86	989
WS06	1.00 – 4.00	6	<0.1	<0.1	3.9	12.0	<1	<1	3.87	<3.93	988
WS07	1.00 – 5.00	6	<0.1	<0.1	4.2	12.7	<1	<1	3.63	4.36	989
WS08	1.00 – 4.00	6	<0.1	<0.1	3.9	13.2	<1	<1	3.85	<3.93	990
WS09	1.00 – 4.00	6	<0.1	<0.1	1.4	16.2	<1	<1	0.30	0.74	990
WS10	1.00 – 4.00	6	<0.1	<0.1	1.4	16.2	<1	<1	0.20	0.63	990
BH01 -S	1.0 – 4.0	6	0.8	<0.1	2.1	10.8	<1	<1	3.38	3.76	988
BH01 -D	12.0 – 15.0	6	<0.1	<0.1	0.6	18.7	<1	<1	4.41	4.56	988
BH05 S	1.0 – 4.0	6	<0.1	<0.1	0.4	18.7	<1	<1	3.12	3.34	991
BH05 D	12.0 – 15.0	6	<0.1	<0.1	0.8	17.6	<1	<1	13.12	14.60	988
BH06A S	1.0 – 4.0	6	<0.1	<0.1	2.1	10.0	<1	<1	3.20	3.37	991
BH06A D	12.0 – 15.0	6	<0.1	<0.1	2.2	3.8	<1	<1	12.78	14.66	991
BH07 S	1.0 – 4.0	6	<0.1	<0.1	1.4	13.9	<1	<1	3.96	<4.03	989
BH07 D	12.0 – 15.0	6	<0.1	<0.1	1.1	17.4	<1	<1	5.12	5.49	989

Ground Gas Assessment

9.7.2 Background information relating to the origin and production of landfill and ground gases are presented in Appendix K, together with current guidance on the assessment of ground gases. In accordance with this approach and the above measured ground gas levels, it is considered that the worst case temporal conditions may not have been measured during the monitoring period. However, as gas concentrations were measured at atmospheric pressures below 1000 mbar on two occasions, it is anticipated that the worst case temporal conditions will not be significantly worse than those presented in Table 11 above. The methane concentration measured across the whole of the site at all of the monitoring visits was less than the instrument detection limit of 0.1 % v/v. The concentrations of hydrogen sulphide and carbon monoxide measured across the site were below the instrument detection limit of 1 ppm at all monitoring visits. From Table 8.5 of CIRIA C665 the worst case Characteristic Situation for the two areas of the site and consequently gas screening value (GSV) are as follows:

Table 14: Characteristic Gas Situations

Borehole Number	Steady State Flow	CH ₄			CO ₂		
	l/h	% v/v	GSV (l/hr)	Characteristic Situation	% v/v	GSV (l/hr)	Characteristic Situation
WS01	0.1	0.1	0.0001	1	0.7	0.0007	1
WS02	0.1	0.1	0.0001	1	0.7	0.0007	1
WS03	3.0	0.1	0.0030	1	4.8	0.144	2
WS04	0.1	0.1	0.0001	1	2.2	0.0022	1
WS05	12.2	0.1	0.0122	1	0.7	0.0854	2
WS06	0.1	0.1	0.0001	1	3.9	0.0039	1
WS07	0.1	0.1	0.0001	1	4.2	0.0042	1
WS08	0.1	0.1	0.0001	1	3.9	0.0039	1
WS09	0.1	0.1	0.0001	1	1.4	0.0014	1
WS10	0.1	0.1	0.0001	1	1.4	0.0014	1
BH01 Shallow	0.8	0.1	0.0008	1	2.1	0.0168	1
BH01 Deep	0.1	0.1	0.0001	1	0.6	0.0006	1
BH05 Shallow	0.1	0.1	0.0001	1	0.4	0.0004	1
BH05 Deep	0.1	0.1	0.0001	1	0.8	0.0008	1
BH06A Shallow	0.1	0.1	0.0001	1	2.1	0.0021	1
BH06A Deep	0.1	0.1	0.0001	1	2.2	0.0022	1
BH07 Shallow	0.1	0.1	0.0001	1	1.4	0.0014	1
BH07 Deep	0.1	0.1	0.0001	1	1.1	0.0011	1

9.7.3 Based on the Ground Gas Assessment it can be seen that the carbon dioxide conditions at the site are the main risk driver regarding the gas conditions. It is recommended that Characteristic Situation 2 gas protection measures are adopted for the development in line with BS8485:2015+A1:2019.

9.8 Ground Gases – Radon

- 9.8.1 Based on Maps in Appendix A of Building Research Establishment, 2015, „Radon: Guidance on protective measures for new buildings” the site is in an area where intermediate probability radon area (5-10% of properties at or above the action level). As such, basic protective measures against radon will be required.
- 9.8.2 Basic Protection: consists of a continuous Radon barrier across the whole footprint of the building, including the external walls.

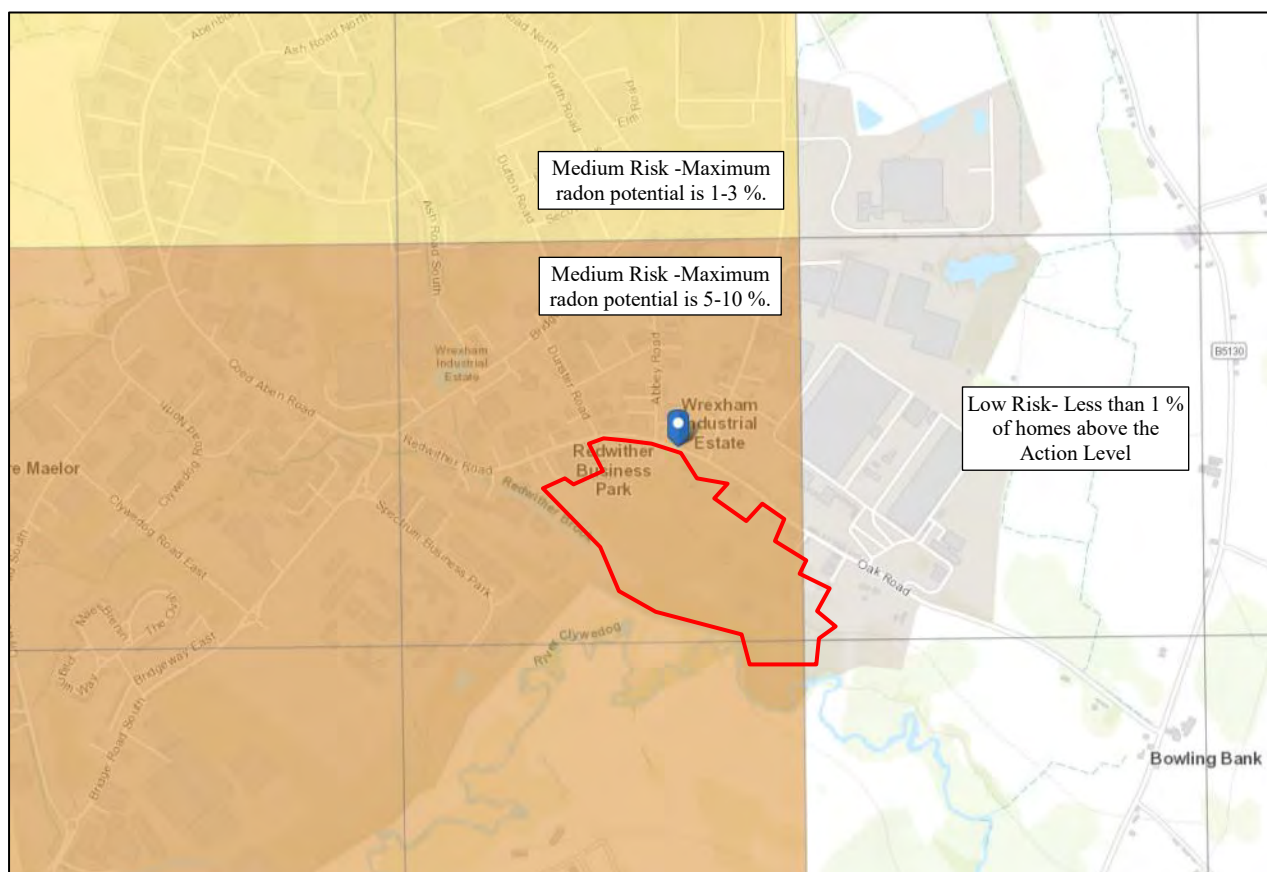


Figure 11: Extract of UK maps of radon
(<https://www.ukradon.org/information/ukmaps>)

9.9 Ground Gas Protection Measures

- 9.9.1 The development should be designed to meet the requirements of CS2 conditions. From BS8485:2015+A1:2019 Table 3 the new building can be classed as a Type D building (commercial/industrial) and would require a „score” of 1.5 points, as detailed in Tables 3 and 4 of BS8485:2015+A1:2019 (see Appendix K) .
- 9.9.2 BS8485:2015 does not give definitive measures; instead encourage developers to reach the maximum points via a combination of structural barriers, ventilation measures and lastly a gas membrane.
- 9.9.3 Due to the medium radon risk the developments will require basic radon protection. Basic Radon Protection should include a verified gas membrane as a minimum and will also be suitable to satisfy the requirements for CS2 requirements. The design and detailing of the ground gas protection measures should be carried out by an

appropriately experienced company and these should be approved in advance by the Local Authority and the warranty provider. The verification of the installation of the gas protection measures will be required and this should be in accordance with CIRIA C735 and BRE 414 (2001).

- 9.9.4 The Principal Contractor must ensure that the gas membrane is suitably protected from damage by follow on trades.

9.10 Updated Conceptual Site Model

- 9.10.1 The conceptual site model initially developed from the desk study and walk-over survey (Section 4.6) has been updated using the findings of the Phase 2 ground investigation.

- 9.10.2 The site investigation revealed the following general downward succession:

Site surface: Vegetated with discrete asphalt and concrete paths.

Topsoil (0.10 to 0.60 m thick). Present across majority of the site

Made Ground and reworked clay (0.20 to 3.00 m thick). Present across site

Glacial Till: Stiff slightly sandy slightly gravelly Clay across entire site. Proven to maximum depth of 15.00 m

Note – no alluvial deposits were encountered.

- 9.10.3 The results of the risk assessments indicate that there is no significant source of contaminants present at the site so there is a negligible risk to humans, ecology or archaeological receptors. One sample was identified to contain asbestos at a concentration below the laboratory quantification limit. Fly-tipped roof sheeting may contain ACM and should be removed from site. Protection measures will be required due to the potential risk from radon, which should also protect against Characteristic Situation 2 ground gas conditions. All below ground concrete should be designed to meet the requirements of ACEC Class AC-4. There is limited risk to controlled waters but remedial measures are required.
- 9.10.4 The risk assessments have concluded that no remediation measures are required to address risks to any potential receptors. However, as with any project on a Brownfield site there is the possibility of encountering unexpected contamination. If this occurs then the procedures set out in Appendix M should be implemented.

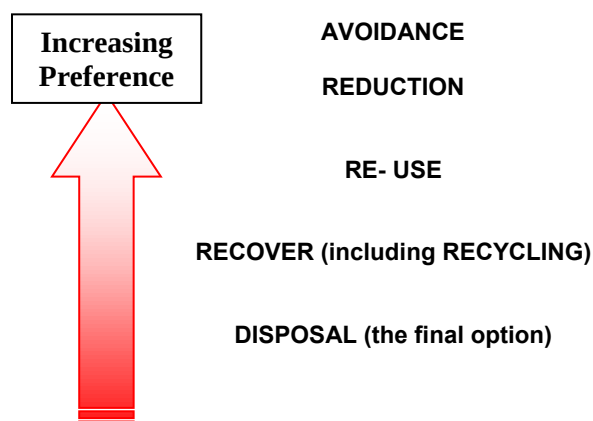
Ground Gas Protection Measures

- 9.10.5 From BS8485:2015 + A1:2019 Table 3 the new building can be classed as a Type D building (Commercial/industrial) and would require a „score“ of 1.5 points, as detailed in Tables 3 and 4 of BS8485:2015 of protection will be required for Characteristic Situation 2 ground gas conditions and will provide basic radon protection.

10. WASTE ASSESSMENT

10.1 Waste Hierarchy

- 10.1.1 In accordance with government guidance, it is required that the production and disposal of waste is managed in accordance with the following hierarchy of preference:



- 10.1.2 Site visits have indicated the presence of fly tipped material including suspected ACM across the site. It is recommended that this material will require quantification, separation into a number of waste types on site so as to enable recovery/recycling of materials to minimise off-site disposal.
- 10.1.3 As with most developments, there will be waste materials produced from excavations for drainage/services. Where possible, these arisings should be incorporated into soft landscaping with the arisings being separated into Made Ground and Glacial Till as they are excavated in order to facilitate the re-use.

10.2 Waste Characterisation and Classification

- 10.2.1 If there is a portion of excess soil this will then have to be sent to a suitable landfill site. A summary of current relatively complex guidance on categorising waste from earthworks is presented in Appendix N. A two phase approach is required comprising comprises:

- Waste Characterisation; and
- Waste Classification (Waste Acceptance Criteria).

Waste Characterisation

- 10.2.2 The results of the total concentrations from the chemical testing on soil samples have been assessed to determine whether or not they are hazardous in terms of waste classification.
- 10.2.3 An initial waste classification exercise of the Made Ground material analysed has been undertaken. Only one sample has been classified as hazardous. This is a sample of Made Ground from BH03 at 0.30m below ground level and is classified as hazardous due to its lead concentration of 4,010 mg/kg. As this is only one sample on the edge of the development area from 62 analysed samples, it is likely that this sample is insignificant. The material analysed from the same location at 1.00 m bgl is far below the threshold for hazardous waste, indicating that this is a localised issue. As mentioned

above, arisings should be separated as they are excavated in order to facilitate the re-use.

Waste Classification

- 10.2.4 In order to determine whether soils can be sent to a licensed landfill for disposal further testing is required comprising landfill Waste Acceptance Criteria (WAC) analysis for both total concentrations for certain chemicals and for leachate analysis. Four samples were analysed as part of this investigation. The assessment concluded that all four of the samples were suitable for disposal at an inert landfill.
- 10.2.5 All other Made Ground material on site is therefore likely to be classified as either inert or non-hazardous. It is expected that the majority of soil will be retained on site for landscaping and re-profiling. For any material that is removed, there are a number of sites which have Environmental Permits for site Reclamation and can accept certain categories of inert and non-hazardous wastes.
- 10.2.6 Note that the above assessment should only be seen as an initial guide. Defining the class of waste is carried out on the actual waste being disposed of and the destination landfill site will have the final decision on acceptability of the waste. Therefore, it is recommended that if soils are to be removed from the site, the appointed contractor should approach a landfill site with the available chemical data and seek a formal waste characterisation.

10.3 Materials Management and Reuse of Arisings On-site

- 10.3.1 When soil is excavated it is technically a waste and it is the responsibility of the holder of a material to form their own view on whether or not it is waste. This includes determining when waste that has been treated in some way can cease to be classed as waste for a particular purpose. Soils can only be re-used if it fulfils the following requirements:
- There is a planned use for the material;
 - There is planning permission for the proposed re-use;
 - The material when re-used will not be a risk to flora, fauna or controlled waters;
 - Appropriate procedures are followed to demonstrate the above criteria are met and the re-use of materials is recorded in a systematic way and appropriate permissions/permits are gained and relevant procedures followed.
- 10.3.2 As soil is technically a waste when it has been excavated, it cannot be re-used on site unless one of the following four procedures are implemented:
- the procedures are followed in the CL:AIRE Code of Practice „The Definition of Waste: Development Industry Code of Practice“ Version 2 (2011).“ If these procedures are followed, excavated arisings can be re-used without them being defined as waste “where it is certain that the material will be used for the purposes of construction in its natural state on the site from which it was excavated.” or:
 - the site registers a waste exemption with the Environment Agency in accordance with The Environmental Permitting (England and Wales) Regulations 2016 (as amended) so the material can be placed without an Environmental Permit (note that the rules for permit exemptions have been

changed and the maximum quantity covered by a permit exemption for re-using soil is 1,000 T), or;

- the site applies for a full Environmental Permit (either a standard rules permit or a bespoke permit) from the Environment Agency under the Environmental Permitting (England and Wales) Regulations 2016 (as amended); or
- WRAP „Quality Protocol: Aggregates from inert waste.“ Only granular aggregates (e.g. Class 1 or Class 6 materials etc. apply, Class 2 materials are not covered by the WRAP Protocol).

10.3.3 The length of time taken for the above regimes also need to be considered:

- CL:AIRE Code of Practice (CoP) takes between 7 and 28 days to gain approval and fees of £40.00 plus £0.01 per m³ of soil used is payable to CL:AIRE;
- An Environmental Permit exemption typically takes up to 7 days to gain approval and there are no fees due;
- Allow a minimum of 12 weeks to develop a Waste Recovery Plan and gain approval or the Environmental Permit from the Environment Agency and there are significant costs preparing an application and for the fees payable to the Agency (typically in excess of £7,000) for the permit.
- There are no fees to pay for the WRAP Aggregates protocol and there are no notice periods or statutory liaison required.

10.3.4 TerraConsult recommend that the CL:AIRE CoP is implemented for this development and a Materials Management Plan is used for the site to allow the re-use of soils at the site.

11. GEOTECHNICAL ASSESSMENT & RECOMMENDATIONS

11.1 Fieldwork and Laboratory Data Review

- 11.1.1 In general there was only a thin coverage of Topsoil with Made Ground beneath it ranging from 0.60 to 3.00 m thick. The Made Ground generally consists of gravelly clay or reworked natural Glacial Till, which is excess construction material placed over the site from adjacent sites. Locally there is sandy mudstone gravel (burnt oil shale). The Made Ground is not appropriate for use as a founding material.
- 11.1.2 Glacial Till has been encountered below the Made Ground in all areas of the site proven to 15.0m. The Glacial Clay is generally stiff slightly sandy slightly gravelly clay. No granular lenses were recorded within the Glacial Till, though laminations were noted at depth.
- 11.1.3 During this site investigation, the proposed development area changed. Due to this change, BH05 is now located outside of the development area. The results from BH05 will not be considered further in this section.
- 11.1.4 The natural clay is suitable for foundations but with varying materials across the site the design will have to take into account variable allowable bearing pressures and differing rates of settlement across the site.
- 11.1.5 Due to the presence of clays and a range of trees present, the depth of desiccation and the volume change potential of the clays will have to be considered in the design. The classification test results on the clay strata are summarised below:

Table 15: Summary of Plasticity Tests									
Hole	Depth (m)	Moisture Content (%)	% passing 425um sieve	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index	Modified Plasticity Index	Plasticity	Volume Change Potential
BH01	3.00	20	95	48	23	25	23.8	Intermediate Cl.	Medium
BH02	1.20	22	100	51	24	27	27.0	High plasticity CH.	Medium
	5.00	22	100	45	22	23	23.0	Intermediate Cl.	Medium
	11.00	24	91	48	24	24	21.8	Intermediate Cl.	Medium
	14.00	25	95	50	26	24	22.8	Intermediate Cl.	Medium
BH03	1.20	25	100	56	25	31	31.0	Intermediate Cl.	Medium
	3.00	20	100	46	22	24	24.0	Intermediate Cl.	Medium
BH04	1.20	22	98	47	23	24	23.5	Intermediate Cl.	Medium
	5.00	24	97	49	24	25	24.3	Intermediate Cl.	Medium
BH06A	3.00	24	100	47	23	24	24.0	Intermediate Cl.	Medium
	5.00	25	100	48	23	25	25.0	Intermediate Cl.	Medium
	11.00	25	92	48	24	24	22.1	Intermediate Cl.	Medium
BH07	8.00	23	90	48	25	23	20.7	Intermediate Cl.	Medium
	8.00	21	97	45	22	23	22.3	Intermediate Cl.	Medium
	14.00	28	94	59	27	32	30.1	High plasticity CH.	Medium
Minimum		19	90	45	22	23	20.7	Intermediate Cl.	-
Average		23.3	96.6	49.0	23.8	25.2	24.4	Intermediate Cl.	Medium
Maximum		28	100	59	27	32	31.0	High plasticity CH.	-

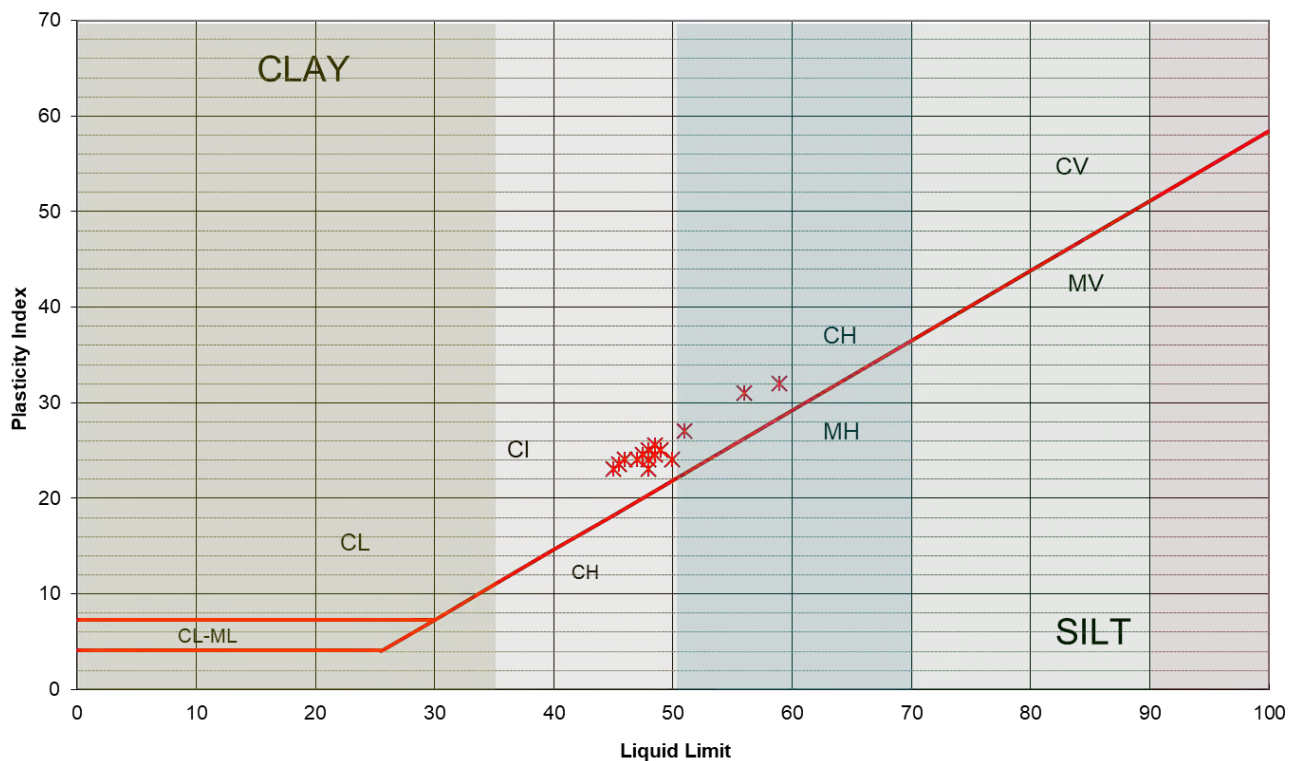


Figure 12: Plasticity Chart

- 11.1.6 The moisture content within the Glacial Clay varies between 19% and 28%, however typically within the range of 20% to 25% (See figure below). The moisture contents are generally lower than the plastic limits. The classification testing has shown intermediate to high plasticity and medium volume change potential.
- 11.1.7 Figure 13 below shows moisture content plotted against depth. The results show generally consistent moisture contents and there is no significant trend with depth.

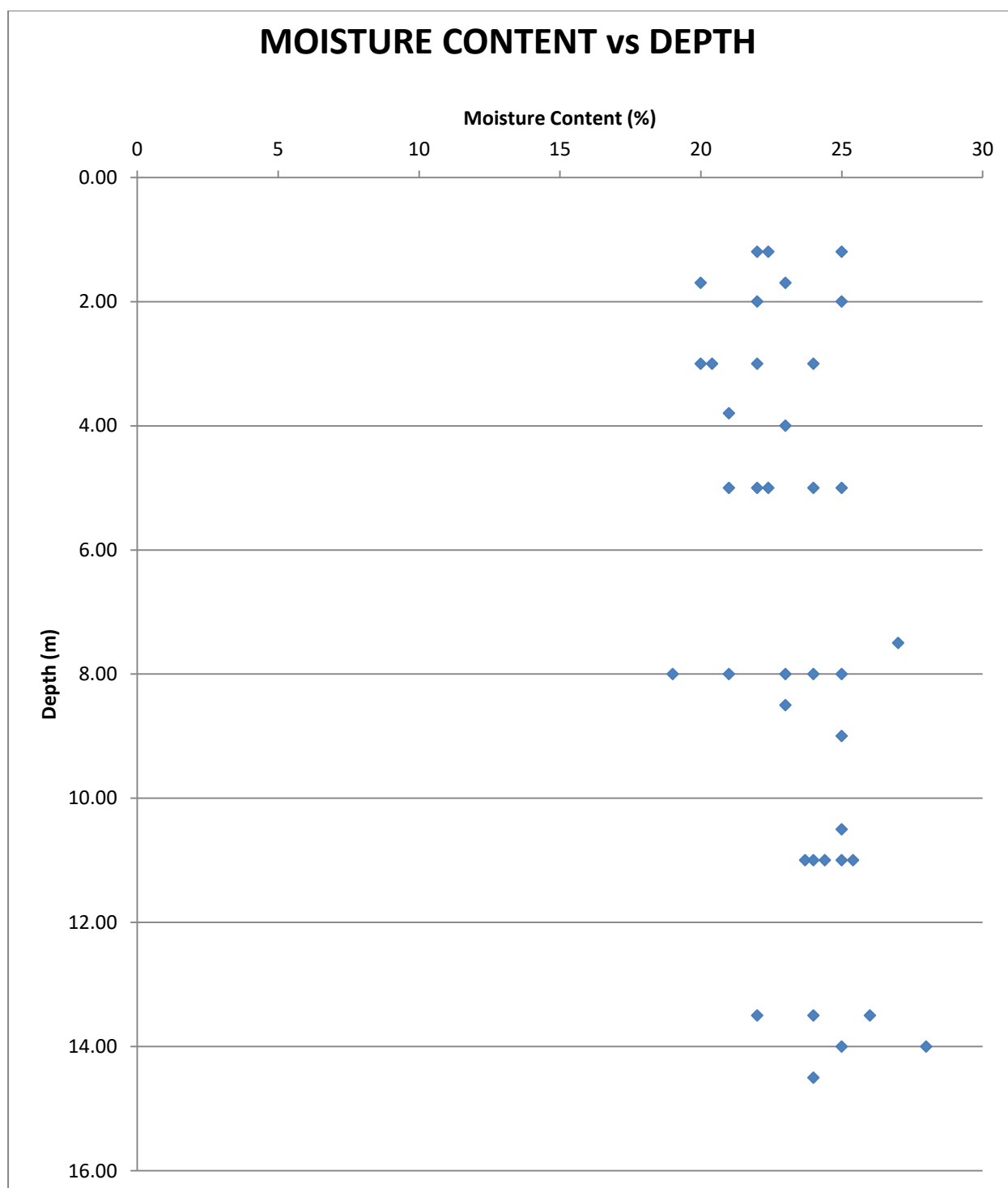


Figure 13: Moisture Content vs Depth Graph

11.1.8 SPT N-values were recorded throughout each borehole and are summarised below. The N-values have been corrected to the standard Energy Ratio of 60% and are therefore reported below as N_{60} values:

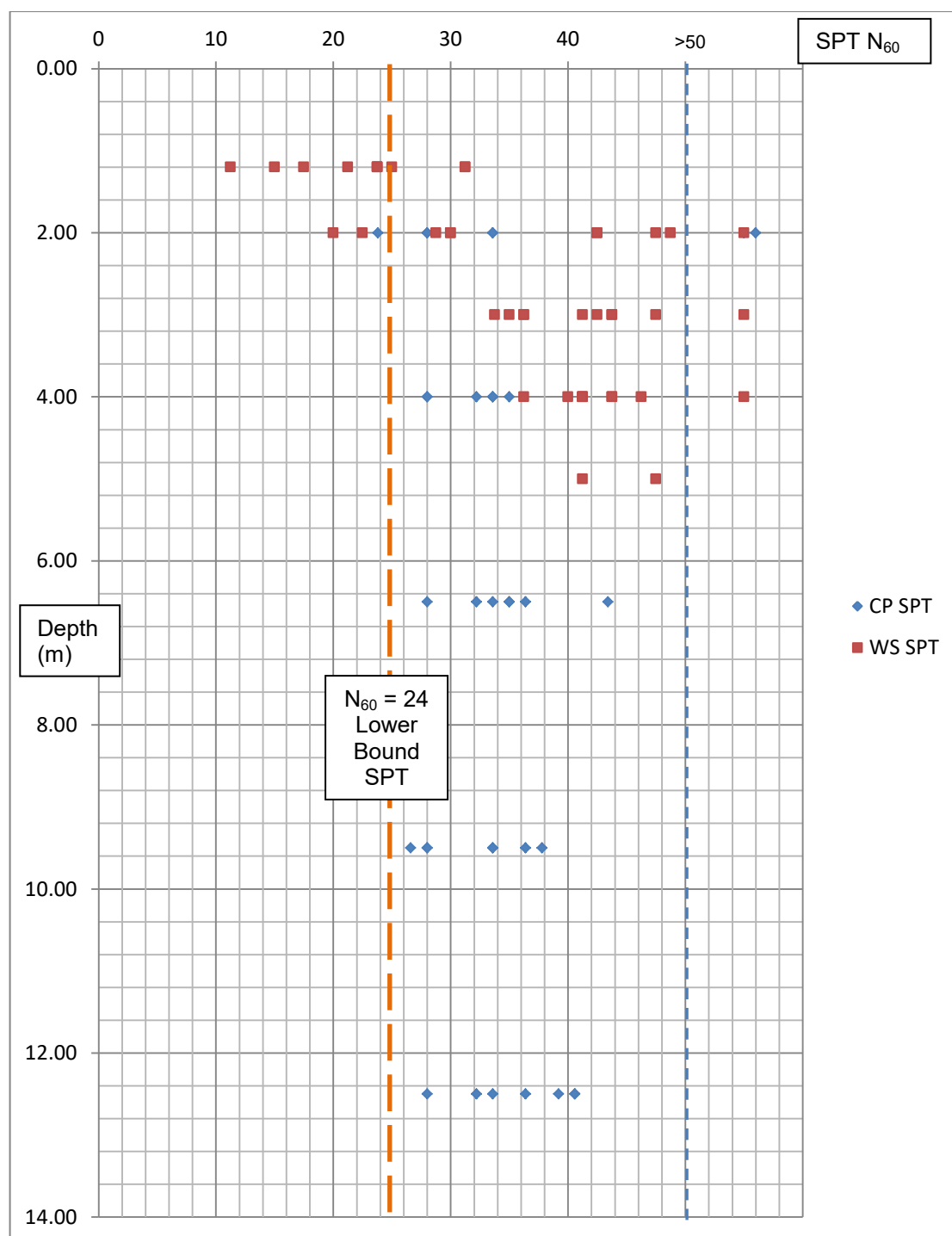


Figure 14: SPT N₆₀ vs Depth Graph

11.1.9 The SPT N₆₀ graph shows a greater variation within the top 4.0m. This is likely to be caused by the variation in thickness within the Made Ground (reworked Clay) and a possible desiccation of the top of the Glacial Till.

11.1.10 The SPT N₆₀ between 4.0m to 12.5m is generally consistent varying between 28 and 40.

11.1.11 Undrained triaxial testing was completed on 20 samples to determine the strength of the Glacial Till at depth. These are presented in Table 16 below.

Table 16: Summary of Undrained Shear Strength Testing							
Hole	Depth (m)	Moisture Content (%)	Bulk Density (Mg/m³)	Dry Density (Mg/m³)	Shear Strength (kPa)	Mode of failure	Strength
BH01	3.00	20	2.13	1.77	195	Brittle	Very High
	8.00	19	1.99	1.67	161	Plastic	Very High
BH02	1.20	22	2.09	1.70	123	Brittle	High
	5.00	22	2.06	1.69	108	Plastic	High
	8.00	24	2.05	1.65	59	Plastic	Medium
	11.00	24	2.05	1.65	69	Plastic	Medium
	14.00	25	2.07	1.66	89	Plastic	High
BH03	1.20	25	1.98	1.59	91	Plastic	High
	3.00	20	2.07	1.72	148	Plastic	High
	5.00	21	2.08	1.72	173	Plastic	Very High
	11.00	24	2.00	1.62	118	Plastic	High
BH04	1.20	22	2.05	1.68	121	Plastic	High
	5.00	24	2.03	1.63	107	Plastic	High
	11.00	24	2.02	1.63	104	Plastic	High
BH06A	3.00	24	2.01	1.63	69	Plastic	Medium
	8.00	25	2.02	1.61	120	Plastic	High
	11.00	25	2.09	1.67	71	Plastic	Medium
BH07	3.00	22	2.07	1.70	95	Plastic	High
	5.00	22	2.11	1.73	81	Plastic	High
	8.00	23	2.10	1.72	142	Plastic	High
	11.00	25	2.06	1.64	60	Plastic	Medium
	14.00	28	1.97	1.54	75	Plastic	High

- 7.1.1 The results from the triaxial testing generally show a greater variability in the soil strength than the SPT N values. The triaxial tests results range from medium strength to high strength. Laminations have been recorded within the Glacial Till, however the variation / reduction in soil strength does not correlate with the laminations. Some of the higher strengths at shallower depths (down to 3.0m) are due to desiccation from tree roots.
- 7.1.2 On the following graph the shear strength derived from the lower bound SPT N₆₀ value of 24 is presented based on a correlation factor of $4.5 \times N_{60}$. The triaxial test results at a depth greater than 10 m are lower than expected based on the moisture contents and SPT N-values and these lower triaxial test results are thought to be due to sample disturbance. It is suggested that the lower bound SPT N-value profile of N = 24 is used for design purposes correlating to an undrained shear strength of 108 kPa which is constant with depth.

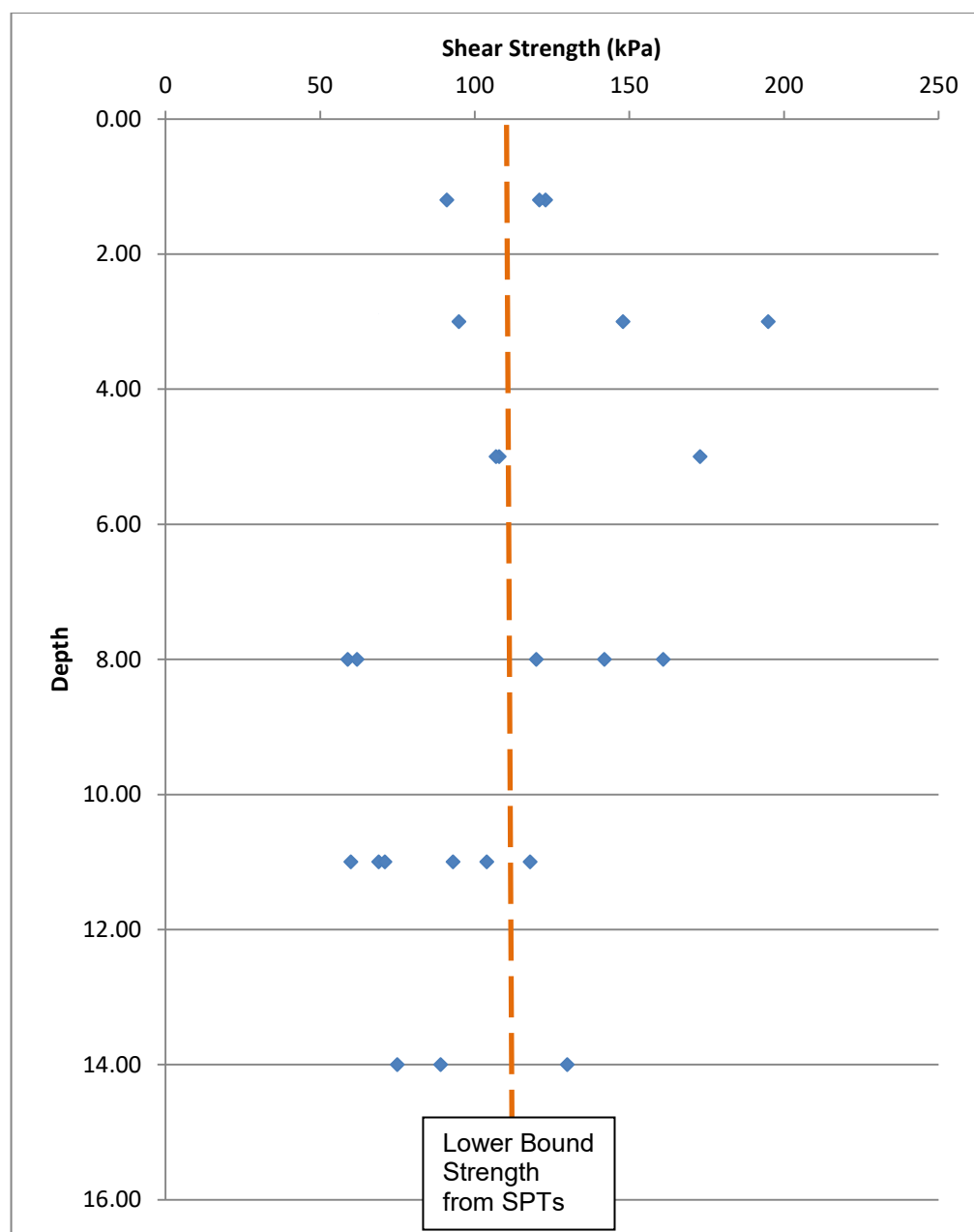


Figure 15: Shear Strength vs Depth Graph

11.2 Trees

- 11.2.1 Numerous mature trees and shrubs are located on the site. A comprehensive tree survey of those trees within the development area boundary, and up to 20m beyond the site boundary (assuming mature high water demand trees are not present along the boundary) will be required to determine the effect of existing trees to proposed properties and also to assess the condition of trees which are to remain.
- 11.2.2 Care must be taken to ensure that any existing trees scheduled for retention are not adversely affected by construction operations. Further guidance on this aspect of site works is given in the British Standards "Guidance for Trees in Relation to Constructions", BS5837.

11.3 Foundation Recommendations

11.3.1 The proposed development is for commercial warehouse units. The current proposed development is shown below.

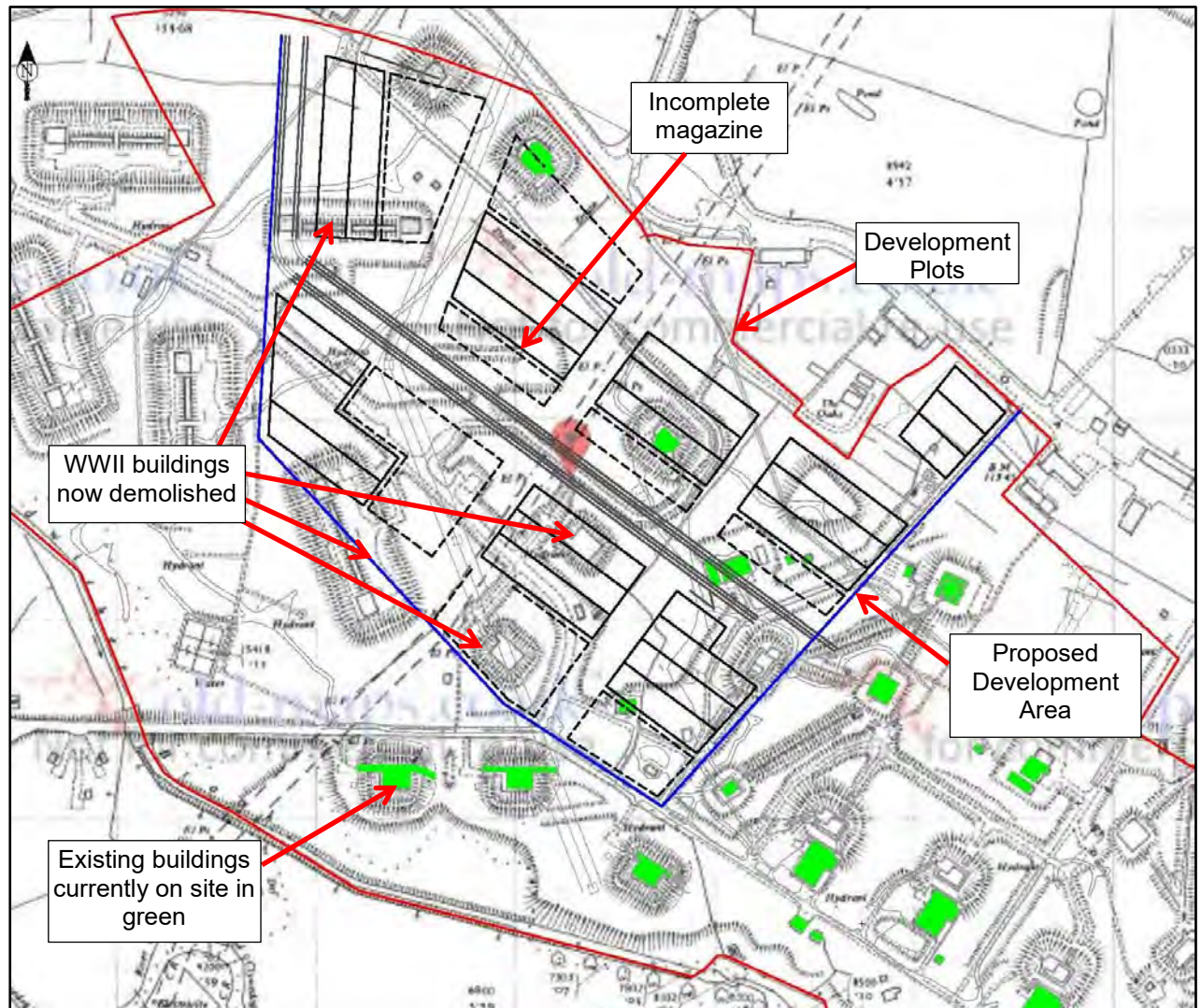


Figure 16: Historical Mapping and Development Plan Overlay

- 11.3.2 Figure 16 shows the WWII buildings located within the proposed development areas. The buildings in green still remain on the site. All other buildings have been removed from the site.
- 11.3.3 Concrete obstructions were encountered within BH6, TP3 and TP8. These may represent relict WWII underground structures. Due to the site history, the possibility of encountering further obstructions during the redevelopment cannot be ruled out.
- 11.3.4 The site will require reprofiling prior to construction and all obstructions shall be removed. No reprofiling plan has been provided at this stage. Upon completion of the final development externals drawing (which includes regrading proposals, retaining measures and slab levels), a plot specific foundation assessment will be required.
- 11.3.5 Based on the anticipated structural loadings and given a lower bound undrained shear strength of 108 kPa then pad foundations in the top of the natural clays should be

appropriate with allowable bearing pressures in the range 150 to 200 kPa depending on the depth and size of footings. The depth of footings will have to take into account the depth of Made Ground, possible obstructions from the WWII structures indicated in Figure 16 and the depth of desiccation from tree roots.

- 11.3.6 When footings have been initially sized and the required depths have been assessed then then full design should be carried out in accordance with BS EN 1997-1: 2004 +A1 2013: Eurocode 7 – Geotechnical Design – Part 1: General rules (including UK National Annex of November 2007) and BS8004: 2015 : Code of practice for foundations.
- 11.3.7 As an alternative to the spread footings, a stiffened raft foundation may be appropriate. If unexpectedly high column loads are required or for certain types of machine bases or other heavily loaded structures then piles may be required. If piles are required then additional deep boreholes are likely be required for the design these piles.

11.4 Groundwater & Excavations

- 11.4.1 There is localised very shallow perched water present at this site at a depth of 0.2 to 1.0m but it should be possible to control this relatively easily with sump pumping as most of the ground is a clay but localised inflows will occur from the more gravely Made Ground. If inflows are relatively localised, this may cause softening of the ground and require localised excavation support in order to prevent instability of the sides of excavations.
- 11.4.2 Whilst there is localised very shallow perched groundwater, in many locations the groundwater in wells 3 to 5 m deep is at a depth of more than 2.0 m. In deeper wells down to 15 m depth the groundwater varies in four wells from about 4.3 m to 11.4 m. the It is anticipated that any groundwater in excavations can be controlled by sump pumping.
- 11.4.3 Excavations through the soils to a depth of about 2.0m should be stable in the short term (up to 3 to 4 hours). All excavations should be carried out in accordance with CIRIA Report 97 “Trenching Practice” and BS6031: 2009: Code of Practice for Earthworks. Further guidance on this aspect of site works is given in the British Standards for “Workmanship on Building Sites”, BS 8000, Parts 1 and 14, and in the Construction Industry Training Board’s Site Safety Note 10.

11.5 Buried Concrete and Pipework

- 11.5.1 The results of laboratory pH and sulphate content indicate that ACEC Class AC-4 conditions prevail in accordance with BRE Special Digest 1, 2005 (the Design Concrete Class).

11.6 Drainage

Soakaways

- 11.6.1 Two soakaway BRE365 tests were carried out within the Made Ground – reworked Glacial Clay.

Table 17: Summary of Soakaway tests BRE Digest DG 365: 2016			
Location	Base of Test (m bgl)	Stratum	Soil infiltration rate, f
SA01	2.30	MG – Reworked Glacial Clay	Water drained 0.09m after 180mins
SA02	2.25	MG – Reworked Glacial Clay	Water failed to drain after 180mins

- 11.6.2 Both test failed to drain after 180mins and therefore it is considered that soakaway drainage are not suitable to be used on site. Given that the majority of the ground is clay, the soakaway test results are as expected from the soil descriptions.

11.7 Road Design

- 11.7.1 The results of the eleven CBR tests carried out across the site using the Transport Research Lab (TRL) Dynamic Cone Penetrometer (DCP) are summarised in Table 20.
- 11.7.2 The measured CBR values are relatively variable across the site with different strata. The results of DCP 06 have been excluded as the test encountered a refusal at approximately 0.35 m bgl.

Table 18: Summary of CBR Values across the site

Hole No	Depth (m)	CBR Value Ranges (%)				CBR Value Layer Average (%)
		Topsoil	Made Ground	Reworked Clay	Glacial Till	
DCP 01	0.14 - 0.47	3.4 - 8.6	-	-	-	5.9
	0.47 - 0.55	-	-	10.5 - 12.7	-	11.4
	0.55 - 0.64	-	-	-	23.9 - 38.6	28.6
	0.64 - 0.99	-	-	-	4.7 - 18.6	8.4
DCP 02	0.17 - 0.25	3.0	-	-	-	3.0
	0.25 - 0.97	-	-	2.0 - 7.5	-	5.3
DCP 03	0.10 - 0.24	2.8 - 4.7	-	-	-	3.7
	0.24 - 0.97	-	4.5 - 7.7	-	-	6.2
DCP 04	0.10 - 0.70	-	4.8 - 12.1	-	-	6.9
	0.70 - 0.72	-	26.5 - 100	-	-	>100
DCP 05	0.10 - 0.97	-	-	3.1 - 9.3	-	4.8
DCP 07	0.11 - 0.58	-	2.5 - 4.0	-	-	3.1
	0.58 - 0.96	-	3.9 - 9.6	-	-	7.1
DCP 08	0.13 - 0.31	1.7 - 4.9	-	-	-	3.3
	0.31 - 0.97	-	-	3.4 - 17.3	-	7.3
DCP 09	0.08 - 0.33	2.6 - 9.6	-	-	-	5.6
	0.33 - 0.36		23.6 - 29.6			27.7
	0.36 - 0.59	-	4.8 - 17.3	-	-	12.4
	0.59 - 0.95	-	-	5.4 - 12.7	-	7.2
DCP 10	0.09 - 0.41	2.9 - 5.7	-	-	-	3.8
	0.41 - 0.95	-	4.6 - 8.3	-	-	6.0
DCP 11	0.10 - 0.33	2.5 - 6.5	-	-	-	5.0
	0.33 - 0.47	-	14.2 - 45.4	-	-	26.6
	0.47 - 0.92	-	-	-	4.4 - 8.3	6.1
Average CBR value across site (%)		4.3	12.0	7.2	14.4	

11.7.3 There is the potential for significant re-profiling of the site as part of the new development. The overall performance of any hard standing will be determined by the weaker areas. Therefore based upon the nature of the ground conditions encountered during the site investigations undertaken including both the CBR testing and the plasticity test results, it is recommended that a lower bound CBR value of 3% is adopted for design purposes. If improvement measures such as lime or cement stabilisation were adopted then considerably higher CBR values would be appropriate and this sub-grade improvement may prove to be more economic than using thicker sub-base materials as there will be less excavated material and a thinner sub-base. The design of soil stabilisation should take into account the presence of sulphates at the site. All exposed formations should be proof rolled and any soft spots revealed should be excavated and replaced with suitable compacted granular fill.

11.8 Proposals for Further Geotechnical Investigation

- 11.8.1 The site will require re-profiling prior to construction, however no detail plan has been provided at this stage. Upon completion of the final development plans and vegetation clearance, additional investigation should be carried out for plot specific foundation assessments. This will need to determine the depth of Made Ground and the presence of any remnant obstructions from former WWII structures.

12. CONCLUSION

12.1 Ground Profile

12.1.1 The site investigation revealed the following general downward succession:

Site surface: Vegetated with discrete asphalt and concrete paths.

Topsoil (0.10 to 0.60 m thick). Present across majority of the site.

Made Ground: Present across site - mainly reworked clay (0.20 to 3.00 m thick), locally sandy gravel of burnt oil shale present.

Glacial Till: Present across entire site. Proven to maximum depth of 15.00 m bgl.

12.1.2 The site is highly vegetated and the topography is undulating. Gaining access, particularly for the cable percussion boreholes was not possible in all areas and was limited to areas adjacent to the access routes.

12.2 Environmental Risk Assessment

12.2.1 A preliminary risk assessment has previously been carried out based on the contaminant-pathway-receptor model as defined in Statutory Guidance to Part IIA of the Environment Protection Act, 1990, and in accordance with BS 10175: 2011 +A2 2017 "Investigation of Potentially Contaminated Sites – Code of Practice". In order to make a more detailed assessment of the potential hazards this Phase 2 intrusive investigation presents a more comprehensive conceptual ground model of the site. This presents details of the characteristic ground conditions and has assisted with identifying the potential contaminants of concern, the potential receptors of the contamination and the potential pathways between them.

12.2.2 The results of the risk assessments indicate that there is no significant source of contaminants present at the development site so there is a negligible risk to all receptors including humans, Controlled Waters and ecological receptors. Whilst it is assessed that there is no significant contaminant source at the site it should be noted that:

- There are locally slightly elevated concentrations of a few potential contaminants but it is assessed that these do not pose a risk to controlled Waters. It is recommended that this assessment is agreed with NRW.
- Basic protection measures are required with respect to ground gases (carbon dioxide) and radon for the development with radon being the principal driver for the ground gas design.
- There is one limited area of potential asbestos containing fly-tipped material near the northern boundary, which will require removing from site.

12.2.3 The risk assessments have concluded that no remediation measures are required to address risks to any potential receptors other than the ground gas risk and the one limited area of asbestos. However, as with any project on a Brownfield site there is the possibility of encountering unexpected contamination. If this occurs then the procedures set out in Appendix M should be implemented.

12.3 Geotechnical Design

- 12.3.1 The site will require re-profiling prior to construction and all obstructions shall be removed. No re-profiling plan has been provided at this stage. Upon completion of the final development external drawing (which includes regrading proposals, retaining measures and slab levels), a plot specific foundation assessment will be required.
- 12.3.2 Based on the anticipated structural loadings and given a lower bound undrained shear strength of 108 kPa then pad foundations in the top of the natural clays should be appropriate with allowable bearing pressures in the range 150 to 200 kPa depending on the depth and size of footings. The depth of footings will have to take into account the depth of Made Ground, possible obstructions from the WWII structures indicated in Figure 16 and the depth of desiccation from tree roots.
- 12.3.3 As an alternative to the spread footings, a stiffened raft foundation may be appropriate. If unexpectedly high column loads are required or for certain types of machine bases or other heavily loaded structures then piles may be required. If piles are required then additional deep boreholes are likely to be required for the design of these piles.
- 12.3.4 Below ground concrete structures are potentially at risk in areas of elevated sulphates and where there is low pH. An assessment of the soil and groundwater data (following the protocol established in BRE Special Digest 1, 2005) indicates that ACEC Class AC-4 conditions prevail. Therefore, special precautions are required at the site for the design of concrete in terms of the durability and structural performance. A second round of groundwater sampling and analysis is suggested in order to confirm this analysis.

12.4 Proposals for Further Geotechnical Investigation

- 12.4.1 The site will require re-profiling prior to construction, however no detail plan has been provided at this stage. Upon completion of the final development plans and vegetation clearance, additional investigation should be carried out for plot specific foundation assessments. This will need to determine the depth of Made Ground and the presence of any remnant obstructions from former WWII structures. This work can be carried out after gaining planning permission.

12.5 Health and Safety

- 12.5.1 As outlined within the HSE publication "Successful Health and Safety Management – HSG65" this report should inform your development of safe systems of work and information as an input into the safety management system. The contents of this report may be used to supplement the contents of the Health and Safety File as required under the Construction Design and Management (CDM) Regulations 2015. All risk control measures should be in accordance with the guidelines laid down within the Management of Health and Safety at Work Regulations 1999.
- 12.5.2 In accordance with the Construction Design and Management (CDM) Regulations 2015, TerraConsult has acted in the role of Principal Contractor and as Principal Designer for the works as described in this report. With issue of this report TerraConsult has discharged and completed all contractual and legal requirements for these positions and we have no further involvement with the project.

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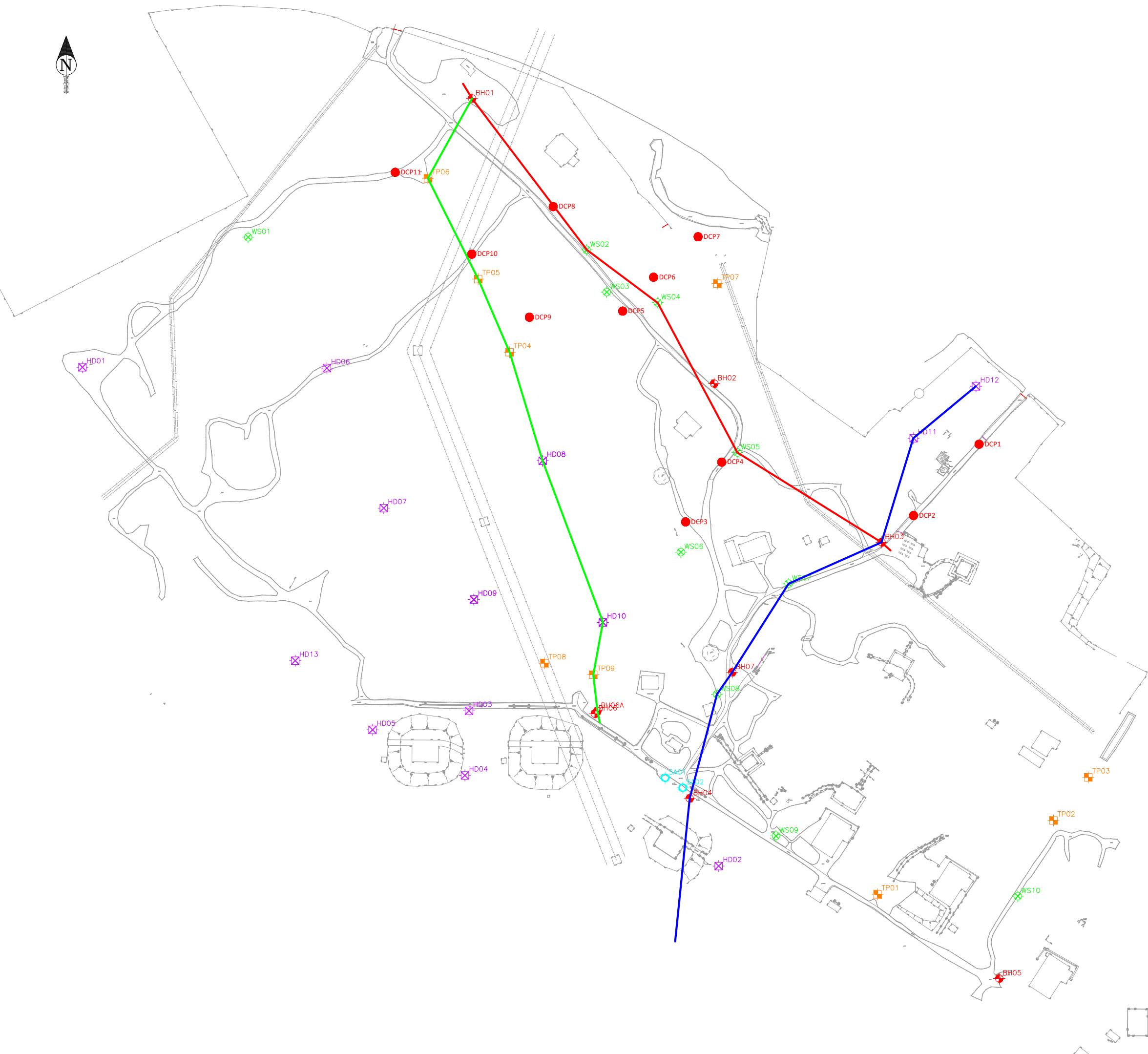
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DRAWINGS

List of Drawings

4292/1/001	Site Investigation Location Plan
4292/1/002	Site Investigation Location Plan with Development Plan
4292/1/003	Site Investigation Location Plan with Historic Mapping and Development Overlay
4292/1/004	Section 1
4292/1/005	Section 2
4292/1/006	Section 3

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Notes

1. Survey information based on data provided by J 10 Planning. Drawing ref OWI-TCL-VTO-XX-DR-D-0001 TopographicalSurvey.dwg
2. Do not scale
3. All dimensions are in millimetres and all levels are in metres above Ordnance Datum.
4. Any anomalies on this drawing should be brought to the attention of TerraConsult Limited.

Key

- Borehole
- Shell and Auger
- Window Sample
- Trial Pit
- Hand Dug
- Dynamic Cone Penetration
- Section1
- Section2
- Section3

TerraConsult

Bold Business Centre, Bold Lane,
Sutton, St Helens WA9 4TX

Client

Cefn Park
Developments

Site

Oak Road Wrexham

Title

Site Investigation Location
Plan

Scale	1:1,000	@ A1
Drawing No.	4292/1/001	
Rev	Date	Description
A	29/03/19	Additional TPS added HD06 to HD13
File	4292.1.001 SI Location Plan.dwg	
Date	03/19	Engineer JT
Drawn	OS	Checked DRAFT



Notes

- 1. Survey information based on data provided by J 10 Planning. Drawing ref OWI-TCL-VTO-XX-DR-D-0001 TopographicalSurvey.dwg
- 2. Do not scale
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Key

- Borehole
- Shell and Auger
- Window Sample
- Trial Pit
- Hand Dug

TerraConsult

Bold Business Centre, Bold Lane,
Sutton, St Helens WA9 4TX

Client

Cefn Park
Developments

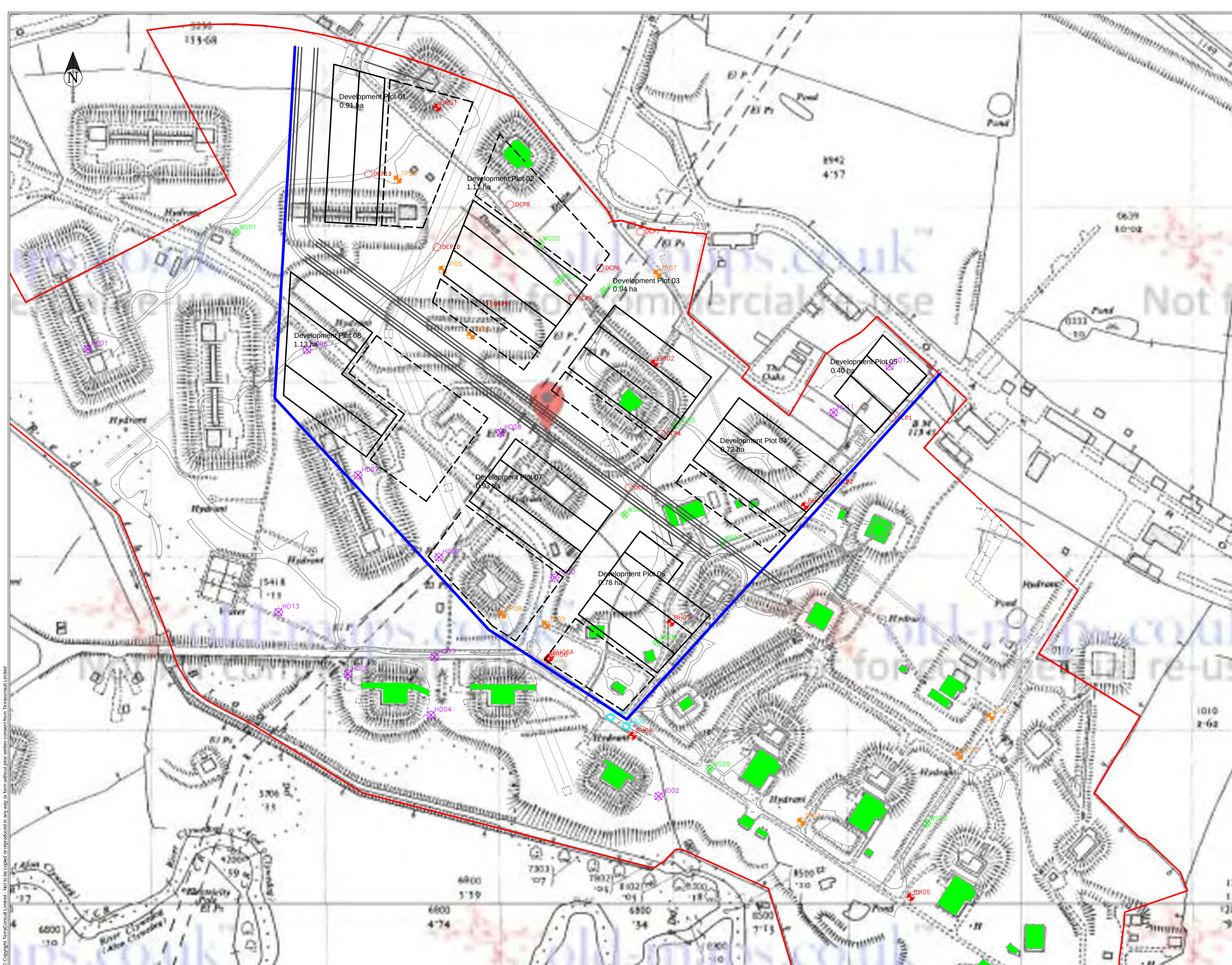
Site

Oak Road Wrexham

Title

Site Investigation Location
Plan with development plan
overlay

Scale	1:1,000	@ A1
Drawing No.	4292/1/002	
Rev	Date	Description
A	29/03/19	Additional TPS added HD06 to HD12
B	20/05/19	Updated Development Plan
File	4292.1.002 SI Location Plan With Development Plan.dwg	
Date	05/19	Engineer JT
Drawn	OS	Checked Final



- Notes
1. Survey information based on data provided by J 10 Planning. Drawing ref OWI-TCL-VTO-XX-DR-D-0001 TopographicalSurvey.dwg
 2. Do not scale
 3. All dimensions are in millimetres and all levels are in metres above Ordnance Datum.
 4. Any anomalies on this drawing should be brought to the attention of TerraConsult Limited.

- Key
- Borehole
 - Shell and Auger
 - Window Sample
 - Trial Pit
 - Hand Dug
 - Dynamic Cone Penetration
 - Overall Site Area
 - Development Area
 - Current Buildings

TerraConsult

Bold Business Centre, Bold Lane,
Sutton, St Helens WA9 4TX

Client

**Cefn Park
Developments**

Site

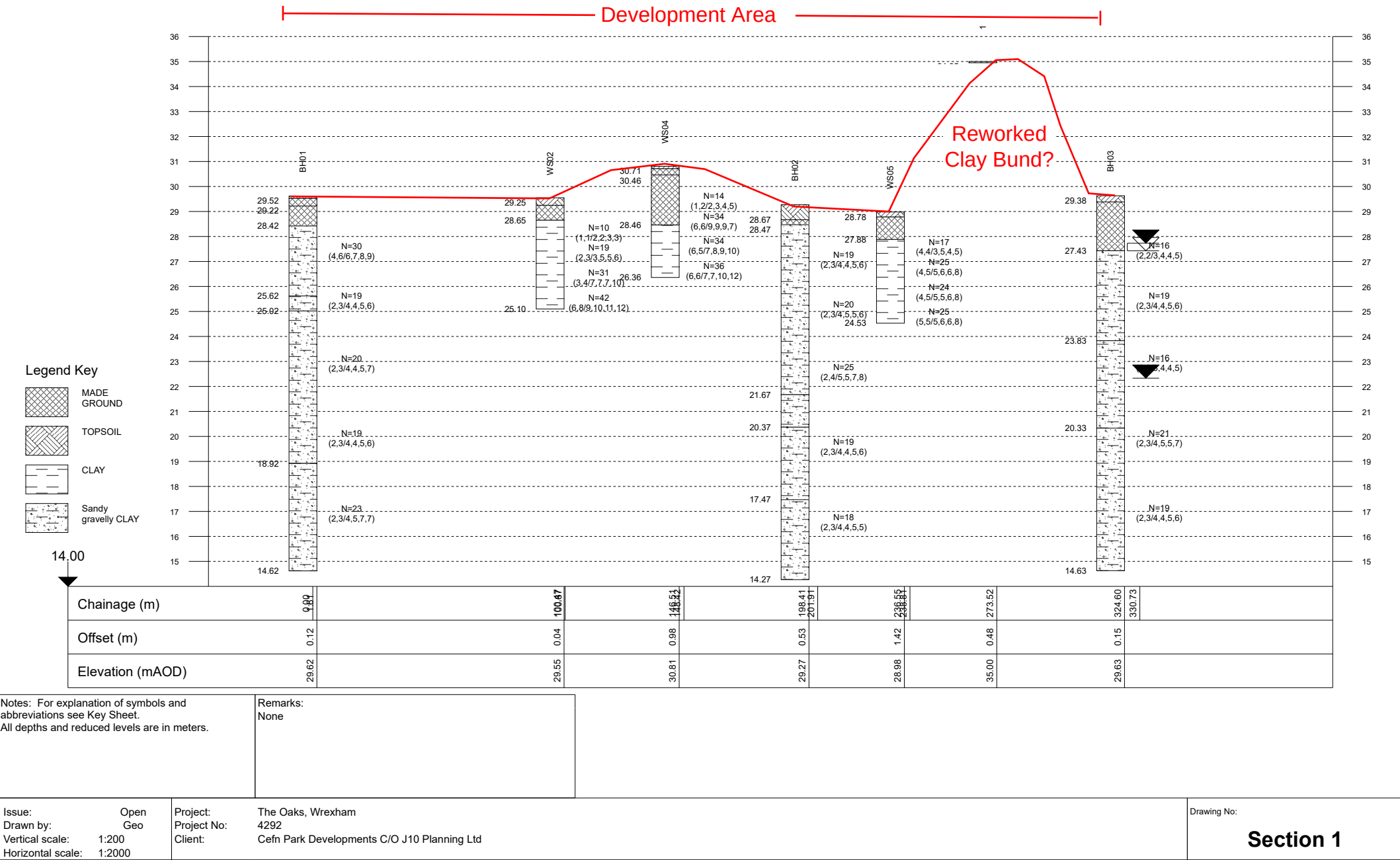
Oak Road Wrexham

Title

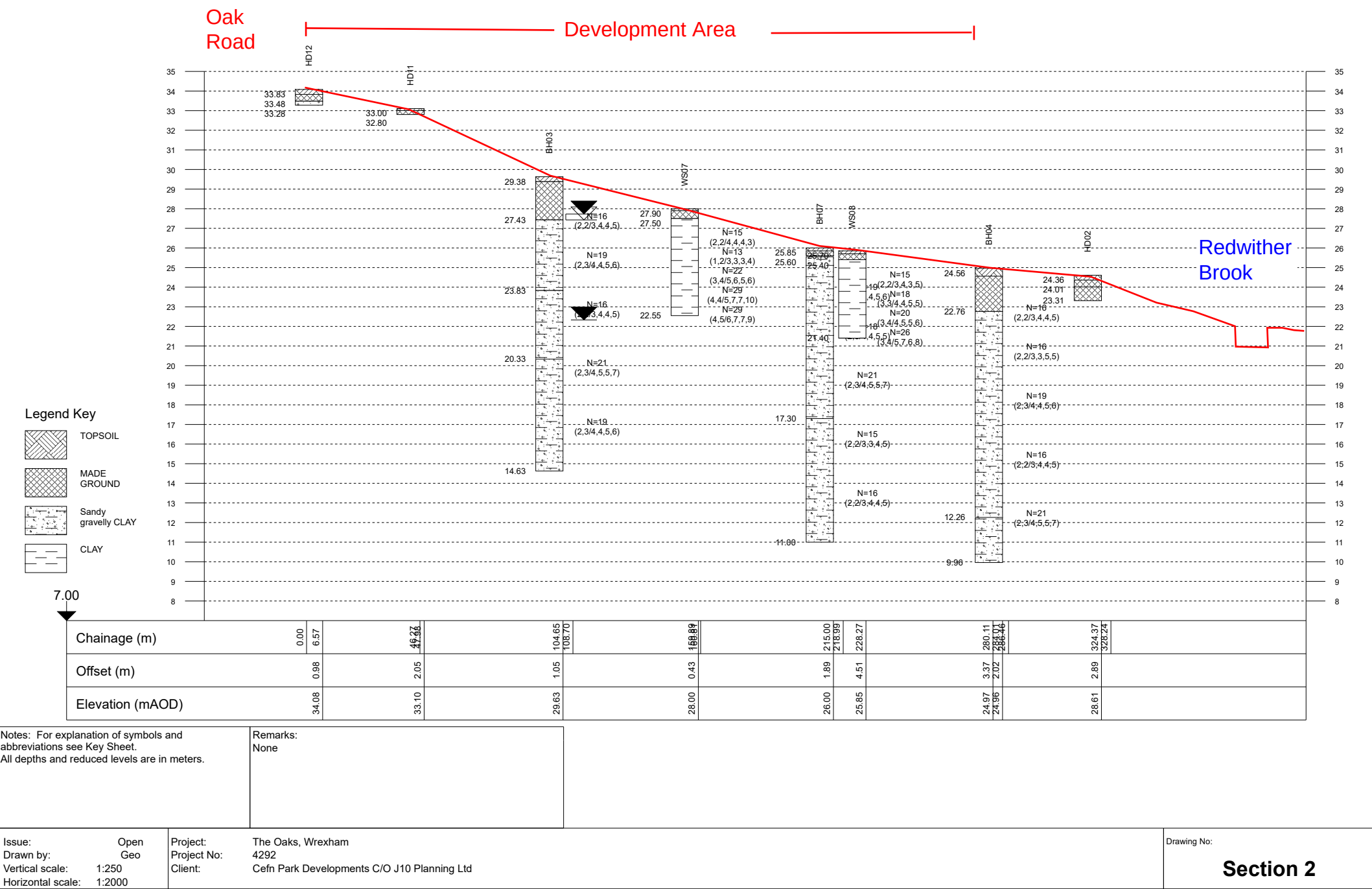
**Site Investigation Location
Plan with historical mapping
& Development overlay**

Scale	1:1,000	@ A1
Drawing No.	4292/1/003	
Rev	Date	Description
File	4292.1.003 SI Location Plan With Historical Overlay.dwg	
Date	04/19	Engineer JT
Drawn	OS	Checked DRAFT

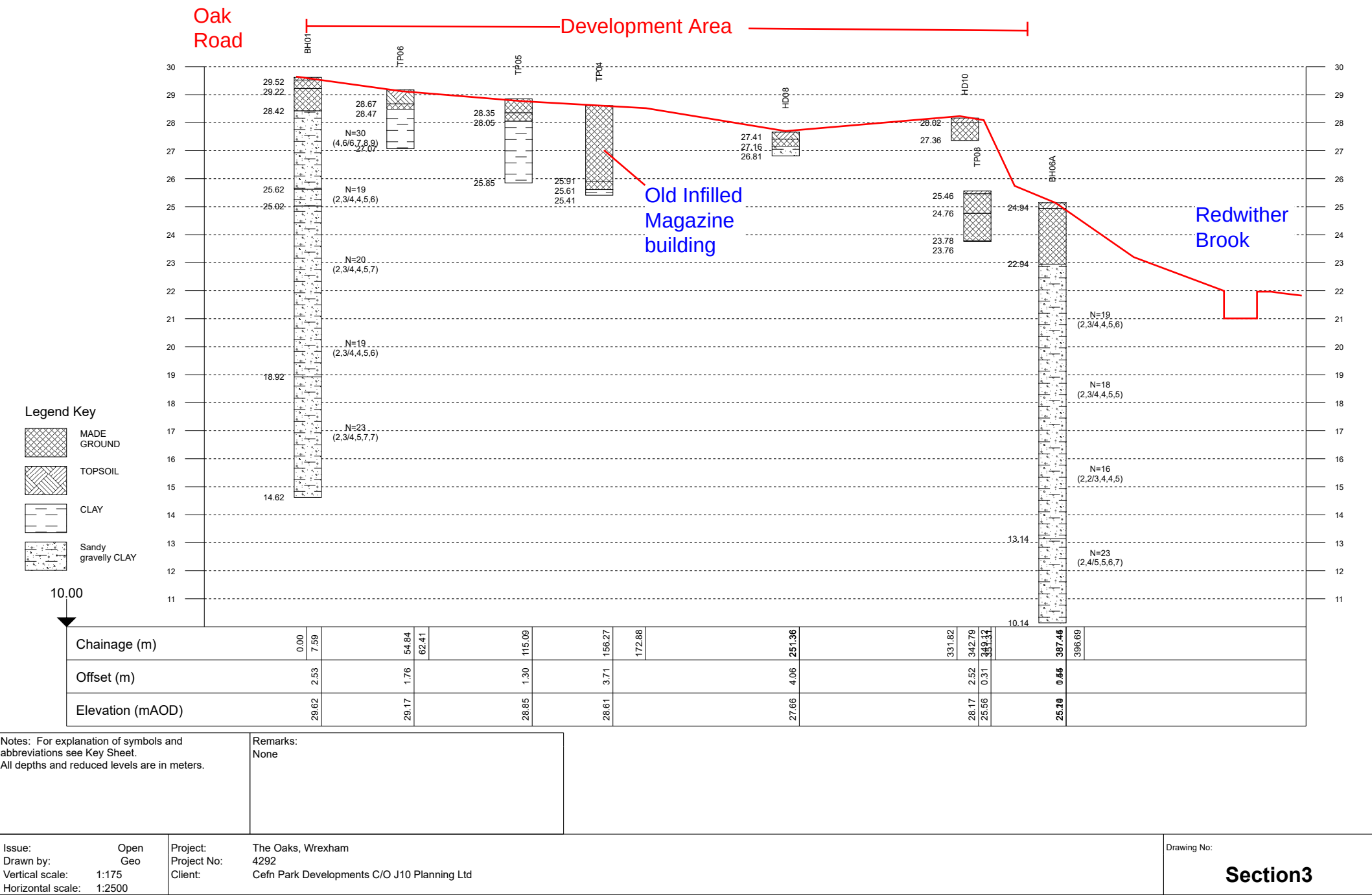
Geological Section A - A'



Geological Section B - B'



Geological Section C - C'



APPENDICES

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APPENDIX A

Service Constraints, Report Limitations & Planning

Service Constraints, Report Limitations & Planning Requirements

This consultancy contract, report and the site investigation (together comprise the "Services") were compiled and carried out by TerraConsult Limited (TCL) for Cefn Park Developments and their planning consultants J10 Planning Ltd (the "client") on the basis of a defined programme and scope of works and the terms of a contract between TCL and the "client." The Services were performed by TCL with all reasonable skill and care ordinarily exercised by a reasonable environmental consultant at the time the Services were performed. Further, and in particular, the Services were performed by TCL taking into account the limits of the scope of works required by the client, the prevailing site conditions, the time scale involved and the resources, including financial and manpower resources, agreed between TCL and the client. TerraConsult Ltd cannot accept responsibility to any parties whatsoever, following the issue of this report, for any matters arising which may be considered outwith the agreed scope of works.

Other than that expressly contained in the above paragraph, TCL provides no other representation or warranty whether express or implied, is made in relation to the Services. Unless otherwise agreed this report has been prepared exclusively for the use and reliance of the client in accordance with generally accepted consulting practices and for the intended purposes as stated in the agreement under which this work was completed. This report may not be relied upon, or transferred to, by any other party without the written agreement of a Director of TCL. If a third party relies on this report, it does so wholly at its own and sole risk and TCL disclaims any liability to such parties.

It is TCL's understanding that this report is to be used for the purpose described in the introduction to the report. That purpose was a significant factor in determining the scope and level of the Services. Should the purpose for which the report is used, or the proposed use of the site change, this report may no longer be valid and any further use of, or reliance upon the report in those circumstances by the client without TCL 's review and advice shall be at the client's sole and own risk.

The information contained in this report is protected by disclosure under Part 3 of the Environmental Information Regulations 2004 pursuant to the provisions of Regulation 12(5) without the consent in writing of a Director of TerraConsult Limited.

The report was written in April 2019 and should be read in light of any subsequent changes in legislation, statutory requirements and industry practices. Ground conditions can also change over time and further investigations or assessment should be made if there is any significant delay in acting on the findings of this report. The passage of time may result in changes in site conditions, regulatory or other legal provisions, technology or economic conditions which could render the report inaccurate or unreliable. The information and conclusions contained in this report should not be relied upon in the future without the written advice of TCL. In the absence of such written advice of TCL, reliance on the report in the future shall be at the client's own and sole risk. Should TCL be requested to review the report in the future, TCL shall be entitled to additional payment at the then existing rate or such other terms as may be agreed between TCL and the client.

The observations and conclusions described in this report are based solely upon the Services that were provided pursuant to the agreement between the client and TCL. TCL has not performed any observations, investigations, studies or testing not specifically set out or mentioned within this report. TCL is not liable for the existence of any condition, the discovery of which would require performance of services not otherwise contained in the Services. For the avoidance of doubt, unless otherwise expressly referred to in the introduction to this report, TCL did not seek to evaluate the presence on or off the site of asbestos, electromagnetic fields, lead paint, radon gas or other radioactive or hazardous materials.

The Services are based upon TCL's observations of existing physical conditions at the site gained from a walkover survey of the site together with TCL's interpretation of information including documentation, obtained from third parties and from the client on the history and usage of the site. The findings and recommendations contained in this report are based in part upon information provided by third parties, and whilst TerraConsult Ltd have no reason to doubt the accuracy and that it has been provided in full from those it was requested from, the items relied on have not been verified. No responsibility can be accepted for errors within third party items presented in this report. Further TCL was not authorised and did not

attempt to independently verify the accuracy or completeness of information, documentation or materials received from the client or third parties, including laboratories and information services, during the performance of the Services. TCL is not liable for any inaccurate information or conclusions, the discovery of which inaccuracies required the doing of any act including the gathering of any information which was not reasonably available to TCL and including the doing of any independent investigation of the information provided to TCL save as otherwise provided in the terms of the contract between the client and TCL.

Where field investigations have been carried out these have been restricted to a level of detail required to achieve the stated objectives of the work. Ground conditions can also be variable and as investigation excavations only allow examination of the ground at discrete locations. The potential exists for ground conditions to be encountered which are different to those considered in this report. The extent of the limited area depends on the soil and groundwater conditions, together with the position of any current structures and underground facilities and natural and other activities on site. In addition, chemical analysis was carried out for a limited number of parameters [as stipulated in the contract between the client and TCL] based on an understanding of the available operational and historical information, and it should not be inferred that other chemical species are not present.

The groundwater conditions entered on the exploratory hole records are those observed at the time of investigation. The normal speed of investigation usually does not permit the recording of an equilibrium water level for any one water strike. Moreover, groundwater levels are subject to seasonal variation or changes in local drainage conditions and higher groundwater levels may occur at other times of the year than were recorded during this investigation.

Any site drawing(s) provided in this report is (are) not meant to be an accurate base plan, but is (are) used to present the general relative locations of features on, and surrounding, the site. Specific access constraints were imposed which meant that the full area of the site could not be investigated. No access was possible into the existing buildings and a large areas of the site has thick vegetation and undulating ground levels.

Throughout the report the term „geotechnical“ is used to describe aspects relating to the physical nature of the site (such as foundation requirements) and the term „geoenvironmental“ is used to describe aspects relating to ground-related environmental issues (such as potential contamination). However, it should be appreciated that this is an integrated investigation and these two main aspects are inter-related. The geoenvironmental sections are written in broad agreement with BS 10175:2011+A2 2017. For the geotechnical aspects of the report, the general requirements of Eurocode 7 (BS EN 1997-2:2007) are to produce a Ground Investigation Report (GIR) which shall form part of the Geotechnical Design Report (GDR). The geotechnical section of this report is intended to fulfil the general requirements of the GIR as outlined in BS EN 1997-2, Section 6. The GIR contains the factual information including geological features and relevant data, and a geotechnical evaluation of the information stating the assumptions made in the interpretation of the test results. This report shall not be considered as being a GDR.

Unexploded Ordnance

Clients have a legal duty under the CDM 2015 Regulations to provide designers and contractors with project-specific health and safety information needed to identify hazards and risks. This includes the possibility of unexploded ordnance (UXO) being encountered on the site. Further details are given in CIRIA Report C681 (Stone et al 2009). A non-UXO specialist screening exercise has been carried out for the site by considering any evidence of UK defence activities on or near the site evident from the gathered desk study information and the unexploded aerial delivered bomb (UXB) regional risk maps produced by Zetica. Other data sources are available, but as a first stage screening exercise the freely available Zetica maps have been used. The level of risk stated is that determined by Zetica, a company experience in the desk study, field investigation and clearance of UXO/UXB.

APPENDIX B

Environmental Risk Assessment Methodology & Terminology

ENVIRONMENTAL RISK ASSESSMENT METHODOLOGY & TERMINOLOGY

LEGISLATION OVERVIEW

This report includes hazard identification and environmental risk assessment in line with the risk-based methods referred to in relevant UK legislation and guidance. Government environmental policy is based upon a "suitable for use approach," which is relevant to both the current use of land and also to any proposed future use. The contaminated land regime is the statutory regime for remediation of contaminated land that causes an unacceptable level of risk and is set out in Part 2A of the Environmental Protection Act 1990 ("EPA 1990"). The main objective of introducing the Part IIA regime is to provide an improved system for the identification and remediation of land where contamination is causing unacceptable risks to human health or the wider environment given the current use and circumstances of the land. Part IIA provides a statutory definition of contaminated land under Section 78A(2) as:

"any land which appears to the Local Authority in whose area it is situated to be in such a condition, by reason of substances in, on, or under the land, that:

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

In order to assist in establishing if there is a "significant possibility of significant harm" there must be a "contaminant linkage" for potential harm to exist. That means there must be a source(s) of contamination, sensitive receptors present and a connection or pathway between the two. This combination of contaminant-pathway-receptor is termed a "contaminant linkage or CPR linkage."

Part IIA of The Environmental Protection Act 1990 is supported by a substantial quantity of guidance and other Regulations. Key implementing legislation of the Part 2A regime includes the Contaminated Land (Wales) Regulations 2006 as amended by the overarching legislation for the contaminated land regime, which implements the provisions of Part IIA of the Environmental Protection Act 1990 (as inserted by section 57 of the Environment Act 1995), came into force on 14th July 2000 together with recent amended regulations: Contaminated Land (Wales) (Amendment) Regulations 2012 and associated Statutory Guidance. Part IIA defines the duties of Local Authorities in dealing with it. Part IIA places contaminated land responsibility as a part of planning and redevelopment process rather than Local Authority direct action except in situations of very high pollution risk.

In the planning process guidance is provided by Planning Policy Wales 2018 which requires that a site which has been developed shall not be capable of being determined "contaminated land" under Part IIA. In practice, Planning Authorities require sites being developed to have a lower level of risk post development than the higher level of risk that is required in order to determine a site as being contaminated in accordance with Part IIA. This is to ensure that there is a suitable zone of safety below the level for Part IIA determination and prevent recently developed sites becoming reclassified as contaminated land if there are future legislative or technical changes (e.g. a substance is subsequently found to be more toxic than previously assessed this increases its hazard).

The criteria for assessing concentrations of contaminants and hence determining whether a site represents a hazard are based on a range of techniques, models and guidance. Within this context it is relevant to note that Government objectives are:

- (a) to identify and remove unacceptable risks to human health and the environment;
- (b) to seek to bring damaged land back into beneficial use;
- (c) to seek to ensure that the cost burdens faced by individuals, companies and society as a whole are proportionate, manageable and economically sustainable.

These three objectives underlie the "suitable for use" approach to risk management and remediation of contaminated land. The "suitable for use" approach focuses on the risks caused by land contamination. The approach recognises that the risks presented by any given level of contamination will vary greatly according to the use of the land and a wide range of other factors, such as the underlying geology of the site. Risks therefore should be assessed on a site-by-site basis.

The "suitable for use" approach then consists of three elements:

- (a) *ensuring that land is suitable for its current use* - in other words, identifying any land where contamination is causing unacceptable risks to human health and the environment, assessed on the basis of the current use and circumstances of the land, and returning such land to a condition where

such risks no longer arise ("remediating" the land); the contaminated land regime provides the regulatory mechanisms to achieve this;

- (b) *ensuring that land is made suitable for any new use, as planning permission is given for that new use* - in other words, assessing the potential risks from contamination, on the basis of the proposed future use and circumstances, before official permission is given for the development and, where necessary to avoid unacceptable risks to human health and the environment, remediating the land before the new use commences; this is the role of the town and country planning and building control regimes; and
- (c) *limiting requirements for remediation to the work necessary to prevent unacceptable risks to human health or the environment in relation to the current use or future use of the land for which planning permission is being sought* - in other words, recognising that the risks from contaminated land can be satisfactory assessed only in the context of specific uses of the land (whether current or proposed), and that any attempt to guess what might be needed at some time in the future for other uses is likely to result either in premature work (thereby running the risk of distorting social, economic and environmental priorities) or in unnecessary work (thereby wasting resources).

The mere presence of contaminants does not therefore necessarily warrant action, and consideration must be given to the scale of risk involved for the use that the site has, and will have in the future.

OVERALL METHODOLOGY

The work presented in this report has been carried out in general accordance with recognised best practice as detailed in guidance documents such as in the CLR 11 Model Procedures for the Management of Land Contamination (Environment Agency, 2004), and BS10175:2011+A2 2017. Important aspects of the risk assessment process are transparency and justification. The particular rationale behind the risk assessments presented is given in this appendix.

The first stage of a two-staged investigation and assessment of a site is the Preliminary Investigation (BS 10175:2011), often referred to as the Phase 1 Study, comprising desk study and walk-over survey, which culminates in the Preliminary Risk Assessment. A preliminary conceptual site model (CSM) is developed which identifies potential geotechnical and geo-environmental hazards and the qualitative degree of risk associated with them. From the geo-environmental perspective, the Hazard Identification process uses professional judgement to evaluate all the hazards in terms of potential contaminant linkages (of contaminant source-pathway-receptor). Potential contaminant linkages are potentially unacceptable risks in terms of the current contaminated land regime legal framework and require either remediation or further assessment. These are normally addressed via intrusive ground investigation and generic risk assessment.

The second stage is the Ground Investigation, Generic Risk Assessment and Geotechnical Interpretation. This represents the further assessment mentioned above. The scope of the Ground Investigation is based on the findings of the Preliminary Risk Assessment and is designed to reduce uncertainty in the geotechnical and geo-environmental hazard identification. The Ground Investigation comprises fieldwork, laboratory testing and usually also on-site monitoring. The Ground Investigation may include the Exploratory, Main and Supplementary Investigations described in BS 10175:2011+A2 2017. The results of the Ground Investigation reduces uncertainty in the geotechnical and geo-environmental risks. Depending on the findings more detailed investigations or assessments may be required.

PRELIMINARY RISK ASSESSMENT

Current practice recommends that the determination of potential liabilities that could arise from land contamination be carried out using the process of risk assessment, whereby "risk" is defined as:

- "(a) The probability, or frequency, or occurrence of a defined hazard; and*
- (b) The magnitude (including the seriousness) of the consequences."*

The UK's approach to the assessment of environmental risk is set out in by the Department of the Environment Transport and the Regions (2000) publication "A Guide to Risk Assessment and Risk Management for Environmental Protection" (also called Greenleaves II). This established an iterative, systematic staged process which comprises:

- (a) Hazard identification;
- (b) Hazard assessment;
- (c) Risk estimation;

- (d) Risk evaluation;
- (e) Risk assessment;

At each stage during the development process, the above steps are repeated as more detailed information becomes available for the site.

For an environmental risk to be present, all three of the following elements must be present:

- Source/Contaminant: hazardous substance that has the potential to cause adverse impacts;
- Receptor: target that may be affected by contamination: examples include human occupants/users of site, water resources (rivers or groundwater), or structures;
- Pathway: a viable route whereby a hazardous substance may come into contact with the receptor.

The absence of one or more of each component (contaminant, pathway, receptor) would prevent a contaminant linkage being established and there would be no significant environmental risk.

The identification of potential contaminant linkages is based on a Conceptual Model of the site, which is subject to continual refinement as additional data becomes available. As part of a Preliminary Risk Assessment (Desk Study and site walk over) a Preliminary Conceptual Site Model (PCSM) is formed. Based on the PCSM, potential contaminant linkages can be assessed. If the PCSM and hazard assessment indicate that a contaminant linkage is not of significance then no further assessment or action is required for this linkage. For each significant and potential linkage a risk assessment is carried out. The linkages which potentially pose significant risks may require a variety of responses ranging from immediate remedial action or risk management or, more commonly, further investigation and risk assessment. This next stage is termed a Phase II Main Site Investigation and should provide additional data to allow refinement of the Conceptual Site Model and assess the level of risk from each contaminant linkage.

Definition of Risk Assessment Terminology

The criteria used for risk assessment are broadly based on those presented in DETR's "A Guide to Risk Assessment and Risk Management for Environmental Protection" (2000). The Severity of the risk is classified according to the criteria in Table B.1 below:

Table B.1 Severity/Consequence of Risk	
Severe	Acute risks to human health. Catastrophic damage to buildings/property (e.g. by explosion). Direct pollution of sensitive water receptors or serious pollution of other controlled water (watercourses or groundwater) bodies.
Medium	Harm to human health from long-term exposure. Slight pollution of sensitive controlled waters (surface waters or aquifers) or pollution of other water bodies. Significant effects on sensitive ecosystems or species.
Mild	No significant harm to human health in either short or long term. No pollution of sensitive controlled waters, no more than slight pollution of non-sensitive waters. Significant damage to buildings or structures. Requirement for protective equipment during site works to mitigate health effects.
Negligible	Damage to non-sensitive ecosystems or species. Minor damage to buildings or structures. No harm or pollution of water.

The probability of the risk occurring is classified according to criteria given in Table B.2 below:

Table B.2: Probability of Risk Occurring	
High likelihood	Contaminant linkage may be present, and risk is almost certain to occur in the long term, or there is evidence of harm to the receptor.
Medium/Reasonably Foreseeable	Contaminant linkage may be present, and it is probable that the risk will occur over the long term.
Low/Unlikely	Contaminant linkage may be present and there is a possibility of the risk occurring, although there is no certainty that it will do so.
Negligible/ Not credible	Contaminant linkage may be present but the circumstances under which harm would occur are improbable.

An overall evaluation of the level of risk is gained from a comparison of the severity and probability, as shown in Table B.3 below:

Table B.3: Comparison of Severity and Probability					
		Severity			
		Severe	Medium	Mild	Negligible
Probability	High likelihood	Very High Risk	High Risk	Medium/Low Risk	Low Risk
	Medium/Reasonably Foreseeable	High Risk	Medium Risk	Low Risk	Near Zero
	Low/Unlikely	High/Medium Risk	Medium/Low Risk	Low Risk	Near Zero
	Negligible/ Not credible	Medium/Low Risk	Low Risk	Low Risk	Near Zero

The various risk rankings provide guidance for recommended actions, whether this is:

- AR - Action Required, Remediation or mitigation or site investigation works required
- SIR - Site Investigation Required, further assessment is required.
- NAR - No Action Required.

A description of the evaluated risk is as follows:

Table B.4 – Description of the Classified Risks and Likely Action Required	
Evaluated Risk	Recommended Actions
Very High Risk	AR: There is a 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 a substantial liability. Urgent investigation (if not undertaken already) and remediation are likely to be required.
High Risk	AR: Harm is likely to arise to a designated receptor from an identified hazard. Realisation of the risk is likely to present a substantial liability. Urgent investigation (if not undertaken already) is required and remedial works may be necessary in the short term and are likely over the long term.
Medium Risk	SI: It is possible that harm could arise to a designated receptor from an identified hazard. However, it is 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 (if not already undertaken) is normally required to clarify the risk and to determine the potential liability. Some remedial works may be required in the longer term.
Low Risk	NAR: It is possible that harm could arise to a designated receptor from an identified hazard, but there is a low likelihood of this hazard occurring and if realised, harm would at worst normally be mild.
Near Zero	NAR: There is a negligible possibility that harm could arise to a receptor. In the event of such harm being realised, it is not likely to be severe.

GENERIC QUANTITATIVE RISK ASSESSMENT

In the following sections the current UK guidance on risks to the following receptors are discussed: human health, plant life and controlled waters

- **Human Health**

The overall methodology for assessing the risk to human health from potential contaminants in soil is set out in the Environment Agency's guidance "Using Soil Guideline Values" SC050021/SGV Introduction, March 2009 and using the CLEA 1.06 model software (and CLEA 1.071 for nickel). The generic assessment criteria are in accordance with the following:

- Science Report SC050021/SR2: Human health toxicological assessment of contaminants in soil;
- Science Report SC050021/SR3: Updated technical background to the CLEA model;
- Science Report SC050021/SR4: CLEA Software (Version 1.071, 2014) & Handbook;
- Toxicological reports and SGV technical notes;
- Toxicological data published by LQM/CIEH (2009) and CL:AIRE/EIC/AGS (2009)
- DEFRA Development of Category 4 Screening Levels for assessment of land affected by contamination - SP1010 (December 2013).
- LQM/CIEH Suitable 4 Use Levels (S4ULs) for Human Health Risk Assessment
- Toxicology review published by the European Food Safety Authority for nickel (2015)

In March 2014 six „proposed" Category 4 Screening Levels (pC4SL) were issued by Defra. These screening values are considered to be within Category 4 as defined in the Contaminated Land Statutory Guidance and indicate safe levels for new developments passing through the planning system. The SGV for lead has been withdrawn, and the pC4SL for lead has been derived using current best practice. In January 2015 LQM/CIEH published S4ULs for 89 contaminants in accordance with the C4SL methodology.

Note that groundwater contamination may pose a risk to human health but that there are no relevant generic assessment criteria available for comparison. TerraConsult has derived our own assessment criteria for this.

- **Phytotoxic Risks**

Generic assessment of phytotoxicity is by comparison with guideline values presented in the British Standard for Topsoil and the MAFF document "Code of Good agricultural practice for the protection of soil", October 1998. This is in accordance with CLR's reference to DEFRA notice CLAN 4/04.

- **Controlled Waters**

Risks to controlled waters (groundwater and surface waters) from contaminants are assessed in accordance with the EA documents "The Environment Agency's Approach to Groundwater Protection" (2017) and Remedial Targets Methodology (RTM, 2006). Pollutant inputs from contaminated land sites are considered as passive inputs under the European Water Framework Directive (2000/60/EC) (WFD) and its daughter Directives, and as such are regulated under the Environment Agency's „limit" pollution objective. Acceptable water quality targets (WQT) are defined for protection of human health (based on Drinking Water Standards (DWS)) and for protection of aquatic ecosystems (Environmental Quality Standards (EQS)). The risk posed to controlled waters from total soil concentrations cannot be directly assessed. The risk is assessed either by comparison of results of leachate tests carried out on soil samples, or from the direct testing of samples of groundwater to screening criteria. Leachate testing generally forms a conservative assessment and is not appropriate for organic contaminants.

CURRENT GUIDANCE ON INTERPRETATION OF CHEMICAL ANALYSIS OF SOILS

Contaminated land is defined under law through Part IIA of the Environmental Protection Act 1990, implemented through Section 57 of the Environment Act 1995. This supports a „suitable for use" based approach to the risk assessment of potentially contaminated land. The site specific risk assessment is based upon assessment of plausible contaminant linkages, referred to as the contaminant-pathway- receptor model, based upon the current or proposed use of the site.

Before undertaking a risk assessment a conceptual site model is devised in order to identify the potential contaminants, pathways and receptors. The individual contaminants, pathways and receptors then need to be further investigated in order to refine the initial assessment and risk assessment undertaken.

In March 2002, the Department for Environment, Food and Rural Affairs (DEFRA) and the Environment Agency published the Contaminated Land Exposure Assessment (CLEA) Model and a series of related reports. These were designed to provide a scientifically based framework for the assessment of chronic risks to human health from

contaminated land. These reports (CLR7-10) together with associated “SGV” documents were withdrawn and the following documents have been published as revised guidance to the CLEA assessment:

- Environment Agency : 2008: Using Soil Guideline Values SC050021/SGV Introduction, March 2008.
- Environment Agency : 2008: Science Report SC050021/SR2: Human health toxicological assessment of contaminants in soil.
- Environment Agency : 2008: Science Report SC050021/SR3: Updated technical background to the CLEA model.
- Environment Agency : 2008 : Compilation of Data for Priority Organic Contaminants for Derivation of Soil Guideline Values Science report SC050021/SR7
- Environment Agency : Science Report SC050021/SR4: CLEA Software (Version 1.071, 2015) & Handbook.
- DEFRA Development of Category 4 Screening Levels for assessment of land affected by contamination - SP1010 (December 2013).
- LQM/CIEH Suitable 4 Use Levels for Human Health Risk Assessment

Additional guidance on statistical assessment replacing CLR 7 is partly provided in:

- CL:AIRE: 2009: Guidance on Comparing Data With a Critical Concentration

A different approach to the statistical appraisal of data is required depending on whether the assessment of risk is to assess whether land is Contaminated Land in accordance with regulations, or whether the assessment is to assess whether the site is suitable for new development in accordance with Planning guidance. This is discussed further in CL:AIRE: 2009 “Guidance on Comparing Data With a Critical Concentration”.

The introduction of the Contaminated Land (England) (Amendment) Regulations 2012 and Contaminated Land Statutory Guidance (DEFRA, 2012) reassessed the CLEA Model and the derived SGVs (and associated GACs calculated using the model). This re-assessment concluded that the SGVs/GACs were conservative screening criteria for determining the suitability of soil with regard to the risk to human health under the planning regime and defined a new upper limit for planning purposes which is the boundary between the new Category 3 and 4. In March and September 2014 DEFRA issued guidance on these new Category 4 Screening Levels (C4SL) and these are discussed further below.

Soil Guideline Values

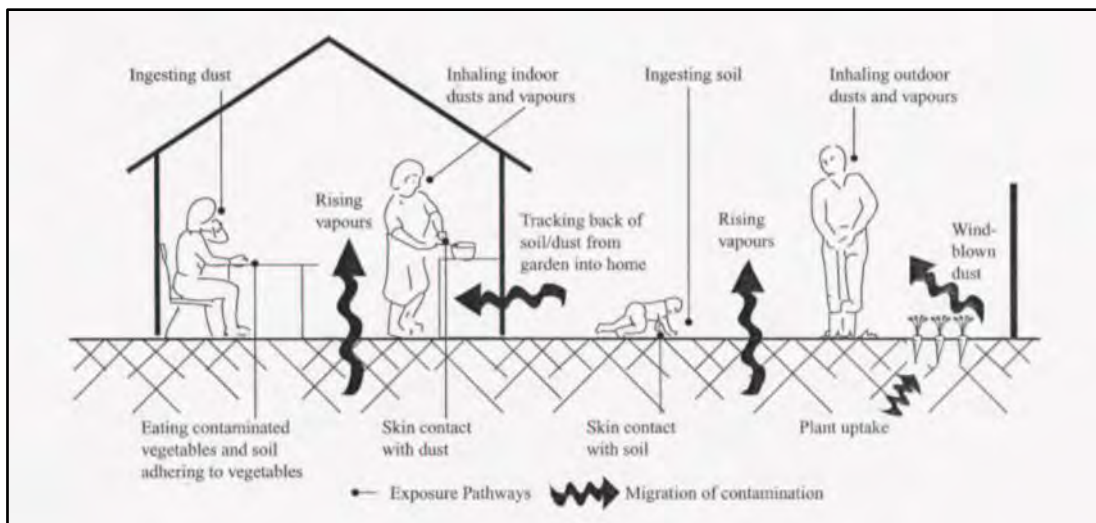
A program for the derivation of SGVs based on the above guidance is provided by the Environment Agency and is entitled “CLEA Software Version 1.06”. These reports, together with supporting toxicology reviews (“Tox” or Supplementary Information Reports) for individual substances (which will be gradually updated), Soil Guideline Value Reports and other guidance referred to in the above documents, provide guidance and the scientific basis for assessing the risk to human health from potential contaminants. Soil Guideline Value Reports (SGV Reports) have been published for a number of contaminants and these are published on the Environment Agency website. Eventually the reports will include SGVs for:

- heavy metals and other inorganic compounds: arsenic, cadmium, chromium, cyanide, lead (now withdrawn), mercury nickel (now withdrawn), and selenium;
- benzene, ethylbenzene, toluene and xylenes;
- phenol;
- dioxins and dioxin-like polychlorinated biphenyls (PCBs);
- polycyclic aromatic hydrocarbons (PAHs) – 11 substances.

In September 2015, CLEA was re-issued as „CLEA Version 1.071”. Currently, the software has been used to produce an in-house GAC for nickel, following with withdrawal of the SGV.

In addition CIEH through LQM and the EIC have published generic assessment criteria (GACs) for a wide variety of other parameters including metals, hydrocarbons, chlorinated aliphatic compounds, PAHs and explosive substances for three standard land uses. These have been produced to supplement the Environment Agency guidance. These GACs will be replaced by SGVs when or if the Environment Agency publishes any more SGVs.

The CLEA model has been developed to calculate an estimated tolerable daily soil intake (TDSI) for site users given a set „default” exposure pathways. Ten human exposure pathways are covered in the CLEA model as presented below:



- **Ingestion**
 - ingestion of outdoor soil;
 - ingestion of indoor dust;
 - ingestion of home grown vegetables;
 - ingestion of soil attached to home grown vegetables.
- **Dermal Contact**
 - dermal contact with outdoor soil;
 - dermal contact with indoor dust.
- **Inhalation**
 - inhalation of outdoor dust;
 - inhalation of indoor dust;
 - inhalation of outdoor soil vapour;
 - inhalation of indoor soil vapour.

It should be noted that there are other potential exposure pathways on some sites not included in the CLEA model e.g. certain organic compounds can pass through plastic water pipes into drinking water supply.

The presence and/or significance of each of the above exposure pathways are dependent on the type of land use being considered and the nature of the contaminant under scrutiny. Accordingly, the CLEA model considers for principle „default“ land use types and makes a series of „default“ assumptions with regard to human exposure frequency, duration and critical human target groups for each land use considered:

- residential land use;
- allotments;
- commercial and industrial land use.

The land use categories defined in the CLEA are detailed below.

Residential: This land use category assumes that people live in a variety of dwellings including terraced, detached and semi-detached houses up to two storeys high. The structure of buildings varies. Default parameters for building materials and building design are included in CLEA documents to calculate the relevant multi-layer diffusion coefficients for vapour intrusion and to model indoor vapour intrusion. The CLEA model assumes that regardless of the style of housing the residents will have access to either a private garden or community open space nearby, and that soil tracked into the home will form indoor dust. It allows for the ingestion pathways from home grown vegetables.

Allotments: The CLEA model incorporates an assessment of land provided by local authorities specifically for people to grow fruit and vegetables for their own consumption. Consumption of such fruit and vegetables present several exposure pathways; plants absorb contaminants mainly via water uptake through roots, the contaminants move to edible portions of plants via translocation and contaminated soil particles become trapped in the skin and between leaves. At present the model fails to account for exposure through the consumption of animals, and their products (e.g. eggs), which have been reared on contaminated land.

Commercial/Industrial: Although there are a wide variety of workplaces and work-related activities, the CLEA assessment of this land-use assumes that work occurs in a permanent, three-storey structure, where employees spend most time indoors, conducting office-based or light physical work. The model assumes employees sit outside during breaks for most of the year. Limitations in applying this land-use to different industries is detailed in EA publication "Updated technical background to the CLEA model" (2011). The generic model assumes that the site would not be covered by hard standing. Risk of exposure to contaminants would be clearly less where commercial land is essentially all buildings and hard standing.

Based on the assumptions of each land use and the associated applicable exposure pathways, a „Soil Guideline Value" (SGV) may be calculated for each contaminant under consideration for a particular land use in order to determine whether certain contaminant soil concentrations pose a significant risk to human health. The primary purpose of the CLEA SGVs are as „trigger values" – indicators to a risk assessor that soil concentrations below this level require no further assessment as it can be assumed that the soil is suitable for the proposed use. Where soil concentrations occur above the SGV then further assessment of the results is required. The Contaminated Land (England) (Amendment) Regulations 2012 and Contaminated Land Statutory Guidance (DEFRA, 2012) which came into force in early April 2012 provides new clarity on the assessment of risk where soil concentrations exceed the SGV. The guidance introduces a four stage classification system relating to concentration of contaminants and the assessed risk which indicates appropriate actions. Category 1 and 2 sites are classified as "Contaminated Land" as defined in Part IIA of The Environmental Protection Act (1990). Category 3 and 4 sites are not considered as "Contaminated Land" in accordance with the Act. This can be explained using the figure on the following page.

There are also difficulties in establishing soil concentrations of contaminants beyond which risks from exposure to these contaminants would be „unacceptable" and that they would lead to "significant possibility of significant harm" as defined in Part IIA of The Environmental Protection Act (1990) and determine that the land is "contaminated." This ultimately requires detailed „toxicological" information of the health effects of individual contaminants and also a scientific judgement on what constitutes an „unacceptable" risk. It is for local authorities or the Environment Agency to determine whether a particular site is contaminated land and it is for local Planning Authorities to determine whether land affected by contamination can be redeveloped.

Given the SGVs have been derived only for a limited number of contaminants and there was little prospect of further SGVs being published, two professional groupings have produced Generic Assessment Criteria (GACs) in accordance with the CLEA model for a large number of additional contaminants. These GACs were recognised in the new Contaminated Land Statutory Guidance (DEFRA, 2012) and have been produced as follows:

LQM/CIEH : 2009 Nathaniel CP, McCaffrey C, Ashmore MH, Cheng NPS GROUP, Gillett A, Ogden R & Scott D : 2009 . The LQM/CIEH Generic Assessment Criteria for Human Health Risk Assessment (2nd edition). Land Quality Press, Nottingham.

CL:AIRE/EIC/AGS: 2009 : Soil Generic Assessment Criteria (GAC) for Human Health Risk Assessment. Contaminated Land: Applications in Real Environments, Environment Industries Commission & Association of Geotechnical and Environmental Specialists. December 2009.

Category 4 Screening Levels and LQM/CIEH Suitable 4 Use Levels

For new developments progressing through the planning regime, it is desirable that the soil concentrations are within Category 4 where there is a valid contaminant linkage. The upper boundary between Category 4 and 3 is not defined in the guidance. This boundary can also be better defined by carrying out a Detailed Quantified Risk Assessment (DQRA) and this is discussed later in this appendix.

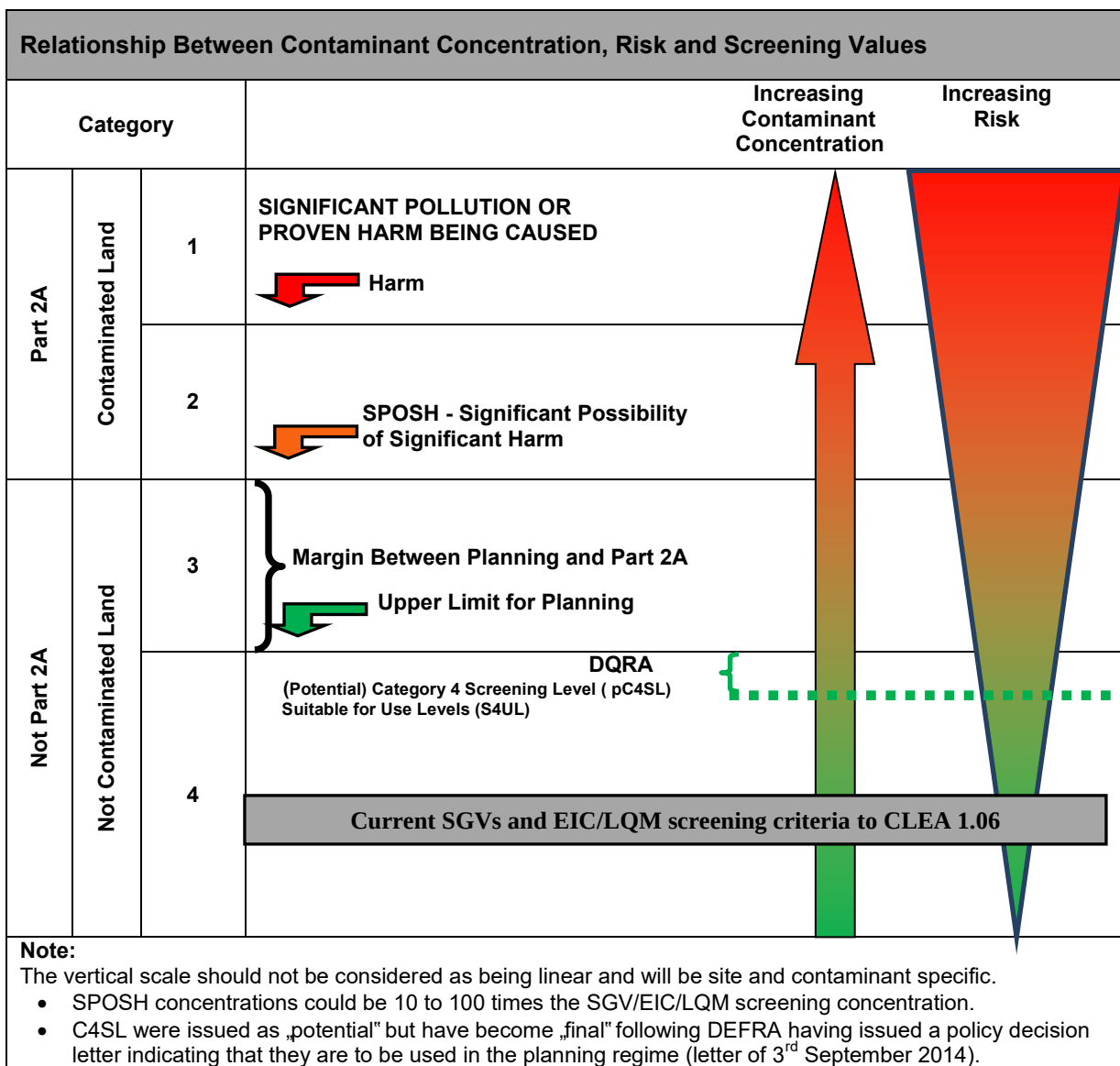
In December 2013 Defra issued the findings of a research project undertaken by CL:AIRE to set out the framework by which potential Category 4 Screening Levels (pC4SL) may be derived. The report was not designed to produce „final" C4SL as the steering group producing the report believes that final C4SL should be set by a „relevant authority" (e.g. Defra), the toxicological framework proposed has not been reviewed by the Committee on Toxicity and the document has yet to be subject to peer review.

In March 2014, appendices to the main Defra report were published detailing the derivation of pC4SL for 6 contaminants and other appendices regarding a review of the CIEH/CL:AIRE statistics guidance and sensitivity analysis. For each contaminant, a range of pC4SL have been produced relating to modifying toxicological parameters only, modifying exposure parameters only or by modifying both. It should be noted that the pC4SL produced for lead (the SGV was withdrawn in 2011) has undertaken a relatively large toxicological review in relation to modelling blood lead concentrations. pC4SL have been produced for:

- Arsenic;
- Benzene;
- Benzo(a)pyrene (as a surrogate marker for PAHs);

- Cadmium;
- Chromium (VI); and
- Lead

As previously discussed the values were initially published as „potential“ C4SL but have become „final“ following DEFRA having issued a policy decision letter indicating that they are to be used in the planning regime (letter of 3rd September 2014). It is considered that the pC4SL provide a simple test for deciding whether land is suitable for use without any remediation. The pC4SL represent a new set of screening levels that are more pragmatic (but strongly precautionary) compared to the existing soil guideline values (SGVs and the other GACs calculate in accordance with the existing CLEA methodology). The pC4SL provide cautious estimates of contaminant concentrations in soil that are still considered to present an acceptable level of risk, within the context of Part 2A, by combining information on toxicology, exposure assessment and normal levels of exposure to these contaminants. pC4SL values should not be seen as „SPOH values.“ Exceeding a pC4SL means that further investigation is required, not that the land is necessarily contaminated. In January 2015, LQM published Suitable 4 Use Levels (S4ULs) for a further 89 contaminants using the Defra C4SL methodology. In a similar manner to the pC4SLs, no authoritative review has been undertaken although the approach and quality of the work undertaken is widely accepted as being of high quality.



Lead

The SGV for lead was withdrawn in 2011 and is not used in this report. The pC4SL for lead provides a technically robust and conservative assessment tool using significantly updated toxicological modelling in line with current scientific understanding of lead toxicology.

Nickel

The SGV for nickel was withdrawn in 2015 and is not used in this report. In-house GACs for nickel have been produced using the updated toxicological review by the EFSA and the CLEA 1.071 software.

Public Open Space

The Defra report (December 2013) has also introduced exposure scenarios for two other commonly occurring land uses which require assessment (under the planning and Part 2A regimes) on a relatively frequent basis. These exposure scenarios are:

- Public Open Space – Space Near Residential Housing (POS_{resi}); and
- Public Open Space – Public Park (POS_{park}).

Potential use of pC4SL relating to Public Open Space (POS) require care due to the significant variability in exposure characteristics. For example, POS may include:

- Children's play areas, public parks where children practise sport several times a week and teenagers only once a week;
- Grassed areas adjacent to residential properties which are rarely used;
- Dedicated sports grounds where exposure is only to players and groundworkers; and
- Nature reserves or open ground with low level activity (for example, dog walking).

Within the Defra report (December 2013) the following exposure scenarios have been modelled as these are considered the most important for potential exposure for the critical receptor i.e. young children:

- Green open space close to housing, including tracking back of soil (POS_{resi}); and
- Park-type scenario where distance is considered sufficient to discount tracking back of soil (POS_{park}).

Detailed Quantified Risk Assessment (DQRA)

SGVs, GACs, pC4SL and S4ULs are based on a number of basic assumptions. There are two main options for developing Site Specific Assessment Criteria (SSAC) by adjusting the CLEA model so that they have greater relevance to the site:

- **Simple adjustment of the generic SGV / C4SL model.** Such adjustment is restricted to the choice of exposure routes selected for the generic land use, building type, soil type and soil organic matter content within the CLEA software.
- **Detailed adjustment.** It may be relevant to make greater modifications to the model due to the specific use of the land in question. This can include modification to any parameter value, including exposure assumptions, building parameters, and the choice and application of fate and transport models. This is equally relevant to site-specific modifications of existing generic land uses, the development of new land uses, and the inclusion of additional exposure pathways. Much of this can be undertaken using the CLEA software. Depending on the complexity of the detailed adjustments required, it may be necessary to use other tools either alone or in conjunction with the CLEA software. Both options should follow established protocols for DQRA and require sufficient justification and supporting information for the adjustments made. Detailed adjustments are likely to require substantially greater technical justification and supporting documentation, especially if modifications are based on information not contained within the SGV framework documents.

The two choices present the risk assessor with three options/decisions:

- (1) Use a published SGV/GAC/pC4SL/S4UL if it can be demonstrated that the assumptions inherent in the value are appropriate to the site in question. If they are not, proceed to either option 2 or 3 below.

- (2) Make simple site-specific adjustments to the generic exposure model used to derive the SSAC. Three examples of when this could be appropriate are:
 - a. High density residential development with no exposed contaminated soil at surface. It is appropriate in this case to consider the relevance of direct contact pathways and consumption of homegrown produce.
 - b. Soil type is significantly different (specifically when soil type is likely to be less protective e.g. made ground) to that assumed in the SGV/GAC/pC4SL/S4UL.
 - c. Soil organic matter content is significantly different to that assumed in the derivation of the SGV/GAC/pC4SL/S4UL.
- (3) If simple adjustments are not sufficient to reflect site conditions, undertake a DQRA. This may be undertaken using the CLEA software or by using an alternative risk assessment methodology that is relevant, appropriate, authoritative and scientifically based. Changes to toxicological end points may also be considered, although this should only be undertaken by a toxicology expert. In the context of this guidance, simple adjustments of a generic land use scenario for soil type or SOM content for example are not considered sufficient to be classed as a DQRA.

DQRAs should be conducted with the agreement of the local authority (or the Environment Agency) since it is the authority that determines whether land is Contaminated Land or whether Planning Permission for a new development may be granted.

Representative Data

The type, quantity and quality of the available soil data influence the method chosen to obtain a site representative soil concentration that is compared with a SGV/GAC/pC4SL/S4UL in the screening process. The soil data should be representative of the exposure scenario being considered. This can include factors such as:

- averaging area over which exposure occurs;
- sample depth;
- heterogeneity of soil

where the „averaging area“ is defined as:

That area (together with a consideration of depth) of soil to which a receptor is exposed or which otherwise contributes to the creation of hazardous conditions’.

Site investigations take discrete samples from a given area (and to a certain depth). It has to be assumed that these samples are to some degree representative of the contaminant concentration throughout that volume of soil. The critical soil volume (taking into account area and depth) which might be usefully compared with a SGV/GAC/pC4SL/S4UL is a site-specific decision, but a starting point is the generic land use scenarios used in the derivation of the SGV/GAC/pC4SL/S4UL. The critical soil volume depends on two factors:

- Contaminant distribution and vertical profile (bands of highly contaminated material or lateral hot spots should not necessarily be averaged out with more extensive cleaner areas of soil without justification)
- Contribution to average exposure underpinning the SGV. Direct contact exposure pathways depend on the adult or child coming into contact with near-surface soils and the area over which that exposure occurs is usually important (i.e. the averaging area). Vapour pathways are less dependent on surface area, for example vapour intrusion may result from a highly concentrated hot spot beneath a building leading to elevated average indoor air concentrations. For the three standard land uses for which SGVs are derived, relevant considerations are:
 - For the standard **residential or allotment land use**, the critical soil volume is the area of an individual garden, communal play area or working plot from the surface to a depth of between 0.5m and 1.0m. This is the ground over which children are most likely to come into contact with soil or from which vegetable and fruit produce will be harvested. In the case of volatile contaminants, it may also be appropriate to consider the volume of soil underneath the footprint of the building although vapour intrusion may be driven by a soil volume much smaller than this if the contaminant source is highly concentrated.
 - For the standard **commercial land use**, the critical soil volume has to be decided on a case-by- case basis due to the wide range of possible site layouts. However, for non-volatile contaminants, landscaped and

recreational areas around the perimeter of office buildings are likely to be most important. For volatile contaminants, the footprint occupied by the building itself should also be considered.

- For **most exposure pathways**, the contamination is assumed to be at or within one metre of the surface.

The use of averaging areas must be justified on the basis of relevance to the exposure scenario. SGVs are relevant only when the exposure assumptions inherent in them are appropriate for the identified exposure averaging area. Further guidance on critical soil volumes and the consideration of averaging exposure areas can be found in:

- *Secondary model procedure for the development of appropriate soil sampling strategies for land contamination (Environment Agency, 2000);*
- *Guidance on comparing soil contamination data with a critical concentration (CIEH/CL:AIRE, 2009); and*
- *Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination – Appendix I (Defra December 2013, March 2014)*

It is the mean soil concentration for the individual contaminant within an individual averaging area, which is compared to the SGV. However, as contaminant concentrations vary across a site, and sampling and analysis will introduce measurement errors, the comparison between measured mean concentration and the SGV must take this uncertainty into account.

There are two principal options available to obtain site representative soil concentrations from a site investigation dataset; statistical and non-statistical methods. Data objectives, quality and quantity are likely to determine which approach is most appropriate. If statistical methods such as those presented in CIEH/CL:AIRE (2011) are to be used, sufficient data need to be available or obtained. No one single statistical approach is applicable to all sites and circumstances. The wider range of robust statistical techniques developed by organisations including the US Environmental Protection Agency (USEPA) are also important tools. Risk assessors should choose an appropriate statistical approach on the basis of the specific site and the decision that is being made. For further guidance on the appropriate use of statistical approaches, refer to USEPA 2006 or good environmental monitoring statistics textbooks.

When statistical approaches are inappropriate (this will depend on the objectives of the site investigation), individual or composite samples should be compared directly to the SGV. Guidance on use of alternative data handling approaches such as the use of composite sampling can be found in documents such as:

- *Verification of remediation of land contamination (Environment Agency, 2010);*
- *Sampling and testing of wastes to meet landfill Waste Acceptance Criteria (Environment Agency, 2005);*
- *Guidance on choosing a sampling design for environmental data collection (USEPA, 2002);*
- *Soil Quality – Sampling, ISO 10381 series (ISO, 2002–2007).*

The statistical tests should not be used as arbiters for decisions under Part 2A. They are an additional, useful line of evidence to assist in decision-making. The implications of the basis for the derivation of the site representative soil concentration must be taken into account in any decision-making process and clearly documented.

Where the statistical tests are conducted in accordance with the method described in CL:AIRE 2009:

- For the Planning situation, it has to be demonstrated that the concentration of contaminants is low compared to the pC4SL/S4UL or SSAC. All of the test data should be below the screening criteria and no statistical analysis is required or if there are exceedances of the criteria then a statistical assessment is required. For the statistical assessment this decision is based on whether there is at least a 95% confidence level that the true mean of the dataset is lower than the screening criteria.
- For the Part 2A scenario the regulator needs to determine whether the concentration of contaminants is greater than the SGV/GAC/pC4SL/S4UL or SSAC. This decision is based on whether there is at least a 95% confidence level that the true mean of the dataset is higher than the SSAC. However, the regulator may proceed with determination if there is just a 51% probability, “on the balance of probabilities.”

If the screening levels are exceeded then more sophisticated quantitative risk assessment can be undertaken or remedial action may be taken to break the contaminant linkages. The benefits of undertaking a quantitative risk assessment must be weighed against the likelihood that it will bring about cost savings in the proposed remediation. Further information about the use of soil guideline values is provided in Environment Agency : 2008: Using Soil Guideline Values SC050021/SGV Introduction, March 2008.

GENERIC RISK ASSESSMENT CRITERIA FOR RISK TO PLANTS

Soil contaminants, if present at sufficient concentrations, can have an adverse effect on the plant population. Phytotoxic effects can be manifested by a variety of responses, such as growth inhibition, interference with plant processes, contaminant-induced nutrient deficiencies and chlorosis (yellowing of leaves). All chemicals are probably capable of causing phytotoxic effects. Thus the phytotoxic potential of substances is dependent on the concentrations capable of having adverse effects on plants and the concentrations likely to be found at contaminated sites. Phytotoxicity is a difficult parameter to quantify given that experimental techniques vary widely and variations exist in plant tolerances, soil effects and synergistic/antagonistic reactions between chemicals. Contaminants may be taken up and accumulated by plants through a range of mechanisms. The principal pathways are active and/or passive uptake through the plant root, adsorption to root surfaces and volatilisation from the soil surface followed by foliar uptake. After plant uptake, contaminants may be metabolised or excreted, or they may be bioaccumulated and this is highly species dependant. Many of the substances capable of adversely affecting vegetation exert this effect because of their water solubility, a characteristic that could result in their transport from contaminated sites into adjacent locations where the chemical may generate a phytotoxic response. This could be important if, for example, the adjacent site has important conservation status.

The concentration in soil at which substances become phytotoxic depend on a range of factors including plant type, soil type, pH, the form and availability of the contaminant and other vegetation stress factors that may be present (such as drought). Some plants (including some rare plants will only grow in soils where there are relatively high concentrations which would be phytotoxic to other species. Whilst many contaminants may be phytotoxic, data are limited. Some heavy metals are essential as trace elements for plant growth but may become toxic at higher concentrations.

TerraConsult has carried out a review of a number of current and former guidance documents and other texts on phytotoxicity. It is not possible to produce a definitive list of phytotoxic substances on account of the variables mentioned above. However, a number of metals are repeatedly cited as commonly occurring priority pollutants. As a result, the following list is adopted by TerraConsult as indicators of the potential for phytotoxicity: As, Cr, Cu, Ni and Zn (note that Boron has been excluded from this list because the more modern studies do not assess this).

As the CLEA framework is a risk based approach, applied to humans, an alternative strategy is required to assess the risk to plants from substances that are phytotoxic. Reference to published criteria and background concentrations can help put site data into context. Published assessment criteria for the protection of plant life from a number of countries are given in the following Table. The most authoritative source is the British Standard for topsoil, but this only lists three elements. CLR 11 states that the ICRCL Guidance Note 70/90 can be used for initial screening criteria. This approach has been adopted by TerraConsult where BS3882 is lacking, but where an ICRCL 70/90 criterion is lacking, the lowest criterion in Table below from, firstly UK, and, secondly, European and then other worldwide criteria. The adopted criteria are highlighted in the table 3.8. The MAFF value of 250 mg/kg has been chosen for As over the ICRCL value of 50 mg/kg as MAFF explains the 50 is applicable to vegetables and human health, whereas 250 is applicable to the plants themselves.

Table B.5: Published Assessment Criteria for Phytotoxic Elements (mg/kg)							
Reference	As	Cr (Total)	Cr (III)	Cr (VI)	Cu	Ni	Zn
British Standard for topsoil (BS3882:2007)	-	-	-	-	200 (pH >7) 135 (pH 6-7) 100 (pH 5.5-6.0)	110 (pH >7) 75 (pH 6-7) 60 (pH 5.5-6.0)	300 (pH >7) 200 (pH 6-7) 200 (pH 5.5-6.0)
MAFF Code of Good Agricultural Practice for the Protection of Soil (1998)	250	-	400 for sites containing sewage and sludge	-	500 (grass) but may fall to 250 for clover and sensitive species (at pH>6)	110 (pH>7) 75 (pH 6-7) 60 (pH 5.5-6.0)	1000 (clover & grass at pH 6), may fall to 300 for sensitive species (at pH 6-7)
ICRCL 59/83 (1987) now withdrawn for human health assessment	-	-	-	-	130	70	300
ICRCL 70/90 (1990) threshold trigger value	50	-	-	25 *	250	-	1000
Dutch ecotoxicological intervention value (Swartjes 1993 & 1994)	40	230	-	7	190	-	-
Australian Guideline B(1) (1999), Interim Urban Ecological Investigation Level (EIL). Soils not generally considered phytotoxic below these EILs.	20	-	400	1	100	60	200
New Zealand guidelines for timber treatment sites (1977), estimated based on Cu bioavailability *	-	-	-	-	500 - 1000 clay soils	-	-
New Zealand guidelines for timber treatment sites (1977), soil criteria for protection of plant life (residential/ agricultural setting)	10-20	-	600	25	130	-	-
Note: * Cr (VI) is only likely to be present in as a significant proportion of total Cr where pH >12 so this does not routinely need to be tested for regarding plant health.							

CURRENT GUIDANCE FOR CONTROLLED WATERS RISK ASSESSMENT

Summary of Regulatory Context

Government policy is based upon a “suitable for use approach,” which is relevant to both the current use of land and also to any proposed future use. When considering the current use of land, Part IIA of the Environment Protection Act 1990 ^[4] (EPA 1990) provides the regulatory regime, which was introduced by Section 57 of the Environment Act 1995 ^[5], which came into force in England on 1 April 2000. The main objective of introducing the Part IIA regime is to provide an improved system for the identification and remediation of land where contamination is causing unacceptable risks to human health, controlled waters or the wider environment given the current use and circumstances of the land. Part IIA provides a statutory definition of contaminated land under Section 78A(2) as:

“any land which appears to the Local Authority in whose area it is situated to be in such a condition, by reason of substances in, on, or under the land, that:

- (a) *Significant harm is being caused or there is a significant possibility of such harm being caused; or*
- (b) *Pollution of controlled waters is being, or is likely to be, caused.”*

Part IIA provides a statutory definition of the pollution of controlled waters under Section 78A(9) as:

*“the entry into controlled waters of **any** poisonous, noxious or polluting matter or **any** solid waste matter”*

Part IIA is supported by a substantial quantity of guidance and other Regulations, especially for England, The Contaminated Land (England) (Amendment) Regulations 2012 and Contaminated Land Statutory Guidance (DEFRA, 2012) which came into force in early April 2012. The document re-confirms the duties of Enforcing Authorities in dealing with contamination including the role of the Environment Agency which has powers under Part 7 of The Water Resources Act (1991) to take action to prevent or remedy the pollution of controlled waters, including circumstances where the pollution arises from contamination in the land.

Part IIA introduces the concept of a contaminant linkage; where for potential harm to exist there must be a connection between the source of the hazard and the receptor via a pathway. Risk assessment in contaminated land is therefore directed towards identifying the contaminants, pathways and receptors that can provide contaminant linkages. This is known as the contaminant-pathway-receptor link (CPR or contaminant linkage).

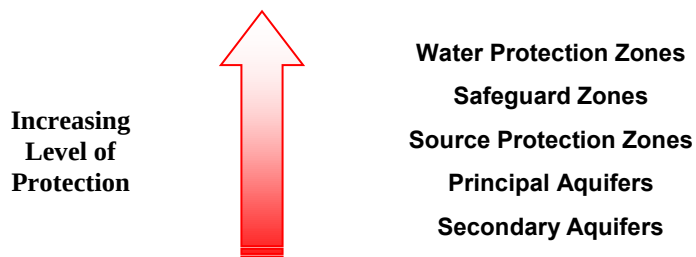
Part IIA places contaminated land responsibility as a part of the planning and redevelopment process rather than Local Authority or Environment Agency taking direct action except in situations of very high pollution risk or where harm is occurring. This requires that a site which has been developed shall not be capable of being determined “contaminated land” under Part IIA. Therefore, appropriate risk-based investigation is required to identify the contaminant linkages that can then be assessed, and then mitigated using methods that can be readily agreed with the planners.

Natural Resources Wales Guidance

Natural Resources Wales have adopted the Environment Agency’s approach to protecting groundwater. The Environment Agency’s overall position on groundwater is *“To protect and manage groundwater resources for present and future generation in ways that are appropriate for the risks that we identify”* (The Environment Agency’s Approach to Groundwater Protection, 2017). In brief, the core objectives of the existing legislation serve to enforce this position.

In 1992, the National Rivers Authority published their Policy and Practice for the Protection of Groundwater (PPPG), this document was influential as it provided a focus for key developments such as Source Protection Zones (SPZs) and Groundwater Vulnerability Maps. The Policy was then revised in 1998, since which there have been substantial changes in legislation, driven by Europe. Key European Directives relating to groundwater include the Groundwater Directive (80/68/EEC) and the Water Framework Directive (2000/60/EC). Aspects of these directives are controlled by primary UK legislation such as the Water Resources Act 1991 as amended by the Water Act 2003. Further to legislative changes, gaps identified in the 1998 PPPG required addressing. These changes are reflected in the Environment Agency Policy document *The Environment Agency’s Approach to Groundwater Protection* of March 2017.

The Environment Agency follows a tiered, risk based approach to drinking water protection and this should be taken into account when carrying out controlled waters risk assessment:



Tools available for Risk Assessment of Controlled Waters

In order for a developer of a potentially contaminated site to fulfil their obligations under the legislation, a site assessment would be required to be undertaken in order to identify any potential risks to controlled waters and to derive suitable clean-up criteria if necessary to ensure the protection of controlled waters. A number of tools are available for this purpose.

Three main stages apply to any risk assessment of controlled waters, these are:

- i) Risk Screening (devise Conceptual Site Model, making reference to groundwater vulnerability maps, site setting etc)
- ii) Generic Risk Assessment (using the EA Remedial Targets Methodology – Tier 1 - Comparison of groundwater data with relevant standards)
- iii) Detailed Quantitative Risk Assessment (Consideration of aquifer properties and site specific parameters, using the EA Remedial Targets Methodology - Tiers 2 & 3)

The process is summarised below (Taken from the Environment Agency GP3 consultation document, 2006):

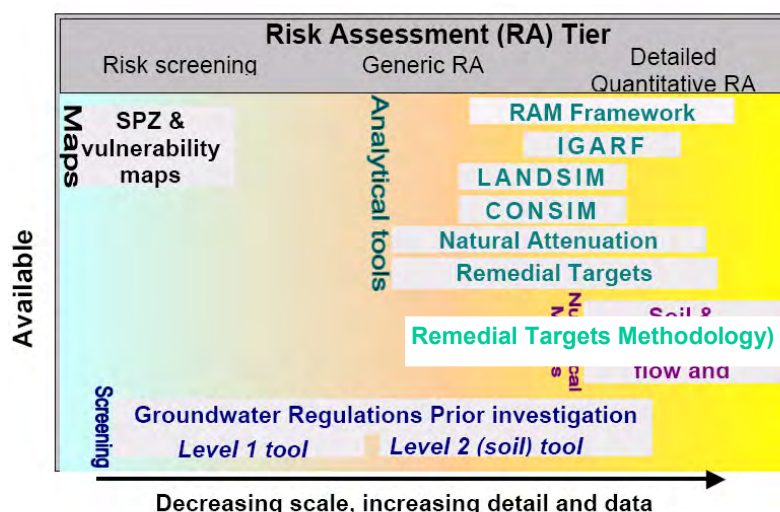


Figure 1-1 Environment Agency groundwater assessment tools, mapped against the different levels of risk assessment.

When assessing groundwater impact the Environment Agency advocate the application of their framework methodology "Remedial Targets Methodology – Hydrogeological Risk Assessment for Land Contamination" Environment Agency (2006). The methodology has four tiers of assessment:

Tier 1 utilises either a soil concentration (calculation of pore water concentrations based on partitioning calculations), leaching test or pore-water concentration of perched water as a source concentration input and these are contrasted directly to water quality standards. No dilution or attenuation is considered at Level 1.

Tier 2 (groundwater) considers dilution of the contaminant within the underlying receiving groundwater or surface water body. To determine a dilution factor the infiltration rate of pore water and the discharge of groundwater beneath the source must be determined. Level 2 Assessment is comprises a comparison between measured groundwater concentrations with to water quality standards.

Tier 3 considers natural attenuation in the form of dispersion, retardation and degradation of the contaminant. As the levels are progressed, the assessment becomes increasingly more detailed and less conservative as the data requirements are increased with each successive tier. The Environment Agency has released Excel Worksheets to carry out basic calculations using a conservative approach up to Tier 3. However, in this case the conceptual model is a simple one and assumes there is a simple migration of contaminants from the source zone into the aquifer receptor. Using these worksheets requires a sensitivity analysis showing how by varying each parameter, what effect it might have on the outcome of the assessment. Groundwater conceptual models are not always this simple.

Tier 4 is for more complex conceptual models where multiple sources, multiple pathways, multiple receptors and complex water balances can be assessed.

The Environment Agency developed a spreadsheet based code to support the Remedial Target Methodology, and the code is capable of undertaking assessments for Tiers 1 to 3. Tier 4 assessment is not supported by the spreadsheet based code.

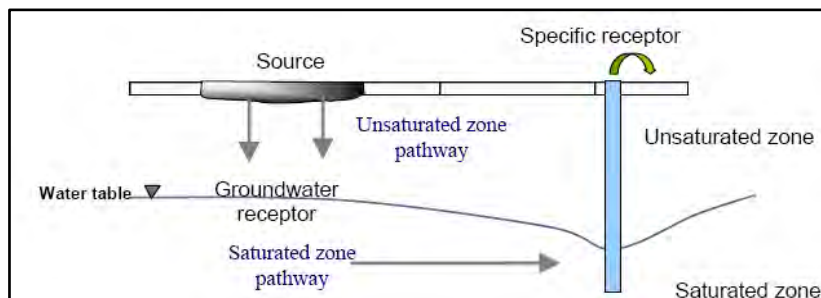
A more advanced code, ConSim 2, developed on behalf of the Environment Agency to support the Remedial Targets Methodology, allows for the introduction of additional geological horizons and is used mainly to determine the concentrations reaching a receptor and the timescales over which this may happen.

The codes assess only the dissolved phase contaminants. There are many further codes commercially available for use in controlled waters risk assessment, particularly for more complex situations, however, these should be used with caution and only once agreement has been obtained from the Environment Agency. All have the overall aim of the estimation of risk from contaminant linkages and the protection of controlled waters.

General notes on each stage of the controlled waters risk assessment process

Risk Screening

The understanding of the Conceptual Site Model (CSM) is the key to assessing any site. Using a robust CSM, potential pathways or receptors may be screened out from any further assessment at an early stage. For example if the pathway through the unsaturated zone is blocked by the presence of a significant thickness of low permeability clay. A greater understanding of the CSM is achieved with each tier of risk assessment. An example of a basic Source-Pathway-Receptor concept is given below (taken from the Environment Agency GP3, 2006):



Generic Risk Assessment

When undertaking the Generic Hydrogeological Risk Assessment (EA Remedial Targets Methodology Tier 1), comparison of chemical analytical results is made with screening criteria. Published values of screening criteria with which chemical test results can be compared are published in the following guidance:

There is a hierarchy of screening criteria which is as follows:

- Updated Recommendations on Environmental Technical Standards, River Basin Management (2015-21), April 2012 by the UK Technical Advisory Group on the Water Framework Directive;
- Environmental Quality Standards (EQS) for freshwaters based on The EC Dangerous Substances Directive (76/464/EEC and Daughter Directives);
- Surface Waters (Abstraction for Drinking Water)(Classification) Regulations (1996)
- Surface Waters (Fishlife) (Classification) Regulations (1997)
- UK Drinking Water Standards (DWS) (Water Supply (Water Quality) Regulations 2000);
- Dutch Ministry of Housing, Spatial Planning and Environment (2001) Intervention Values and Target Values – soil quality standards;
- World Health Organisation Guidelines for Drinking Water (2004)

Should the Level 1 or 2 assessments indicate threshold levels to be exceeded, then there are three alternative ways in which to proceed:

- To devise suitable remedial solutions;

- To carry out more investigation, sampling and analysis;
- To conduct a site-specific Detailed Quantitative Risk Assessment (DQRA) to whether or not the soil materials are suitable for their site-specific intended use or to devise a site-specific clean-up level.

Detailed Quantitative Risk Assessment (DQRA)

The decision to carry out a DQRA will be dependent on the extent and implications of the initial qualitative and generic assessment. The scope of any such assessment will be accurately defined by the outcomes of the former two stages. The CSM will be sufficiently refined by this stage that only certain contaminants of concern, certain pathways and certain receptors will require further assessment, the remainder having been screened out.

Additional site specific data is normally required for this stage of assessment, as explained above, more processes that are capable of affecting contaminant concentrations are considered (such as dilution and attenuation).

Remediation criteria derived will therefore be specific to each site and will be based on a detailed assessment of the potential impact at the identified receptor or *compliance point*. A greater level of confidence can be placed on the predicted impact on the compliance point following a DQRA.

Definition of Controlled Waters

The term „controlled waters“ is defined in Section 104 of the Water Resources Act 1991 as:

“Territorial Waters...which extend seawards for three miles..., coastal waters..., inland freshwaters, waters in any relevant lake or pond or of so much of any relevant river or watercourse as is above the freshwater limit, and ground waters, that is to say, any waters contained in underground strata.”

Note that the definition of groundwater under the Water Resources Act 1991 includes all water within underground strata (including soil / pore water in the unsaturated zone). The definition of groundwater under the Groundwater Directive however is limited to water in the saturated zone. For the purposes of Part IIA of the Environmental Protection Act 1990, the Environment Agency recommends that the groundwater within the saturated zone only is considered as the receptor (rather than soil / pore water).

Aquifer Designations

The Environment Agency have classified different types of aquifer from which groundwater can be extracted. The aquifer designations reflect the importance of aquifers in terms of groundwater as a resource (drinking water supply) but also their role in supporting surface water flows and wetland ecosystems. The aquifer designation data is based on geological mapping provided by the British Geological Survey.

The maps are split into two different types of aquifer designation:

- **Superficial (Drift)** – permeable unconsolidated (loose) deposits.
- **Bedrock (Solid)**– solid permeable formations e.g. sandstone, chalk, limestone.

The aquifer designations displayed on the Environment Agency maps are as follows:

- **Principal Aquifers (formerly termed Major Aquifers)** – These are layers of rock or drift deposits that have high intergranular and/or fracture permeability - meaning they usually provide a high level of water storage. They may support water supply and/or river base flow on a strategic scale. In most cases, principal aquifers are aquifers previously designated as a major aquifer.
- **Secondary Aquifers (formerly termed Minor Aquifers)** – These include a wide range of rock layers or drift deposits with an equally wide range of water permeability and storage. Secondary aquifers are subdivided into two types:

- **Secondary A** - 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;
 - **Secondary B** - predominantly lower permeability layers which may store and yield limited amounts of groundwater due to localised features such as fissures, thin permeable horizons and weathering. These are generally the water-bearing parts of the former non-aquifers.
 - **Secondary Undifferentiated** - has been assigned in cases where it has not been possible to attribute either category A or B to a rock type. In most cases, this means that the layer in question has previously been designated as both minor and non-aquifer in different locations due to the variable characteristics of the rock type.
- **Unproductive Strata (formerly termed Non-Aquifer)** – These are rock layers or drift deposits with low permeability that have negligible significance for water supply or river base flow.

Hazardous and Non Hazardous Substances

The Groundwater (England and Wales) Regulations 2009 control the disposal to the hydrogeological environment of potentially polluting substances which are divided into Hazardous Substances and Non-hazardous Contaminants (this roughly approximates to the former List 1 and List 2 substances).

Hazardous Substances are the most damaging and toxic and must be prevented from directly or indirectly entering the groundwater environment. Hazardous Substances include mineral oils and hydrocarbons, pesticides, biocides, herbicides, solvents and some metals. Discharge of Hazardous Substances to Controlled Waters must be prevented.

Non-hazardous Pollutants are any contaminants other than Hazardous Substances. Non-hazardous Pollutants are potentially toxic but are less harmful than Hazardous Substances, but their direct discharge to groundwater is generally not permitted and any indirect discharge to groundwater must be limited and be controlled by technical precautions in order to prevent pollution. Non-hazardous Pollutants include ammonia and nitrites, many metals and fluorides.

MANAGEMENT OF CONTAMINATED LAND

When risk assessment of the site has been completed and this indicates that remedial works are required, the main guidance in managing this process is set out in the DEFRA/EA publication CLR11 (2004) "Model Procedures for the Management of Land Contamination." The stages of managing remediation are as follows:

- (a) Options Appraisal and develop Remediation Strategy;
- (b) Develop Implementation Plan and Verification Plan;
- (c) Remediation, Verification and Monitoring.

The Remediation Strategy sets out the remediation targets, identifies technically feasible remedial solutions and presents an evaluation of the options so that these can be assessed enabling that the most suitable solution is adopted. An outline of the proposed remedial method should be presented. Agreement should be sought of the appropriate statutory bodies for the Remediation Strategy before proceeding to the next stage.

The Implementation Plan is a detailed method statement setting out how the remediation is to be carried out including stating how the site will be managed, welfare procedures, health and safety considerations together with practical measures such as details of temporary works, programme of works, waste management licences and regulatory consents required. Agreement should again be sought of the appropriate statutory bodies for this Plan.

The Verification Plan sets out the requirements for gathering data to demonstrate that the remediation has met the required remediation objectives and criteria. The Verification Plan presents the requirements for a wide range of issues including the level of supervision, sampling and testing regimes for treated materials, waste and imported materials, required monitoring works during and post remediation, how compliance with all licenses and consents will be checked etc. Agreement should again be sought of the appropriate statutory bodies for the Verification Plan. On completion of the remediation a Verification Report should be produced to provide a complete record of all remediation activities on site and the data collected as required in the Verification Plan. The Verification Report should demonstrate that the remediation has met the remedial targets to show that the site is suitable for the proposed use.

GLOSSARY

TERMS		UNITS	
AST	Above Ground Storage Tank	m	Metres
BGS	British Geological Survey	km	Kilometres
BSI	British Standards Institute	%	Percent
BTEX	Benzene, Toluene, Ethylbenzene, Xylenes	%v/v	Percent volume in air
CIEH	Chartered Institute of Environmental Health	mb	Milli Bars (atmospheric pressure)
CIRIA	Construction Industry Research Association	l/hr	Litres per hour
CLEA	Contaminated Land Exposure Assessment	ha	Hectare (10,000 m ²)
CSM	Conceptual Site Model	µg/l	Micrograms per Litre (parts per billion)
DNAPL	Dense Non-Aqueous Phase Liquid (chlorinated solvents, PCB)	ppb	Parts Per Billion
DWS	Drinking Water Standard	mg/kg	Milligrams per kilogram (parts per million)
EA	Environment Agency	ppm	Parts Per Million
EQS	Environmental Quality Standard	mg/m ³	Milligram per metre cubed
GAC	General Assessment Criteria	Mg/m ³	Megagram per metre cubed
GL	Ground Level	µg/m ³	Microgram per metre cubed
GSV	Gas Screening Value	m bgl	Metres Below Ground Level
HCV	Health Criteria Value	m bcl	Metre Below Cover Level
LNAPL	Light Non-Aqueous Phase Liquid (petrol, diesel)	mOD	Metres Above Ordnance Datum (sea level)
ND	Not Detected	kN/m ²	Kilo Newtons per metre squared
LMRL	Lower Method Reporting Limit	kPa	Kilo Pascal – same as kN/m ²
NR	Not Recorded	µm	Micro metre
NRW	Natural Resources Wales		
OD	Ordnance Datum		
PAH	Poly Aromatic Hydrocarbon		
PCB	Poly-Chlorinated Biphenyl		
PID	Photo Ionisation Detector		
PCSM	Preliminary Conceptual Site Model		
SGV	Soil Guideline Value		
TPH (CWG)	Total Petroleum Hydrocarbon (Criteria Working Group)		
SPT	Standard Penetration Test		
SVOC	Semi Volatile Organic Compound		
UST	Underground Storage Tank		
VCCs	Vibro Concrete Columns	VSCs	Vibro Stone Columns
VOC	Volatile Organic Compound		

APPENDIX C

Site Photographs

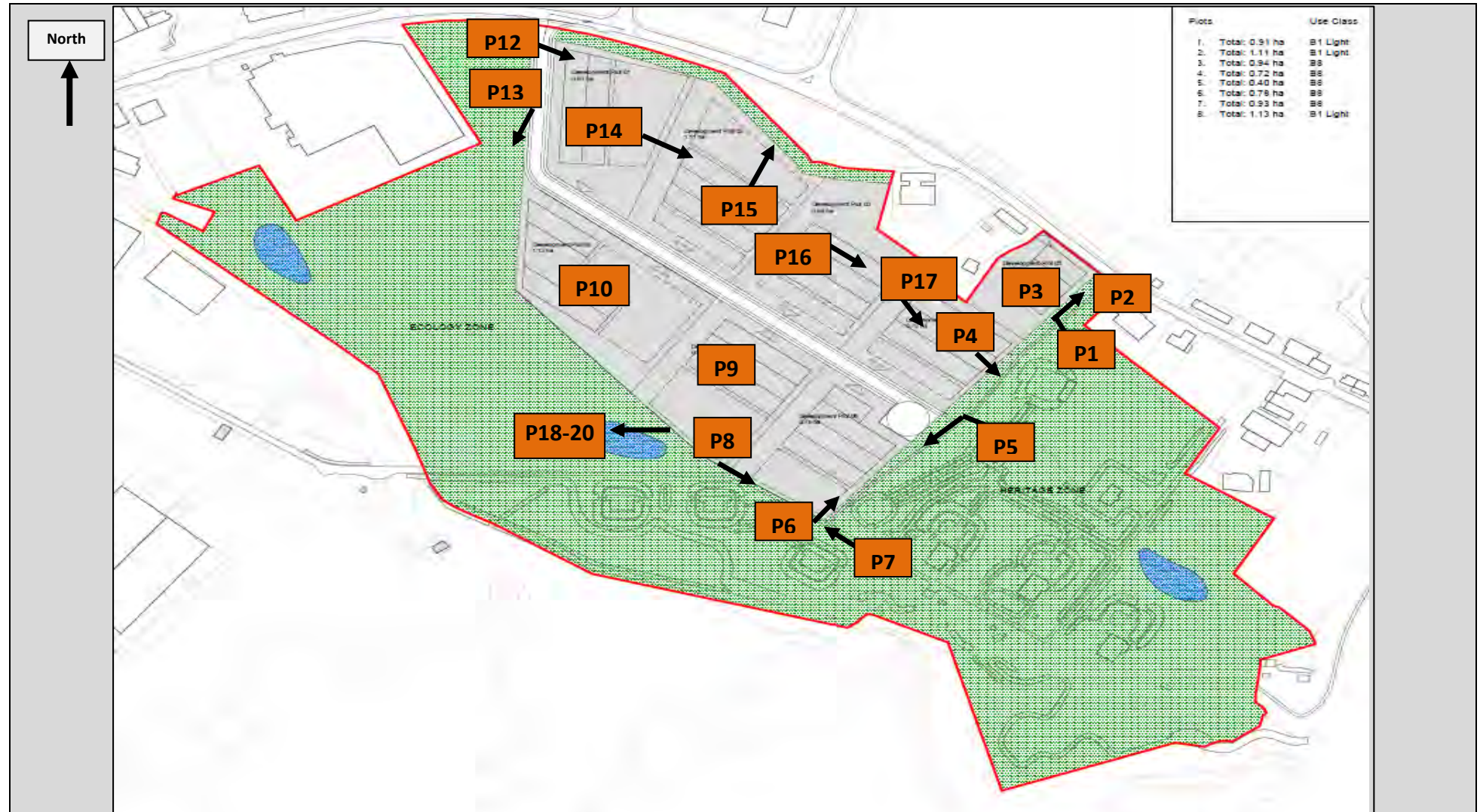


Diagram:	Site Plan provided by client (Proposed Site parameters Plan', Land Studio, February 2019)
Description:	General Site Photographs during site investigation
Labels:	Photograph and positions and directions



Photograph 1: Looking north east along the eastern access track.



Photograph 2: Fly tipped cemented asbestos sheeting immediately next to the eastern access track.



Photograph 3: Chambers for waters services noted to run parallel with part of the eastern access track.



Photograph 4: Looking south east towards the eastern access track from an elevated north eastern area of the proposed development area.



Photograph 5: Looking south at the south eastern corner of the proposed development.



Photograph 6: Looking north from the south eastern boundary of the proposed development



Photograph 7: Looking west from the south eastern corner of the proposed development, along the southern boundary.



Photograph 8: Looking east along part of the proposed developments southern boundary.



Photograph 9: Looking north from a central area of the site (dense vegetation & undulating ground levels).



Photograph 10: Looking north from a central area of the site (very dense vegetation surrounding a track)



Photograph 11: Looking north from a central area of the site (dense vegetation & undulating ground levels).



Photograph 12: Looking east from the main access road in the north west of the site.



Photograph 13: Looking south along the proposed developments western boundary.



Photograph 14: Looking east along the northern area of the proposed development



Photograph 15: Looking at the raised elevated central northern area.



Photograph 16: Looking east at the elevated north eastern area of the proposed development.



Photograph 17: North eastern area of the proposed development.



Photograph 18: SW of the proposed development area. Photo showing extent of concrete debris wall/bank created from magazine buildings demolition material



Photographs 19 & 20: Bank created from concrete demolition material originating from magazine buildings.

APPENDIX D

Exploratory Hole Records

Exploratory Hole Location Plan



- Legend Key
- Locations By Type - CP
 - Locations By Type - TP
 - Locations By Type - WLS





Version 2.0.6

BGS ID: 153140 : BGS Reference: SJ34NE34/1
British National Grid (27700) : 338860,349450

[Report an issue with this borehole](#)

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BOREHOLE LOG

SITE **WREXHAM** SJ 34 NE 34(1)

BOREHOLE No. **1** DIAMETER **6"** SHEET No. **1**

GROUND LEVEL **109.61** DATE **21st - 26th MARCH 1966** 3886 4945

Description	Level	Legend	Sample	Depth	Thick- ness	Remarks
Topsoil	109.61			0'-0"	0'-0"	
Firm brown silty clay with blue streaks & small stones	109.11			32'-0"		
Firm brown silty clay with small pockets of boulder clay	77.11			32'-0"		
						52'-0" - 54'-0" 6' 3' 3' 3' 3' 12 8 11 13 14
						63'-0"
						82'-0" - 83'-0" 6' 3' 3' 3' 3' 11 10 10 14 5
Firm brown sandy silty clay	13.61			96'-0"		
Medium grained SAND with bands of silt	5.61			100'-0"		
	-4.39			115'-0"		
						Water entry at 106'-0" 111'-0" - 113'-0" 6' 3' 3' 3' 3' 23 22 32 32 35
						Water level:- 27.3.66 10 AM. - 58'-0"

SCALE 1/4" = 1 foot • DISTURBED SAMPLE CORE SAMPLE PENETRATION TESTS

BOREHOLE LOG

SJ 34NE/34
(4)

SITE WREXHAM

BOREHOLE No. 4 **DIAMETER** 8" **SHEET No.** 1

GROUND LEVEL 109.11 **DATE** 28.31 MARCH 1966 3914 4925

Description	Level	Legend	Sample	Depth	Thick- ness	Remarks										
Red Shale Firm brown-blue silty CLAY	109.11 106.36			0'-0" 0'-9"	0'-9"											
					24'-3"											
Firm brown silty CLAY	84.11			25'-0"												
					22'-0"											
Firm brown boulder CLAY	62.11			47'-0"												
					48'-0"											
						86'-0" - 88'-0"										
						<table border="1"> <tr> <td>6'</td> <td>3'</td> <td>3'</td> <td>3'</td> <td>3'</td> </tr> <tr> <td>11</td> <td>10</td> <td>11</td> <td>20</td> <td>18</td> </tr> </table>	6'	3'	3'	3'	3'	11	10	11	20	18
6'	3'	3'	3'	3'												
11	10	11	20	18												
Firm brown boulder CLAY with thin bands of sand	14.11			95'-0"		Water entry at 100' 0"										
						110'-0" - 112'-0"										
	-2.89			112'-0"		<table border="1"> <tr> <td>6'</td> <td>3'</td> <td>3'</td> <td>3'</td> <td>3'</td> </tr> <tr> <td>20</td> <td>16</td> <td>27</td> <td>43</td> <td>70</td> </tr> </table>	6'	3'	3'	3'	3'	20	16	27	43	70
6'	3'	3'	3'	3'												
20	16	27	43	70												
						WATER LEVELS:- 31.3.66, 7.A.M. 85' 0" 1.4.66, 10.A.M. 80' 0"										

SCALE 1/2" = 1 Foot **DISTURBED SAMPLE** **CORE SAMPLE** **PENETRATION TESTS**



Version 2.0.6

BGS ID: 153131 : BGS Reference: SJ34NE25
British National Grid (27700) : 338600,349430

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British Geological Survey

SJ 34 NE 25**3860 4943**

British Geological Survey

Redwither, Abenbury

Surface level +28.8 m
Water not encountered
Shell and auger 152 mm diameter
September 1977

British Geological Survey

Block C

Waste 18.0 m+

LOG

Geological classification	Lithology	Thickness m	Depth m
British Geological Survey	Made ground	1.0	1.0
Boulder Clay	Clay, silty, dark brown, soft to 6 m stiff below; scattered stones	17.0+	18.0

British Geological Survey

British Geological Survey

British Geological Survey

British Geological Survey

British Geological Survey

British Geological Survey

British Geological Survey

British Geological Survey

British Geological Survey

British Geological Survey

British Geological Survey

British Geological Survey

SS 34 NE/42

River Division	SJ34NE42	GR '3810 4926
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Block

Surface level

--	--

British Geological Survey

British Geological Survey

British Geological Survey

O.D. 25m.

LOG

[illegible]

British Geological Survey

Exploratory Hole Key Sheet

TerraConsult

SAMPLES:

Undisturbed:	
U	Driven tube sample
UT	Thin wall driven tube sample
TW	Pushed thin wall tube sample
P	Pushed piston sample
L	Liner sample (from windowless or similar sampler), full recovery unless otherwise stated
CBR	CBR mould sample
BLK	Block sample
C	Core sample (from rotary core) taken for laboratory testing
Disturbed:	
D	Small sample
B	Bulk sample
AMAL	Amalgamated sample
Environmental:	
ES	Environmental soil sample
EW	Environmental water sample
Comments:	Sample reference numbers are assigned to every sample taken. A sample reference of 'NR' indicates that an attempt was made to take a tube sample; however, there was no recovery. Sample recovery is given as a percentage.

TESTS:

SPT S or SPT C	Standard Penetration Test, open shoe (S) or solid cone (C)
	The Standard Penetration Test is defined in BS EN ISO 22476-3 (2005). The incremental blow counts are given in the Field Records column; each increment is 75mm unless stated otherwise and any penetration under self weight in mm (SW) is noted. Where the full 300mm test drive is achieved the total number of blows for the test drive is presented as N = ** in the Test column. Where the test drive blows reach 50 (either in total or for a single increment) the total blow count beyond the seating drive is given (without the N = prefix).
ICBR	In situ CBR
IV	In situ vane shear strength, peak (p) and remoulded (r), kPa
HV	Hand vane shear strength, peak (p) and remoulded (r), kPa
PP	Pocket penetrometer test, converted to shear strength, kPa
KFH, KRH, KPI	Variable head permeability tests (KFH = falling head test, KRH = rising head test, KPI = packer test), permeability value
PID/FID	Photo-ionisation detector/Flame-ionisation detector
	Test results provided in Field Records column

DRILLING RECORDS:

The mechanical indices (TCR/SCR/RQD & If) are defined in BS 5930: 2015 and BS EN ISO 22575-1 (2006)

TCR	Total Core Recovery, %
SCR	Solid Core Recovery, %
RQD	Rock Quality Designation, %
If	Fracture spacing, mm. Minimum, typical and maximum spacings are presented.
NI	Non intact is used where the core is fragmented.
CRF	Core recovered (length in m) in the following run
AZCL	Assessed zone of core loss
NR	Not recovered

GROUNDWATER:



Groundwater strike



Groundwater level after standing period

DEPTH REMARKS:

EoS	End of Shift
SoS	Start of Shift
EoBH	End of Borehole

INSTRUMENTATION:

Details of installations are given on the Record. Legend column shows installed instrument depths including slotted pipe section or tip depth, response zone filter material type and layers of backfill. The type of instrument installed is indicated by a code adjacent to the Legend column at the base of the instrument.

SP	Standpipe
SPIE	Standpipe piezometer
PPIE	Pneumatic piezometer
EPIE	Electronic piezometer
AP	Access pipe
GMP	Gas monitoring standpipe
(xx)	Internal diameter (mm)
ICE	Biaxial inclinometer
ICM	Inclinometer tubing for use with probe
SLIP	Slip indicator
ESET	Electronic settlement cell/gauge
ETM	Magnetic extensometer settlement point
ETR	Rod extensometer

EXPLORATORY HOLE TYPE:

CP	Cable percussion
DP	Dynamic probe
DCP	Dynamic cone penetrometer
HA	Hand auger
IP	Inspection pit
OP	Observation pit/trench
PC	Pavement core
RC	Rotary core
RO	Rotary open hole
SH	Shaft
SNC	Sonic (resonance)
TP	Trial pit/trench
TRAV	Traverse
WLS	Windowless (dynamic) sample
WS	Window (dynamic) sample



Project: **The Oaks, Wrexham**
 Project No: **4292**
 Client: **Cefn Park Developments C/O J10 Planning Ltd**

Reference

KEY SHEET

Sheet 1 of 1

Borehole Log

TerraConsult

Borehole formation details:												Location details:			
Type: CP	From: 0.00	To: 15.00	Start date: 11-02-19	End date: 11-02-19	Crew: SL	Plant: Dando 2000	Barrel type: N/A	Drill Bit: N/A	Logged:	Logger: GB	Remarks:	mE: 338662.30	mN: 349460.20	mAOD: 29.62	Grid: OSGB

Backfill/Instal'n	Water-strike	Legend	Level	Depth (thick-ness)	Stratum Description	Samples & In Situ Testing					
						Water	Casing	Depth	Type & No	Results/Remarks	
			29.52	0.10	Yellowish grey slightly silty sandy GRAVEL of subangular to subrounded fine to medium limestone and concrete. (MADE GROUND)	Dry	1.70	0.30	D1	100 (80%)	
			29.22	0.40	Soft dark brown slightly sandy gravelly CLAY. Gravel is angular to subrounded fine to medium of shale. (MADE GROUND)			0.30	ES2		
			28.42	1.20	Firm light brown slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to medium of shale (REWORKED CLAY)			1.00	D3		
					1.00			ES4			
					1.20 - 1.65			U5			
			(2.80)		Very high strength stiff brown mottled grey slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to medium of sandstone, siltstone and mudstone. (GLACIAL TILL)			1.70	D6		N=30 (4,6/6,7,8,9)
								1.80	D7		
								2.00 - 2.45	S		
								2.00	D8		
								2.80			
3.00 - 3.45	U10										
3.50	D11										
3.80	D12										
4.00 - 4.45	S										
25.62	4.00	Stiff brown slightly sandy slightly gravelly laminated CLAY. Gravel is subangular to subrounded fine to coarse of sandstone and mudstone. (GLACIAL TILL)	Dry	4.00	4.00	D13	N=19 (2,3/4,4,5,6)				
					4.00						
25.02	4.60	Very high strength stiff brown mottled grey slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to medium of sandstone, siltstone and mudstone. (GLACIAL TILL)			4.80	D14	76 (95%)				
					5.00 - 5.45	U15					
(6.10)					5.50	D16	N=20 (2,3/4,4,5,7)				
					6.00	D17					
					6.50 - 6.95	S					
					6.50	D18					
					7.50	D19					
					8.00 - 8.45	U20	75 (100%)				
					8.50	D21					
					9.00	D22					
					9.50 - 9.95	S					
					9.50	B23	N=19 (2,3/4,4,5,6)				

Inst (D)		Water		Casing	Depth	Type & No	Results				
Groundwater entries:		Diameter & casing:		Depth related remarks:		Chiselling details:					
Struck:	Rose to:	Casing:	Sealed:	Dia (mm): 150	Depth: 15.00	Casing: 12.00	From: To: Remarks:	From: to: Duration: Tool:			

	Notes: For explanation of symbols and abbreviations see Key Sheet. All depths and reduced levels are in metres.	Project: The Oaks, Wrexham	Exploratory position reference:
	Log issue:	Project No: 4292	BH01
Scale: 1:50	Client: Cefn Park Developments C/O J10 Planning Ltd	Sheet 1 of 2	

Borehole Log

TerraConsult

Borehole formation details:											Location details:	
Type: CP	From: 0.00	To: 15.00	Start date: 11-02-19	End date: 11-02-19	Crew: SL	Plant: Dando 2000	Barrel type: N/A	Drill Bit: N/A	Logged:	Logger: GB	Remarks:	mE: 338662.30 mN: 349460.20 mAOD: 29.62 Grid: OSGB

Backfill/ Instal'n	Water- strike	Legend	Level	Depth (thick- ness)	Stratum Description	Samples & In Situ Testing				
						Water	Casing	Depth	Type & No	Results/Remarks
			18.92	10.70	Very high strength stiff brown mottled grey slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to medium of sandstone, siltstone and mudstone. (GLACIAL TILL)			10.50	D24	
					Stiff brown slightly sandy slightly gravelly laminated CLAY. Gravel is subangular to subrounded fine to coarse of sandstone and mudstone. (GLACIAL TILL)			11.00 - 11.45	U25	67 (100%)
								11.50	D26	
								12.00	D27	
						Dry	12.00	12.50 - 12.95 12.50	S D28	N=23 (2,3/4,5,7,7)
								13.50	D29	
								14.00 - 14.45	U30	59 (100%)
								14.50	D31	
								15.00	D32	
			14.62	15.00	Borehole ends at 15.00m (Target depth)					

Groundwater entries:				Diameter & casing:			Depth related remarks:			Chiselling details:	
Struck:	Rose to:	Casing:	Sealed:	Dia (mm): 150	Depth: 15.00	Casing: 12.00	From:	To:	Remarks:	From:	to: Duration: Tool:

 Notes: For explanation of symbols and abbreviations see Key Sheet. All depths and reduced levels are in metres.		Project: The Oaks, Wrexham Project No: 4292 Client: Cefn Park Developments C/O J10 Planning Ltd				Exploratory position reference: BH01	
Log issue: Scale: 1:50							

Borehole Log

TerraConsult

Borehole formation details:												Location details:			
Type: CP	From: 0.00	To: 15.00	Start date: 12-02-19	End date: 12-02-19	Crew: SL	Plant: Dando 2000	Barrel type: N/A	Drill Bit: N/A	Logged:	Logger: GB	Remarks:	mE: 338788.40	mN: 349311.80	mAOD: 29.27	Grid: OSGB

Backfill/Instal'n	Water-strike	Legend	Level	Depth (thickness)	Stratum Description	Samples & In Situ Testing							
						Water	Casing	Depth	Type & No	Results/Remarks			
				(0.60)	Soft dark brown slightly sandy slightly gravelly CLAY with frequent rootlets. Gravel is angular to subrounded fine to medium of shale. (TOPSOIL)			0.20 0.20	D1 ES2				
			28.67	0.60	Brownish orange slightly silty sandy GRAVEL. Gravel is angular to subrounded fine to medium of oil shale. (MADE GROUND)			1.00 1.00	D3 ES4	87 (95%)			
			28.47	0.80		1.20 - 1.65	U5						
					High strength stiff brown mottled grey slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to medium of sandstone, siltstone and mudstone. (GLACIAL TILL)			1.70 1.80	D6 D7				
						Dry	1.70	2.00 - 2.45 2.00 2.00	S D9 ES8	N=19 (2,3/4,4,5,6)			
								2.80 3.00 - 3.45	D10 U11	100 (100%)			
								3.50 3.80	D12 D13				
						Dry	4.00	4.00 - 4.45 4.00	S D14	N=20 (2,3/4,5,5,6)			
								4.80 5.00 - 5.45	D14 U15	100 (85%)			
								5.50	D16				
								6.00	D17				
						Dry	6.00	6.50 - 6.95 6.50	S D18	N=25 (2,4/5,5,7,8)			
								7.50	D19				
						21.67	7.60	Medium strength stiff brown slightly sandy slightly gravelly laminated CLAY. Gravel is subangular to subrounded fine to coarse of mudstone and sandstone. (GLACIAL TILL)			8.00 - 8.45	U20	81 (100%)
							(1.30)			8.50	D21		
			20.37	8.90	Firm to stiff brown slightly sandy slightly gravelly laminated CLAY. Gravel is angular to subrounded fine to coarse of sandstone and mudstone. (GLACIAL TILL)			9.00	D22				
							9.50 - 9.95 9.50	S D23	N=19 (2,3/4,4,5,6)				

	Inst (O)											Water	Casing	Depth	Type & No	Results
--	----------	--	--	--	--	--	--	--	--	--	--	-------	--------	-------	-----------	---------

Groundwater entries:				Diameter & casing:			Depth related remarks:				Chiselling details:			
Struck:	Rose to:	Casing:	Sealed:	Dia (mm): 150	Depth: 15.00	Casing: 13.50	From:	To:	Remarks:	From: 5.80	to: 6.00	Duration: 00:40	Tool: Cross	

Notes: For explanation of symbols and abbreviations see Key Sheet.
All depths and reduced levels are in metres.

Log issue:

Scale: 1:50

Project: The Oaks, Wrexham

Project No: 4292

Client: Cefn Park Developments C/O J10 Planning Ltd

Exploratory position reference:

BH02

Sheet 1 of 2

Borehole Log

TerraConsult

Borehole formation details:												Location details:			
Type: CP	From: 0.00	To: 15.00	Start date: 12-02-19	End date: 12-02-19	Crew: SL	Plant: Dando 2000	Barrel type: N/A	Drill Bit: N/A	Logged:	Logger: GB	Remarks:	mE: 338788.40	mN: 349311.80	mAOD: 29.27	Grid: OSGB

Backfill/ Instal'n	Water- strike	Legend	Level	Depth (thick- ness)	Stratum Description	Samples & In Situ Testing				
						Water	Casing	Depth	Type & No	Results/Remarks
			17.47	11.80	Firm to stiff brown slightly sandy slightly gravelly laminated CLAY. Gravel is angular to subrounded fine to coarse of sandstone and mudstone. (GLACIAL TILL)	Dry	12.00	10.50	D24	67 (100%)
					11.00 - 11.45			U25		
					11.50			D26		
					12.00			D27		
					12.50 - 12.95 12.50			S D28	N=18 (2,3/4,4,5,5)	
					13.50			D29		
					14.00 - 14.45			U30	63 (85%)	
					14.50			D31		
					15.00			D32		
					14.27			15.00	Borehole ends at 15.00m (Target depth)	

Inst (Ø)						Water	Casing	Depth	Type & No	Results
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Groundwater entries:				Diameter & casing:			Depth related remarks:			Chiselling details:			
Struck:	Rose to:	Casing:	Sealed:	Dia (mm): 150	Depth: 15.00	Casing: 13.50	From:	To:	Remarks:	From:	to:	Duration:	Tool:

Notes: For explanation of symbols and abbreviations see Key Sheet. All depths and reduced levels are in metres.

Log issue:

Scale: 1:50

Project: The Oaks, Wrexham

Project No: 4292

Client: Cefn Park Developments C/O J10 Planning Ltd

Exploratory position reference:

BH02

Sheet 2 of 2

Borehole Log

TerraConsult

Borehole formation details:												Location details:			
Type: CP	From: 0.00	To: 15.00	Start date: 13-02-19	End date: 13-02-19	Crew: SL	Plant: Dando 2000	Barrel type: N/A	Drill Bit: N/A	Logged:	Logger: GB	Remarks:	mE: 338875.60	mN: 349229.20	mAOD: 29.63	Grid: OSGB

Backfill/Instal'n	Water-strike	Legend	Level	Depth (thickness)	Stratum Description	Samples & In Situ Testing				
						Water	Casing	Depth	Type & No	Results/Remarks
			29.38	0.25	Soft dark brown slightly sandy slightly gravelly CLAY with frequent rootlets. Gravel is angular to subrounded fine to medium of shale. (TOPSOIL)			0.30	D1	
								0.30	ES2	
								1.00	D3	
								1.00	ES4	
								1.20 - 1.65	U5	76 (50%)
								1.70	D6	
								1.80	D7	
								2.00 - 2.45	S	N=16 (2,2/3,4,4,5)
								2.00	D9	
								2.00	ES8	
			27.43	2.20	High becoming very high strength stiff brown mottled grey slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to medium sandstone, siltstone and mudstone. (GLACIAL TILL)	Dry	1.70			
								2.80	D10	
								3.00	ES11	
								3.00 - 3.45	U12	100 (100%)
								3.50	D13	
								3.80	D14	
								4.00 - 4.45	S	N=19 (2,3/4,4,5,6)
								4.00	D15	
								4.80	D16	
								5.00 - 5.45	U17	89 (100%)
								5.50	D18	
			23.83	5.80	Stiff dark brown slightly sandy slightly gravelly laminated CLAY. Gravel is subangular to subrounded fine to coarse of mudstone and sandstone. (GLACIAL TILL)					
								6.00	D19	
								6.50 - 6.95	S	N=16 (2,2/3,4,4,5)
								6.50	D20	
								7.50	D21	
								8.00 - 8.45	U22	67 (90%)
								8.50	D23	
								9.00	D24	
			20.33	9.30	High strength stiff brown slightly sandy slightly gravelly laminated CLAY. Gravel is subangular to subrounded fine to medium of sandstone, siltstone and mudstone. (GLACIAL TILL)	Dry	9.00			
								9.50 - 9.95	S	N=21 (2,3/4,5,5,7)
								9.50	D25	

Inst (0)															
Groundwater entries:		Diameter & casing:		Depth related remarks:		Chiselling details:									
Struck:	Rose to:	Casing:	Sealed:	Dia (mm):	Depth:	Casing:	From:	To:	Remarks:	From:	to:	Duration:	Tool:		
2.20	1.90	1.70		150	15.00	13.50				2.20	2.40	00:30	Cross		
7.30	7.30	6.00													

Notes: For explanation of symbols and abbreviations see Key Sheet. All depths and reduced levels are in metres.

Log issue:

Scale: 1:50

Project: The Oaks, Wrexham

Project No: 4292

Client: Cefn Park Developments C/O J10 Planning Ltd

Exploratory position reference:

BH03

Sheet 1 of 2

Borehole Log

TerraConsult

Borehole formation details:												Location details:			
Type: CP	From: 0.00	To: 15.00	Start date: 13-02-19	End date: 13-02-19	Crew: SL	Plant: Dando 2000	Barrel type: N/A	Drill Bit: N/A	Logged:	Logger: GB	Remarks:	mE: 338875.60	mN: 349229.20	mAOD: 29.63	Grid: OSGB

Backfill/ Instal'n	Water- strike	Legend	Level	Depth (thick- ness)	Stratum Description	Samples & In Situ Testing					
						Water	Casing	Depth	Type & No	Results/Remarks	
				(5.70)	High strength stiff brown slightly sandy slightly gravelly laminated CLAY. Gravel is subangular to subrounded fine to medium of sandstone, siltstone and mudstone. (GLACIAL TILL)	Dry	12.00	10.50	D26	N=19 (2,3/4,4,5,6)	
								11.00 - 11.45	U27		87 (100%)
								11.50	D28		
								12.00	D29		
								12.50 - 12.95 12.50	S D30		
								13.50	D31		
								14.00 - 14.45	U32		77 (100%)
								14.50	D33		
								15.00	D34		

Inst (Ø)												Water	Casing	Depth	Type & No	Results
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Groundwater entries:				Diameter & casing:			Depth related remarks:				Chiselling details:			
Struck:	Rose to:	Casing:	Sealed:	Dia (mm): 150	Depth: 15.00	Casing: 13.50	From:	To:	Remarks:	From:	to:	Duration:	Tool:	

Notes: For explanation of symbols and abbreviations see Key Sheet. All depths and reduced levels are in metres.

Log issue:

Scale: 1:50

Project: The Oaks, Wrexham

Project No: 4292

Client: Cefn Park Developments C/O J10 Planning Ltd

Exploratory position reference:

BH03

Sheet 2 of 2

TerraConsult

Sheet 1 of 2

Borehole Log

TerraConsult

Borehole formation details:											Location details:	
Type: CP	From: 0.00	To: 15.00	Start date: 14-02-19	End date: 14-02-19	Crew: SL	Plant: Dando 2000	Barrel type: N/A	Drill Bit: N/A	Logged:	Logger: GB	Remarks:	mE: 338775.70 mN: 349095.80 mAOD: 24.96 Grid: OSGB

Backfill/ Instal'n	Water- strike	Legend	Level	Depth (thick- ness)	Stratum Description	Samples & In Situ Testing				
						Water	Casing	Depth	Type & No	Results/Remarks
			12.26	12.70	High strength stiff brown slightly sandy slightly gravelly laminated CLAY. Gravel is subangular to subrounded fine to medium of sandstone, siltstone and mudstone. (GLACIAL TILL)	Dry	12.00	10.50	D25	77 (95%)
								11.00 - 11.45	U26	
								11.50	D27	
								12.00	D28	
								12.50 - 12.95 12.50	S D29	N=21 (2,3/4,5,5,7)
								13.50	D30	100 (90%)
								14.00 - 14.45	U31	
								14.50	D32	
								15.00	D33	
			9.96	15.00	Stiff reddish brown slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to medium sandstone, siltstone and mudstone. (GLACIAL TILL)					
					(2.30)					
					Borehole ends at 15.00m (Target depth)					

Groundwater entries:				Diameter & casing:			Depth related remarks:			Chiselling details:	
Struck:	Rose to:	Casing:	Sealed:	Dia (mm): 150	Depth: 15.00	Casing: 12.00	From:	To:	Remarks:	From:	to: Duration: Tool:

 Notes: For explanation of symbols and abbreviations see Key Sheet. All depths and reduced levels are in metres.		Project: The Oaks, Wrexham Project No: 4292 Client: Cefn Park Developments C/O J10 Planning Ltd				Exploratory position reference: BH04	
Log issue: Scale: 1:50							

Borehole Log

TerraConsult

Borehole formation details:												Location details:			
Type: CP	From: 0.00	To: 15.00	Start date: 18-02-19	End date: 18-02-19	Crew: SL	Plant: Dando 2000	Barrel type: N/A	Drill Bit: N/A	Logged:	Logger: GB	Remarks:	mE: 338936.90	mN: 349002.10	mAOD: 25.28	Grid: OSGB

Backfill/ Instal'n	Water- strike	Legend	Level	Depth (thick- ness)	Stratum Description	Samples & In Situ Testing						
						Water	Casing	Depth	Type & No	Results/Remarks		
			25.13	0.15	Soft dark brown slightly sandy slightly gravelly CLAY with frequent rootlets. Gravel is angular to subrounded fine to medium of shale. (TOPSOIL)	Dry	1.70	0.30	D1	82 (85%)		
			(1.65)	0.30	ES2							
				1.00	D3							
				1.00	ES4							
				1.20 - 1.65	U5							
				23.48	1.80			Medium strength firm light brown slightly sandy slightly gravelly (REWORKED CLAY)	1.70		D6	
			(51)	SP				(12.00)	2.00 - 2.45		D7	N=14 (1,2/3,4,5)
									2.00		S	
									2.00		D8	
									2.00		ES7	
									2.80		D9	
									3.00		ES9	
3.00 - 3.45	U10											
3.50	D11											
3.80	D12											
4.00	S											
(51)	SP		(12.00)	4.00 - 4.45	D13	N=16 (2,2/3,4,4,5)						
				4.00	S							
				4.00	D13							
				4.80	D14							
				5.00 - 5.45	U15							
				5.50	D16							
				5.80	D17							
				6.00	D18							
				6.50 - 6.95	S							
				(51)	SP			(12.00)	6.50 - 6.95	S	N=20 (2,3/4,4,5,7)	
6.50	S											
6.50	D19											
7.50	D19											
8.00 - 8.45	U20											
8.50	D21											
(51)	SP		(12.00)	8.50	D21	76 (100%)						
				9.00	D22							
				9.00	D22							
				9.50 - 9.95	S							
				9.50	S							
				9.50	D23							
(51)	SP		(12.00)	9.50 - 9.95	S	N=22 (2,3/4,5,6,7)						
				9.50	S							
				9.50	D23							
				9.50	D23							
				9.50	D23							
				9.50	D23							

Groundwater entries:				Diameter & casing:			Depth related remarks:			Chiselling details:			
Struck:	Rose to:	Casing:	Sealed:	Dia (mm):	Depth:	Casing:	From:	To:	Remarks:	From:	to:	Duration:	Tool:
1.70	1.70	1.20		150	15.00	12.00				1.70	1.90	00:30	Cross
										2.50	2.60	00:40	Cross

 Notes: For explanation of symbols and abbreviations see Key Sheet. All depths and reduced levels are in metres.	Project: The Oaks, Wrexham Project No: 4292 Client: Cefn Park Developments C/O J10 Planning Ltd	Exploratory position reference: BH05
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Log issue: Scale: 1:50

Sheet 1 of 2

Borehole Log

TerraConsult

Borehole formation details:

Location details:

Type: CP	From: 0.00	To: 15.00	Start date: 18-02-19	End date: 18-02-19	Crew: SL	Plant: Dando 2000	Barrel type: N/A	Drill Bit: N/A	Logged:	Logger: GB	Remarks:	mE: 338936.90 mN: 349002.10 mAOD: 25.28 Grid: OSGB
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Backfill/ Instal'n	Water- strike	Legend	Level	Depth (thick- ness)	Stratum Description	Samples & In Situ Testing				
						Water	Casing	Depth	Type & No	Results/Remarks
					Medium strength firm brown mottled grey slightly sandy slightly gravelly laminated CLAY. Gravel is subangular to subrounded fine to medium sandstone, siltstone and mudstone. (GLACIAL TILL)			10.50	D24	
								11.00 - 11.45	U25	88 (100%)
								11.50	D26	
								12.00	D27	
						Dry	12.00	12.50 - 12.95 12.50	S D28	N=24 (2,3/4,5,7,8)
								13.50	D29	
			11.48	13.80	Stiff brown slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to coarse of sandstone and mudstone. (GLACIAL TILL)			14.00 - 14.45	U30	100 (90%)
				(1.20)				14.50	D31	
			10.28	15.00	Borehole ends at 15.00m (Target depth)			15.00	D32	

	Inst (Ø)									Water	Casing	Depth	Type & No	Results
Groundwater entries:				Diameter & casing:			Depth related remarks:					Chiselling details:		
Struck:	Rose to:	Casing:	Sealed:	Dia (mm):	Depth:	Casing:	From:	To:	Remarks:			From:	to:	Duration: Tool:
				150	15.00	12.00								

Notes: For explanation of symbols and abbreviations see Key Sheet.
All depths and reduced levels are in metres.

Log issue:

Scale: 1:50

Project:	The Oaks, Wrexham
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Project No: 4292

Client: Cefn Park Developments C/O J10 Planning Ltd

Exploratory position reference:	
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BH05

Sheet 2 of 2

Borehole Log

TerraConsult

Borehole formation details:											Location details:	
Type: CP	From: 0.00	To: 2.00	Start date: 19-02-19	End date: 19-02-19	Crew: SL	Plant: Dando 2000	Barrel type: N/A	Drill Bit: N/A	Logged:	Logger: GB	Remarks:	mE: 338726.30 mN: 349139.90 mAOD: 25.20 Grid: OSGB

Backfill/ Instal'n	Water- strike	Legend	Level	Depth (thick- ness)	Stratum Description	Samples & In Situ Testing				
						Water	Casing	Depth	Type & No	Results/Remarks
			25.00	0.20	Soft dark brown slightly sandy slightly gravelly CLAY with frequent rootlets. Gravel is angular to subrounded fine to medium of shale. (TOPSOIL)			0.30	D1	
					Firm light brown slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to medium of shale. (REWORKED CLAY)			0.30	ES2	
				(1.78)				1.00 1.00 1.20 1.20 - 1.65	D3 ES4 B5 U4	100 (0%)
			23.22	1.98	CONCRETE	Dry	1.70	1.80	D6	
			23.20	2.00	(MADE GROUND)				S	50 (25 for 18mm/50 for 22mm)
					Borehole ends at 2.00m (Concrete obstruction)					

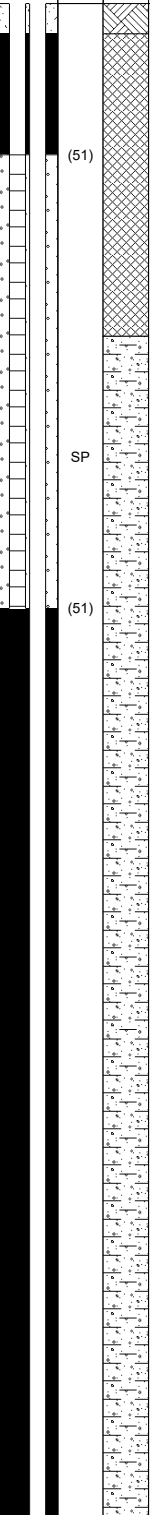
Groundwater entries:				Diameter & casing:			Depth related remarks:			Chiselling details:		
Struck:	Rose to:	Casing:	Sealed:	Dia (mm): 150	Depth: 15.00	Casing: 1.70	From:	To:	Remarks:	From: 1.30	to: 1.50	Duration: 00:40
										2.00	2.00	00:15
												Tool: Cross
												Tool: Cross

 Notes: For explanation of symbols and abbreviations see Key Sheet. All depths and reduced levels are in metres.		Project: The Oaks, Wrexham Project No: 4292 Client: Cefn Park Developments C/O J10 Planning Ltd				Exploratory position reference: BH06	
Log issue: Scale: 1:50							

Borehole Log

TerraConsult

Borehole formation details:												Location details:			
Type: CP	From: 0.00	To: 15.00	Start date: 19-02-19	End date: 19-02-19	Crew: SL	Plant: Dando 2000	Barrel type: N/A	Drill Bit: N/A	Logged:	Logger: GB	Remarks:	mE: 338727.60	mN: 349141.40	mAOD: 25.14	Grid: OSGB

Backfill/Instal'n	Water-strike	Legend	Level	Depth (thickness)	Stratum Description	Samples & In Situ Testing								
						Water	Casing	Depth	Type & No	Results/Remarks				
	(51)		24.94	0.20	Soft dark brown slightly sandy slightly gravelly CLAY with frequent rootlets. Gravel is angular to subrounded fine to medium of shale. (TOPSOIL)	Dry	4.00	4.00 - 4.45 4.00	D1	N=19 (2,3/4,4,5,6)				
			(2.00)	Firm light brown slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to medium of shale. (REWORKED CLAY)	3.00 - 3.45				U2		71 (100%)			
									3.50			D3		
												3.80	D4	
													S	
			22.94	2.20	Medium strength stiff brown mottled grey slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to medium sandstone, siltstone and mudstone. (GLACIAL TILL)				5.00 - 5.45		D6	59 (100%)		
											U7			
													5.50	D8
														D9
			(9.80)	Dry	6.00				6.50 - 6.95 6.50		S	N=18 (2,3/4,4,5,5)		
D10														
	7.50	D11												
		8.00 - 8.45				U12	62 (85%)							
8.50	D13													
	9.00	D14												
		Dry	9.00	9.50 - 9.95 9.50	S	N=16 (2,2/3,4,4,5)								
B15														

Inst (0)		Water		Casing	Depth	Type & No	Results				
Groundwater entries:		Diameter & casing:		Depth related remarks:		Chiselling details:					
Struck:	Rose to:	Casing:	Sealed:	Dia (mm): 150	Depth: 2.00	Casing: 13.50	From: 9.60	to: 9.70	Duration: 00:30	Tool: Cross	
				Project: The Oaks, Wrexham				Exploratory position reference:			
				Project No: 4292				BH06A			
				Client: Cefn Park Developments C/O J10 Planning Ltd							
Log issue:											
Scale: 1:50								Sheet 1 of 2			



Notes: For explanation of symbols and abbreviations see Key Sheet.
All depths and reduced levels are in metres.

Project: The Oaks, Wrexham

Project No: 4292

Client: Cefn Park Developments C/O J10 Planning Ltd

Exploratory position reference:

BH06A

Borehole Log

TerraConsult

Borehole formation details:												Location details:			
Type: CP	From: 0.00	To: 15.00	Start date: 19-02-19	End date: 19-02-19	Crew: SL	Plant: Dando 2000	Barrel type: N/A	Drill Bit: N/A	Logged:	Logger: GB	Remarks:	mE: 338727.60	mN: 349141.40	mAOD: 25.14	Grid: OSGB

Backfill/ Instal'n	Water- strike	Legend	Level	Depth (thick- ness)	Stratum Description	Samples & In Situ Testing				
						Water	Casing	Depth	Type & No	Results/Remarks
	(51)		13.14	12.00	Medium strength stiff brown mottled grey slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to medium sandstone, siltstone and mudstone. (GLACIAL TILL)	Dry	12.00	10.50	D16	57 (85%)
					11.00 - 11.45			U17		
					11.50			D18		
					12.00			D19		
					12.50 - 12.95 12.50			S D20	N=23 (2,4/5,5,6,7)	
					13.50			D21		
					14.00 - 14.45			U22	79 (90%)	
					14.50			D23		
					15.00			D24		
								SP (51)		

Groundwater entries:				Diameter & casing:			Depth related remarks:			Chiselling details:			
Struck:	Rose to:	Casing:	Sealed:	Dia (mm): 150	Depth: 2.00	Casing: 13.50	From:	To:	Remarks:	From:	to:	Duration:	Tool:

Notes: For explanation of symbols and abbreviations see Key Sheet. All depths and reduced levels are in metres.

Log issue:

Scale: 1:50

Project: The Oaks, Wrexham

Project No: 4292

Client: Cefn Park Developments C/O J10 Planning Ltd

Exploratory position reference:

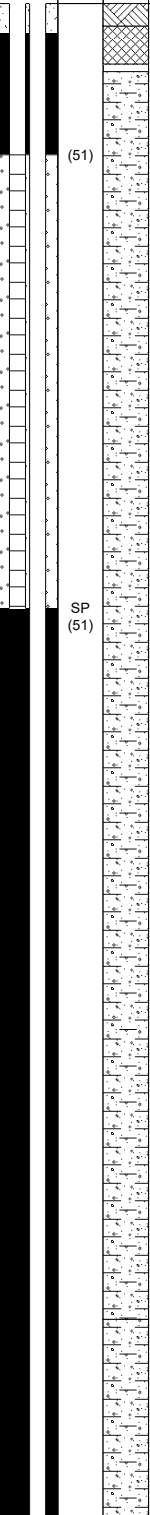
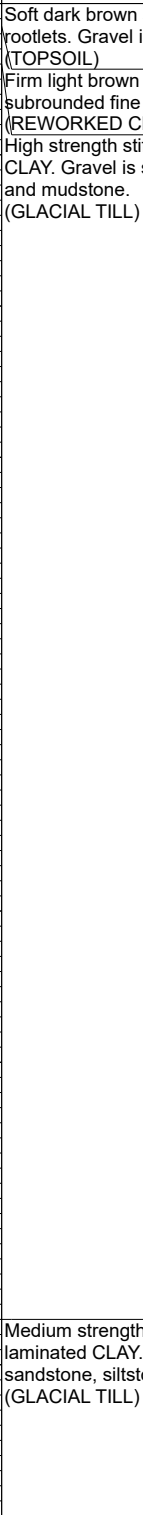
BH06A

Sheet 2 of 2

Borehole Log

TerraConsult

Borehole formation details:												Location details:			
Type: CP	From: 0.00	To: 15.00	Start date: 20-02-19	End date: 20-02-19	Crew: SL	Plant: Dando 2000	Barrel type: N/A	Drill Bit: N/A	Logged:	Logger: GB	Remarks:	mE: 338797.80	mN: 349161.50	mAOD: 26.00	Grid: OSGB

Backfill/Instal'n	Water-strike	Legend	Level	Depth (thick-ness)	Stratum Description	Samples & In Situ Testing				
						Water	Casing	Depth	Type & No	Results/Remarks
			25.85	0.15	Soft dark brown slightly sandy slightly gravelly CLAY with frequent rootlets. Gravel is angular to subrounded fine to medium of shale. (TOPSOIL)			0.30	D1	
			25.60	0.40	Firm light brown slightly sandy slightly CLAY. Gravel is subangular to subrounded fine to medium of shale and concrete. (REWORKED CLAY)			0.30	ES2	
					High strength stiff brown mottled grey slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to medium sandstone and mudstone. (GLACIAL TILL)			1.00	D3	
								1.00	ES4	
								1.20 - 1.65	U5	79 (100%)
								1.70	D6	
								1.80	D7	
								2.00 - 2.45	S	N=19 (2,3/4,4,5,6)
								2.00	D8	
								2.80	D9	
								3.00 - 3.45	U10	83 (100%)
								3.50	D11	
								3.80	D12	
								4.00 - 4.45	S	N=18 (2,3/4,4,5,5)
								4.00	D13	
					4.80	D14				
					5.00 - 5.45	U15	67 (90%)			
					5.50	D16				
					6.00	D17				
					6.50 - 6.95	S	N=21 (2,3/4,5,5,7)			
					6.50	D18				
					7.50	D19				
					8.00 - 8.45	U20	87 (100%)			
					8.50	D21				
					9.00	D22				
					9.50 - 9.95	S	N=15 (2,2/3,3,4,5)			
					9.50	D23				

Groundwater entries:						Diameter & casing:			Depth related remarks:			Chiselling details:		
Struck:	Rose to:	Casing:	Sealed:	Dia (mm): 150	Depth: 15.00	Casing: 13.50	From:	To:	Remarks:	From: 4.60	to: 4.80	Duration: 00:30	Tool: Cross	

 Notes: For explanation of symbols and abbreviations see Key Sheet. All depths and reduced levels are in metres. Log issue: Scale: 1:50	Project: The Oaks, Wrexham Project No: 4292 Client: Cefn Park Developments C/O J10 Planning Ltd	Exploratory position reference: BH07
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Sheet 1 of 2

Borehole Log

TerraConsult

Borehole formation details:											Location details:	
Type: CP	From: 0.00	To: 15.00	Start date: 20-02-19	End date: 20-02-19	Crew: SL	Plant: Dando 2000	Barrel type: N/A	Drill Bit: N/A	Logged:	Logger: GB	Remarks:	mE: 338797.80 mN: 349161.50 mAOD: 26.00 Grid: OSGB

Backfill/ Instal'n	Water- strike	Legend	Level	Depth (thick- ness)	Stratum Description	Samples & In Situ Testing				
						Water	Casing	Depth	Type & No	Results/Remarks
					Medium strength firm brown mottled grey slightly sandy slightly gravelly laminated CLAY. Gravel is subangular to subrounded fine to medium sandstone, siltstone and mudstone. (GLACIAL TILL)			10.50	D24	
								11.00 - 11.45	U25	66 (100%)
								11.50	D26	
								12.00	D27	
						Dry	12.00	12.50 - 12.95 12.50	S D28	N=16 (2,2/3,4,4,5)
								13.50	D29	
								14.00 - 14.45	U30	67 (100%)
								14.50	D31	
								15.00	D32	
					Borehole ends at 15.00m (Target depth)					

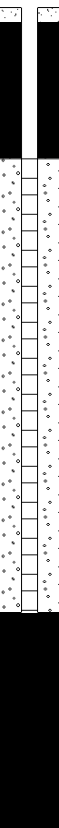
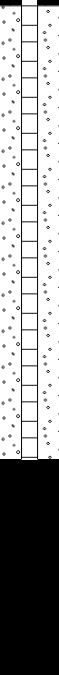
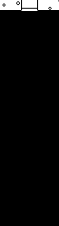
Groundwater entries:				Diameter & casing:			Depth related remarks:			Chiselling details:	
Struck:	Rose to:	Casing:	Sealed:	Dia (mm): 150	Depth: 15.00	Casing: 13.50	From:	To:	Remarks:	From:	to: Duration: Tool:

 Notes: For explanation of symbols and abbreviations see Key Sheet. All depths and reduced levels are in metres.		Project: The Oaks, Wrexham Project No: 4292 Client: Cefn Park Developments C/O J10 Planning Ltd				Exploratory position reference: BH07	
Log issue: Scale: 1:50							

Borehole Log

TerraConsult

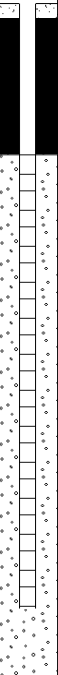
Borehole formation details:												Location details:	
Type: WLS	From: 0.00	To: 5.45	Start date: 18-02-19	End date: 18-02-19	Crew: JR	Plant: Archway Dart	Barrel type:	Drill Bit:	Logged:	Logger: GB	Remarks:	mE: 338545.70	
												mN: 349388.00	
												mAOD: 27.49	
												Grid: OSGB	

Backfill/ Instal'n	Water- strike	Legend	Level	Depth (thick- ness)	Stratum Description	Samples & In Situ Testing				
						Water	Casing	Depth	Type & No	Results/Remarks
			27.09	(0.40)	Soft dark brown slightly sandy slightly gravelly CLAY with frequent rootlets. Gravel is angular to subrounded fine to medium of shale. (TOPSOIL)	Dry		0.10	ES	N=21 (2,2/3,4,6,8)
				0.40	Firm light brown slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to medium of shale. (REWORKED CLAY)			0.50	ES	
				(0.60)						
				26.49	1.00			1.20 - 1.65	S	
								2.00 - 2.45	S	
						Dry		3.00 - 3.45	S	N=27 (3,5/4,7,8,8)
								4.00 - 4.45	S	
								4.00	D	
								5.00 - 5.45	S	
										

Borehole Log

TerraConsult

Borehole formation details:												Location details:			
Type: WLS	From: 0.00	To: 4.45	Start date: 18-02-19	End date: 18-02-19	Crew: JR	Plant: Archway Dart	Barrel type:	Drill Bit:	Logged:	Logger: GB	Remarks:	mE: 338722.00	mN: 349381.40	mAOD: 29.55	Grid: OSGB

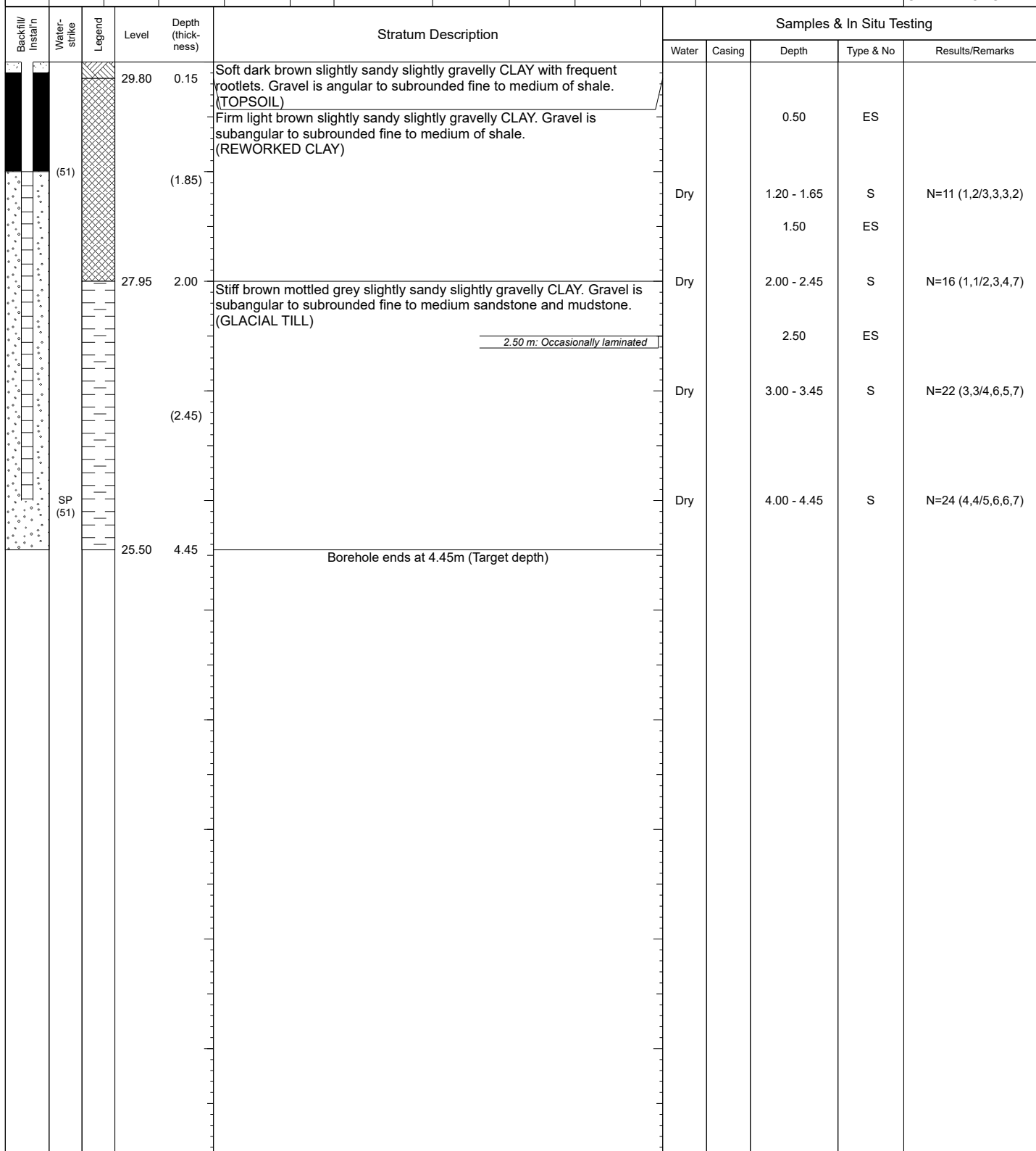
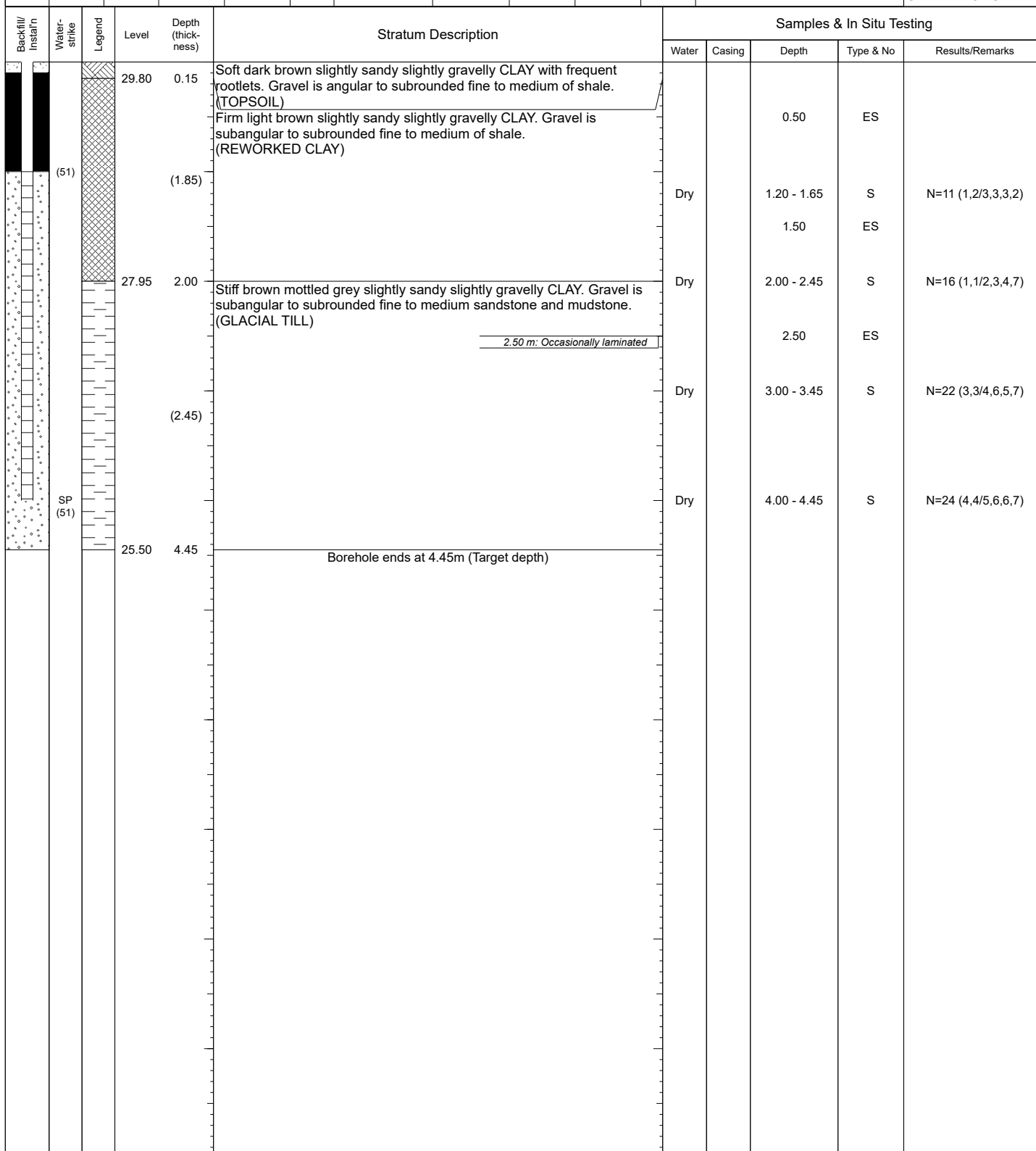
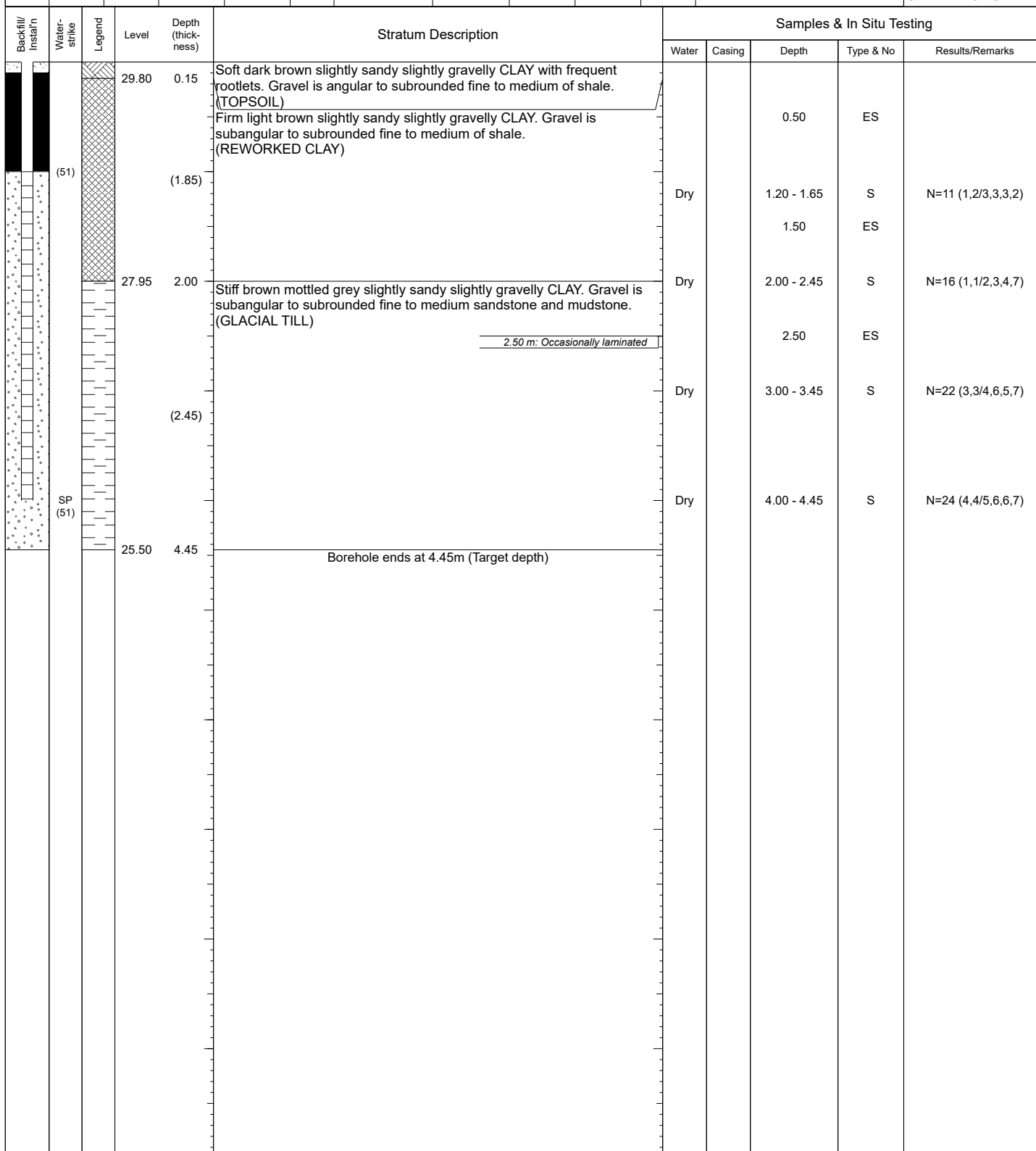
Backfill/Instal'n	Water-strike	Legend	Level	Depth (thickness)	Stratum Description	Samples & In Situ Testing				
						Water	Casing	Depth	Type & No	Results/Remarks
			29.25	(0.30)	Soft dark brown slightly sandy slightly gravelly CLAY with frequent rootlets. Gravel is angular to subrounded fine to medium of shale. (TOPSOIL)	Dry		0.40	ES	N=10 (1,1/2,2,3,3)
			28.65	(0.60)	Firm light brown slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to medium of shale. (REWORKED CLAY)					
				0.90	Stiff brown mottled grey slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to medium sandstone and mudstone. (GLACIAL TILL)					
				(3.55)						
				25.10	4.45					

Inst (Ø)						Water	Casing	Depth	Type & No	Results			
Groundwater entries:		Diameter & casing:		Depth related remarks:				Chiselling details:					
Struck:	Rose to:	Casing:	Sealed:	Dia (mm):	Depth:	Casing:	From:	To:	Remarks:	From:	to:	Duration:	Tool:

 Notes: For explanation of symbols and abbreviations see Key Sheet. All depths and reduced levels are in metres. Log issue: Scale: 1:50	Project: The Oaks, Wrexham Project No: 4292 Client: Cefn Park Developments C/O J10 Planning Ltd	Exploratory position reference: WS02
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Sheet 1 of 1

TerraConsult

Backfill/ Instal'n	Water- strike	Legend	Level	Depth (thick- ness)	Stratum Description	Samples & In Situ Testing						
						Water	Casing	Depth	Type & No	Results/Remarks		
	(51)		29.80	0.15	Soft dark brown slightly sandy slightly gravelly CLAY with frequent rootlets. Gravel is angular to subrounded fine to medium of shale. (TOPSOIL)	Dry		0.50	ES	N=11 (1,2/3,3,3,2)		
			(1.85)	Firm light brown slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to medium of shale. (REWORKED CLAY)	1.20 - 1.65			S				
					1.50			ES				
					2.00			27.95	2.00		Stiff brown mottled grey slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to medium sandstone and mudstone. (GLACIAL TILL)	2.00 - 2.45
			(2.45)		2.50			ES	N=22 (3,3/4,6,5,7)			
3.00 - 3.45	S											
4.00 - 4.45	S	N=24 (4,4/5,6,6,7)										
			25.50	4.45	Borehole ends at 4.45m (Target depth)							

Borehole Log

TerraConsult

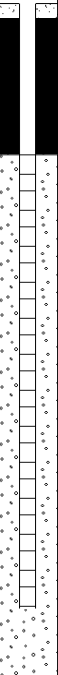
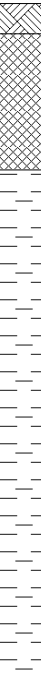
Borehole formation details:												Location details:			
Type: WLS	From: 0.00	To: 4.45	Start date: 19-02-19	End date: 19-02-19	Crew: JR	Plant: Archway Dart	Barrel type:	Drill Bit:	Logged:	Logger: GB	Remarks:	mE: 338759.00	mN: 349354.00	mAOD: 30.81	Grid: OSGB

Backfill/Instal'n	Water-strike	Legend	Level	Depth (thick-ness)	Stratum Description	Samples & In Situ Testing				
						Water	Casing	Depth	Type & No	Results/Remarks
			30.71	0.10	Soft dark brown slightly sandy slightly gravelly CLAY with frequent rootlets. Gravel is angular to subrounded fine to medium of shale. (TOPSOIL)			0.20	ES	
			30.46	0.35	Brownish orange slightly silty sandy GRAVEL. Gravel is angular to subrounded fine to medium of oil shale. (MADE GROUND)			0.40	ES	
					Soft dark brown slightly sandy slightly gravelly CLAY with frequent rootlets. Gravel is angular to subrounded fine to medium of shale. (MADE GROUND)	Dry		1.20 - 1.65	S	N=14 (1,2/2,3,4,5)
						Dry		2.00 - 2.45	S	N=34 (6,6/9,9,9,7)
						Dry		3.00 - 3.45	S	N=34 (6,5/7,8,9,10)
								3.80	D	
								4.00 - 4.45	S	N=36 (6,6/7,7,10,12)
			26.36	4.45	Borehole ends at 4.45m (Target depth)					

Inst (0)				Water	Casing	Depth	Type & No	Results					
Groundwater entries:				Diameter & casing:		Depth related remarks:		Chiselling details:					
Struck:	Rose to:	Casing:	Sealed:	Dia (mm):	Depth:	Casing:	From:	To:	Remarks:	From:	to:	Duration:	Tool:
				Project: The Oaks, Wrexham						Exploratory position reference:			
Log issue:				Project No: 4292						WS04			
Scale: 1:50				Client: Cefn Park Developments C/O J10 Planning Ltd									
Sheet 1 of 1													

Borehole Log

TerraConsult

Borehole formation details:												Location details:			
Type:	From:	To:	Start date:	End date:	Crew:	Plant:	Barrel type:	Drill Bit:	Logged:	Logger:	Remarks:	mE:	mN:	mAOD:	Grid:
WLS	0.00	4.45	19-02-19	19-02-19	JR	Archway Dart				GB		338800.50	349275.90	28.98	OSGB
Backfill/Instal'n	Water-strike	Legend	Level	Depth (thickness)	Stratum Description	Samples & In Situ Testing									
						Water	Casing	Depth	Type & No	Results/Remarks					
	(51)		28.78	0.20	Soft dark brown slightly sandy slightly gravelly CLAY with frequent rootlets. Gravel is angular to subrounded fine to medium of shale. (TOPSOIL)			0.10	ES						
			(0.90)	Firm light brown slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to medium of shale. (MADE GROUND)			0.40	ES							
			27.88	1.10	Stiff brown mottled grey slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to medium sandstone and mudstone. (GLACIAL TILL)	Dry		1.20 - 1.65	S	N=17 (4,4/3,5,4,5)					
						1.50	ES								
						2.00 - 2.45	S	N=25 (4,5/5,6,6,8)							
			(3.35)			Dry		3.00 - 3.45	S	N=24 (4,5/5,5,6,8)					
						Dry		4.00 - 4.45	S	N=25 (5,5/5,6,6,8)					
			24.53	4.45	Borehole ends at 4.45m (Target depth)										
Inst (Ø)	Water	Casing	Depth	Type & No	Results										
Groundwater entries:				Diameter & casing:		Depth related remarks:			Chiselling details:						
Struck:	Rose to:	Casing:	Sealed:	Dia (mm):	Depth:	Casing:	From:	To:	Remarks:	From:	to:	Duration:	Tool:		
 Notes: For explanation of symbols and abbreviations see Key Sheet. All depths and reduced levels are in metres. Log issue: Scale: 1:50	Project: The Oaks, Wrexham Project No: 4292 Client: Cefn Park Developments C/O J10 Planning Ltd	Exploratory position reference: WS05 Sheet 1 of 1													

Borehole Log

TerraConsult

Borehole formation details:												Location details:			
Type: WLS	From: 0.00	To: 4.45	Start date: 19-02-19	End date: 19-02-19	Crew: JR	Plant: Archway Dart	Barrel type:	Drill Bit:	Logged:	Logger: GB	Remarks:	mE: 338771.10	mN: 349224.10	mAOD: 29.30	Grid: OSGB

Backfill/Instal'n	Water-strike	Legend	Level	Depth (thickness)	Stratum Description	Samples & In Situ Testing				
						Water	Casing	Depth	Type & No	Results/Remarks
	(51)		29.10	0.20	Soft dark brown slightly sandy slightly gravelly CLAY with frequent rootlets. Gravel is angular to subrounded fine to medium of shale. (TOPSOIL)			0.10	ES	
			(0.80)		Firm light brown slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to medium of shale. (REWORKED CLAY)			0.50	ES	
			28.30	1.00	Stiff brown mottled grey slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to medium sandstone and mudstone. (GLACIAL TILL)	Dry		1.20 - 1.65	S	N=17 (1,2/2,3,5,7)
						Dry		2.00 - 2.45	S	N=29 (4,5/5,8,8,8)
						Dry		2.50	D	
						Dry		3.00 - 3.45	S	N=27 (4,4/5,6,7,9)
						Dry		4.00 - 4.45	S	N=23 (5,5/4,6,6,7)
			24.85	4.45	Borehole ends at 4.45m (Target depth)					

Inst (0)				Water	Casing	Depth	Type & No	Results
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Groundwater entries:				Diameter & casing:			Depth related remarks:			Chiselling details:			
Struck:	Rose to:	Casing:	Sealed:	Dia (mm):	Depth:	Casing:	From:	To:	Remarks:	From:	to:	Duration:	Tool:

Notes: For explanation of symbols and abbreviations see Key Sheet. All depths and reduced levels are in metres.	Project: The Oaks, Wrexham	Exploratory position reference: WS06
Log issue:	Project No: 4292	
Scale: 1:50	Client: Cefn Park Developments C/O J10 Planning Ltd	

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Borehole Log

TerraConsult

Borehole formation details:												Location details:			
Type: WLS	From: 0.00	To: 5.45	Start date: 19-02-19	End date: 19-02-19	Crew: JR	Plant: Archway Dart	Barrel type:	Drill Bit:	Logged:	Logger: GB	Remarks:	mE: 338827.20	mN: 349207.60	mAOD: 28.00	Grid: OSGB

Backfill/Instal'n	Water-strike	Legend	Level	Depth (thickness)	Stratum Description	Samples & In Situ Testing				
						Water	Casing	Depth	Type & No	Results/Remarks
			27.90	0.10	Soft dark brown slightly sandy slightly gravelly CLAY with frequent rootlets. Gravel is angular to subrounded fine to medium of shale. (TOPSOIL)			0.20	ES	
			27.50	0.50	Firm light brown slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to medium of shale and concrete. (MADE GROUND)			0.60	ES	
					Stiff brown mottled grey slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to medium sandstone and mudstone. (GLACIAL TILL)	Dry		1.20 - 1.65	S	N=15 (2,2/4,4,4,3)
						Dry		2.00 - 2.45	S	N=13 (1,2/3,3,3,4)
								2.50	D	
						Dry		3.00 - 3.45	S	N=22 (3,4/5,6,5,6)
						Dry		4.00 - 4.45	S	N=29 (4,4/5,7,7,10)
								4.50	D	
						Dry		5.00 - 5.45	S	N=29 (4,5/6,7,7,9)
				22.55	5.45	Borehole ends at 5.45m (Target depth)				

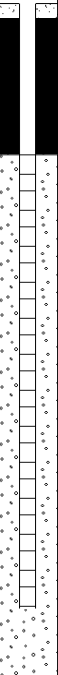
Inst (Ø)				Water	Casing	Depth	Type & No	Results					
Groundwater entries:				Diameter & casing:		Depth related remarks:		Chiselling details:					
Struck:	Rose to:	Casing:	Sealed:	Dia (mm):	Depth:	Casing:	From:	To:	Remarks:	From:	to:	Duration:	Tool:

Notes: For explanation of symbols and abbreviations see Key Sheet. All depths and reduced levels are in metres.	Project: The Oaks, Wrexham Project No: 4292 Client: Cefn Park Developments C/O J10 Planning Ltd	Exploratory position reference: WS07
Log issue: Scale: 1:50		Sheet 1 of 1

Borehole Log

TerraConsult

Borehole formation details:												Location details:			
Type: WLS	From: 0.00	To: 4.45	Start date: 19-02-19	End date: 19-02-19	Crew: JR	Plant: Archway Dart	Barrel type:	Drill Bit:	Logged:	Logger: GB	Remarks:	mE: 338789.90	mN: 349150.10	mAOD: 25.85	Grid: OSGB

Backfill/Instal'n	Water-strike	Legend	Level	Depth (thick-ness)	Stratum Description	Samples & In Situ Testing				
						Water	Casing	Depth	Type & No	Results/Remarks
	(51)		25.70	0.15 (0.30)	Soft dark brown slightly sandy slightly gravelly CLAY with frequent rootlets. Gravel is angular to subrounded fine to medium of shale. (TOPSOIL)			0.10	ES	
			25.40	0.45	Firm light brown slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to medium of shale and concrete. (MADE GROUND)			0.30	ES	
					Stiff brown mottled grey slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to medium sandstone and mudstone. (GLACIAL TILL)	Dry		1.20 - 1.65	S	N=15 (2,2/3,4,3,5)
							1.50	ES		
						Dry		2.00 - 2.45	S	N=18 (3,3/4,4,5,5)
						Dry		3.00 - 3.45	S	N=20 (3,4/4,5,5,6)
						Dry		4.00 - 4.45	S	N=26 (3,4/5,7,6,8)
						21.40	4.45	Borehole ends at 4.45m (Target depth)		

Inst (0)						Water	Casing	Depth	Type & No	Results			
Groundwater entries:			Diameter & casing:			Depth related remarks:			Chiselling details:				
Struck:	Rose to:	Casing:	Sealed:	Dia (mm):	Depth:	Casing:	From:	To:	Remarks:	From:	to:	Duration:	Tool:

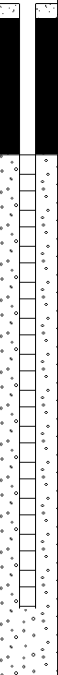
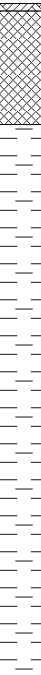
 Notes: For explanation of symbols and abbreviations see Key Sheet. All depths and reduced levels are in metres. Log issue: Scale: 1:50	Project: The Oaks, Wrexham Project No: 4292 Client: Cefn Park Developments C/O J10 Planning Ltd	Exploratory position reference: WS08
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Borehole Log

TerraConsult

Borehole formation details:												Location details:			
Type: WLS	From: 0.00	To: 4.45	Start date: 19-02-19	End date: 19-02-19	Crew: JR	Plant: Archway Dart	Barrel type:	Drill Bit:	Logged:	Logger: GB	Remarks:	mE: 338820.60	mN: 349076.40	mAOD: 25.02	Grid: OSGB

Backfill/ Instal'n	Water- strike	Legend	Level	Depth (thick- ness)	Stratum Description	Samples & In Situ Testing									
						Water	Casing	Depth	Type & No	Results/Remarks					
			24.97	0.05	Soft dark brown slightly sandy slightly gravelly CLAY with frequent rootlets. Gravel is angular to subrounded fine to medium of shale. (TOPSOIL)			0.40	ES						
			24.22	0.80	Firm light brown slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to medium of shale and concrete. (MADE GROUND)			1.00	ES						
					Stiff brown mottled grey slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to medium sandstone and mudstone. (GLACIAL TILL)	Dry		1.20 - 1.65	S	N=5 (2,2/2,1,1,1)					
						Dry		2.00 - 2.45	S	N=26 (3,5/5,6,7,8)					
						Dry		3.00 - 3.45	S	N=22 (3,4/4,6,5,7)					
						Dry		4.00 - 4.45	S	N=23 (3,3/4,6,6,7)					
			20.57	4.45	Borehole ends at 4.45m (Target depth)										

Inst (Ø)						Water	Casing	Depth	Type & No	Results			
Groundwater entries:			Diameter & casing:			Depth related remarks:			Chiselling details:				
Struck:	Rose to:	Casing:	Sealed:	Dia (mm):	Depth:	Casing:	From:	To:	Remarks:	From:	to:	Duration:	Tool:

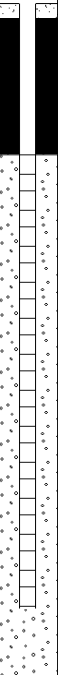
 Notes: For explanation of symbols and abbreviations see Key Sheet. All depths and reduced levels are in metres. Log issue: Scale: 1:50	Project: The Oaks, Wrexham Project No: 4292 Client: Cefn Park Developments C/O J10 Planning Ltd	Exploratory position reference: WS09
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Borehole Log

TerraConsult

Borehole formation details:												Location details:			
Type: WLS	From: 0.00	To: 4.45	Start date: 19-02-19	End date: 19-02-19	Crew: JR	Plant: Archway Dart	Barrel type:	Drill Bit:	Logged:	Logger: GB	Remarks:	mE: 338946.60	mN: 349044.90	mAOD: 28.07	Grid: OSGB

Backfill/ Instal'n	Water- strike	Legend	Level	Depth (thick- ness)	Stratum Description	Samples & In Situ Testing					
						Water	Casing	Depth	Type & No	Results/Remarks	
			27.92	0.15	Soft dark brown slightly sandy slightly gravelly CLAY with frequent rootlets. Gravel is angular to subrounded fine to medium of shale. (TOPSOIL)			0.20	ES		
			27.77	0.30				0.50	ES		
					Firm light brown slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to medium of shale and concrete. (MADE GROUND)						
					Stiff brown mottled grey slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to medium sandstone and mudstone. (GLACIAL TILL)	Dry		1.20 - 1.65	S	N=15 (2,2/3,3,4,5)	
						Dry		2.00 - 2.45 2.00	S ES	N=17 (3,3/4,3,5,5)	
				(4.15)		Dry		3.00 - 3.45	S	N=25 (4,5/5,7,5,8)	
						Dry		4.00 - 4.45	S	N=25 (5,5/6,6,5,8)	
			23.62	4.45	Borehole ends at 4.45m (Target depth)						

Inst (0)						Water	Casing	Depth	Type & No	Results
Groundwater entries:			Diameter & casing:			Depth related remarks:			Chiselling details:	
Struck:	Rose to:	Casing:	Sealed:	Dia (mm):	Depth:	Casing:	From:	To:	Remarks:	From: to: Duration: Tool:

 Notes: For explanation of symbols and abbreviations see Key Sheet. All depths and reduced levels are in metres. Log issue: Scale: 1:50	Project: The Oaks, Wrexham Project No: 4292 Client: Cefn Park Developments C/O J10 Planning Ltd	Exploratory position reference: WS10
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TerraConsult

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TerraConsult

Personnel: Logged by: GB Checked by:			Equipment & methods: Method: Machine excavated Plant: 9T tracked excavator Shoring: None		Dimensions: Width: 0.98 Length: 2.30 Orientation: Bearing = 70		Coordinates & level: mE: 338965.10 mN: 349084.30 mAOD: 27.90 Grid: OSGB		Dates: Start: 12/02/2019 End: 12/02/2019 Logged:	
Backfill/ Instal'n	Water- strike	Legend	Level & Depth (Thickness)	Stratum Description	Samples & In Situ Testing					
					Depth	Type & No	Results			
			27.65 0.25	Soft dark brown slightly sandy slightly gravelly CLAY with frequent rootlets. Gravel is angular to subrounded fine to medium of shale and rare clinker. (TOPSOIL)	0.40	ES				
			(0.35)	Brownish orange slightly silty sandy GRAVEL with a low cobble content of subangular brick and concrete. Gravel is angular to subrounded fine to medium of oil shale and brick. (MADE GROUND)						
			27.30 0.60	Very stiff brown mottled grey slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to medium sandstone and mudstone. (GLACIAL TILL)						
			(1.40)	1.40 - 1.80 m: With cobble size pockets of fine sand						
			25.90 2.00	Trial pit ends at 2.00m						
					Depth	Type & No	Results			
Groundwater entries: Depth: 1.40 Rose to: 0.00 Remarks:				Depth related remarks: From to: Remarks:			General remarks: Weather: Stability: Remarks:			
Notes: For explanation of symbols and abbreviations see Key Sheet. All depths and reduced levels are in metres. Log issue: Scale: 1:25				Project: The Oaks, Wrexham Project No: 4292 Client: Cefn Park Developments C/O J10 Planning Ltd			Exploratory position reference: TP02			

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TerraConsult

Logged:

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TerraConsult

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TerraConsult

Personnel: Logged by: GB Checked by:			Equipment & methods: Method: Machine excavated Plant: 9T tracked excavator Shoring: None		Dimensions: Width: 0.95 Length: 2.40 Orientation: Bearing = 310		Coordinates & level: mE: 338639.30 mN: 349418.70 mAOD: 29.17 Grid: OSGB		Dates: Start: 13/02/2019 End: 13/02/2019 Logged:	
Backfill/ Instal'n	Water- strike	Legend	Level & Depth (Thickness)	Stratum Description	Samples & In Situ Testing					
					Depth	Type & No	Results			
			(0.50)	Soft dark brown slightly sandy slightly gravelly CLAY with frequent rootlets. Gravel is angular to subrounded fine to medium of shale. (TOPSOIL)	0.60	ES				
			28.67 0.50	Brownish orange slightly silty sandy GRAVEL subangular brick and concrete. Gravel is angular to subrounded fine to medium of oil shale and brick. (MADE GROUND)						
			28.47 0.70	Stiff brown mottled grey CLAY. (GLACIAL TILL)						
			(1.40)							
			27.07 2.10	Trial pit ends at 2.10m						
				Depth			Type & No	Results		
Groundwater entries: Depth: Rose to: Remarks:				Depth related remarks: From to: Remarks:			General remarks: Weather: Stability: Remarks:			
 Notes: For explanation of symbols and abbreviations see Key Sheet. All depths and reduced levels are in metres. Log issue: Scale: 1:25				Project: The Oaks, Wrexham Project No: 4292 Client: Cefn Park Developments C/O J10 Planning Ltd			Exploratory position reference: TP06			

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TerraConsult

Start:	14/02/2019
End:	14/02/2019
Logged:	

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Trial Pit Log

TerraConsult

Personnel:		Equipment & methods:		Dimensions:	Coordinates & level:	Dates:
Logged by:	GB	Method:	Machine excavated	Width: 0.97	mE: 338725.50	Start: 14/02/2019
Checked by:		Plant:	9T tracked excavator	Length: 2.38	mN: 349160.20	End: 14/02/2019
		Shoring:	None	Orientation:	mAOD: 25.71	Logged:
				Bearing = 44	Grid: OSGB	

Backfill/ Instal'n	Water- strike	Legend	Level & Depth (Thickness)	Stratum Description	Samples & In Situ Testing		
					Depth	Type & No	Results
			25.61 0.10	Soft dark brown slightly sandy slightly gravelly CLAY with frequent rootlets. Gravel is angular to subrounded fine to medium of shale. (TOPSOIL)	0.20	ES	
			(1.00)	Soft orangish brown slightly sandy CLAY. Gravel is subangular to subrounded fine to medium limestone and rare shale. (MADE GROUND)			
			24.61 1.10	Stiff brown mottled grey CLAY. (GLACIAL TILL)			
			23.71 2.00	Trial pit ends at 2.00m			

Groundwater entries:		Depth related remarks:		General remarks:
Depth:	Rose to:	Remarks:		Weather:
				Stability:
				Remarks:

Notes: For explanation of symbols and abbreviations see Key Sheet. All depths and reduced levels are in metres. Log issue: Scale: 1:25		Project: The Oaks, Wrexham Project No: 4292 Client: Cefn Park Developments C/O J10 Planning Ltd	Exploratory position reference: TP09 Sheet 1 of 1
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Trial Pit Log				TerraConsult							
Personnel: Logged by: Checked by:				Equipment & methods: Method: Machine excavated Plant: Shoring:		Dimensions: Width: Length: Orientation: Bearing =		Coordinates & level: mE: 338762.90 mN: 349106.60 mAOD: 25.01 Grid: OSGB		Dates: Start: 20/02/2019 End: 20/02/2019 Logged:	
Backfill/ Instal'n	Water- strike	Legend	Level & Depth (Thickness)	Stratum Description	Samples & In Situ Testing						
					Depth	Type & No	Results				
			24.81 0.20	Black and orange slightly clayey SAND. Abundant rootlets. (TOPSOIL)							
			(2.10)	Stiff orangish brown slightly gravelly CLAY. Gravel fine to medium subrounded to rounded of mudstone. (REWORKED CLAY)							
			22.71 2.30	Trial pit ends at 2.30m (Target depth)							
					Depth	Type & No	Results				
Groundwater entries: Depth: Rose to: Remarks:				Depth related remarks: From to: Remarks:		General remarks: Weather: Stability: Remarks:					
Notes: For explanation of symbols and abbreviations see Key Sheet. All depths and reduced levels are in metres. Log issue: Scale: 1:25				Project: The Oaks, Wrexham Project No: 4292 Client: Cefn Park Developments C/O J10 Planning Ltd		Exploratory position reference: SA01 Sheet 1 of 1					

TerraConsult

Personnel:	Equipment & methods:	Dimensions:	Coordinates & level:	Dates:
Logged by:	Method: Machine excavated	Width:	mE: 338772.10	Start: 20/02/2019
Checked by:		Length:	mN: 349101.40	End: 20/02/2019
	Plant:	Orientation:	mAOD: 24.97	Logged:
	Shoring:	Bearing =	Grid: OSGB	

Backfill/ Instal'n	Water- strike	Legend	Level & Depth (Thickness)	Stratum Description	Samples & In Situ Testing		
					Depth	Type & No	Results
			24.77 0.20	Black and orange slightly clayey SAND. Abundant rootlets. (TOPSOIL)			
			(2.05)	Stiff orangish brown slightly gravelly CLAY. Gravel fine to coarse angular to subrounded of mudstone and sandstone. (REWORKED CLAY)			
			22.72 2.25	Trial pit ends at 2.25m (Target depth)			

Groundwater entries:	Depth related remarks:	General remarks:
Depth: Rose to: Remarks:	From to: Remarks:	Weather: Stability: Remarks:



TP01





TP02





TP03





TP04





TP05





TP06





TP07





TP08

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TerraConsult

Personnel:		Equipment & methods:		Dimensions:		Coordinates & level:		Dates:	
Logged by:	GB	Method:	Machine Excavated Trial Pit	Width:		mE: 338790.80		Start:	18/02/2019
Checked by:				Length:		mN: 349060.70		End:	18/02/2019
		Plant:	9T Tracked Excavator	Orientation:		mAOD: 24.61		Logged:	
		Shoring:		Bearing =		Grid: OSGB			

Backfill/ Instal'n	Water- strike	Legend	Level & Depth (Thickness)	Stratum Description	Samples & In Situ Testing		
					Depth	Type & No	Results
				Black and brown slightly clayey SAND. Abundant rootlets. (TOPSOIL)	0.50	ES32	
			24.36 0.25 (0.35)	Mottled black and red slightly clayey gravelly SAND. Gravel fine to coarse angular to subangular of brick. (MADE GROUND)			
			24.01 0.60 (0.70)	Orangish brown slightly clayey sandy GRAVEL. Gravel is angular to subrounded fine to medium of oil shale, brick and concrete. (MADE GROUND)			
			23.31 1.30	Trial pit ends at 1.30m (Target depth)			
Groundwater entries: Depth: Rose to: Remarks:				Depth related remarks: From to: Remarks:		General remarks: Weather: Stability: Remarks:	
Notes: For explanation of symbols and abbreviations see Key Sheet. All depths and reduced levels are in metres. Log issue: Scale: 1:25				Project: The Oaks, Wrexham Project No: 4292 Client: Cefn Park Developments C/O J10 Planning Ltd		Exploratory position reference: HD02	
Sheet 1 of 2							

TerraConsult

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TerraConsult

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TerraConsult

Personnel:		Equipment & methods:		Dimensions:		Coordinates & level:		Dates:	
Logged by:	GB	Method:	Machine Excavated Trial Pit	Width:		mE:	338610.50	Start:	18/02/2019
Checked by:				Length:		mN:	349131.60	End:	18/02/2019
		Plant:	9T Tracked Excavator	Orientation:		mAOD:	23.92	Logged:	
		Shoring:		Bearing =		Grid:	OSGB		

[illegible]

TerraConsult

Personnel:		Equipment & methods:		Dimensions:		Coordinates & level:		Dates:	
Logged by:	GB	Method:	Hand Excavated Trial Pit	Width:		mE:	338586.72	Start:	01/04/2019
Checked by:				Length:		mN:	349319.83	End:	01/04/2019
		Plant:	Hand digging tools	Orientation:		mAOD:	27.13	Logged:	
		Shoring:		Bearing =		Grid:	OSGB		

Backfill/ Instal'n	Water- strike	Legend	Level & Depth (Thickness)	Stratum Description	Samples & In Situ Testing		
					Depth	Type & No	Results
			27.03 0.10	Soft dark brown slightly sandy slightly gravelly CLAY with frequent rootlets. Gravel is angular to subrounded fine to medium of shale.	0.45	ES	
			(0.30)	Firm light brown slightly sandy slightly CLAY. Gravel is subangular to subrounded fine to medium of oil shale and mudstone.			
			26.73 0.40	(MADE GROUND)			
26.58 0.55	Dense dark brownish orange slightly silty sandy GRAVEL. Gravel is angular to subrounded fine to medium of oil shale and brick.						
	(REWORKED CLAY)						
Trial pit ends at 0.55m							
						</	

Groundwater entries:	Depth related remarks:	General remarks:
Depth: Rose to: Remarks:	From to: Remarks:	Weather: Stability: Remarks:

TerraConsult

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TerraConsult

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TerraConsult

Personnel: Logged by: GB Checked by:				Equipment & methods: Method: Hand Excavated Trial Pit Plant: Hand digging tools Shoring:		Dimensions: Width: Length: Orientation: Bearing =		Coordinates & level: mE: 338678.44 mN: 349159.87 mAOD: 28.29 Grid: OSGB		Dates: Start: 01/04/2019 End: 01/04/2019 Logged:	
Backfill/ Instal'n	Water- strike	Legend	Level & Depth (Thickness)	Stratum Description	Samples & In Situ Testing						
					Depth	Type & No	Results				
			28.04 0.25	Soft dark brown slightly sandy slightly gravelly CLAY with frequent rootlets. Gravel is angular to subrounded fine to medium of oil shale. (TOPSOIL)	0.30	ES					
			27.79 0.50	Soft to firm brown slightly sandy gravelly CLAY. Gravel is subangular to subrounded fine to medium of oil shale. (REWORKED CLAY)							
			(0.30)	Stiff becoming very stiff brown mottled grey slightly sandy slightly gravelly laminated CLAY. Gravel is subangular to subrounded fine to medium sandstone, siltstone and mudstone. (GLACIAL TILL)							
			27.49 0.80	Trial pit ends at 0.80m (Target depth)							
Groundwater entries: Depth: Rose to: Remarks:				Depth related remarks: From to: Remarks:			General remarks: Weather: Stability: Remarks:				
 Notes: For explanation of symbols and abbreviations see Key Sheet. All depths and reduced levels are in metres. Log issue: Scale: 1:25				Project: The Oaks, Wrexham Project No: 4292 Client: Cefn Park Developments C/O J10 Planning Ltd			Exploratory position reference: HD09				
								Sheet 1 of 1			

TerraConsult[illegible]

TerraConsult

Personnel:		Equipment & methods:		Dimensions:		Coordinates & level:		Dates:	
Logged by:	GB	Method:	Hand Excavated Trial Pit	Width:		mE:	338892.31	Start:	01/04/2019
Checked by:				Length:		mN:	349283.35	End:	01/04/2019
		Plant:	Hand digging tools	Orientation:		mAOD:	33.10	Logged:	
		Shoring:		Bearing =		Grid:	OSGB		

[illegible]

Groundwater entries:	Depth related remarks:	General remarks:
Depth: Rose to: Remarks:	From to: Remarks:	Weather:
		Stability:
		Remarks:

TerraConsult

Personnel:						Equipment & methods:		Dimensions:		Coordinates & level:		Dates:	
Logged by: GB						Method: Hand Excavated Trial Pit		Width:		mE:	338924.81	Start: 01/04/2019	
Checked by:								Length:		mN:	349310.35	End: 01/04/2019	
						Plant: Hand digging tools		Orientation:		mAOD:	34.08	Logged:	
						Shoring:		Bearing =		Grid:	OSGB		
Backfill/ Instal'n	Water- strike	Legend	Level & Depth (Thickness)	Stratum Description	Samples & In Situ Testing								
					Depth	Type & No	Results						
			33.83 0.25	Soft dark brown slightly sandy slightly gravelly CLAY with frequent rootlets. Gravel is angular to subrounded fine to medium of oil shale. (TOPSOIL)	0.30	ES							
			(0.35)	Soft to firm brown slightly sandy gravelly CLAY. Gravel is subangular to subrounded fine to medium of shale, brick and rare coal. (REWORKED CLAY)									
			33.48 0.60	Stiff becoming very stiff brown mottled grey slightly sandy slightly gravelly laminated CLAY. Gravel is subangular to subrounded fine to medium sandstone, siltstone and mudstone.									
			33.28 0.80	(GLACIAL TILL) Trial pit ends at 0.80m (Target depth)									
Groundwater entries: Depth: Rose to: Remarks:				Depth related remarks: From to: Remarks:				General remarks: Weather: Stability: Remarks:					
Notes: For explanation of symbols and abbreviations see Key Sheet. All depths and reduced levels are in metres. Log issue: Scale: 1:25				Project: The Oaks, Wrexham Project No: 4292 Client: Cefn Park Developments C/O J10 Planning Ltd				Exploratory position reference: HD12					

TerraConsult

Personnel:		Equipment & methods:	Dimensions:	Coordinates & level:	Dates:
Logged by:	GB	Method: Hand Excavated Trial Pit	Width:	mE: 338570.24	Start: 01/04/2019
Checked by:		Plant: Hand digging tools	Length:	mN: 349167.55	End: 01/04/2019
		Shoring:	Orientation:		Logged:
			Bearing =	Grid:	

[illegible]

Groundwater entries:	Depth related remarks:	General remarks:
Depth: Rose to: Remarks:	From to: Remarks:	Weather: Stability: Remarks:



HD01





HD02





HD03





HD04





HD05





HD06



HD07



HD08



HD09



HD10



HD11



HD12



HD13

SPT Hammer Calibration Certificate

SPT Hammer Energy Test Report

In accordance with BSEN ISO 22476-3:2005

ARCHWAY ENGINEERING (UK) LTD
AINLEYS INDUSTRIAL ESTATE
ELLAND
WEST YORKSHIRE
HX5 9JP

SPT Hammer Ref: AR2636
Test Date: 15/02/2019
Report Date: 15/02/2019
File Name: AR2636.spt
Test Operator: CM

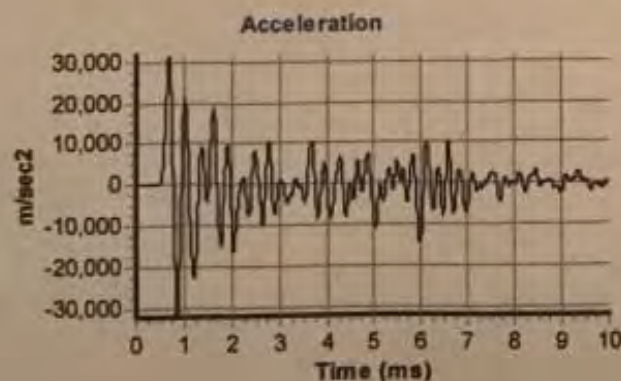
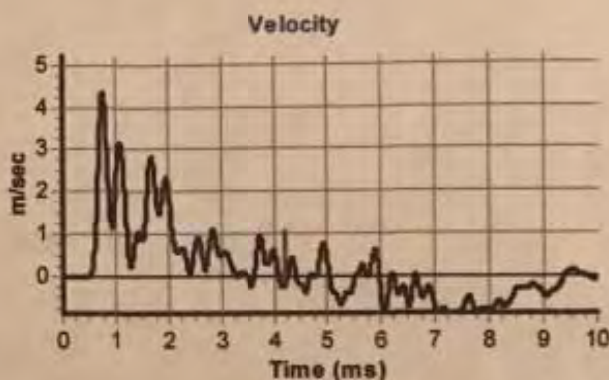
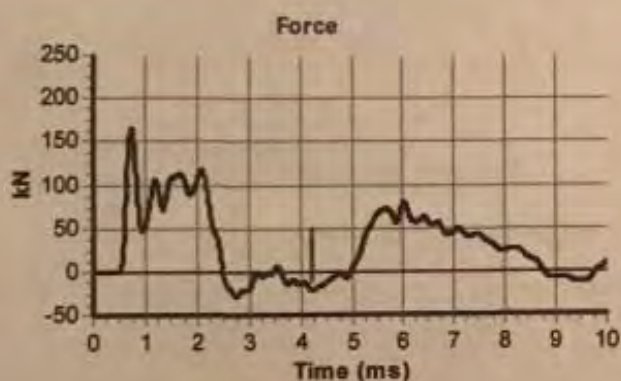
Instrumented Rod Data

Diameter d_r (mm): 54
Wall Thickness t_r (mm): 6.0
Assumed Modulus E_a (GPa): 208
Accelerometer No.1: 7080
Accelerometer No.2: 11609

SPT Hammer Information

Hammer Mass m (kg): 63.5
Falling Height h (mm): 760
SPT String Length L (m): 10.0

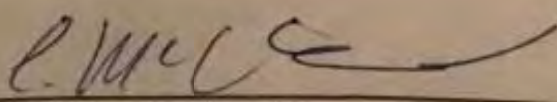
Comments / Location



Calculations

Area of Rod A (mm^2): 905
Theoretical Energy E_{theor} (J): 473
Measured Energy E_{meas} (J): 337

Energy Ratio E_r (%): **71**


Signed: C.MCCLUSKEY
Title: FITTER

The recommended calibration interval is 12 months

SPT Hammer Energy Test Report

in accordance with BSEN ISO 22476-3:2005

ARCHWAY ENGINEERING (UK) LTD
AINLEYS INDUSTRIAL ESTATE
ELLAND
WEST YORKSHIRE
HX5 9JP

SPT Hammer Ref: DART416
Test Date: 07/12/2018
Report Date: 07/12/2018
File Name: DART416.spt
Test Operator: SH

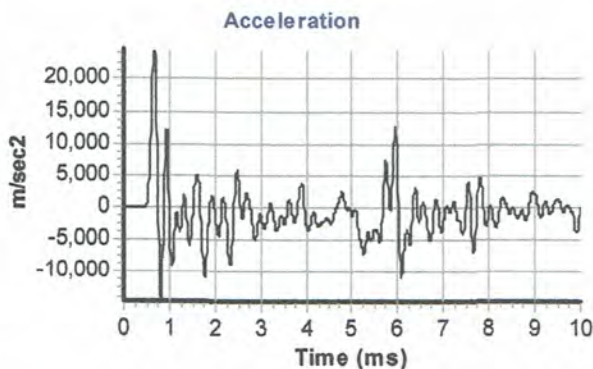
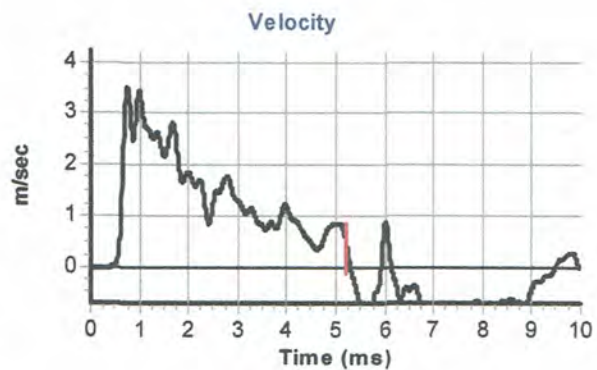
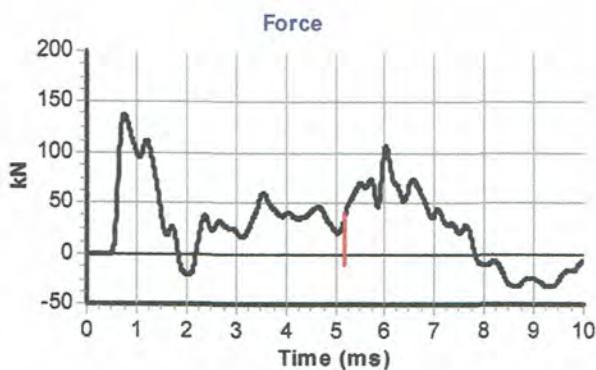
Instrumented Rod Data

Diameter d_r (mm): 54
Wall Thickness t_r (mm): 6.0
Assumed Modulus E_a (GPa): 208
Accelerometer No.1: 7080
Accelerometer No.2: 11609

SPT Hammer Information

Hammer Mass m (kg): 63.5
Falling Height h (mm): 760
SPT String Length L (m): 10.0

Comments / Location



Calculations

Area of Rod A (mm^2): 905
Theoretical Energy E_{theor} (J): 473
Measured Energy E_{meas} (J): 365

Energy Ratio E_r (%): **77**

Signed: M.GARDNER
Title: FITTER

The recommended calibration interval is 12 months

APPENDIX E

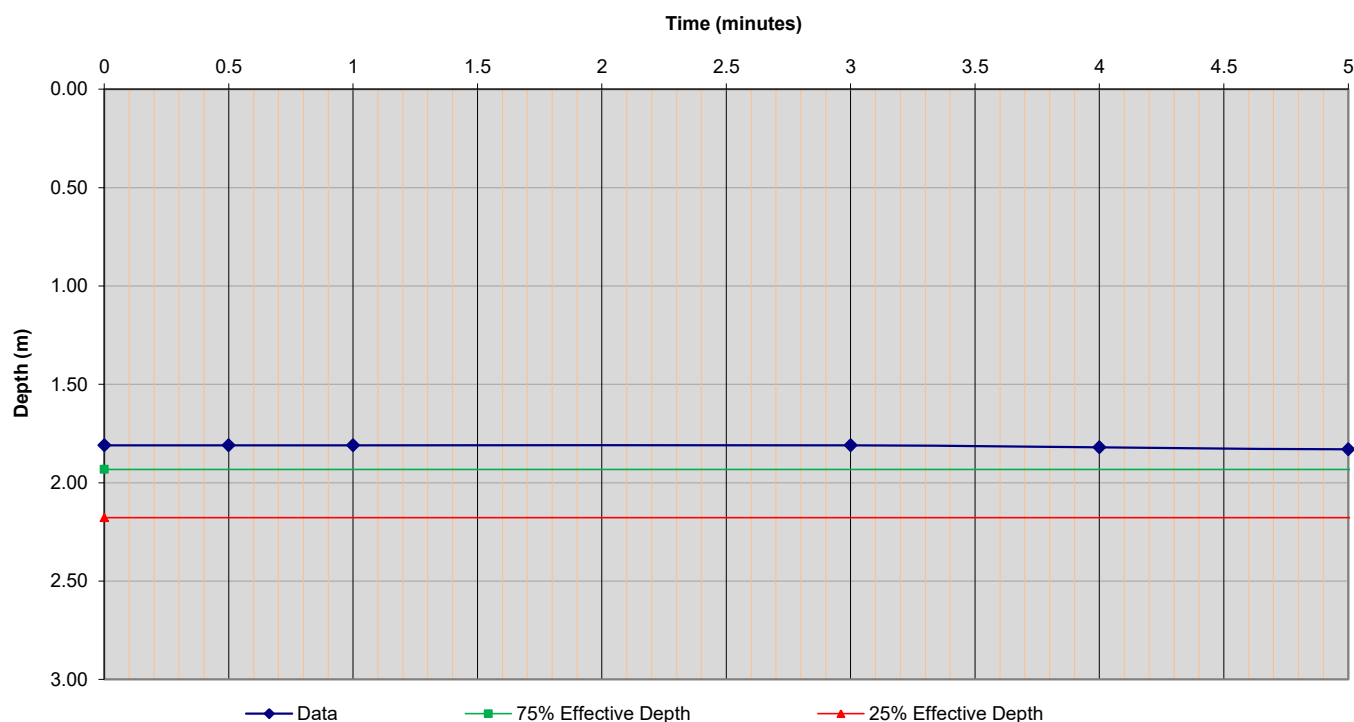
In Situ Testing

TerraConsult

[illegible]

Soil infiltration rate, f	N/A	m ³ /m ² /s
Soil infiltration rate, f	N/A	m/hr
Percolation Value, vp	N/A	s/mm

Notes: 1. Water drained 0.09m after 180mins
2. See accompanying trial pit log;

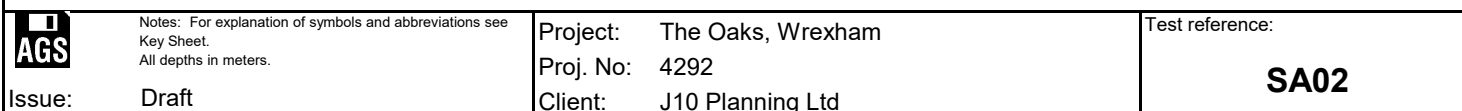


TerraConsult

[illegible]

Soil infiltration rate, f	N/A	m ³ /m ² /s
Soil infiltration rate, f	N/A	m/hr
Percolation Value, vp	N/A	s/mm

Notes: 1. Water failed to drain after 180mins
2. See accompanying trial pit log;



IN SITU CBR (TRRL DCP)DCP01

Depth reading (mm)	Depth below Ground Level (m)	Blows	mm per blow	CBR (%)	Mean CBR %	Log CBR%
70	0.070	0				
140	0.140	1	70	3.4		0.5
187	0.187	1	47	5.2		0.7
231	0.231	1	44	5.5		0.7
280	0.280	1	49	4.9		0.7
325	0.325	1	45	5.4	5.9	0.7
361	0.361	1	36	6.8		0.8
391	0.391	1	30	8.3		0.9
420	0.420	1	29	8.6		0.9
465	0.465	1	45	5.4		0.7
487	0.487	1	22	11.5		1.1
511	0.511	1	24	10.5	11.4	1.0
531	0.531	1	20	12.7		1.1
554	0.554	1	23	11.0		1.0
562	0.562	1	8	33.5		1.5
571	0.571	1	9	29.6		1.5
579	0.579	1	8	33.5		1.5
590	0.590	1	11	23.9		1.4
600	0.600	1	10	26.5	28.6	1.4
611	0.611	1	11	23.9		1.4
622	0.622	1	11	23.9		1.4
633	0.633	1	11	23.9		1.4
640	0.640	1	7	38.6		1.6
670	0.670	1	30	8.3		0.9
710	0.710	1	40	6.1		0.8
751	0.751	1	41	6.0		0.8
781	0.781	1	30	8.3		0.9
830	0.830	1	49	4.9	8.4	0.7
867	0.867	1	37	6.6		0.8
881	0.881	1	14	18.6		1.3
923	0.923	1	42	5.8		0.8
940	0.940	1	17	15.1		1.2
991	0.991	1	51	4.7		0.7

IN SITU CBR (TRRL DCP)DCP02

Depth reading (mm)	Depth below Ground Level (m)	Blows	mm per blow	CBR (%)	Mean CBR %	Log CBR%
173	0.173	0				
252	0.252	1	79	3.0	3.0	0.5
311	0.311	1	59	4.1		0.6
369	0.369	1	58	4.1		0.6
428	0.428	1	59	4.1		0.6
542	0.542	1	114	2.0		0.3
588	0.588	1	46	5.3		0.7
649	0.649	1	61	3.9		0.6
692	0.692	1	43	5.7	5.3	0.8
732	0.732	1	40	6.1		0.8
779	0.779	1	47	5.2		0.7
813	0.813	1	34	7.3		0.9
852	0.852	1	39	6.3		0.8
889	0.889	1	37	6.6		0.8
922	0.922	1	33	7.5		0.9
965	0.965	1	43	5.7		0.8

IN SITU CBR (TRRL DCP)DCP03

Depth reading (mm)	Depth below Ground Level (m)	Blows	mm per blow	CBR (%)	Mean CBR %	Log CBR%
108	0.108	0				
193	0.193	1	85	2.8	3.7	0.4
244	0.244	1	51	4.7		0.7
283	0.283	1	39	6.3		0.8
324	0.324	1	41	6.0		0.8
357	0.357	1	33	7.5		0.9
395	0.395	1	38	6.5		0.8
430	0.430	1	35	7.0		0.8
467	0.467	1	37	6.6		0.8
499	0.499	1	32	7.7		0.9
540	0.540	1	41	6.0		0.8
594	0.594	1	54	4.5		0.6
631	0.631	1	37	6.6	6.2	0.8
673	0.673	1	42	5.8		0.8
714	0.714	1	41	6.0		0.8
761	0.761	1	47	5.2		0.7
804	0.804	1	43	5.7		0.8
847	0.847	1	43	5.7		0.8
883	0.883	1	36	6.8		0.8
923	0.923	1	40	6.1		0.8
966	0.966	1	43	5.7		0.8

IN SITU CBR (TRRL DCP)

DCP04

[illegible]

IN SITU CBR (TRRL DCP)DCP05

Depth reading (mm)	Depth below Ground Level (m)	Blows	mm per blow	CBR (%)	Mean CBR %	Log CBR%
104	0.104	0				
180	0.180	1	76	3.1		0.5
240	0.240	1	60	4.0		0.6
281	0.281	1	41	6.0	4.6	0.8
327	0.327	1	46	5.3		0.7
378	0.378	1	51	4.7		0.7
384	0.384	1	6	45.4	45.4	1.7
461	0.461	1	77	3.1		0.5
511	0.511	1	50	4.8		0.7
573	0.573	1	62	3.8		0.6
613	0.613	1	40	6.1		0.8
674	0.674	1	61	3.9		0.6
750	0.750	1	76	3.1	4.9	0.5
797	0.797	1	47	5.2		0.7
841	0.841	1	44	5.5		0.7
892	0.892	1	51	4.7		0.7
945	0.945	1	53	4.5		0.7
972	0.972	1	27	9.3		1.0

DCP06

[illegible]

IN SITU CBR (TRRL DCP)DCP07

Depth reading (mm)	Depth below Ground Level (m)	Blows	mm per blow	CBR (%)	Mean CBR %	Log CBR%
114	0.114	0				
174	0.174	1	60	4.0		0.6
246	0.246	1	72	3.3		0.5
335	0.335	1	89	2.6		0.4
417	0.417	1	82	2.9	3.1	0.5
510	0.510	1	93	2.5		0.4
580	0.580	1	70	3.4		0.5
606	0.606	1	26	9.6		1.0
666	0.666	1	60	4.0		0.6
698	0.698	1	32	7.7		0.9
732	0.732	1	34	7.3		0.9
772	0.772	1	40	6.1	7.1	0.8
802	0.802	1	30	8.3		0.9
863	0.863	1	61	3.9		0.6
889	0.889	1	26	9.6		1.0
922	0.922	1	33	7.5		0.9
956	0.956	1	34	7.3		0.9

IN SITU CBR (TRRL DCP)DCP08

Depth reading (mm)	Depth below Ground Level (m)	Blows	mm per blow	CBR (%)	Mean CBR %	Log CBR%
128	0.128	0				
265	0.265	1	137	1.7	3.3	0.2
314	0.314	1	49	4.9		0.7
345	0.345	1	31	8.0		0.9
414	0.414	1	69	3.4		0.5
465	0.465	1	51	4.7		0.7
520	0.520	1	55	4.4		0.6
575	0.575	1	55	4.4		0.6
620	0.620	1	45	5.4		0.7
651	0.651	1	31	8.0		0.9
680	0.680	1	29	8.6		0.9
710	0.710	1	30	8.3		0.9
725	0.725	1	15	17.3		1.2
770	0.770	1	45	5.4	7.3	0.7
810	0.810	1	40	6.1		0.8
835	0.835	1	25	10.1		1.0
870	0.870	1	35	7.0		0.8
900	0.900	1	30	8.3		0.9
931	0.931	1	31	8.0		0.9
966	0.966	1	35	7.0		0.8

IN SITU CBR (TRRL DCP)

DCP09

Depth reading (mm)	Depth below Ground Level (m)	Blows	mm per blow	CBR (%)	Mean CBR %	Log CBR%
75	0.075	0				
164	0.164	1	89	2.6		0.4
214	0.214	1	50	4.8		0.7
264	0.264	1	50	4.8	5.6	0.7
305	0.305	1	41	6.0		0.8
331	0.331	1	26	9.6		1.0
340	0.340	1	9	29.6		1.5
351	0.351	1	11	23.9	27.7	1.4
360	0.360	1	9	29.6		1.5
375	0.375	1	15	17.3		1.2
400	0.400	1	25	10.1		1.0
415	0.415	1	15	17.3		1.2
465	0.465	1	50	4.8		0.7
484	0.484	1	19	13.4	12.4	1.1
502	0.502	1	18	14.2		1.2
520	0.520	1	18	14.2		1.2
540	0.540	1	20	12.7		1.1
565	0.565	1	25	10.1		1.0
590	0.590	1	25	10.1		1.0
620	0.620	1	30	8.3		0.9
655	0.655	1	35	7.0		0.8
700	0.700	1	45	5.4		0.7
745	0.745	1	45	5.4		0.7
780	0.78	1	35	7.0	7.24	0.8
820	0.82	1	40	6.1		0.8
860	0.86	1	40	6.1		0.8
892	0.892	1	32	7.7		0.9
930	0.93	1	38	6.5		0.8
950	0.95	1	20	12.7		1.1

IN SITU CBR (TRRL DCP)DCP10

Depth reading (mm)	Depth below Ground Level (m)	Blows	mm per blow	CBR (%)	Mean CBR %	Log CBR%
85	0.085	0				
145	0.145	1	60	4.0		0.6
220	0.220	1	75	3.1		0.5
301	0.301	1	81	2.9	3.8	0.5
344	0.344	1	43	5.7		0.8
412	0.412	1	68	3.5		0.5
454	0.454	1	42	5.8		0.8
490	0.490	1	36	6.8		0.8
520	0.520	1	30	8.3		0.9
560	0.560	1	40	6.1		0.8
600	0.600	1	40	6.1		0.8
645	0.645	1	45	5.4		0.7
688	0.688	1	43	5.7	6.0	0.8
740	0.740	1	52	4.6		0.7
787	0.787	1	47	5.2		0.7
830	0.830	1	43	5.7		0.8
870	0.870	1	40	6.1		0.8
914	0.914	1	44	5.5		0.7
952	0.952	1	38	6.5		0.8

IN SITU CBR (TRRL DCP)DCP11

Depth reading (mm)	Depth below Ground Level (m)	Blows	mm per blow	CBR (%)	Mean CBR %	Log CBR%
140	0.108	0				
232	0.200	1	92	2.5		0.4
284	0.252	1	52	4.6		0.7
322	0.290	1	38	6.5	5.0	0.8
360	0.328	1	38	6.5		0.8
373	0.341	1	13	20.1		1.3
384	0.352	1	11	23.9		1.4
392	0.360	1	8	33.5		1.5
404	0.372	1	12	21.8		1.3
414	0.382	1	10	26.5		1.4
422	0.390	1	8	33.5		1.5
434	0.402	1	12	21.8	26.6	1.3
440	0.408	1	6	45.4		1.7
450	0.418	1	10	26.5		1.4
464	0.432	1	14	18.6		1.3
473	0.441	1	9	29.6		1.5
482	0.450	1	9	29.6		1.5
500	0.468	1	18	14.2		1.2
530	0.498	1	30	8.3		0.9
580	0.548	1	50	4.8		0.7
621	0.589	1	41	6.0		0.8
666	0.634	1	45	5.4		0.7
721	0.689	1	55	4.4		0.6
770	0.738	1	49	4.9	6.1	0.7
804	0.772	1	34	7.3		0.9
845	0.813	1	41	6.0		0.8
880	0.848	1	35	7.0		0.8
914	0.882	1	34	7.3		0.9
954	0.922	1	40	6.1		0.8

APPENDIX F

Gas and Groundwater Monitoring

No: 4292

GROUNDWATER AND GROUND GAS MONITORING

TerraConsult

Site: The Oaks, Wrexham

Location	Date	Monitored by	Well Details		Groundwater		Gas												Weather		Serial No.
			Standpipe diameter (mm)	Depth to Base (m bgl)	Water Depth (m bgl)	Water Sample Taken?	Atmospheric Pressure (mb)	Atmospheric Pressure Comment	Relative Pressure (mb)	Steady Flow (l/hr)	Peak Flow (l/hr)	CH ₄ (% v/v)	GSV CH ₄ (l/hr)	CO ₂ (% v/v)	GSV CO ₂ (l/hr)	O ₂ (% v/v)	CO (ppm)	H ₂ S (ppm)	Conditions	Ambient Temp °C	
BH01 Shallow	07/03/19	GB	51	4.06	3.76	N	988	Rising	0.01	0.1	0.1	0.1	0.0001	0.9	0.0009	13.7	1	1	Rain	5	11380
	12/03/19	DK	51	4.06	3.64	N	999	Rising	0.03	0.8	0.8	0.1	0.0008	0.8	0.0064	18.4	1	1	Rain	6	11380
	19/03/19	DK	51	4.06	3.71	N	1024	Falling	0.01	0.1	0.1	0.1	0.0001	1.2	0.0012	12.3	1	1	Dry	9	12417
	27/03/19	GB	51	4.06	3.38	N	1036	Steady	0.01	0.1	0.1	0.1	0.0001	1.9	0.0019	10.8	1	1	Cloudy	10	11380
	01/04/19	DK	51	4.06	3.30	N	1030	Falling	0.01	0.1	0.1	0.1	0.0001	1.5	0.0015	11.2	1	1	Dry	11	11380
	05/04/19	GB	51	4.06	3.20	N	997	Steady	0.01	0.1	0.1	0.1	0.0001	2.1	0.0021	12.4	1	1	Overcast/ light rain	6	11380
BH01 Deep	07/03/19	GB	51	15.20	4.47	Y	988	Rising	0.01	0.1	0.1	0.1	0.0001	0.1	0.0001	19.8	1	1	Rain	5	11380
	12/03/19	DK	51	15.20	4.54	N	999	Rising	0.01	0.1	0.1	0.1	0.0001	0.1	0.0001	20.2	1	1	Rain	6	11380
	19/03/19	DK	51	15.20	4.56	N	1023	Falling	0.01	0.1	0.1	0.1	0.0001	0.1	0.0001	19.8	1	1	Dry	9	12417
	27/03/19	GB	51	15.20	4.41	N	1036	Steady	0.01	0.1	0.1	0.1	0.0001	0.2	0.0002	20.0	1	1	Cloudy	10	11380
	01/04/19	DK	51	15.20	4.39	N	1030	Falling	0.01	0.1	0.1	0.1	0.0001	0.1	0.0001	19.1	1	1	Dry	11	11380
	05/04/19	GB	51	15.20	4.33	N	997	Steady	0.01	0.1	0.1	0.1	0.0001	0.6	0.0006	19.8	1	1	Overcast/ light rain	6	11380
BH05 Shallow	07/03/19	GB	51	4.01	3.34	N	991	Rising	0.01	0.1	0.1	0.1	0.0001	0.1	0.0001	18.7	1	1	Rain	5	11380
	12/03/19	DK	51	4.01	3.15	N	999	Rising	0.01	0.1	0.1	0.1	0.0001	0.1	0.0001	18.9	1	1	Rain	6	11380
	19/03/19	DK	51	4.01	3.12	N	1020	Falling	0.01	0.1	0.1	0.1	0.0001	0.1	0.0001	19.2	1	1	Dry	9	12417
	27/03/19	GB	51	4.01	3.27	N	1035	Steady	0.01	0.1	0.1	0.1	0.0001	0.1	0.0001	20.0	1	1	Cloudy	10	11380
	01/04/19	DK	51	4.01	3.25	N	1030	Falling	0.01	0.1	0.1	0.1	0.0001	0.1	0.0001	19.5	1	1	Dry	11	11380
	05/04/19	GB	51	4.01	3.27	N	997	Steady	0.01	0.1	0.1	0.1	0.0001	0.4	0.0004	19.8	1	1	Overcast/ light rain	6	11380
BH05 Deep	07/03/19	GB	51	15.20	14.60	N	988	Rising	0.01	0.1	0.1	0.1	0.0001	0.1	0.0001	18.6	1	1	Rain	5	11380
	12/03/19	DK	51	15.20	14.50	N	999	Rising	0.01	0.1	0.1	0.1	0.0001	0.1	0.0001	18.4	1	1	Rain	6	11380
	19/03/19	DK	51	15.20	14.47	N	1020	Falling	0.01	0.1	0.1	0.1	0.0001	0.1	0.0001	17.6	1	1	Dry	9	12417
	27/03/19	GB	51	15.20	13.12	N	1035	Steady	0.01	0.1	0.1	0.1	0.0001	0.1	0.0001	19.7	1	1	Cloudy	10	11380
	01/04/19	DK	51	15.20	13.25	N	1029	Falling	0.01	0.1	0.1	0.1	0.0001	0.1	0.0001	19.4	1	1	Dry	11	11380
	05/04/19	GB	51	15.20	12.54	N	997	Steady	0.01	0.1	0.1	0.1	0.0001	0.8	0.0008	18.4	1	1	Overcast/ light rain	6	11380
BH06A Shallow	07/03/19	GB	51	4.11	3.37	N	991	Rising	0.01	0.1	0.1	0.1	0.0001	1.3	0.0013	16.3	1	1	Rain	5	11380
	12/03/19	DK	51	4.11	3.21	N	998	Rising	0.01	0.1	0.1	0.1	0.0001	1.5	0.0015	17.2	1	1	Rain	6	11380
	19/03/19	DK	51	4.11	3.20	N	1021	Falling	0.01	0.1	0.1	0.1	0.0001	2.1	0.0021	18.8	1	1	Dry	9	12417
	27/03/19	GB	51	4.11	3.34	N	1035	Steady	0.01	0.1	0.1	0.1	0.0001	1.8	0.0018	17.8	1	1	Cloudy	10	11380
	01/04/19	DK	51	4.11	3.40	N	1029	Falling	0.01	0.1	0.1	0.1	0.0001	0.5	0.0005	18.5	1	1	Dry	11	11380
	05/04/19	GB	51	4.11	3.33	N	997	Steady	0.01	0.1	0.1	0.1	0.0001	2.0	0.0020	10.0	1	1	Overcast/ light rain	6	11380
BH06A Deep	07/03/19	GB	51	15.16	14.66	N	991	Rising	0.01	0.1	0.1	0.1	0.0001	0.9	0.0009	16.0	1	1	Rain	5	11380
	12/03/19	DK	51	15.16	14.40	N	998	Rising	0.01	0.1	0.1	0.1	0.0001	1.0	0.0010	15.1	1	1	Rain	6	11380
	19/03/19	DK	51	15.16	14.42	N	1021	Falling	0.01	0.1	0.1	0.1	0.0001	1.1	0.0011	14.5	1	1	Dry	9	12417
	27/03/19	GB	51	15.16	12.78	N	1035	Steady	0.01	0.1	0.1	0.1	0.0001	0.8	0.0008	16.8	1	1	Cloudy	10	11380
	01/04/19	DK	51	15.16	13.11	N	1029	Falling	0.01	0.1	0.1	0.1	0.0001	1.2	0.0012	15.7	1	1	Dry	11	11380
	05/04/19	GB	51	15.16	11.36	N	997	Steady	0.01	0.1	0.1	0.1	0.0001	2.2	0.0022	3.7	1	1	Overcast/ light rain	6	11380
BH07 Shallow	07/03/19	GB	51	4.03	Dry	N	989	Rising	0.01	0.1	0.1	0.1	0.0001	1.0	0.0010	13.9	1	1	Rain	5	11380
	12/03/19	DK	51	4.03	Dry	N	996	Rising	0.01	0.1	0.1	0.1	0.0001	1.2	0.0012	14.8	1	1	Rain	6	11380
	19/03/19	DK	51	4.03	Dry	N	1021	Falling	0.01	0.1	0.1	0.1	0.0001	1.4	0.0014	15.2	1	1	Dry	9	12417
	27/03/19	GB	51	4.03	3.96	N	1035	Steady	0.01	0.1	0.1	0.1	0.0001	0.9	0.0009	15.8	1	1	Cloudy	10	11380
	01/04/19	DK	51	4.03	3.99	N	1028	Falling	0.01	0.1	0.1	0.1	0.0001	1.3	0.0013	15.5	1	1	Dry	11	11380
	05/04/19	GB	51	4.03	3.92	N	997	Steady	0.01	0.1	0.1	0.1	0.0001	0.6	0.0006	18.8	1	1	Overcast/ light rain	6	11380
BH07 Deep	07/03/19	GB	51	14.46	5.49	Y	989	Rising	0.01	0.1	0.1	0.1	0.0001	0.8	0.0008	17.4	1	1	Rain	5	11380
	12/03/19	DK	51	14.46	5.14	N	996	Rising	0.01	0.1	0.1	0.1	0.0001	0.9	0.0009	18.2	1	1	Rain	6	11380
	19/03/19	DK	51	14.46	5.12	N	1022	Falling	0.01	0.1	0.1	0.1	0.0001	1.1	0.0011	17.8	1	1	Dry	9	12417
	27/03/19	GB	51	14.46	5.44	N	1035	Steady	0.01	0.1	0.1	0.1	0.0001	1.0	0.0010	17.6	1	1	Cloudy	10	11380
	01/04/19	DK	51	14.46	5.56	N	1028	Falling	0.01	0.1	0.1	0.1	0.0001	1.4	0.0014	17.0	1	1	Dry	11	11380
	05/04/19	GB	51	14.46		N	997	Steady	0.01	0.1	0.1	0.1	0.0001	1.1	0.0011	18.1	1	1	Overcast/ light rain	6	11380
WS01	07/03/19	GB	51	5.00	4.91	N	988	Rising	0.01	0.1	0.1	0.1	0.0001	0.7	0.0007	17.8	1	1	Rain	5	11380
	N/A	-	-	-	-	-													-	-	-
	N/A	-	-	-	-	-													-	-	-
	27/03/19	GB	51	5.00	2.29	N													Cloudy	10	11380
	01/04/19	DK	51	5.00	2.50	N													Dry	11	11380
	05/04/19	GB	51	5.00	2.78	N	997	Steady	0.01	0.1	0.1	0.1	0.0001	0.6	0.0006	18.0	1	1	Overcast/ light rain	6	11380
WS02	07/03/19	GB	51	3.98	0.63	Y	989	Rising	0.01	0.1	0.1	0.1	0.0001	0.7	0.0007	17.6	1	1	Rain	5	11380
	12/03/19	DK	51	3.98	0.47	N	998	Rising	0.01	0.1	0.1	0.1	0.0001	0.2	0.0002	20.1	1	1	Rain	6	11380
	19/03/19	DK	51	3.98	0.50	N	1022	Falling	0.01	0.1	0.1	0.1	0.0001	0.3	0.0003	19.7	1	1	Dry	9	12417
	27/03/19	GB	51	3.98	0.85	N	1035	Steady	0.01	0.1	0.1	0.1	0.0001	0.3	0.0003	20.2	1	1	Cloudy	10	11380
	01/04/19	DK	51	3.98	0.91	N	1030	Falling	0.01	0.1	0.1	0.1	0.0001	0.3	0.0003	19.6	1	1	Dry	11	11380
	05/04/19	GB	51	3.98	0.59	N	997	Steady	0.01	0.1	0.1	0.1	0.0001	0.6	0.0006	19.6	1	1	Overcast/ light rain	6	11380

NOTES:

NM = Not Measured.

(x) = Peak value recorded.

[grey] = Below detection limit.

No: 4292

GROUNDWATER AND GROUND GAS MONITORING

TerraConsult

Site: The Oaks, Wrexham

Location	Date	Monitored by	Well Details		Groundwater		Gas												Weather		Serial No.
			Standpipe diameter (mm)	Depth to Base (m bgl)	Water Depth (m bgl)	Water Sample Taken?	Atmospheric Pressure (mb)	Atmospheric Pressure Comment	Relative Pressure (mb)	Steady Flow (l/hr)	Peak Flow (l/hr)	CH ₄ (% v/v)	GSV CH ₄ (l/hr)	CO ₂ (% v/v)	GSV CO ₂ (l/hr)	O ₂ (% v/v)	CO (ppm)	H ₂ S (ppm)	Conditions	Ambient Temp °C	
WS03	07/03/19	GB	51	3.36	2.57	N	989	Rising	0.10	2.4	2.4	0.1	0.0024	2.8	0.0672	12.2	1	1	Rain	5	11380
	12/03/19	DK	51	3.36	2.41	N	998	Rising	0.14	3.0	3.0	0.1	0.0030	2.8	0.0840	13.1	1	1	Rain	6	11380
	19/03/19	DK	51	3.36	2.44	N	1022	Falling	0.01	0.1	0.1	0.1	0.0001	0.4	0.0004	19.2	1	1	Dry	9	12417
	27/03/19	GB	51	3.36	2.51	N	1035	Steady	0.01	0.1	0.1	0.1	0.0001	1.5	0.0015	18.4	1	1	Cloudy	10	11380
	01/04/19	DK	51	3.36	2.47	N	1030	Falling	0.01	0.1	0.1	0.1	0.0001	1.1	0.0011	18.7	1	1	Dry	11	11380
	05/04/19	GB	51	3.36	2.48	N	997	Steady	0.01	0.1	0.1	0.1	0.0001	4.8	0.0048	14.4	1	1	Overcast/ light rain	6	11380
WS04	07/03/19	GB	51	4.09	0.32	Y	989	Rising	0.01	0.1	0.1	0.1	0.0001	1.4	0.0014	17.9	1	1	Rain	5	11380
	12/03/19	DK	51	4.09	0.24	N	998	Rising	0.01	0.1	0.1	0.1	0.0001	1.0	0.0010	20.1	1	1	Rain	6	11380
	19/03/19	DK	51	4.09	0.20	N	1021	Falling	0.01	0.1	0.1	0.1	0.0001	1.6	0.0016	18.3	1	1	Dry	9	12417
	27/03/19	GB	51	4.09	0.20	N	1035	Steady	0.01	0.1	0.1	0.1	0.0001	0.8	0.0008	18.8	1	1	Cloudy	10	11380
	01/04/19	DK	51	4.09	0.22	N	1030	Falling	0.01	0.1	0.1	0.1	0.0001	0.4	0.0004	19.6	1	1	Dry	11	11380
	05/04/19	GB	51	4.06	0.19	N	997	Steady	0.01	0.1	0.1	0.1	0.0001	2.2	0.0022	17.2	1	1	Overcast/ light rain	6	11380
WS05	07/03/19	GB	51	3.90	0.73	Y	989	Rising	0.88	11.0	11.0	0.1	0.0110	0.5	0.0550	18.8	1	1	Rain	5	11380
	12/03/19	DK	51	3.90	0.61	N	999	Rising	1.11	12.2	12.2	0.1	0.0122	0.4	0.0488	18.0	1	1	Rain	6	11380
	19/03/19	DK	51	3.90	0.55	N	1021	Falling	0.50	8.2	8.2	0.1	0.0082	0.6	0.0492	19.3	1	1	Dry	9	12417
	27/03/19	GB	51	3.90	0.86	N	1035	Steady	0.01	0.1	0.1	0.1	0.0001	0.4	0.0004	18.1	1	1	Cloudy	10	11380
	01/04/19	DK	51	3.90	0.90	N	1029	Falling	0.01	0.1	0.1	0.1	0.0001	0.8	0.0008	17.5	1	1	Dry	11	11380
	05/04/19	GB	51	3.90	0.69	N	997	Steady	0.01	0.1	0.1	0.1	0.0001	0.7	0.0007	19.4	1	1	Overcast/ light rain	6	11380
WS06	07/03/19	GB	51	3.91	Dry	N	988	Rising	0.01	0.1	0.1	0.1	0.0001	2.2	0.0022	14.2	1	1	Rain	5	11380
	12/03/19	DK	51	3.91	Dry	N	998	Rising	0.01	0.1	0.1	0.1	0.0001	3.1	0.0031	13.2	1	1	Rain	6	11380
	19/03/19	DK	51	3.91	Dry	N	1022	Falling	0.01	0.1	0.1	0.1	0.0001	2.7	0.0027	18.1	1	1	Dry	9	12417
	27/03/19	GB	51	3.91	3.87	N	1035	Steady	0.01	0.1	0.1	0.1	0.0001	2.7	0.0027	18.2	1	1	Cloudy	10	11380
	01/04/19	DK	51	3.91	Dry	N	1029	Falling	0.01	0.1	0.1	0.1	0.0001	2.5	0.0025	18.3	1	1	Dry	11	11380
	05/04/19	GB	51	3.91	Dry	N	997	Steady	0.01	0.1	0.1	0.1	0.0001	3.9	0.0039	12	1	1	Overcast/ light rain	6	11380
WS07	07/03/19	GB	51	4.82	4.36	Y	989	Rising	0.01	0.1	0.1	0.1	0.0001	3.4	0.0034	12.7	1	1	Rain	5	11380
	12/03/19	DK	51	4.82	4.14	N	997	Rising	0.01	0.1	0.1	0.1	0.0001	4.2	0.0042	13.1	1	1	Rain	6	11380
	19/03/19	DK	51	4.82	4.12	N	1021	Falling	0.01	0.1	0.1	0.1	0.0001	3.1	0.0031	15.2	1	1	Dry	9	12417
	27/03/19	GB	51	4.82	3.63	N	1035	Steady	0.01	0.1	0.1	0.1	0.0001	3.3	0.0033	15.1	1	1	Cloudy	10	11380
	01/04/19	DK	51	4.82	3.76	N	1028	Falling	0.01	0.1	0.1	0.1	0.0001	3.1	0.0031	16.0	1	1	Dry	11	11380
	05/04/19	GB	51	4.82	3.07	N	997	Steady	0.01	0.1	0.1	0.1	0.0001	2.4	0.0024	17.2	1	1	Overcast/ light rain	6	11380
WS08	07/03/19	GB	51	3.93	Dry	N	990	Rising	0.01	0.1	0.1	0.1	0.0001	2.2	0.0022	15.6	1	1	Rain	5	11380
	12/03/19	DK	51	3.93	3.87	N	998	Rising	0.01	0.1	0.1	0.1	0.0001	2.6	0.0026	16.0	1	1	Rain	6	11380
	19/03/19	DK	51	3.93	3.85	N	1021	Falling	0.01	0.1	0.1	0.1	0.0001	2.8	0.0028	17.1	1	1	Dry	9	12417
	27/03/19	GB	51	3.93	3.91	N	1035	Steady	0.01	0.1	0.1	0.1	0.0001	2.5	0.0025	16.9	1	1	Cloudy	10	11380
	01/04/19	DK	51	3.93	3.84	N	1028	Falling	0.01	0.1	0.1	0.1	0.0001	2.1	0.0021	17.5	1	1	Dry	11	11380
	05/04/19	GB	51	3.93	3.90	N	997	Steady	0.01	0.1	0.1	0.1	0.0001	3.9	0.0039	13.2	1	1	Overcast/ light rain	6	11380
WS09	07/03/19	GB	51	3.72	0.45	Y	990	Rising	0.01	0.1	0.1	0.1	0.0001	1.0	0.0010	17.2	1	1	Rain	5	11380
	12/03/19	DK	51	3.72	0.32	N	997	Rising	0.01	0.1	0.1	0.1	0.0001	1.4	0.0014	18.9	1	1	Rain	6	11380
	19/03/19	DK	51	3.72	0.30	N	1021	Falling	0.01	0.1	0.1	0.1	0.0001	0.9	0.0009	16.2	1	1	Dry	9	12417
	27/03/19	GB	51	3.72	0.74	N	1035	Steady	0.01	0.1	0.1	0.1	0.0001	1.1	0.0011	17.1	1	1	Cloudy	10	11380
	01/04/19	DK	51	3.72	0.81	N	1027	Falling	0.01	0.1	0.1	0.1	0.0001	1.3	0.0013	17.1	1	1	Dry	11	11380
	05/04/19	GB	51	3.72	0.52	N	997	Steady	0.01	0.1	0.1	0.1	0.0001	1.0	0.0010	17.2	1	1	Overcast/ light rain	6	11380
WS10	07/03/19	GB	51	3.90	0.24	Y	990	Rising	0.01	0.1	0.1	0.1	0.0001	1.2	0.0012	17.2	1	1	Rain	5	11380
	12/03/19	DK	51	3.90	0.20	N	999	Rising	0.01	0.1	0.1	0.1	0.0001	0.9	0.0009	17.5	1	1	Rain	6	11380
	19/03/19	DK	51	3.90	0.25	N	1019	Falling	0.01	0.1	0.1	0.1	0.0001	1.4	0.0014	16.2	1	1	Dry	9	12417
	27/03/19	GB	51	3.90	0.63	N	1035	Steady	0.01	0.1	0.1	0.1	0.0001	0.7	0.0007	17.5	1	1	Cloudy	10	11380
	01/04/19	DK	51	3.90	0.55	N	1027	Falling	0.01	0.1	0.1	0.1	0.0001	1.0	0.0010	17.7	1	1	Dry	11	11380
	05/04/19	GB	51	3.90	0.12	N	997	Steady	0.01	0.1	0.1	0.1	0.0001	1.1	0.0011	17.9	1	1	Overcast/ light rain	6	11380

NOTES:

NM = Not Measured.

(x) = Peak value recorded.

[grey] = Below detection limit.

$$\text{GSV (l/HR)} = [\text{gas concentration (\%v/v)}] \times [\text{gas well flow rate (l/hr)}]$$

No: 4292

GROUNDWATER AND GROUND GAS MONITORING

TerraConsult

Site: The Oaks, Wrexham

Location	Date	Monitored by	Well Details		Groundwater		Gas										Weather		Serial No.
			Standpipe diameter (mm)	Depth to Base (m bgl)	Water Depth (m bgl)	Water Sample Taken?	Atmospheric Pressure (mb)	Atmospheric Pressure Comment	Relative Pressure (mb)	Steady Flow (l/h)	Peak Flow (l/h)	CH ₄ (% v/v)	GSV CH ₄ (l/hr)	CO ₂ (% v/v)	GSV CO ₂ (l/hr)	O ₂ (% v/v)	CO (ppm)	H2S (ppm)	

TEST DATE AND CONDITIONS			
Date		25/06/18	
Atmospheric Pressure		1008	mB
Ambient Temperature		21.7	°C
EnviroNics Serial No.		5089	

GFM435 Final Inspection & Calibration
Check Certificate

Customer	Terraconsult Ltd
Certificate Number	120264
Order Number	320071

Serial Number	11380
Software Version	G435-00.0024/0004

GAS DATA LTD

Unit 4, Fairfield Court

Seven Stars Estate

Wheler Rd

Coventry

CV3 4LJ

Tel 02476303311

Fax 02476307711



Recalibration DUE Date

25/06/19

Instrument Checks					
Keyboard	✓		Display Contrast	✓	
Pump Flow In	500	Accept > 200 cc/min	Pump Flow @ -200mB	200	Accept > 200 cc/min
Clock Set / Running	✓		Labels Fitted	✓	

Gas Checks						
Sensor	CH ₄		CO ₂		O ₂	
	Instrument Gas	True Gas Value %	Instrument Gas	True Gas Value %	Instrument Gas	True Gas Value %
	Readings %		Readings %		Readings %	
	59.7	60	39.4	40	20.9	20.9
	Accept ±3.0		Accept ±3.0		Accept ±0.5	
Zero Reading 100% N2	4.9	5	4.9	5	6	6
	Accept ±0.3		Accept ±0.3		Accept ±0.3	
	0	0	0	0	0	0
	Accept ±0.0		Accept ±0.0		Accept ±0.1	

Optional Gas Checks						
Applied Gas & Range	Concentration Tested @ (ppm)	Instrument Readings (ppm)				
Gas Type	Range (ppm)		Zero Reading		Instrument Gas Reading	
H ₂ S	5000	1500	0	Accept ±0.0	1500	Accept ±5.0
CO	2000	1000	0	Accept ±0.0	1000	Accept ±5.0
Hexane	2.0%	2.0%	0	Accept ±0.0	1.99	Accept ±10.0

TEST DATE AND CONDITIONS			
Date		03/04/18	
Atmospheric Pressure		973	mB
Ambient Temperature		22.3	°C
EnviroNics Serial No.		5089	

GFM436 Final Inspection & Calibration
Check Certificate

Customer	Terraconsult Ltd
Certificate Number	120054
Order Number	318572

Serial Number	12417
Software Version	G436-00.0027/0009

GAS DATA LTD

Unit 4, Fairfield Court

Seven Stars Estate

Wheler Rd

Coventry

CV3 4LJ

Tel 02476303311

Fax 02476307711



Recalibration DUE Date

03/04/19

Instrument Checks					
Keyboard	✓		Display Contrast	✓	
Pump Flow In	400	Accept > 200 cc/min	Pump Flow @ -200mB	250	Accept > 200 cc/min
Clock Set / Running	✓		Labels Fitted	✓	

Gas Checks						
Sensor	CH ₄		CO ₂		O ₂	
	Instrument Gas	True Gas Value %	Instrument Gas	True Gas Value %	Instrument Gas	True Gas Value %
	Readings %		Readings %		Readings %	
	59.9	60	39.4	40	20.9	20.9
	Accept ±3.0		Accept ±3.0		Accept ±0.5	
Zero Reading 100% N2	5	5	4.9	5	6	6
	Accept ±0.3		Accept ±0.3		Accept ±0.3	
	0	0	0	0	0	0
	Accept ±0.0		Accept ±0.0		Accept ±0.1	

Optional Gas Checks						
Applied Gas & Range	Concentration Tested @ (ppm)	Instrument Readings (ppm)				
Gas Type	Range (ppm)		Zero Reading		Instrument Gas Reading	
H ₂ S	5000	1500	0	Accept ±0.0	1500	Accept ±5.0
CO	2000	1000	0	Accept ±0.0	999	Accept ±5.0
Hexane	2.0%	2.6%	0	Accept ±0.0	1.99	Accept ±10.0

NOTES:

NM = Not Measured.

(x) = Peak value recorded.

[grey] = Below detection limit.

$$\text{GSV (l/hr)} = [\text{gas concentration (\%v/v)}] \times [\text{gas well flow rate (l/hr)}]$$

Instrumentation Specifications

Gas Monitoring – Permanent Gases

Gas monitoring for permanent gases (e.g. methane, carbon dioxide, oxygen etc) at TerraConsult is carried out using a GasData GFM 400 series gas analyser with flow meter which measures borehole flow rates, bulk gas concentrations (methane, carbon dioxide and oxygen), barometric and differential pressure.

The specification range of the GFM 400 series is as follows:

Feature	Method/Type	Range	Resolution
Methane	Infrared	0 - 100%v/v	0.1%
Lower Detection Limit (LEL)	Infrared	0 - 100%v/v	0.1%
Carbon Dioxide	Infrared	0 - 100%v/v	0.1%
Oxygen	Electrochemical	0 - 25%v/v	0.1%
Hydrogen Sulphide	Electrochemical	0 - 5,000ppm	1ppm
Carbon monoxide	Electrochemical	0 – 2,000ppm	1ppm
Atmospheric Pressure	Absolute Pressure Sensor	800 – 1,200mb	1mb
Differential Pressure	Thermal Dissipation	±1,250Pa	0.1Pa
Temperature	Bi-metal	-10°C to +100°C	1°C
Flow	Thermal Dissipation	-60 – 100 l/hr	0.1 l/hr

Volatile Organic Compounds

TerraConsult uses a PhoCheck Tiger Photo Ionisation Detector (PID) to detect a large range of Volatile Organic Compounds (VOCs) which are potentially dangerous from both a poisoning and/or an explosive perspective.

The sensor specification is as follows:

Feature	Method/Type	Range	Resolution
Total VOCs	PID	1ppb – 10,000ppm & 1ppb to 20,000ppm for specific gases	+/- 5% displayed reading +/- one digit

Calibration

Measuring equipment owned by TerraConsult is maintained in good condition and regularly inspected to ensure that it is capable of accurate and effective operation and is calibrated in line with the manufacturer's recommendations. When equipment is hired for use, the hirer will be required to provide a calibration certificate with the equipment.

In accordance with TerraConsult's ISO 9001:2015 accreditation, the process of calibrating and maintenance of TerraConsult's own measuring equipment is carried out in accordance with our quality system procedures and a register of all measuring equipment is maintained and calibration certificates collated and stored accordingly.

Prior to the use of any measuring equipment, the user will undertake suitable checks to ensure that it is fit for use and within the calibration tolerances specified.

APPENDIX G

Laboratory Chemical Test Results



Unit A2
Windmill Road
Ponswood Industrial Estate
St Leonards on Sea
East Sussex
TN38 9BY
Telephone: (01424) 718618

cs@elab-uk.co.uk
info@elab-uk.co.uk

THE ENVIRONMENTAL LABORATORY LTD

Analytical Report Number: 19-21967

Issue: 1

Date of Issue: 04/03/2019

Contact: Jimmy Thorburn

Customer Details: TerraConsult Ltd
Bold Business Centre
Unit 20, Bold Lane
St Helens
Merseyside
WA9 4TX

Quotation No: Q18-01061

Order No: PO-004578

Customer Reference: 4292

Date Received: 21/02/2019

Date Approved: 04/03/2019

Details: Oaks Road, Wrexham

Approved by: 

Mike Varley, Technical Manager

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

Sample Summary

Report No.: 19-21967

Elab No.	Client's Ref.	Date Sampled	Date Scheduled	Description	Deviations
166500	TP01 0.10	12/02/2019	25/02/2019	Silty loam	
166501	TP01 0.30	12/02/2019	25/02/2019	Sandy silty loam	fg
166502	TP02 0.40	12/02/2019	25/02/2019	Sandy silty loam	fg
166503	TP02 1.00	12/02/2019	25/02/2019	Clayey loam	c
166504	TP03 0.15	12/02/2019	25/02/2019	Silty loam	fg
166505	TP03 0.40	12/02/2019	25/02/2019	Sandy clayey loam	fg
166506	TP03 0.80	12/02/2019	25/02/2019	Clay	c
166507	TP04 0.80	13/02/2019	25/02/2019	Silty clayey loam	fg
166508	TP04 2.50	13/02/2019	25/02/2019	Silty loam	
166509	TP04 2.80	13/02/2019	25/02/2019	Silty loam	fg
166510	TP05 0.10	13/02/2019	25/02/2019	Silty loam	
166511	TP05 0.60	13/02/2019	25/02/2019	Sandy silty loam	fg
166512	TP05 1.50	13/02/2019	25/02/2019	Silty clayey loam	c
166513	TP06 0.60	13/02/2019	25/02/2019	Loamy sand + stones	fg
166514	TP07 0.10	14/02/2019	25/02/2019	Silty loam	g
166515	TP07 0.30	14/02/2019	25/02/2019	Sandy silty loam	g
166516	TP07 1.20	14/02/2019	25/02/2019	Silty loam	
166517	WS01 0.10	18/02/2019	25/02/2019	Silty loam	
166518	WS01 0.50	18/02/2019	25/02/2019	Silty loam	
166519	WS01 4.00	18/02/2019	25/02/2019	Clay	
166520	WS02 0.40	18/02/2019	25/02/2019	Silty loam	
166521	WS02 1.00	18/02/2019	25/02/2019	Silty clayey loam	
166522	WS03 0.50	19/02/2019	25/02/2019	Silty clayey loam	
166523	WS03 1.50	19/02/2019	25/02/2019	Silty clayey loam	
166524	WS03 2.50	19/02/2019	25/02/2019	Silty clayey loam	c
166525	WS04 0.20	19/02/2019	25/02/2019	Sandy silty loam	
166526	WS04 0.40	19/02/2019	25/02/2019	Silty clayey loam	
166527	WS04 3.80	19/02/2019	25/02/2019		
166528	WS05 0.10	19/02/2019	25/02/2019	Silty loam	
166529	WS05 0.40	19/02/2019	25/02/2019	Clayey loam	
166530	WS05 1.50	19/02/2019	25/02/2019	Clayey loam	
166531	WS06 0.10	19/02/2019	25/02/2019	Silty loam	
166532	WS06 0.50	19/02/2019	25/02/2019	Silty clayey loam	
166533	WS06 2.50	19/02/2019	25/02/2019	Clay	c
166534	WS07 0.20	19/02/2019	25/02/2019	Sandy clayey loam	
166535	WS07 0.60	19/02/2019	25/02/2019	Clayey loam	
166536	WS07 2.50	19/02/2019	25/02/2019	Clay	
166537	WS07 4.50	19/02/2019	25/02/2019	Clayey loam	
166538	WS08 0.10	19/02/2019	25/02/2019	Silty loam	
166539	WS08 0.30	19/02/2019	25/02/2019	Silty clayey loam	
166540	WS08 1.50	19/02/2019	25/02/2019	Clayey loam	c
166541	WS09 0.40	19/02/2019	25/02/2019	Sandy loam	
166542	WS09 1.00	19/02/2019	25/02/2019	Silty clayey loam	
166543	WS10 0.20	19/02/2019	25/02/2019	Silty loam	
166544	WS10 0.50	19/02/2019	25/02/2019	Silty clayey loam	
166545	WS10 2.00	18/02/2019	25/02/2019	Clayey loam	
166546	BH1 0.30	11/02/2019	25/02/2019	Silty clayey loam	fg
166547	BH1 1.00	11/02/2019	25/02/2019		
166548	HD01 0.30	18/02/2019	25/02/2019	Silty loam	
166549	HD02 0.50	18/02/2019	25/02/2019	Sandy silty loam	
166550	HD02 1.20	18/02/2019	25/02/2019	Silty clayey loam	
166551	HD03 0.70	18/02/2019	25/02/2019	Silty clayey loam	
166552	HD04 0.60	18/02/2019	25/02/2019	Silty clayey loam	
166553	HD05 0.30	18/02/2019	25/02/2019	Silty loam	
166554	BH5 0.30	18/02/2019	25/02/2019	Silty clayey loam	
166555	BH6 0.30	18/02/2019	25/02/2019	Silty clayey loam	
166556	BH4 0.30	12/02/2019	25/02/2019	Clayey loam	fg
166557	BH4 1.00	12/02/2019	25/02/2019	Clayey loam	
166558	BH4 2.00	12/02/2019	25/02/2019		
166559	BH5 1.00	12/02/2019	25/02/2019	Clayey loam	fg
166560	BH5 2.00	12/02/2019	25/02/2019	Clayey loam	
166561	BH5 3.00	12/02/2019	25/02/2019		
166562	BH6 1.00	12/02/2019	25/02/2019	Clayey loam	fg
166563	BH6 1.90	12/02/2019	25/02/2019	Silty clayey loam	

Results Summary

Report No.: 19-21967

2683

ELAB Reference	166500	166501	166502	166503	166504	166505
Customer Reference						
Sample ID						
Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Sample Location	TP01	TP01	TP02	TP02	TP03	TP03
Sample Depth (m)	0.10	0.30	0.40	1.00	0.15	0.40
Sampling Date	12/02/2019	12/02/2019	12/02/2019	12/02/2019	12/02/2019	12/02/2019

Determinand	Codes	Units	LOD						
Metals									
Arsenic	M	mg/kg	1	13.7	18.8	12.2	15.3	14.5	10.7
Cadmium	M	mg/kg	0.5	< 0.5	< 0.5	0.5	< 0.5	0.7	< 0.5
Chromium	M	mg/kg	5	41.2	26.2	28.5	57.9	39.0	27.8
Copper	M	mg/kg	5	32.6	31.3	175	29.9	56.3	33.6
Lead	M	mg/kg	5	66.4	39.1	126	19.2	359	73.7
Water soluble magnesium	N	g/l	0.01	n/t	< 0.01	n/t	n/t	n/t	< 0.01
Mercury	M	mg/kg	0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Nickel	M	mg/kg	5	41.2	24.4	26.1	50.1	34.7	25.2
Selenium	M	mg/kg	1	< 1.0	1.8	< 1.0	< 1.0	< 1.0	< 1.0
Zinc	M	mg/kg	5	113	39.9	194	91.3	360	112
Anions									
Water Soluble Chloride	M	mg/l	20	n/t	< 20	n/t	n/t	n/t	34
Water Soluble Nitrate	N	mg/l	20	n/t	< 20	n/t	n/t	n/t	< 20
Water Soluble Sulphate	M	g/l	0.02	< 0.02	0.06	0.04	0.07	0.04	0.07
Inorganics									
Total Cyanide	M	mg/kg	1	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Total Sulphur	N	%	0.01	n/t	0.13	n/t	n/t	n/t	0.09
Acid Soluble Sulphate (SO4)	U	%	0.02	n/t	0.20	0.05	n/t	0.05	0.15
Miscellaneous									
Acid Neutralisation Capacity	N	mol/kg	0.1	n/t	n/t	n/t	n/t	n/t	n/t
Loss On Ignition (450°C)	M	%	0.01	n/t	n/t	n/t	n/t	n/t	n/t
Moisture Content	N	%	0.1	28.1	14.8	18.1	21.6	44.6	18.6
pH	M	pH units	0.1	7.2	7.8	8.3	8.5	8.1	9.1
Soil Organic Matter	U	%	0.1	4.0	1.1	1.7	0.3	8.5	1.1
Stones Content	N	%	0.1	< 0.1	34.7	32.3	< 0.1	< 0.1	27.5
Total Organic Carbon	N	%	0.01	1.9	0.87	1.1	0.27	5.1	0.72
Organics									
>C8-C10 BCB	N	mg/kg	1	n/t	fg < 1.0	fg < 1.0	n/t	fg < 1.0	fg < 1.0
>C10-C12 BCB	N	mg/kg	1	n/t	fg < 1.0	fg < 1.0	n/t	fg < 1.0	fg < 1.0
>C12-C16 BCB	N	mg/kg	1	n/t	fg < 1.0	fg < 1.0	n/t	fg < 1.0	fg < 1.0
>C16-C21 BCB	N	mg/kg	1	n/t	fg < 1.0	fg 8.3	n/t	fg < 1.0	fg < 1.0
Diesel Range Organics (>C8-C21)	N	mg/kg	1	n/t	fg < 1	fg 8	n/t	fg < 1	fg < 1
Phenols									
Total Monohydric Phenols	N	mg/kg	5	< 5	< 5	< 5	c < 5	< 5	< 5

Results Summary

Report No.: 19-21967

ELAB Reference	166500	166501	166502	166503	166504	166505
Customer Reference						
Sample ID						
Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Sample Location	TP01	TP01	TP02	TP02	TP03	TP03
Sample Depth (m)	0.10	0.30	0.40	1.00	0.15	0.40
Sampling Date	12/02/2019	12/02/2019	12/02/2019	12/02/2019	12/02/2019	12/02/2019

Determinand	Codes	Units	LOD						
Polyaromatic hydrocarbons									
Naphthalene	M	mg/kg	0.1	< 0.1	< 0.1	< 0.1	c < 0.1	< 0.1	< 0.1
Acenaphthylene	M	mg/kg	0.1	< 0.1	< 0.1	< 0.1	c < 0.1	< 0.1	< 0.1
Acenaphthene	M	mg/kg	0.1	< 0.1	< 0.1	< 0.1	c < 0.1	< 0.1	< 0.1
Fluorene	M	mg/kg	0.1	< 0.1	< 0.1	< 0.1	c < 0.1	< 0.1	< 0.1
Phenanthrene	M	mg/kg	0.1	< 0.1	< 0.1	< 0.1	c < 0.1	0.7	< 0.1
Anthracene	M	mg/kg	0.1	< 0.1	< 0.1	< 0.1	c < 0.1	0.3	< 0.1
Fluoranthene	M	mg/kg	0.1	0.2	< 0.1	< 0.1	c < 0.1	1.9	0.1
Pyrene	M	mg/kg	0.1	0.1	< 0.1	< 0.1	c < 0.1	1.6	< 0.1
Benzo(a)anthracene	M	mg/kg	0.1	< 0.1	< 0.1	< 0.1	c < 0.1	0.9	< 0.1
Chrysene	M	mg/kg	0.1	< 0.1	< 0.1	< 0.1	c < 0.1	1.2	< 0.1
Benzo(b)fluoranthene	M	mg/kg	0.1	0.2	< 0.1	< 0.1	c < 0.1	1.4	< 0.1
Benzo(k)fluoranthene	M	mg/kg	0.1	0.2	< 0.1	< 0.1	c < 0.1	1.3	< 0.1
Benzo(a)pyrene	M	mg/kg	0.1	< 0.1	< 0.1	< 0.1	c < 0.1	1.1	< 0.1
Indeno(1,2,3-cd)pyrene	M	mg/kg	0.1	< 0.1	< 0.1	< 0.1	c < 0.1	1.0	< 0.1
Dibenzo(a,h)anthracene	M	mg/kg	0.1	< 0.1	< 0.1	< 0.1	c < 0.1	0.3	< 0.1
Benzo[g,h,i]perylene	M	mg/kg	0.1	< 0.1	< 0.1	< 0.1	c < 0.1	0.8	< 0.1
Coronene	N	mg/kg	0.1	0.1	< 0.1	< 0.1	c < 0.1	0.4	< 0.1
Total PAH(16)	M	mg/kg	0.4	1.2	< 0.4	< 0.4	c < 0.4	12.6	0.8
Total PAH (Including Coronene)	N	mg/kg	2	n/t	n/t	n/t	n/t	n/t	n/t
BTEX									
Benzene	M	ug/kg	10	n/t	fg < 10.0	fg < 10.0	n/t	fg < 10.0	fg < 10.0
Toluene	M	ug/kg	10	n/t	fg < 10.0	fg < 10.0	n/t	fg < 10.0	fg < 10.0
Ethylbenzene	M	ug/kg	10	n/t	fg < 10.0	fg < 10.0	n/t	fg < 10.0	fg < 10.0
Xylenes	M	ug/kg	10	n/t	fg < 10.0	fg < 10.0	n/t	fg < 10.0	fg < 10.0
MTBE	N	ug/kg	10	n/t	fg < 10.0	fg < 10.0	n/t	fg < 10.0	fg < 10.0
Total BTEX	M	mg/kg	0.01	n/t	n/t	n/t	n/t	n/t	n/t
TPH CWG									
>C5-C6 Aliphatic	N	mg/kg	0.01	n/t	f < 0.01	f < 0.01	n/t	f < 0.01	f < 0.01
>C6-C8 Aliphatic	N	mg/kg	0.01	n/t	f < 0.01	f < 0.01	n/t	f < 0.01	f < 0.01
>C8-C10 Aliphatic	N	mg/kg	1	n/t	fg < 1.0	fg < 1.0	n/t	fg < 1.0	fg < 1.0
>C10-C12 Aliphatic	N	mg/kg	1	n/t	fg < 1.0	fg < 1.0	n/t	fg < 1.0	fg < 1.0
>C12-C16 Aliphatic	N	mg/kg	1	n/t	fg < 1.0	fg < 1.0	n/t	fg < 1.0	fg < 1.0
>C16-C21 Aliphatic	N	mg/kg	1	n/t	fg < 1.0	fg 2.2	n/t	fg < 1.0	fg < 1.0
>C21-C35 Aliphatic	N	mg/kg	1	n/t	fg < 1.0	fg 8.2	n/t	fg 3.3	fg < 1.0
>C35-C40 Aliphatic	N	mg/kg	1	n/t	fg < 1.0	fg 1.7	n/t	fg < 1.0	fg < 1.0
>C5-C7 Aromatic	N	mg/kg	0.01	n/t	f < 0.01	f < 0.01	n/t	f < 0.01	f < 0.01
>C7-C8 Aromatic	N	mg/kg	0.01	n/t	f < 0.01	f < 0.01	n/t	f < 0.01	f < 0.01
>C8-C10 Aromatic	N	mg/kg	1	n/t	fg < 1.0	fg < 1.0	n/t	fg < 1.0	fg < 1.0
>C10-C12 Aromatic	N	mg/kg	1	n/t	fg < 1.0	fg < 1.0	n/t	fg < 1.0	fg < 1.0
>C12-C16 Aromatic	N	mg/kg	1	n/t	fg < 1.0	fg < 1.0	n/t	fg < 1.0	fg < 1.0
>C16-C21 Aromatic	N	mg/kg	1	n/t	fg < 1.0	fg 5.3	n/t	fg < 1.0	fg < 1.0
>C21-C35 Aromatic	N	mg/kg	1	n/t	fg 2.2	fg 16.4	n/t	fg 7.2	fg 1.8
>C35-C40 Aromatic	N	mg/kg	1	n/t	fg < 1.0	fg 3.8	n/t	fg < 1.0	fg < 1.0
Total (>C5-C40) Ali/Aro	N	mg/kg	1	n/t	fg 2.2	fg 37.6	n/t	fg 10.4	fg 1.8
Total Petroleum Hydrocarbons									
Mineral Oil	U	mg/kg	5	n/t	fg < 5	fg < 5	n/t	fg 9	fg < 5
PCB (ICES 7 congeners)									
PCB 28	M	mg/kg	0.01	n/t	n/t	n/t	n/t	n/t	n/t
PCB 52	M	mg/kg	0.01	n/t	n/t	n/t	n/t	n/t	n/t
PCB 101	M	mg/kg	0.01	n/t	n/t	n/t	n/t	n/t	n/t
PCB 118	M	mg/kg	0.01	n/t	n/t	n/t	n/t	n/t	n/t

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Results Summary

Report No.: 19-21967

ELAB Reference	166500	166501	166502	166503	166504	166505
Customer Reference						
Sample ID						
Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Sample Location	TP01	TP01	TP02	TP02	TP03	TP03
Sample Depth (m)	0.10	0.30	0.40	1.00	0.15	0.40
Sampling Date	12/02/2019	12/02/2019	12/02/2019	12/02/2019	12/02/2019	12/02/2019

Determinand	Codes	Units	LOD						
PCB 153	M	mg/kg	0.01	n/t	n/t	n/t	n/t	n/t	n/t
PCB 138	M	mg/kg	0.01	n/t	n/t	n/t	n/t	n/t	n/t
PCB 180	M	mg/kg	0.01	n/t	n/t	n/t	n/t	n/t	n/t
PCB (Total of 7 Congeners)	M	mg/kg	0.03	n/t	n/t	n/t	n/t	n/t	n/t

Results Summary

Report No.: 19-21967

ELAB Reference	166506	166507	166508	166509	166510	166511
Customer Reference						
Sample ID						
Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Sample Location	TP03	TP04	TP04	TP04	TP05	TP05
Sample Depth (m)	0.80	0.80	2.50	2.80	0.10	0.60
Sampling Date	12/02/2019	13/02/2019	13/02/2019	13/02/2019	13/02/2019	13/02/2019

Determinand	Codes	Units	LOD						
Metals									
Arsenic	M	mg/kg	1	16.3	14.3	12.7	16.9	12.1	15.8
Cadmium	M	mg/kg	0.5	< 0.5	< 0.5	< 0.5	0.5	< 0.5	< 0.5
Chromium	M	mg/kg	5	56.9	54.0	49.5	30.6	34.3	32.3
Copper	M	mg/kg	5	28.3	25.0	25.5	31.6	25.0	30.2
Lead	M	mg/kg	5	25.8	46.8	34.0	44.7	69.6	73.3
Water soluble magnesium	N	g/l	0.01	n/t	n/t	n/t	n/t	n/t	n/t
Mercury	M	mg/kg	0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Nickel	M	mg/kg	5	51.7	46.2	45.0	33.1	30.9	31.0
Selenium	M	mg/kg	1	< 1.0	< 1.0	< 1.0	2.6	1.0	< 1.0
Zinc	M	mg/kg	5	95.2	86.1	97.0	57.9	132	92.2
Anions									
Water Soluble Chloride	M	mg/l	20	n/t	n/t	n/t	n/t	n/t	n/t
Water Soluble Nitrate	N	mg/l	20	n/t	n/t	n/t	n/t	n/t	n/t
Water Soluble Sulphate	M	g/l	0.02	0.05	0.13	0.04	0.11	0.03	0.03
Inorganics									
Total Cyanide	M	mg/kg	1	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Total Sulphur	N	%	0.01	n/t	n/t	n/t	n/t	n/t	n/t
Acid Soluble Sulphate (SO4)	U	%	0.02	n/t	0.05	n/t	0.31	n/t	0.07
Miscellaneous									
Acid Neutralisation Capacity	N	mol/kg	0.1	n/t	n/t	n/t	n/t	n/t	n/t
Loss On Ignition (450°C)	M	%	0.01	n/t	n/t	n/t	n/t	n/t	n/t
Moisture Content	N	%	0.1	26.7	22.5	24.8	14.9	37.3	21.9
pH	M	pH units	0.1	8.4	8.1	8.3	8.3	7.6	7.9
Soil Organic Matter	U	%	0.1	0.7	0.9	1.7	1.3	6.4	2.1
Stones Content	N	%	0.1	< 0.1	< 0.1	< 0.1	23.1	< 0.1	17.2
Total Organic Carbon	N	%	0.01	0.28	0.52	0.82	0.96	3.5	1.9
Organics									
>C8-C10 BCB	N	mg/kg	1	n/t	f < 1.0	n/t	f < 1.0	n/t	f < 1.0
>C10-C12 BCB	N	mg/kg	1	n/t	f < 1.0	n/t	f < 1.0	n/t	f < 1.0
>C12-C16 BCB	N	mg/kg	1	n/t	f < 1.0	n/t	f 4.3	n/t	f < 1.0
>C16-C21 BCB	N	mg/kg	1	n/t	f < 1.0	n/t	f 43.5	n/t	f < 1.0
Diesel Range Organics (>C8-C21)	N	mg/kg	1	n/t	f < 1	n/t	f 48	n/t	f < 1
Phenols									
Total Monohydric Phenols	N	mg/kg	5	c < 5	< 5	< 5	< 5	< 5	< 5

Results Summary

Report No.: 19-21967

ELAB Reference	166506	166507	166508	166509	166510	166511
Customer Reference						
Sample ID						
Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Sample Location	TP03	TP04	TP04	TP04	TP05	TP05
Sample Depth (m)	0.80	0.80	2.50	2.80	0.10	0.60
Sampling Date	12/02/2019	13/02/2019	13/02/2019	13/02/2019	13/02/2019	13/02/2019

Determinand	Codes	Units	LOD						
Polyaromatic hydrocarbons									
Naphthalene	M	mg/kg	0.1	c < 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Acenaphthylene	M	mg/kg	0.1	c < 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Acenaphthene	M	mg/kg	0.1	c < 0.1	< 0.1	< 0.1	0.1	< 0.1	< 0.1
Fluorene	M	mg/kg	0.1	c < 0.1	< 0.1	< 0.1	0.3	< 0.1	< 0.1
Phenanthrene	M	mg/kg	0.1	c < 0.1	< 0.1	< 0.1	5.7	< 0.1	< 0.1
Anthracene	M	mg/kg	0.1	c < 0.1	< 0.1	< 0.1	0.7	< 0.1	< 0.1
Fluoranthene	M	mg/kg	0.1	c < 0.1	< 0.1	< 0.1	0.7	< 0.1	< 0.1
Pyrene	M	mg/kg	0.1	c < 0.1	< 0.1	< 0.1	0.5	< 0.1	< 0.1
Benzo(a)anthracene	M	mg/kg	0.1	c < 0.1	< 0.1	< 0.1	0.2	< 0.1	< 0.1
Chrysene	M	mg/kg	0.1	c < 0.1	< 0.1	< 0.1	0.2	< 0.1	< 0.1
Benzo(b)fluoranthene	M	mg/kg	0.1	c < 0.1	< 0.1	0.1	0.2	< 0.1	< 0.1
Benzo(k)fluoranthene	M	mg/kg	0.1	c < 0.1	< 0.1	0.1	0.2	< 0.1	< 0.1
Benzo(a)pyrene	M	mg/kg	0.1	c < 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Indeno(1,2,3-cd)pyrene	M	mg/kg	0.1	c < 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Dibenzo(a,h)anthracene	M	mg/kg	0.1	c < 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Benzo[g,h,i]perylene	M	mg/kg	0.1	c < 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Coronene	N	mg/kg	0.1	c < 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Total PAH(16)	M	mg/kg	0.4	c < 0.4	< 0.4	0.6	8.8	< 0.4	< 0.4
Total PAH (Including Coronene)	N	mg/kg	2	n/t	n/t	n/t	n/t	n/t	n/t
BTEX									
Benzene	M	ug/kg	10	n/t	f < 10.0	n/t	f < 10.0	n/t	f < 10.0
Toluene	M	ug/kg	10	n/t	f < 10.0	n/t	f < 10.0	n/t	f < 10.0
Ethylbenzene	M	ug/kg	10	n/t	f < 10.0	n/t	f < 10.0	n/t	f < 10.0
Xylenes	M	ug/kg	10	n/t	f < 10.0	n/t	f < 10.0	n/t	f < 10.0
MTBE	N	ug/kg	10	n/t	f < 10.0	n/t	f < 10.0	n/t	f < 10.0
Total BTEX	M	mg/kg	0.01	n/t	n/t	n/t	n/t	n/t	n/t
TPH CWG									
>C5-C6 Aliphatic	N	mg/kg	0.01	n/t	f < 0.01	n/t	f < 0.01	n/t	f < 0.01
>C6-C8 Aliphatic	N	mg/kg	0.01	n/t	f < 0.01	n/t	f < 0.01	n/t	f < 0.01
>C8-C10 Aliphatic	N	mg/kg	1	n/t	f < 1.0	n/t	f < 1.0	n/t	f < 1.0
>C10-C12 Aliphatic	N	mg/kg	1	n/t	f < 1.0	n/t	f < 1.0	n/t	f < 1.0
>C12-C16 Aliphatic	N	mg/kg	1	n/t	f < 1.0	n/t	f < 1.0	n/t	f < 1.0
>C16-C21 Aliphatic	N	mg/kg	1	n/t	f < 1.0	n/t	f 14.1	n/t	f < 1.0
>C21-C35 Aliphatic	N	mg/kg	1	n/t	f < 1.0	n/t	f 6.7	n/t	f < 1.0
>C35-C40 Aliphatic	N	mg/kg	1	n/t	f < 1.0	n/t	f < 1.0	n/t	f < 1.0
>C5-C7 Aromatic	N	mg/kg	0.01	n/t	f < 0.01	n/t	f < 0.01	n/t	f < 0.01
>C7-C8 Aromatic	N	mg/kg	0.01	n/t	f < 0.01	n/t	f < 0.01	n/t	f < 0.01
>C8-C10 Aromatic	N	mg/kg	1	n/t	fg < 1.0	n/t	fg < 1.0	n/t	fg < 1.0
>C10-C12 Aromatic	N	mg/kg	1	n/t	f < 1.0	n/t	f < 1.0	n/t	f < 1.0
>C12-C16 Aromatic	N	mg/kg	1	n/t	f < 1.0	n/t	f 4.0	n/t	f < 1.0
>C16-C21 Aromatic	N	mg/kg	1	n/t	f < 1.0	n/t	f 31.9	n/t	f < 1.0
>C21-C35 Aromatic	N	mg/kg	1	n/t	f < 1.0	n/t	f 10.7	n/t	f < 1.0
>C35-C40 Aromatic	N	mg/kg	1	n/t	f < 1.0	n/t	f < 1.0	n/t	f < 1.0
Total (>C5-C40) Ali/Aro	N	mg/kg	1	n/t	f < 1.0	n/t	f 67.4	n/t	f < 1.0
Total Petroleum Hydrocarbons									
Mineral Oil	U	mg/kg	5	n/t	f < 5	n/t	f < 5	n/t	f < 5
PCB (ICES 7 congeners)									
PCB 28	M	mg/kg	0.01	n/t	< 0.01	n/t	< 0.01	n/t	n/t
PCB 52	M	mg/kg	0.01	n/t	< 0.01	n/t	< 0.01	n/t	n/t
PCB 101	M	mg/kg	0.01	n/t	< 0.01	n/t	< 0.01	n/t	n/t
PCB 118	M	mg/kg	0.01	n/t	< 0.01	n/t	< 0.01	n/t	n/t



Results Summary

Report No.: 19-21967

ELAB Reference	166506	166507	166508	166509	166510	166511
Customer Reference						
Sample ID						
Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Sample Location	TP03	TP04	TP04	TP04	TP05	TP05
Sample Depth (m)	0.80	0.80	2.50	2.80	0.10	0.60
Sampling Date	12/02/2019	13/02/2019	13/02/2019	13/02/2019	13/02/2019	13/02/2019

Determinand	Codes	Units	LOD						
PCB 153	M	mg/kg	0.01	n/t	< 0.01	n/t	< 0.01	n/t	n/t
PCB 138	M	mg/kg	0.01	n/t	< 0.01	n/t	< 0.01	n/t	n/t
PCB 180	M	mg/kg	0.01	n/t	< 0.01	n/t	< 0.01	n/t	n/t
PCB (Total of 7 Congeners)	M	mg/kg	0.03	n/t	< 0.03	n/t	< 0.03	n/t	n/t

Results Summary

Report No.: 19-21967

ELAB Reference	166512	166513	166514	166515	166516	166517
Customer Reference						
Sample ID						
Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Sample Location	TP05	TP06	TP07	TP07	TP07	WS01
Sample Depth (m)	1.50	0.60	0.10	0.30	1.20	0.10
Sampling Date	13/02/2019	13/02/2019	14/02/2019	14/02/2019	14/02/2019	18/02/2019

Determinand	Codes	Units	LOD						
Metals									
Arsenic	M	mg/kg	1	14.6	^ 19.9	8.2	21.8	13.7	11.6
Cadmium	M	mg/kg	0.5	< 0.5	^ < 0.5	1.2	< 0.5	< 0.5	0.9
Chromium	M	mg/kg	5	51.1	^ 24.7	28.6	24.2	54.2	43.7
Copper	M	mg/kg	5	26.8	^ 49.2	36.2	35.6	20.7	27.1
Lead	M	mg/kg	5	20.5	^ 31.9	84.8	38.1	32.0	89.6
Water soluble magnesium	N	g/l	0.01	n/t	< 0.01	n/t	n/t	n/t	n/t
Mercury	M	mg/kg	0.5	< 0.5	^ < 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Nickel	M	mg/kg	5	49.0	^ 41.8	20.6	26.6	41.7	37.3
Selenium	M	mg/kg	1	< 1.0	^ 1.4	< 1.0	2.3	< 1.0	< 1.0
Zinc	M	mg/kg	5	81.1	^ 54.8	106	52.1	82.7	239
Anions									
Water Soluble Chloride	M	mg/l	20	n/t	^ < 20	n/t	n/t	n/t	n/t
Water Soluble Nitrate	N	mg/l	20	n/t	< 20	n/t	n/t	n/t	n/t
Water Soluble Sulphate	M	g/l	0.02	0.17	^ 0.07	0.02	0.03	0.02	0.02
Inorganics									
Total Cyanide	M	mg/kg	1	< 1.0	^ < 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Total Sulphur	N	%	0.01	n/t	0.13	n/t	n/t	n/t	n/t
Acid Soluble Sulphate (SO4)	U	%	0.02	n/t	0.23	0.06	0.12	n/t	n/t
Miscellaneous									
Acid Neutralisation Capacity	N	mol/kg	0.1	n/t	< 0.1	n/t	n/t	n/t	n/t
Loss On Ignition (450°C)	M	%	0.01	n/t	^ 1.80	n/t	n/t	n/t	n/t
Moisture Content	N	%	0.1	18.7	12.4	22.9	15.6	22.1	26.9
pH	M	pH units	0.1	8.5	^ 7.9	7.7	7.4	7.6	7.8
Soil Organic Matter	U	%	0.1	0.5	0.9	12	3.7	1.7	5.8
Stones Content	N	%	0.1	< 0.1	45.9	38.4	38.6	< 0.1	< 0.1
Total Organic Carbon	N	%	0.01	0.26	1.9	5.8	1.9	1.1	2.8
Organics									
>C8-C10 BCB	N	mg/kg	1	n/t	f < 1.0	< 1.0	< 1.0	n/t	n/t
>C10-C12 BCB	N	mg/kg	1	n/t	f < 1.0	< 1.0	< 1.0	n/t	n/t
>C12-C16 BCB	N	mg/kg	1	n/t	f < 1.0	1.7	< 1.0	n/t	n/t
>C16-C21 BCB	N	mg/kg	1	n/t	f < 1.0	15.0	2.1	n/t	n/t
Diesel Range Organics (>C8-C21)	N	mg/kg	1	n/t	f < 1	17	2	n/t	n/t
Phenols									
Total Monohydric Phenols	N	mg/kg	5	c < 5	< 5	< 5	< 5	< 5	< 5

Results Summary

Report No.: 19-21967

ELAB Reference	166512	166513	166514	166515	166516	166517
Customer Reference						
Sample ID						
Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Sample Location	TP05	TP06	TP07	TP07	TP07	WS01
Sample Depth (m)	1.50	0.60	0.10	0.30	1.20	0.10
Sampling Date	13/02/2019	13/02/2019	14/02/2019	14/02/2019	14/02/2019	18/02/2019

Determinand	Codes	Units	LOD						
Polyaromatic hydrocarbons									
Naphthalene	M	mg/kg	0.1	c < 0.1	^ < 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Acenaphthylene	M	mg/kg	0.1	c < 0.1	^ < 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Acenaphthene	M	mg/kg	0.1	c < 0.1	^ < 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Fluorene	M	mg/kg	0.1	c < 0.1	^ < 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Phenanthrene	M	mg/kg	0.1	c < 0.1	^ < 0.1	0.3	0.2	< 0.1	0.4
Anthracene	M	mg/kg	0.1	c < 0.1	^ < 0.1	0.4	< 0.1	< 0.1	0.2
Fluoranthene	M	mg/kg	0.1	c < 0.1	^ < 0.1	1.4	0.2	< 0.1	1.3
Pyrene	M	mg/kg	0.1	c < 0.1	^ < 0.1	1.3	0.1	< 0.1	1.2
Benzo(a)anthracene	M	mg/kg	0.1	c < 0.1	^ < 0.1	1.1	0.1	< 0.1	0.8
Chrysene	M	mg/kg	0.1	c < 0.1	^ < 0.1	1.4	0.2	< 0.1	1.0
Benzo(b)fluoranthene	M	mg/kg	0.1	c < 0.1	^ < 0.1	2.3	0.4	< 0.1	1.2
Benzo(k)fluoranthene	M	mg/kg	0.1	c < 0.1	^ < 0.1	1.9	0.3	< 0.1	1.1
Benzo(a)pyrene	M	mg/kg	0.1	c < 0.1	^ < 0.1	1.9	0.3	< 0.1	1.0
Indeno(1,2,3-cd)pyrene	M	mg/kg	0.1	c < 0.1	^ < 0.1	2.4	0.3	< 0.1	0.9
Dibenzo(a,h)anthracene	M	mg/kg	0.1	c < 0.1	^ < 0.1	0.6	< 0.1	< 0.1	0.3
Benzo[g,h,i]perylene	M	mg/kg	0.1	c < 0.1	^ < 0.1	2.1	0.2	< 0.1	0.8
Coronene	N	mg/kg	0.1	c < 0.1	< 0.1	0.8	< 0.1	< 0.1	0.3
Total PAH(16)	M	mg/kg	0.4	c < 0.4	^ < 0.4	17.2	2.5	< 0.4	10.2
Total PAH (Including Coronene)	N	mg/kg	2	n/t	< 2	n/t	n/t	n/t	n/t
BTEX									
Benzene	M	ug/kg	10	n/t	f^ < 10.0	< 10.0	< 10.0	n/t	n/t
Toluene	M	ug/kg	10	n/t	f^ < 10.0	< 10.0	< 10.0	n/t	n/t
Ethylbenzene	M	ug/kg	10	n/t	f^ < 10.0	< 10.0	< 10.0	n/t	n/t
Xylenes	M	ug/kg	10	n/t	f^ < 10.0	< 10.0	< 10.0	n/t	n/t
MTBE	N	ug/kg	10	n/t	f < 10.0	< 10.0	< 10.0	n/t	n/t
Total BTEX	M	mg/kg	0.01	n/t	f^ < 0.01	n/t	n/t	n/t	n/t
TPH CWG									
>C5-C6 Aliphatic	N	mg/kg	0.01	n/t	f < 0.01	< 0.01	< 0.01	n/t	n/t
>C6-C8 Aliphatic	N	mg/kg	0.01	n/t	f < 0.01	< 0.01	< 0.01	n/t	n/t
>C8-C10 Aliphatic	N	mg/kg	1	n/t	f < 1.0	< 1.0	< 1.0	n/t	n/t
>C10-C12 Aliphatic	N	mg/kg	1	n/t	f < 1.0	< 1.0	< 1.0	n/t	n/t
>C12-C16 Aliphatic	N	mg/kg	1	n/t	f < 1.0	< 1.0	< 1.0	n/t	n/t
>C16-C21 Aliphatic	N	mg/kg	1	n/t	f < 1.0	4.0	< 1.0	n/t	n/t
>C21-C35 Aliphatic	N	mg/kg	1	n/t	f < 1.0	157	35.7	n/t	n/t
>C35-C40 Aliphatic	N	mg/kg	1	n/t	f < 1.0	33.7	5.5	n/t	n/t
>C5-C7 Aromatic	N	mg/kg	0.01	n/t	f < 0.01	< 0.01	< 0.01	n/t	n/t
>C7-C8 Aromatic	N	mg/kg	0.01	n/t	f < 0.01	< 0.01	< 0.01	n/t	n/t
>C8-C10 Aromatic	N	mg/kg	1	n/t	fg < 1.0	g < 1.0	g < 1.0	n/t	n/t
>C10-C12 Aromatic	N	mg/kg	1	n/t	f < 1.0	< 1.0	< 1.0	n/t	n/t
>C12-C16 Aromatic	N	mg/kg	1	n/t	f < 1.0	< 1.0	< 1.0	n/t	n/t
>C16-C21 Aromatic	N	mg/kg	1	n/t	f < 1.0	5.8	< 1.0	n/t	n/t
>C21-C35 Aromatic	N	mg/kg	1	n/t	f < 1.5	275	69.0	n/t	n/t
>C35-C40 Aromatic	N	mg/kg	1	n/t	f < 1.0	80.4	15.8	n/t	n/t
Total (>C5-C40) Ali/Aro	N	mg/kg	1	n/t	f < 1.5	556	126	n/t	n/t
Total Petroleum Hydrocarbons									
Mineral Oil	U	mg/kg	5	n/t	f < 5	881	36	n/t	n/t
PCB (ICES 7 congeners)									
PCB 28	M	mg/kg	0.01	n/t	n/t	< 0.01	n/t	n/t	n/t
PCB 52	M	mg/kg	0.01	n/t	n/t	< 0.01	n/t	n/t	n/t
PCB 101	M	mg/kg	0.01	n/t	n/t	< 0.01	n/t	n/t	n/t
PCB 118	M	mg/kg	0.01	n/t	n/t	< 0.01	n/t	n/t	n/t



Results Summary

Report No.: 19-21967

ELAB Reference	166512	166513	166514	166515	166516	166517
Customer Reference						
Sample ID						
Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Sample Location	TP05	TP06	TP07	TP07	TP07	WS01
Sample Depth (m)	1.50	0.60	0.10	0.30	1.20	0.10
Sampling Date	13/02/2019	13/02/2019	14/02/2019	14/02/2019	14/02/2019	18/02/2019

Determinand	Codes	Units	LOD						
PCB 153	M	mg/kg	0.01	n/t	n/t	< 0.01	n/t	n/t	n/t
PCB 138	M	mg/kg	0.01	n/t	n/t	< 0.01	n/t	n/t	n/t
PCB 180	M	mg/kg	0.01	n/t	n/t	< 0.01	n/t	n/t	n/t
PCB (Total of 7 Congeners)	M	mg/kg	0.03	n/t	[^] < 0.03	< 0.03	n/t	n/t	n/t

Results Summary

Report No.: 19-21967

ELAB Reference	166518	166519	166520	166521	166522	166523
Customer Reference						
Sample ID						
Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Sample Location	WS01	WS01	WS02	WS02	WS03	WS03
Sample Depth (m)	0.50	4.00	0.40	1.00	0.50	1.50
Sampling Date	18/02/2019	18/02/2019	18/02/2019	18/02/2019	19/02/2019	19/02/2019

Determinand	Codes	Units	LOD						
Metals									
Arsenic	M	mg/kg	1	14.1	n/t	12.0	9.1	14.3	14.9
Cadmium	M	mg/kg	0.5	< 0.5	n/t	< 0.5	< 0.5	< 0.5	< 0.5
Chromium	M	mg/kg	5	50.6	n/t	38.3	36.7	49.7	50.3
Copper	M	mg/kg	5	18.6	n/t	22.2	14.7	25.2	24.9
Lead	M	mg/kg	5	43.2	n/t	40.9	34.8	76.1	53.6
Water soluble magnesium	N	g/l	0.01	n/t	0.02	n/t	< 0.01	n/t	n/t
Mercury	M	mg/kg	0.5	< 0.5	n/t	< 0.5	< 0.5	< 0.5	< 0.5
Nickel	M	mg/kg	5	39.2	n/t	36.4	29.0	48.8	48.9
Selenium	M	mg/kg	1	< 1.0	n/t	< 1.0	< 1.0	< 1.0	< 1.0
Zinc	M	mg/kg	5	95.0	n/t	92.2	72.0	88.0	87.4
Anions									
Water Soluble Chloride	M	mg/l	20	n/t	29	n/t	< 20	n/t	n/t
Water Soluble Nitrate	N	mg/l	20	n/t	22	n/t	< 20	n/t	n/t
Water Soluble Sulphate	M	g/l	0.02	< 0.02	0.13	0.02	0.02	0.03	0.03
Inorganics									
Total Cyanide	M	mg/kg	1	< 1.0	n/t	< 1.0	< 1.0	< 1.0	< 1.0
Total Sulphur	N	%	0.01	n/t	0.03	n/t	0.02	n/t	n/t
Acid Soluble Sulphate (SO4)	U	%	0.02	n/t	0.05	0.04	0.02	0.03	n/t
Miscellaneous									
Acid Neutralisation Capacity	N	mol/kg	0.1	n/t	n/t	n/t	n/t	n/t	n/t
Loss On Ignition (450°C)	M	%	0.01	n/t	n/t	n/t	n/t	n/t	n/t
Moisture Content	N	%	0.1	21.1	n/t	16.6	19.2	22.5	25.3
pH	M	pH units	0.1	7.8	8.5	8.0	8.0	8.3	8.3
Soil Organic Matter	U	%	0.1	1.9	n/t	1.1	1.2	0.9	0.9
Stones Content	N	%	0.1	< 0.1	n/t	< 0.1	< 0.1	< 0.1	< 0.1
Total Organic Carbon	N	%	0.01	1.0	n/t	0.96	0.79	0.53	0.43
Organics									
>C8-C10 BCB	N	mg/kg	1	n/t	n/t	< 1.0	n/t	< 1.0	n/t
>C10-C12 BCB	N	mg/kg	1	n/t	n/t	< 1.0	n/t	< 1.0	n/t
>C12-C16 BCB	N	mg/kg	1	n/t	n/t	< 1.0	n/t	< 1.0	n/t
>C16-C21 BCB	N	mg/kg	1	n/t	n/t	< 1.0	n/t	< 1.0	n/t
Diesel Range Organics (>C8-C21)	N	mg/kg	1	n/t	n/t	< 1	n/t	< 1	n/t
Phenols									
Total Monohydric Phenols	N	mg/kg	5	< 5	n/t	< 5	< 5	< 5	< 5

Results Summary

Report No.: 19-21967

ELAB Reference	166518	166519	166520	166521	166522	166523
Customer Reference						
Sample ID						
Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Sample Location	WS01	WS01	WS02	WS02	WS03	WS03
Sample Depth (m)	0.50	4.00	0.40	1.00	0.50	1.50
Sampling Date	18/02/2019	18/02/2019	18/02/2019	18/02/2019	19/02/2019	19/02/2019

Determinand	Codes	Units	LOD						
Polyaromatic hydrocarbons									
Naphthalene	M	mg/kg	0.1	< 0.1	n/t	< 0.1	< 0.1	< 0.1	< 0.1
Acenaphthylene	M	mg/kg	0.1	< 0.1	n/t	< 0.1	< 0.1	< 0.1	< 0.1
Acenaphthene	M	mg/kg	0.1	< 0.1	n/t	< 0.1	< 0.1	< 0.1	< 0.1
Fluorene	M	mg/kg	0.1	< 0.1	n/t	< 0.1	< 0.1	< 0.1	< 0.1
Phenanthrene	M	mg/kg	0.1	< 0.1	n/t	< 0.1	< 0.1	< 0.1	< 0.1
Anthracene	M	mg/kg	0.1	< 0.1	n/t	< 0.1	< 0.1	< 0.1	< 0.1
Fluoranthene	M	mg/kg	0.1	< 0.1	n/t	< 0.1	< 0.1	< 0.1	< 0.1
Pyrene	M	mg/kg	0.1	< 0.1	n/t	< 0.1	< 0.1	< 0.1	< 0.1
Benzo(a)anthracene	M	mg/kg	0.1	< 0.1	n/t	< 0.1	< 0.1	< 0.1	< 0.1
Chrysene	M	mg/kg	0.1	< 0.1	n/t	< 0.1	< 0.1	< 0.1	< 0.1
Benzo(b)fluoranthene	M	mg/kg	0.1	< 0.1	n/t	< 0.1	< 0.1	< 0.1	< 0.1
Benzo(k)fluoranthene	M	mg/kg	0.1	< 0.1	n/t	< 0.1	< 0.1	< 0.1	< 0.1
Benzo(a)pyrene	M	mg/kg	0.1	< 0.1	n/t	< 0.1	< 0.1	< 0.1	< 0.1
Indeno(1,2,3-cd)pyrene	M	mg/kg	0.1	< 0.1	n/t	< 0.1	< 0.1	< 0.1	< 0.1
Dibenzo(a,h)anthracene	M	mg/kg	0.1	< 0.1	n/t	< 0.1	< 0.1	< 0.1	< 0.1
Benzo[g,h,i]perylene	M	mg/kg	0.1	< 0.1	n/t	< 0.1	< 0.1	< 0.1	< 0.1
Coronene	N	mg/kg	0.1	< 0.1	n/t	< 0.1	< 0.1	< 0.1	< 0.1
Total PAH(16)	M	mg/kg	0.4	< 0.4	n/t	< 0.4	< 0.4	< 0.4	< 0.4
Total PAH (Including Coronene)	N	mg/kg	2	n/t	n/t	n/t	n/t	n/t	n/t
BTEX									
Benzene	M	ug/kg	10	n/t	n/t	< 10.0	n/t	< 10.0	n/t
Toluene	M	ug/kg	10	n/t	n/t	< 10.0	n/t	< 10.0	n/t
Ethylbenzene	M	ug/kg	10	n/t	n/t	< 10.0	n/t	< 10.0	n/t
Xylenes	M	ug/kg	10	n/t	n/t	< 10.0	n/t	< 10.0	n/t
MTBE	N	ug/kg	10	n/t	n/t	< 10.0	n/t	< 10.0	n/t
Total BTEX	M	mg/kg	0.01	n/t	n/t	n/t	n/t	n/t	n/t
TPH CWG									
>C5-C6 Aliphatic	N	mg/kg	0.01	n/t	n/t	< 0.01	n/t	< 0.01	n/t
>C6-C8 Aliphatic	N	mg/kg	0.01	n/t	n/t	< 0.01	n/t	< 0.01	n/t
>C8-C10 Aliphatic	N	mg/kg	1	n/t	n/t	< 1.0	n/t	< 1.0	n/t
>C10-C12 Aliphatic	N	mg/kg	1	n/t	n/t	< 1.0	n/t	< 1.0	n/t
>C12-C16 Aliphatic	N	mg/kg	1	n/t	n/t	< 1.0	n/t	< 1.0	n/t
>C16-C21 Aliphatic	N	mg/kg	1	n/t	n/t	< 1.0	n/t	< 1.0	n/t
>C21-C35 Aliphatic	N	mg/kg	1	n/t	n/t	< 1.0	n/t	< 1.0	n/t
>C35-C40 Aliphatic	N	mg/kg	1	n/t	n/t	< 1.0	n/t	< 1.0	n/t
>C5-C7 Aromatic	N	mg/kg	0.01	n/t	n/t	< 0.01	n/t	< 0.01	n/t
>C7-C8 Aromatic	N	mg/kg	0.01	n/t	n/t	< 0.01	n/t	< 0.01	n/t
>C8-C10 Aromatic	N	mg/kg	1	n/t	n/t	< 1.0	n/t	< 1.0	n/t
>C10-C12 Aromatic	N	mg/kg	1	n/t	n/t	< 1.0	n/t	< 1.0	n/t
>C12-C16 Aromatic	N	mg/kg	1	n/t	n/t	< 1.0	n/t	< 1.0	n/t
>C16-C21 Aromatic	N	mg/kg	1	n/t	n/t	< 1.0	n/t	< 1.0	n/t
>C21-C35 Aromatic	N	mg/kg	1	n/t	n/t	< 1.0	n/t	< 1.0	n/t
>C35-C40 Aromatic	N	mg/kg	1	n/t	n/t	< 1.0	n/t	< 1.0	n/t
Total (>C5-C40) Ali/Aro	N	mg/kg	1	n/t	n/t	< 1.0	n/t	< 1.0	n/t
Total Petroleum Hydrocarbons									
Mineral Oil	U	mg/kg	5	n/t	n/t	< 5	n/t	< 5	n/t
PCB (ICES 7 congeners)									
PCB 28	M	mg/kg	0.01	n/t	n/t	n/t	n/t	n/t	n/t
PCB 52	M	mg/kg	0.01	n/t	n/t	n/t	n/t	n/t	n/t
PCB 101	M	mg/kg	0.01	n/t	n/t	n/t	n/t	n/t	n/t
PCB 118	M	mg/kg	0.01	n/t	n/t	n/t	n/t	n/t	n/t



Results Summary

Report No.: 19-21967

ELAB Reference	166518	166519	166520	166521	166522	166523
Customer Reference						
Sample ID						
Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Sample Location	WS01	WS01	WS02	WS02	WS03	WS03
Sample Depth (m)	0.50	4.00	0.40	1.00	0.50	1.50
Sampling Date	18/02/2019	18/02/2019	18/02/2019	18/02/2019	19/02/2019	19/02/2019

Determinand	Codes	Units	LOD						
PCB 153	M	mg/kg	0.01	n/t	n/t	n/t	n/t	n/t	n/t
PCB 138	M	mg/kg	0.01	n/t	n/t	n/t	n/t	n/t	n/t
PCB 180	M	mg/kg	0.01	n/t	n/t	n/t	n/t	n/t	n/t
PCB (Total of 7 Congeners)	M	mg/kg	0.03	n/t	n/t	n/t	n/t	n/t	n/t

Results Summary

Report No.: 19-21967

ELAB Reference	166524	166525	166526	166528	166529	166530
Customer Reference						
Sample ID						
Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Sample Location	WS03	WS04	WS04	WS05	WS05	WS05
Sample Depth (m)	2.50	0.20	0.40	0.10	0.40	1.50
Sampling Date	19/02/2019	19/02/2019	19/02/2019	19/02/2019	19/02/2019	19/02/2019

Determinand	Codes	Units	LOD						
Metals									
Arsenic	M	mg/kg	1	13.3	40.0	16.0	11.3	13.8	11.3
Cadmium	M	mg/kg	0.5	< 0.5	0.7	2.7	0.7	< 0.5	< 0.5
Chromium	M	mg/kg	5	49.2	25.3	44.9	44.1	49.9	49.6
Copper	M	mg/kg	5	24.3	44.2	30.1	48.4	25.7	23.5
Lead	M	mg/kg	5	29.5	53.8	40.4	77.8	20.9	16.8
Water soluble magnesium	N	g/l	0.01	c 0.01	< 0.01	n/t	n/t	n/t	n/t
Mercury	M	mg/kg	0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Nickel	M	mg/kg	5	48.5	33.0	43.8	35.8	49.0	48.3
Selenium	M	mg/kg	1	< 1.0	2.5	< 1.0	< 1.0	< 1.0	< 1.0
Zinc	M	mg/kg	5	82.2	68.5	606	214	89.6	80.7
Anions									
Water Soluble Chloride	M	mg/l	20	< 20	< 20	n/t	n/t	n/t	n/t
Water Soluble Nitrate	N	mg/l	20	< 20	< 20	n/t	n/t	n/t	n/t
Water Soluble Sulphate	M	g/l	0.02	0.04	0.07	0.03	0.02	0.03	0.14
Inorganics									
Total Cyanide	M	mg/kg	1	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Total Sulphur	N	%	0.01	0.03	0.34	n/t	n/t	n/t	n/t
Acid Soluble Sulphate (SO4)	U	%	0.02	0.04	0.74	0.07	0.07	0.05	n/t
Miscellaneous									
Acid Neutralisation Capacity	N	mol/kg	0.1	n/t	n/t	n/t	n/t	n/t	n/t
Loss On Ignition (450°C)	M	%	0.01	n/t	n/t	n/t	n/t	n/t	n/t
Moisture Content	N	%	0.1	23.8	16.5	18.6	42.7	22.7	22.1
pH	M	pH units	0.1	8.5	7.8	8.2	7.9	8.5	8.6
Soil Organic Matter	U	%	0.1	0.7	2.8	1.2	8.7	0.7	0.4
Stones Content	N	%	0.1	< 0.1	33.3	< 0.1	< 0.1	< 0.1	< 0.1
Total Organic Carbon	N	%	0.01	0.32	2.7	0.76	5.0	0.39	0.20
Organics									
>C8-C10 BCB	N	mg/kg	1	n/t	< 1.0	< 1.0	< 1.0	< 1.0	n/t
>C10-C12 BCB	N	mg/kg	1	n/t	< 1.0	< 1.0	< 1.0	< 1.0	n/t
>C12-C16 BCB	N	mg/kg	1	n/t	< 1.0	< 1.0	< 1.0	< 1.0	n/t
>C16-C21 BCB	N	mg/kg	1	n/t	< 1.0	< 1.0	< 1.0	< 1.0	n/t
Diesel Range Organics (>C8-C21)	N	mg/kg	1	n/t	< 1	< 1	< 1	< 1	n/t
Phenols									
Total Monohydric Phenols	N	mg/kg	5	< 5	< 5	< 5	< 5	< 5	< 5

Results Summary

Report No.: 19-21967

ELAB Reference	166524	166525	166526	166528	166529	166530
Customer Reference						
Sample ID						
Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Sample Location	WS03	WS04	WS04	WS05	WS05	WS05
Sample Depth (m)	2.50	0.20	0.40	0.10	0.40	1.50
Sampling Date	19/02/2019	19/02/2019	19/02/2019	19/02/2019	19/02/2019	19/02/2019

Determinand	Codes	Units	LOD						
Polyaromatic hydrocarbons									
Naphthalene	M	mg/kg	0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Acenaphthylene	M	mg/kg	0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Acenaphthene	M	mg/kg	0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Fluorene	M	mg/kg	0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Phenanthrene	M	mg/kg	0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Anthracene	M	mg/kg	0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Fluoranthene	M	mg/kg	0.1	< 0.1	0.2	< 0.1	0.3	< 0.1	< 0.1
Pyrene	M	mg/kg	0.1	< 0.1	0.1	< 0.1	0.3	< 0.1	< 0.1
Benzo(a)anthracene	M	mg/kg	0.1	< 0.1	0.1	< 0.1	0.2	< 0.1	< 0.1
Chrysene	M	mg/kg	0.1	< 0.1	0.1	< 0.1	0.2	< 0.1	< 0.1
Benzo(b)fluoranthene	M	mg/kg	0.1	< 0.1	0.2	< 0.1	0.3	< 0.1	< 0.1
Benzo(k)fluoranthene	M	mg/kg	0.1	< 0.1	0.2	< 0.1	0.5	< 0.1	< 0.1
Benzo(a)pyrene	M	mg/kg	0.1	< 0.1	0.1	< 0.1	0.3	< 0.1	< 0.1
Indeno(1,2,3-cd)pyrene	M	mg/kg	0.1	< 0.1	< 0.1	< 0.1	0.3	< 0.1	< 0.1
Dibenzo(a,h)anthracene	M	mg/kg	0.1	< 0.1	< 0.1	< 0.1	0.1	< 0.1	< 0.1
Benzo[g,h,i]perylene	M	mg/kg	0.1	< 0.1	< 0.1	< 0.1	0.2	< 0.1	< 0.1
Coronene	N	mg/kg	0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Total PAH(16)	M	mg/kg	0.4	< 0.4	1.4	< 0.4	2.9	< 0.4	< 0.4
Total PAH (Including Coronene)	N	mg/kg	2	n/t	n/t	n/t	n/t	n/t	n/t
BTEX									
Benzene	M	ug/kg	10	n/t	< 10.0	< 10.0	< 10.0	< 10.0	n/t
Toluene	M	ug/kg	10	n/t	< 10.0	< 10.0	< 10.0	< 10.0	n/t
Ethylbenzene	M	ug/kg	10	n/t	< 10.0	< 10.0	< 10.0	< 10.0	n/t
Xylenes	M	ug/kg	10	n/t	< 10.0	< 10.0	< 10.0	< 10.0	n/t
MTBE	N	ug/kg	10	n/t	< 10.0	< 10.0	< 10.0	< 10.0	n/t
Total BTEX	M	mg/kg	0.01	n/t	n/t	n/t	n/t	n/t	n/t
TPH CWG									
>C5-C6 Aliphatic	N	mg/kg	0.01	n/t	< 0.01	< 0.01	< 0.01	< 0.01	n/t
>C6-C8 Aliphatic	N	mg/kg	0.01	n/t	< 0.01	< 0.01	< 0.01	< 0.01	n/t
>C8-C10 Aliphatic	N	mg/kg	1	n/t	< 1.0	< 1.0	< 1.0	< 1.0	n/t
>C10-C12 Aliphatic	N	mg/kg	1	n/t	< 1.0	< 1.0	< 1.0	< 1.0	n/t
>C12-C16 Aliphatic	N	mg/kg	1	n/t	< 1.0	< 1.0	< 1.0	< 1.0	n/t
>C16-C21 Aliphatic	N	mg/kg	1	n/t	< 1.0	< 1.0	< 1.0	< 1.0	n/t
>C21-C35 Aliphatic	N	mg/kg	1	n/t	< 1.0	< 1.0	< 1.0	< 1.0	n/t
>C35-C40 Aliphatic	N	mg/kg	1	n/t	< 1.0	< 1.0	< 1.0	< 1.0	n/t
>C5-C7 Aromatic	N	mg/kg	0.01	n/t	< 0.01	< 0.01	< 0.01	< 0.01	n/t
>C7-C8 Aromatic	N	mg/kg	0.01	n/t	< 0.01	< 0.01	< 0.01	< 0.01	n/t
>C8-C10 Aromatic	N	mg/kg	1	n/t	< 1.0	< 1.0	< 1.0	< 1.0	n/t
>C10-C12 Aromatic	N	mg/kg	1	n/t	< 1.0	< 1.0	< 1.0	< 1.0	n/t
>C12-C16 Aromatic	N	mg/kg	1	n/t	< 1.0	< 1.0	< 1.0	< 1.0	n/t
>C16-C21 Aromatic	N	mg/kg	1	n/t	< 1.0	< 1.0	< 1.0	< 1.0	n/t
>C21-C35 Aromatic	N	mg/kg	1	n/t	1.2	< 1.0	4.8	< 1.0	n/t
>C35-C40 Aromatic	N	mg/kg	1	n/t	< 1.0	< 1.0	< 1.0	< 1.0	n/t
Total (>C5-C40) Ali/Aro	N	mg/kg	1	n/t	1.2	< 1.0	4.8	< 1.0	n/t
Total Petroleum Hydrocarbons									
Mineral Oil	U	mg/kg	5	n/t	< 5	< 5	< 5	< 5	n/t
PCB (ICES 7 congeners)									
PCB 28	M	mg/kg	0.01	n/t	n/t	n/t	n/t	n/t	n/t
PCB 52	M	mg/kg	0.01	n/t	n/t	n/t	n/t	n/t	n/t
PCB 101	M	mg/kg	0.01	n/t	n/t	n/t	n/t	n/t	n/t
PCB 118	M	mg/kg	0.01	n/t	n/t	n/t	n/t	n/t	n/t



Results Summary

Report No.: 19-21967

ELAB Reference	166524	166525	166526	166528	166529	166530
Customer Reference						
Sample ID						
Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Sample Location	WS03	WS04	WS04	WS05	WS05	WS05
Sample Depth (m)	2.50	0.20	0.40	0.10	0.40	1.50
Sampling Date	19/02/2019	19/02/2019	19/02/2019	19/02/2019	19/02/2019	19/02/2019

Determinand	Codes	Units	LOD						
PCB 153	M	mg/kg	0.01	n/t	n/t	n/t	n/t	n/t	n/t
PCB 138	M	mg/kg	0.01	n/t	n/t	n/t	n/t	n/t	n/t
PCB 180	M	mg/kg	0.01	n/t	n/t	n/t	n/t	n/t	n/t
PCB (Total of 7 Congeners)	M	mg/kg	0.03	n/t	n/t	n/t	n/t	n/t	n/t

Results Summary

Report No.: 19-21967

ELAB Reference	166531	166532	166533	166534	166535	166536
Customer Reference						
Sample ID						
Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Sample Location	WS06	WS06	WS06	WS07	WS07	WS07
Sample Depth (m)	0.10	0.50	2.50	0.20	0.60	2.50
Sampling Date	19/02/2019	19/02/2019	19/02/2019	19/02/2019	19/02/2019	19/02/2019

Determinand	Codes	Units	LOD						
Metals									
Arsenic	M	mg/kg	1	11.4	13.7	13.7	14.8	11.8	n/t
Cadmium	M	mg/kg	0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	n/t
Chromium	M	mg/kg	5	34.0	45.5	46.3	37.3	43.0	n/t
Copper	M	mg/kg	5	20.3	23.6	23.6	27.8	24.1	n/t
Lead	M	mg/kg	5	46.8	33.0	15.7	30.3	18.7	n/t
Water soluble magnesium	N	g/l	0.01	n/t	n/t	n/t	n/t	n/t	0.05
Mercury	M	mg/kg	0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	n/t
Nickel	M	mg/kg	5	38.3	45.6	48.0	41.7	45.6	n/t
Selenium	M	mg/kg	1	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	n/t
Zinc	M	mg/kg	5	79.1	92.1	77.7	79.8	79.6	n/t
Anions									
Water Soluble Chloride	M	mg/l	20	n/t	n/t	n/t	n/t	n/t	37
Water Soluble Nitrate	N	mg/l	20	n/t	n/t	n/t	n/t	n/t	< 20
Water Soluble Sulphate	M	g/l	0.02	0.03	0.03	0.14	0.03	0.03	0.29
Inorganics									
Total Cyanide	M	mg/kg	1	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	n/t
Total Sulphur	N	%	0.01	n/t	n/t	n/t	n/t	n/t	0.04
Acid Soluble Sulphate (SO4)	U	%	0.02	n/t	0.02	n/t	0.13	n/t	0.08
Miscellaneous									
Acid Neutralisation Capacity	N	mol/kg	0.1	n/t	n/t	n/t	n/t	n/t	n/t
Loss On Ignition (450°C)	M	%	0.01	n/t	n/t	n/t	n/t	n/t	n/t
Moisture Content	N	%	0.1	21.9	17.2	18.5	15.7	20.7	n/t
pH	M	pH units	0.1	7.8	8.4	8.6	8.4	8.5	8.4
Soil Organic Matter	U	%	0.1	4.9	1.1	0.6	0.8	0.5	n/t
Stones Content	N	%	0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	n/t
Total Organic Carbon	N	%	0.01	1.9	0.67	0.23	0.55	0.25	n/t
Organics									
>C8-C10 BCB	N	mg/kg	1	n/t	< 1.0	n/t	< 1.0	n/t	n/t
>C10-C12 BCB	N	mg/kg	1	n/t	< 1.0	n/t	< 1.0	n/t	n/t
>C12-C16 BCB	N	mg/kg	1	n/t	< 1.0	n/t	< 1.0	n/t	n/t
>C16-C21 BCB	N	mg/kg	1	n/t	< 1.0	n/t	< 1.0	n/t	n/t
Diesel Range Organics (>C8-C21)	N	mg/kg	1	n/t	< 1	n/t	< 1	n/t	n/t
Phenols									
Total Monohydric Phenols	N	mg/kg	5	< 5	< 5	c < 5	< 5	< 5	n/t

Results Summary

Report No.: 19-21967

ELAB Reference	166531	166532	166533	166534	166535	166536
Customer Reference						
Sample ID						
Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Sample Location	WS06	WS06	WS06	WS07	WS07	WS07
Sample Depth (m)	0.10	0.50	2.50	0.20	0.60	2.50
Sampling Date	19/02/2019	19/02/2019	19/02/2019	19/02/2019	19/02/2019	19/02/2019

Determinand	Codes	Units	LOD						
Polyaromatic hydrocarbons									
Naphthalene	M	mg/kg	0.1	< 0.1	< 0.1	c < 0.1	< 0.1	< 0.1	n/t
Acenaphthylene	M	mg/kg	0.1	< 0.1	< 0.1	c < 0.1	< 0.1	< 0.1	n/t
Acenaphthene	M	mg/kg	0.1	< 0.1	< 0.1	c < 0.1	< 0.1	< 0.1	n/t
Fluorene	M	mg/kg	0.1	< 0.1	< 0.1	c < 0.1	< 0.1	< 0.1	n/t
Phenanthrene	M	mg/kg	0.1	< 0.1	< 0.1	c < 0.1	0.1	< 0.1	n/t
Anthracene	M	mg/kg	0.1	< 0.1	< 0.1	c < 0.1	< 0.1	< 0.1	n/t
Fluoranthene	M	mg/kg	0.1	0.2	< 0.1	c < 0.1	0.1	< 0.1	n/t
Pyrene	M	mg/kg	0.1	0.2	< 0.1	c < 0.1	< 0.1	< 0.1	n/t
Benzo(a)anthracene	M	mg/kg	0.1	0.2	< 0.1	c < 0.1	< 0.1	< 0.1	n/t
Chrysene	M	mg/kg	0.1	0.2	< 0.1	c < 0.1	< 0.1	< 0.1	n/t
Benzo(b)fluoranthene	M	mg/kg	0.1	0.3	< 0.1	c < 0.1	0.1	< 0.1	n/t
Benzo(k)fluoranthene	M	mg/kg	0.1	0.3	< 0.1	c < 0.1	0.2	< 0.1	n/t
Benzo(a)pyrene	M	mg/kg	0.1	0.2	< 0.1	c < 0.1	< 0.1	< 0.1	n/t
Indeno(1,2,3-cd)pyrene	M	mg/kg	0.1	0.2	< 0.1	c < 0.1	< 0.1	< 0.1	n/t
Dibenzo(a,h)anthracene	M	mg/kg	0.1	< 0.1	< 0.1	c < 0.1	< 0.1	< 0.1	n/t
Benzo[g,h,i]perylene	M	mg/kg	0.1	0.2	< 0.1	c < 0.1	< 0.1	< 0.1	n/t
Coronene	N	mg/kg	0.1	< 0.1	< 0.1	c < 0.1	< 0.1	< 0.1	n/t
Total PAH(16)	M	mg/kg	0.4	2.0	< 0.4	c < 0.4	0.9	< 0.4	n/t
Total PAH (Including Coronene)	N	mg/kg	2	n/t	n/t	n/t	n/t	n/t	n/t
BTEX									
Benzene	M	ug/kg	10	n/t	< 10.0	n/t	< 10.0	n/t	n/t
Toluene	M	ug/kg	10	n/t	< 10.0	n/t	< 10.0	n/t	n/t
Ethylbenzene	M	ug/kg	10	n/t	< 10.0	n/t	< 10.0	n/t	n/t
Xylenes	M	ug/kg	10	n/t	< 10.0	n/t	< 10.0	n/t	n/t
MTBE	N	ug/kg	10	n/t	< 10.0	n/t	< 10.0	n/t	n/t
Total BTEX	M	mg/kg	0.01	n/t	n/t	n/t	n/t	n/t	n/t
TPH CWG									
>C5-C6 Aliphatic	N	mg/kg	0.01	n/t	< 0.01	n/t	< 0.01	n/t	n/t
>C6-C8 Aliphatic	N	mg/kg	0.01	n/t	< 0.01	n/t	< 0.01	n/t	n/t
>C8-C10 Aliphatic	N	mg/kg	1	n/t	< 1.0	n/t	< 1.0	n/t	n/t
>C10-C12 Aliphatic	N	mg/kg	1	n/t	< 1.0	n/t	< 1.0	n/t	n/t
>C12-C16 Aliphatic	N	mg/kg	1	n/t	< 1.0	n/t	< 1.0	n/t	n/t
>C16-C21 Aliphatic	N	mg/kg	1	n/t	< 1.0	n/t	< 1.0	n/t	n/t
>C21-C35 Aliphatic	N	mg/kg	1	n/t	< 1.0	n/t	< 1.0	n/t	n/t
>C35-C40 Aliphatic	N	mg/kg	1	n/t	< 1.0	n/t	< 1.0	n/t	n/t
>C5-C7 Aromatic	N	mg/kg	0.01	n/t	< 0.01	n/t	< 0.01	n/t	n/t
>C7-C8 Aromatic	N	mg/kg	0.01	n/t	< 0.01	n/t	< 0.01	n/t	n/t
>C8-C10 Aromatic	N	mg/kg	1	n/t	< 1.0	n/t	< 1.0	n/t	n/t
>C10-C12 Aromatic	N	mg/kg	1	n/t	< 1.0	n/t	< 1.0	n/t	n/t
>C12-C16 Aromatic	N	mg/kg	1	n/t	< 1.0	n/t	< 1.0	n/t	n/t
>C16-C21 Aromatic	N	mg/kg	1	n/t	< 1.0	n/t	< 1.0	n/t	n/t
>C21-C35 Aromatic	N	mg/kg	1	n/t	< 1.0	n/t	< 1.0	n/t	n/t
>C35-C40 Aromatic	N	mg/kg	1	n/t	< 1.0	n/t	< 1.0	n/t	n/t
Total (>C5-C40) Ali/Aro	N	mg/kg	1	n/t	< 1.0	n/t	< 1.0	n/t	n/t
Total Petroleum Hydrocarbons									
Mineral Oil	U	mg/kg	5	n/t	< 5	n/t	< 5	n/t	n/t
PCB (ICES 7 congeners)									
PCB 28	M	mg/kg	0.01	n/t	n/t	n/t	n/t	n/t	n/t
PCB 52	M	mg/kg	0.01	n/t	n/t	n/t	n/t	n/t	n/t
PCB 101	M	mg/kg	0.01	n/t	n/t	n/t	n/t	n/t	n/t
PCB 118	M	mg/kg	0.01	n/t	n/t	n/t	n/t	n/t	n/t



Results Summary

Report No.: 19-21967

ELAB Reference	166531	166532	166533	166534	166535	166536
Customer Reference						
Sample ID						
Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Sample Location	WS06	WS06	WS06	WS07	WS07	WS07
Sample Depth (m)	0.10	0.50	2.50	0.20	0.60	2.50
Sampling Date	19/02/2019	19/02/2019	19/02/2019	19/02/2019	19/02/2019	19/02/2019

Determinand	Codes	Units	LOD						
PCB 153	M	mg/kg	0.01	n/t	n/t	n/t	n/t	n/t	n/t
PCB 138	M	mg/kg	0.01	n/t	n/t	n/t	n/t	n/t	n/t
PCB 180	M	mg/kg	0.01	n/t	n/t	n/t	n/t	n/t	n/t
PCB (Total of 7 Congeners)	M	mg/kg	0.03	n/t	n/t	n/t	n/t	n/t	n/t

Results Summary

Report No.: 19-21967

ELAB Reference	166537	166538	166539	166540	166541	166542
Customer Reference						
Sample ID						
Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Sample Location	WS07	WS08	WS08	WS08	WS09	WS09
Sample Depth (m)	4.50	0.10	0.30	1.50	0.40	1.00
Sampling Date	19/02/2019	19/02/2019	19/02/2019	19/02/2019	19/02/2019	19/02/2019

Determinand	Codes	Units	LOD						
Metals									
Arsenic	M	mg/kg	1	n/t	12.8	13.7	7.8	13.1	13.6
Cadmium	M	mg/kg	0.5	n/t	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Chromium	M	mg/kg	5	n/t	40.5	47.8	45.9	20.3	45.6
Copper	M	mg/kg	5	n/t	28.3	25.0	24.7	38.3	25.2
Lead	M	mg/kg	5	n/t	165	38.4	18.3	1590	88.9
Water soluble magnesium	N	g/l	0.01	0.06	n/t	n/t	n/t	n/t	n/t
Mercury	M	mg/kg	0.5	n/t	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Nickel	M	mg/kg	5	n/t	39.4	48.1	47.3	21.8	47.6
Selenium	M	mg/kg	1	n/t	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Zinc	M	mg/kg	5	n/t	147	88.6	82.8	161	85.1
Anions									
Water Soluble Chloride	M	mg/l	20	46	n/t	n/t	n/t	n/t	n/t
Water Soluble Nitrate	N	mg/l	20	24	n/t	n/t	n/t	n/t	n/t
Water Soluble Sulphate	M	g/l	0.02	0.38	0.03	0.03	0.15	0.05	0.08
Inorganics									
Total Cyanide	M	mg/kg	1	n/t	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Total Sulphur	N	%	0.01	0.04	n/t	n/t	n/t	n/t	n/t
Acid Soluble Sulphate (SO4)	U	%	0.02	0.09	0.05	n/t	n/t	0.09	0.05
Miscellaneous									
Acid Neutralisation Capacity	N	mol/kg	0.1	n/t	n/t	n/t	n/t	n/t	n/t
Loss On Ignition (450°C)	M	%	0.01	n/t	n/t	n/t	n/t	n/t	n/t
Moisture Content	N	%	0.1	n/t	32.3	21.0	22.3	11.9	21.2
pH	M	pH units	0.1	8.3	7.8	8.3	8.3	8.4	8.4
Soil Organic Matter	U	%	0.1	n/t	9.8	0.8	0.6	1.1	0.5
Stones Content	N	%	0.1	n/t	< 0.1	< 0.1	< 0.1	34.8	< 0.1
Total Organic Carbon	N	%	0.01	n/t	4.7	0.64	0.27	1.2	0.35
Organics									
>C8-C10 BCB	N	mg/kg	1	n/t	< 1.0	n/t	n/t	< 1.0	< 1.0
>C10-C12 BCB	N	mg/kg	1	n/t	< 1.0	n/t	n/t	< 1.0	< 1.0
>C12-C16 BCB	N	mg/kg	1	n/t	< 1.0	n/t	n/t	< 1.0	< 1.0
>C16-C21 BCB	N	mg/kg	1	n/t	< 1.0	n/t	n/t	< 1.0	< 1.0
Diesel Range Organics (>C8-C21)	N	mg/kg	1	n/t	< 1	n/t	n/t	< 1	< 1
Phenols									
Total Monohydric Phenols	N	mg/kg	5	n/t	< 5	< 5	c < 5	< 5	< 5

Results Summary

Report No.: 19-21967

ELAB Reference	166537	166538	166539	166540	166541	166542
Customer Reference						
Sample ID						
Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Sample Location	WS07	WS08	WS08	WS08	WS09	WS09
Sample Depth (m)	4.50	0.10	0.30	1.50	0.40	1.00
Sampling Date	19/02/2019	19/02/2019	19/02/2019	19/02/2019	19/02/2019	19/02/2019

Determinand	Codes	Units	LOD						
Polyaromatic hydrocarbons									
Naphthalene	M	mg/kg	0.1	n/t	< 0.1	< 0.1	c < 0.1	< 0.1	< 0.1
Acenaphthylene	M	mg/kg	0.1	n/t	< 0.1	< 0.1	c < 0.1	< 0.1	< 0.1
Acenaphthene	M	mg/kg	0.1	n/t	0.9	< 0.1	c < 0.1	< 0.1	< 0.1
Fluorene	M	mg/kg	0.1	n/t	< 0.1	< 0.1	c < 0.1	< 0.1	< 0.1
Phenanthrene	M	mg/kg	0.1	n/t	< 0.1	< 0.1	c < 0.1	< 0.1	< 0.1
Anthracene	M	mg/kg	0.1	n/t	< 0.1	< 0.1	c < 0.1	< 0.1	< 0.1
Fluoranthene	M	mg/kg	0.1	n/t	0.2	< 0.1	c < 0.1	< 0.1	< 0.1
Pyrene	M	mg/kg	0.1	n/t	0.2	< 0.1	c < 0.1	< 0.1	< 0.1
Benzo(a)anthracene	M	mg/kg	0.1	n/t	0.2	< 0.1	c < 0.1	< 0.1	< 0.1
Chrysene	M	mg/kg	0.1	n/t	0.2	< 0.1	c < 0.1	< 0.1	< 0.1
Benzo(b)fluoranthene	M	mg/kg	0.1	n/t	0.4	< 0.1	c < 0.1	< 0.1	< 0.1
Benzo(k)fluoranthene	M	mg/kg	0.1	n/t	0.4	< 0.1	c < 0.1	< 0.1	< 0.1
Benzo(a)pyrene	M	mg/kg	0.1	n/t	0.3	< 0.1	c < 0.1	< 0.1	< 0.1
Indeno(1,2,3-cd)pyrene	M	mg/kg	0.1	n/t	0.2	< 0.1	c < 0.1	< 0.1	< 0.1
Dibenzo(a,h)anthracene	M	mg/kg	0.1	n/t	0.1	< 0.1	c < 0.1	< 0.1	< 0.1
Benzo[g,h,i]perylene	M	mg/kg	0.1	n/t	0.2	< 0.1	c < 0.1	< 0.1	< 0.1
Coronene	N	mg/kg	0.1	n/t	< 0.1	< 0.1	c < 0.1	< 0.1	< 0.1
Total PAH(16)	M	mg/kg	0.4	n/t	3.5	< 0.4	c < 0.4	< 0.4	< 0.4
Total PAH (Including Coronene)	N	mg/kg	2	n/t	n/t	n/t	n/t	n/t	n/t
BTEX									
Benzene	M	ug/kg	10	n/t	< 10.0	n/t	n/t	< 10.0	< 10.0
Toluene	M	ug/kg	10	n/t	< 10.0	n/t	n/t	< 10.0	< 10.0
Ethylbenzene	M	ug/kg	10	n/t	< 10.0	n/t	n/t	< 10.0	< 10.0
Xylenes	M	ug/kg	10	n/t	< 10.0	n/t	n/t	< 10.0	< 10.0
MTBE	N	ug/kg	10	n/t	< 10.0	n/t	n/t	< 10.0	< 10.0
Total BTEX	M	mg/kg	0.01	n/t	n/t	n/t	n/t	n/t	n/t
TPH CWG									
>C5-C6 Aliphatic	N	mg/kg	0.01	n/t	< 0.01	n/t	n/t	< 0.01	< 0.01
>C6-C8 Aliphatic	N	mg/kg	0.01	n/t	< 0.01	n/t	n/t	< 0.01	< 0.01
>C8-C10 Aliphatic	N	mg/kg	1	n/t	< 1.0	n/t	n/t	< 1.0	< 1.0
>C10-C12 Aliphatic	N	mg/kg	1	n/t	< 1.0	n/t	n/t	< 1.0	< 1.0
>C12-C16 Aliphatic	N	mg/kg	1	n/t	< 1.0	n/t	n/t	< 1.0	< 1.0
>C16-C21 Aliphatic	N	mg/kg	1	n/t	< 1.0	n/t	n/t	< 1.0	< 1.0
>C21-C35 Aliphatic	N	mg/kg	1	n/t	< 1.0	n/t	n/t	< 1.0	< 1.0
>C35-C40 Aliphatic	N	mg/kg	1	n/t	< 1.0	n/t	n/t	< 1.0	< 1.0
>C5-C7 Aromatic	N	mg/kg	0.01	n/t	< 0.01	n/t	n/t	< 0.01	< 0.01
>C7-C8 Aromatic	N	mg/kg	0.01	n/t	< 0.01	n/t	n/t	< 0.01	< 0.01
>C8-C10 Aromatic	N	mg/kg	1	n/t	< 1.0	n/t	n/t	< 1.0	< 1.0
>C10-C12 Aromatic	N	mg/kg	1	n/t	< 1.0	n/t	n/t	< 1.0	< 1.0
>C12-C16 Aromatic	N	mg/kg	1	n/t	< 1.0	n/t	n/t	< 1.0	< 1.0
>C16-C21 Aromatic	N	mg/kg	1	n/t	< 1.0	n/t	n/t	< 1.0	< 1.0
>C21-C35 Aromatic	N	mg/kg	1	n/t	5.1	n/t	n/t	< 1.0	< 1.0
>C35-C40 Aromatic	N	mg/kg	1	n/t	< 1.0	n/t	n/t	< 1.0	< 1.0
Total (>C5-C40) Ali/Aro	N	mg/kg	1	n/t	5.1	n/t	n/t	< 1.0	< 1.0
Total Petroleum Hydrocarbons									
Mineral Oil	U	mg/kg	5	n/t	18	n/t	n/t	< 5	15
PCB (ICES 7 congeners)									
PCB 28	M	mg/kg	0.01	n/t	< 0.01	n/t	n/t	n/t	n/t
PCB 52	M	mg/kg	0.01	n/t	< 0.01	n/t	n/t	n/t	n/t
PCB 101	M	mg/kg	0.01	n/t	< 0.01	n/t	n/t	n/t	n/t
PCB 118	M	mg/kg	0.01	n/t	< 0.01	n/t	n/t	n/t	n/t



Results Summary

Report No.: 19-21967

ELAB Reference	166537	166538	166539	166540	166541	166542
Customer Reference						
Sample ID						
Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Sample Location	WS07	WS08	WS08	WS08	WS09	WS09
Sample Depth (m)	4.50	0.10	0.30	1.50	0.40	1.00
Sampling Date	19/02/2019	19/02/2019	19/02/2019	19/02/2019	19/02/2019	19/02/2019

Determinand	Codes	Units	LOD						
PCB 153	M	mg/kg	0.01	n/t	< 0.01	n/t	n/t	n/t	n/t
PCB 138	M	mg/kg	0.01	n/t	< 0.01	n/t	n/t	n/t	n/t
PCB 180	M	mg/kg	0.01	n/t	< 0.01	n/t	n/t	n/t	n/t
PCB (Total of 7 Congeners)	M	mg/kg	0.03	n/t	< 0.03	n/t	n/t	n/t	n/t

Results Summary

Report No.: 19-21967

ELAB Reference				166543	166544	166545	166546	166548	166549
Customer Reference									
Sample ID									
Sample Type				SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Sample Location				WS10	WS10	WS10	BH1	HD01	HD02
Sample Depth (m)				0.20	0.50	2.00	0.30	0.30	0.50
Sampling Date				19/02/2019	19/02/2019	18/02/2019	11/02/2019	18/02/2019	18/02/2019
Determinand	Codes	Units	LOD						
Metals									
Arsenic	M	mg/kg	1	19.9	12.7	n/t	14.9	12.8	13.9
Cadmium	M	mg/kg	0.5	1.1	< 0.5	n/t	< 0.5	< 0.5	0.6
Chromium	M	mg/kg	5	37.0	39.1	n/t	46.9	41.1	18.6
Copper	M	mg/kg	5	52.1	23.3	n/t	25.0	25.0	118
Lead	M	mg/kg	5	119	18.0	n/t	21.8	250	48.6
Water soluble magnesium	N	g/l	0.01	n/t	n/t	0.02	n/t	n/t	n/t
Mercury	M	mg/kg	0.5	< 0.5	< 0.5	n/t	< 0.5	< 0.5	< 0.5
Nickel	M	mg/kg	5	45.6	42.7	n/t	52.6	46.9	21.4
Selenium	M	mg/kg	1	< 1.0	< 1.0	n/t	< 1.0	< 1.0	1.8
Zinc	M	mg/kg	5	193	72.8	n/t	80.5	177	65.1
Anions									
Water Soluble Chloride	M	mg/l	20	n/t	n/t	21	n/t	n/t	n/t
Water Soluble Nitrate	N	mg/l	20	n/t	n/t	< 20	n/t	n/t	n/t
Water Soluble Sulphate	M	g/l	0.02	0.05	0.04	0.07	0.07	0.22	0.06
Inorganics									
Total Cyanide	M	mg/kg	1	< 1.0	< 1.0	n/t	< 1.0	< 1.0	< 1.0
Total Sulphur	N	%	0.01	n/t	n/t	0.02	n/t	n/t	n/t
Acid Soluble Sulphate (SO ₄)	U	%	0.02	0.07	n/t	0.03	0.04	0.10	0.14
Miscellaneous									
Acid Neutralisation Capacity	N	mol/kg	0.1	n/t	n/t	n/t	n/t	< 0.1	< 0.1
Loss On Ignition (450°C)	M	%	0.01	n/t	n/t	n/t	n/t	3.34	4.46
Moisture Content	N	%	0.1	24.7	16.7	n/t	21.3	19.4	17.1
pH	M	pH units	0.1	8.0	8.6	8.5	8.3	10.1	8.2
Soil Organic Matter	U	%	0.1	4.0	0.2	n/t	0.7	0.9	3.9
Stones Content	N	%	0.1	< 0.1	< 0.1	n/t	< 0.1	< 0.1	40.1
Total Organic Carbon	N	%	0.01	2.4	0.25	n/t	0.45	0.60	2.4
Organics									
>C8-C10 BCB	N	mg/kg	1	< 1.0	n/t	n/t	fg < 1.0	< 1.0	< 1.0
>C10-C12 BCB	N	mg/kg	1	< 1.0	n/t	n/t	fg < 1.0	< 1.0	< 1.0
>C12-C16 BCB	N	mg/kg	1	< 1.0	n/t	n/t	fg 11.3	< 1.0	< 1.0
>C16-C21 BCB	N	mg/kg	1	3.2	n/t	n/t	fg 90.2	< 1.0	1.8
Diesel Range Organics (>C8-C21)	N	mg/kg	1	3	n/t	n/t	fg 101	< 1	2
Phenols									
Total Monohydric Phenols	N	mg/kg	5	< 5	< 5	n/t	< 5	< 5	< 5

Results Summary

Report No.: 19-21967

ELAB Reference	166543	166544	166545	166546	166548	166549
Customer Reference						
Sample ID						
Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Sample Location	WS10	WS10	WS10	BH1	HD01	HD02
Sample Depth (m)	0.20	0.50	2.00	0.30	0.30	0.50
Sampling Date	19/02/2019	19/02/2019	18/02/2019	11/02/2019	18/02/2019	18/02/2019

Determinand	Codes	Units	LOD						
Polyaromatic hydrocarbons									
Naphthalene	M	mg/kg	0.1	0.1	< 0.1	n/t	< 0.1	< 0.1	0.1
Acenaphthylene	M	mg/kg	0.1	0.2	< 0.1	n/t	< 0.1	< 0.1	< 0.1
Acenaphthene	M	mg/kg	0.1	0.4	< 0.1	n/t	0.1	< 0.1	0.1
Fluorene	M	mg/kg	0.1	0.4	< 0.1	n/t	< 0.1	< 0.1	< 0.1
Phenanthrene	M	mg/kg	0.1	6.6	< 0.1	n/t	0.4	< 0.1	1.8
Anthracene	M	mg/kg	0.1	3.0	< 0.1	n/t	0.2	< 0.1	0.5
Fluoranthene	M	mg/kg	0.1	26.7	< 0.1	n/t	1.2	< 0.1	1.2
Pyrene	M	mg/kg	0.1	24.8	< 0.1	n/t	1.3	< 0.1	0.9
Benzo(a)anthracene	M	mg/kg	0.1	16.0	< 0.1	n/t	0.6	< 0.1	0.4
Chrysene	M	mg/kg	0.1	14.7	< 0.1	n/t	0.8	< 0.1	0.5
Benzo(b)fluoranthene	M	mg/kg	0.1	15.0	< 0.1	n/t	0.8	< 0.1	0.2
Benzo(k)fluoranthene	M	mg/kg	0.1	13.6	< 0.1	n/t	0.9	< 0.1	0.2
Benzo(a)pyrene	M	mg/kg	0.1	13.4	< 0.1	n/t	0.9	< 0.1	0.2
Indeno(1,2,3-cd)pyrene	M	mg/kg	0.1	10.8	< 0.1	n/t	0.8	< 0.1	0.2
Dibenzo(a,h)anthracene	M	mg/kg	0.1	2.8	< 0.1	n/t	0.2	< 0.1	< 0.1
Benzo[g,h,i]perylene	M	mg/kg	0.1	8.5	< 0.1	n/t	0.6	< 0.1	0.1
Coronene	N	mg/kg	0.1	2.9	< 0.1	n/t	0.2	< 0.1	< 0.1
Total PAH(16)	M	mg/kg	0.4	157	< 0.4	n/t	8.7	< 0.4	6.6
Total PAH (Including Coronene)	N	mg/kg	2	n/t	n/t	n/t	n/t	< 2	7
BTEX									
Benzene	M	ug/kg	10	< 10.0	n/t	n/t	fg < 10.0	< 10.0	< 10.0
Toluene	M	ug/kg	10	< 10.0	n/t	n/t	fg < 10.0	< 10.0	< 10.0
Ethylbenzene	M	ug/kg	10	< 10.0	n/t	n/t	fg < 10.0	< 10.0	< 10.0
Xylenes	M	ug/kg	10	< 10.0	n/t	n/t	fg < 10.0	< 10.0	< 10.0
MTBE	N	ug/kg	10	< 10.0	n/t	n/t	fg < 10.0	< 10.0	< 10.0
Total BTEX	M	mg/kg	0.01	n/t	n/t	n/t	n/t	< 0.01	< 0.01
TPH CWG									
>C5-C6 Aliphatic	N	mg/kg	0.01	< 0.01	n/t	n/t	fg < 0.01	< 0.01	< 0.01
>C6-C8 Aliphatic	N	mg/kg	0.01	< 0.01	n/t	n/t	fg < 0.01	< 0.01	< 0.01
>C8-C10 Aliphatic	N	mg/kg	1	< 1.0	n/t	n/t	fg < 1.0	< 1.0	< 1.0
>C10-C12 Aliphatic	N	mg/kg	1	< 1.0	n/t	n/t	fg < 1.0	< 1.0	< 1.0
>C12-C16 Aliphatic	N	mg/kg	1	< 1.0	n/t	n/t	fg 3.6	< 1.0	< 1.0
>C16-C21 Aliphatic	N	mg/kg	1	< 1.0	n/t	n/t	fg 19.9	< 1.0	< 1.0
>C21-C35 Aliphatic	N	mg/kg	1	4.2	n/t	n/t	fg 97.0	< 1.0	< 1.0
>C35-C40 Aliphatic	N	mg/kg	1	< 1.0	n/t	n/t	fg 13.8	< 1.0	< 1.0
>C5-C7 Aromatic	N	mg/kg	0.01	< 0.01	n/t	n/t	fg < 0.01	< 0.01	< 0.01
>C7-C8 Aromatic	N	mg/kg	0.01	< 0.01	n/t	n/t	fg < 0.01	< 0.01	< 0.01
>C8-C10 Aromatic	N	mg/kg	1	< 1.0	n/t	n/t	fg < 1.0	< 1.0	< 1.0
>C10-C12 Aromatic	N	mg/kg	1	< 1.0	n/t	n/t	fg < 1.0	< 1.0	< 1.0
>C12-C16 Aromatic	N	mg/kg	1	< 1.0	n/t	n/t	fg 8.7	< 1.0	< 1.0
>C16-C21 Aromatic	N	mg/kg	1	2.8	n/t	n/t	fg 91.5	< 1.0	< 1.0
>C21-C35 Aromatic	N	mg/kg	1	22.7	n/t	n/t	fg 553	< 1.0	3.3
>C35-C40 Aromatic	N	mg/kg	1	1.3	n/t	n/t	fg 55.8	< 1.0	< 1.0
Total (>C5-C40) Ali/Aro	N	mg/kg	1	30.9	n/t	n/t	fg 843	< 1.0	3.3
Total Petroleum Hydrocarbons									
Mineral Oil	U	mg/kg	5	126	n/t	n/t	fg 282	< 5	11
PCB (ICES 7 congeners)									
PCB 28	M	mg/kg	0.01	n/t	n/t	n/t	n/t	< 0.01	< 0.01
PCB 52	M	mg/kg	0.01	n/t	n/t	n/t	n/t	< 0.01	< 0.01
PCB 101	M	mg/kg	0.01	n/t	n/t	n/t	n/t	< 0.01	< 0.01
PCB 118	M	mg/kg	0.01	n/t	n/t	n/t	n/t	< 0.01	< 0.01



Results Summary

Report No.: 19-21967

ELAB Reference	166543	166544	166545	166546	166548	166549
Customer Reference						
Sample ID						
Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Sample Location	WS10	WS10	WS10	BH1	HD01	HD02
Sample Depth (m)	0.20	0.50	2.00	0.30	0.30	0.50
Sampling Date	19/02/2019	19/02/2019	18/02/2019	11/02/2019	18/02/2019	18/02/2019

Determinand	Codes	Units	LOD						
PCB 153	M	mg/kg	0.01	n/t	n/t	n/t	n/t	< 0.01	< 0.01
PCB 138	M	mg/kg	0.01	n/t	n/t	n/t	n/t	< 0.01	< 0.01
PCB 180	M	mg/kg	0.01	n/t	n/t	n/t	n/t	< 0.01	< 0.01
PCB (Total of 7 Congeners)	M	mg/kg	0.03	n/t	n/t	n/t	n/t	< 0.03	< 0.03

Results Summary

Report No.: 19-21967

ELAB Reference	166550	166551	166552	166553	166554	166555
Customer Reference						
Sample ID						
Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Sample Location	HD02	HD03	HD04	HD05	BH5	BH6
Sample Depth (m)	1.20	0.70	0.60	0.30	0.30	0.30
Sampling Date	18/02/2019	18/02/2019	18/02/2019	18/02/2019	18/02/2019	18/02/2019

Determinand	Codes	Units	LOD						
Metals									
Arsenic	M	mg/kg	1	14.8	14.9	11.8	14.0	13.5	15.8
Cadmium	M	mg/kg	0.5	< 0.5	< 0.5	< 0.5	2.8	< 0.5	< 0.5
Chromium	M	mg/kg	5	45.3	50.4	38.4	29.5	36.4	34.7
Copper	M	mg/kg	5	28.3	25.0	22.9	29.4	28.9	27.9
Lead	M	mg/kg	5	22.4	20.0	16.2	514	38.4	70.1
Water soluble magnesium	N	g/l	0.01	n/t	n/t	n/t	n/t	n/t	n/t
Mercury	M	mg/kg	0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Nickel	M	mg/kg	5	50.2	58.3	42.5	34.6	47.4	43.0
Selenium	M	mg/kg	1	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Zinc	M	mg/kg	5	84.0	81.5	73.3	582	96.6	85.4
Anions									
Water Soluble Chloride	M	mg/l	20	n/t	n/t	n/t	n/t	n/t	n/t
Water Soluble Nitrate	N	mg/l	20	n/t	n/t	n/t	n/t	n/t	n/t
Water Soluble Sulphate	M	g/l	0.02	0.11	0.02	0.03	0.02	0.02	0.04
Inorganics									
Total Cyanide	M	mg/kg	1	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Total Sulphur	N	%	0.01	n/t	n/t	n/t	n/t	n/t	n/t
Acid Soluble Sulphate (SO4)	U	%	0.02	0.03	< 0.02	0.03	0.03	< 0.02	0.13
Miscellaneous									
Acid Neutralisation Capacity	N	mol/kg	0.1	< 0.1	n/t	n/t	n/t	n/t	n/t
Loss On Ignition (450°C)	M	%	0.01	3.19	n/t	n/t	n/t	n/t	n/t
Moisture Content	N	%	0.1	17.8	21.5	20.1	34.4	20.0	21.0
pH	M	pH units	0.1	8.2	8.4	8.5	8.0	8.1	8.3
Soil Organic Matter	U	%	0.1	0.7	0.6	0.6	6.7	1.0	0.7
Stones Content	N	%	0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Total Organic Carbon	N	%	0.01	0.39	0.33	0.32	3.5	0.76	0.65
Organics									
>C8-C10 BCB	N	mg/kg	1	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
>C10-C12 BCB	N	mg/kg	1	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
>C12-C16 BCB	N	mg/kg	1	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
>C16-C21 BCB	N	mg/kg	1	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Diesel Range Organics (>C8-C21)	N	mg/kg	1	< 1	< 1	< 1	< 1	< 1	< 1
Phenols									
Total Monohydric Phenols	N	mg/kg	5	< 5	< 5	< 5	< 5	< 5	< 5

Results Summary

Report No.: 19-21967

ELAB Reference	166550	166551	166552	166553	166554	166555
Customer Reference						
Sample ID						
Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Sample Location	HD02	HD03	HD04	HD05	BH5	BH6
Sample Depth (m)	1.20	0.70	0.60	0.30	0.30	0.30
Sampling Date	18/02/2019	18/02/2019	18/02/2019	18/02/2019	18/02/2019	18/02/2019

Determinand	Codes	Units	LOD						
Polyaromatic hydrocarbons									
Naphthalene	M	mg/kg	0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Acenaphthylene	M	mg/kg	0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Acenaphthene	M	mg/kg	0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Fluorene	M	mg/kg	0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Phenanthrene	M	mg/kg	0.1	< 0.1	< 0.1	< 0.1	0.1	< 0.1	< 0.1
Anthracene	M	mg/kg	0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Fluoranthene	M	mg/kg	0.1	< 0.1	< 0.1	< 0.1	0.2	< 0.1	< 0.1
Pyrene	M	mg/kg	0.1	< 0.1	< 0.1	< 0.1	0.2	< 0.1	< 0.1
Benzo(a)anthracene	M	mg/kg	0.1	< 0.1	< 0.1	< 0.1	0.1	< 0.1	< 0.1
Chrysene	M	mg/kg	0.1	< 0.1	< 0.1	< 0.1	0.1	< 0.1	< 0.1
Benzo(b)fluoranthene	M	mg/kg	0.1	< 0.1	< 0.1	< 0.1	0.1	< 0.1	< 0.1
Benzo(k)fluoranthene	M	mg/kg	0.1	< 0.1	< 0.1	< 0.1	0.3	< 0.1	< 0.1
Benzo(a)pyrene	M	mg/kg	0.1	< 0.1	< 0.1	< 0.1	0.1	< 0.1	< 0.1
Indeno(1,2,3-cd)pyrene	M	mg/kg	0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Dibenzo(a,h)anthracene	M	mg/kg	0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Benzo[g,h,i]perylene	M	mg/kg	0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Coronene	N	mg/kg	0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Total PAH(16)	M	mg/kg	0.4	< 0.4	< 0.4	< 0.4	1.5	< 0.4	< 0.4
Total PAH (Including Coronene)	N	mg/kg	2	< 2	n/t	n/t	n/t	n/t	n/t
BTEX									
Benzene	M	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
Toluene	M	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
Ethylbenzene	M	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
Xylenes	M	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
MTBE	N	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
Total BTEX	M	mg/kg	0.01	< 0.01	n/t	n/t	n/t	n/t	n/t
TPH CWG									
>C5-C6 Aliphatic	N	mg/kg	0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
>C6-C8 Aliphatic	N	mg/kg	0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
>C8-C10 Aliphatic	N	mg/kg	1	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
>C10-C12 Aliphatic	N	mg/kg	1	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
>C12-C16 Aliphatic	N	mg/kg	1	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
>C16-C21 Aliphatic	N	mg/kg	1	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
>C21-C35 Aliphatic	N	mg/kg	1	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
>C35-C40 Aliphatic	N	mg/kg	1	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
>C5-C7 Aromatic	N	mg/kg	0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
>C7-C8 Aromatic	N	mg/kg	0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
>C8-C10 Aromatic	N	mg/kg	1	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
>C10-C12 Aromatic	N	mg/kg	1	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
>C12-C16 Aromatic	N	mg/kg	1	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
>C16-C21 Aromatic	N	mg/kg	1	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
>C21-C35 Aromatic	N	mg/kg	1	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
>C35-C40 Aromatic	N	mg/kg	1	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Total (>C5-C40) Ali/Aro	N	mg/kg	1	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Total Petroleum Hydrocarbons									
Mineral Oil	U	mg/kg	5	< 5	< 5	< 5	< 5	< 5	< 5
PCB (ICES 7 congeners)									
PCB 28	M	mg/kg	0.01	n/t	< 0.01	n/t	n/t	n/t	n/t
PCB 52	M	mg/kg	0.01	n/t	< 0.01	n/t	n/t	n/t	n/t
PCB 101	M	mg/kg	0.01	n/t	< 0.01	n/t	n/t	n/t	n/t
PCB 118	M	mg/kg	0.01	n/t	< 0.01	n/t	n/t	n/t	n/t



Results Summary

Report No.: 19-21967

ELAB Reference	166550	166551	166552	166553	166554	166555
Customer Reference						
Sample ID						
Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Sample Location	HD02	HD03	HD04	HD05	BH5	BH6
Sample Depth (m)	1.20	0.70	0.60	0.30	0.30	0.30
Sampling Date	18/02/2019	18/02/2019	18/02/2019	18/02/2019	18/02/2019	18/02/2019

Determinand	Codes	Units	LOD						
PCB 153	M	mg/kg	0.01	n/t	< 0.01	n/t	n/t	n/t	n/t
PCB 138	M	mg/kg	0.01	n/t	< 0.01	n/t	n/t	n/t	n/t
PCB 180	M	mg/kg	0.01	n/t	< 0.01	n/t	n/t	n/t	n/t
PCB (Total of 7 Congeners)	M	mg/kg	0.03	< 0.03	< 0.03	n/t	n/t	n/t	n/t

Results Summary

Report No.: 19-21967

ELAB Reference	166556	166557	166559	166560	166562	166563
Customer Reference						
Sample ID						
Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Sample Location	BH4	BH4	BH5	BH5	BH6	BH6
Sample Depth (m)	0.30	1.00	1.00	2.00	1.00	1.90
Sampling Date	12/02/2019	12/02/2019	12/02/2019	12/02/2019	12/02/2019	12/02/2019

Determinand	Codes	Units	LOD						
Metals									
Arsenic	M	mg/kg	1	13.6	13.0	12.8	10.8	12.7	13.1
Cadmium	M	mg/kg	0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Chromium	M	mg/kg	5	42.4	45.8	41.9	36.9	41.3	37.3
Copper	M	mg/kg	5	24.6	26.0	24.5	23.9	23.9	25.2
Lead	M	mg/kg	5	18.7	19.6	21.4	19.9	21.4	27.0
Water soluble magnesium	N	g/l	0.01	n/t	n/t	n/t	n/t	n/t	n/t
Mercury	M	mg/kg	0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Nickel	M	mg/kg	5	47.5	49.8	46.5	44.1	46.2	45.5
Selenium	M	mg/kg	1	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Zinc	M	mg/kg	5	77.4	81.7	75.6	77.8	80.4	92.6
Anions									
Water Soluble Chloride	M	mg/l	20	n/t	n/t	n/t	n/t	n/t	n/t
Water Soluble Nitrate	N	mg/l	20	n/t	n/t	n/t	n/t	n/t	n/t
Water Soluble Sulphate	M	g/l	0.02	0.05	0.03	0.04	0.09	0.12	0.25
Inorganics									
Total Cyanide	M	mg/kg	1	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Total Sulphur	N	%	0.01	n/t	n/t	n/t	n/t	n/t	n/t
Acid Soluble Sulphate (SO4)	U	%	0.02	0.03	n/t	0.03	n/t	0.04	n/t
Miscellaneous									
Acid Neutralisation Capacity	N	mol/kg	0.1	n/t	n/t	n/t	n/t	n/t	n/t
Loss On Ignition (450°C)	M	%	0.01	n/t	n/t	n/t	n/t	n/t	n/t
Moisture Content	N	%	0.1	21.4	22.0	20.5	20.4	22.2	25.5
pH	M	pH units	0.1	8.6	8.5	8.3	8.7	8.5	9.5
Soil Organic Matter	U	%	0.1	0.3	0.5	0.6	0.5	0.4	0.4
Stones Content	N	%	0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Total Organic Carbon	N	%	0.01	0.21	0.36	0.45	0.27	0.33	0.44
Organics									
>C8-C10 BCB	N	mg/kg	1	fg < 1.0	n/t	fg < 1.0	n/t	fg < 1.0	n/t
>C10-C12 BCB	N	mg/kg	1	fg < 1.0	n/t	fg < 1.0	n/t	fg < 1.0	n/t
>C12-C16 BCB	N	mg/kg	1	fg < 1.0	n/t	fg < 1.0	n/t	fg < 1.0	n/t
>C16-C21 BCB	N	mg/kg	1	fg < 1.0	n/t	fg < 1.0	n/t	fg < 1.0	n/t
Diesel Range Organics (>C8-C21)	N	mg/kg	1	fg < 1	n/t	fg < 1	n/t	fg < 1	n/t
Phenols									
Total Monohydric Phenols	N	mg/kg	5	< 5	< 5	< 5	< 5	< 5	< 5

Results Summary

Report No.: 19-21967

ELAB Reference	166556	166557	166559	166560	166562	166563
Customer Reference						
Sample ID						
Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Sample Location	BH4	BH4	BH5	BH5	BH6	BH6
Sample Depth (m)	0.30	1.00	1.00	2.00	1.00	1.90
Sampling Date	12/02/2019	12/02/2019	12/02/2019	12/02/2019	12/02/2019	12/02/2019

Determinand	Codes	Units	LOD						
Polyaromatic hydrocarbons									
Naphthalene	M	mg/kg	0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Acenaphthylene	M	mg/kg	0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Acenaphthene	M	mg/kg	0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Fluorene	M	mg/kg	0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Phenanthrene	M	mg/kg	0.1	< 0.1	< 0.1	< 0.1	0.9	< 0.1	< 0.1
Anthracene	M	mg/kg	0.1	< 0.1	< 0.1	< 0.1	0.2	< 0.1	< 0.1
Fluoranthene	M	mg/kg	0.1	< 0.1	< 0.1	< 0.1	1.3	< 0.1	< 0.1
Pyrene	M	mg/kg	0.1	< 0.1	< 0.1	< 0.1	1.0	< 0.1	< 0.1
Benzo(a)anthracene	M	mg/kg	0.1	< 0.1	< 0.1	< 0.1	0.3	< 0.1	< 0.1
Chrysene	M	mg/kg	0.1	< 0.1	< 0.1	< 0.1	0.4	< 0.1	< 0.1
Benzo(b)fluoranthene	M	mg/kg	0.1	< 0.1	< 0.1	< 0.1	0.2	< 0.1	< 0.1
Benzo(k)fluoranthene	M	mg/kg	0.1	< 0.1	< 0.1	< 0.1	0.3	< 0.1	< 0.1
Benzo(a)pyrene	M	mg/kg	0.1	< 0.1	< 0.1	< 0.1	0.2	< 0.1	< 0.1
Indeno(1,2,3-cd)pyrene	M	mg/kg	0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Dibenzo(a,h)anthracene	M	mg/kg	0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Benzo[g,h,i]perylene	M	mg/kg	0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Coronene	N	mg/kg	0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Total PAH(16)	M	mg/kg	0.4	< 0.4	< 0.4	< 0.4	4.9	< 0.4	< 0.4
Total PAH (Including Coronene)	N	mg/kg	2	n/t	n/t	n/t	n/t	n/t	n/t
BTEX									
Benzene	M	ug/kg	10	fg < 10.0	n/t	fg < 10.0	n/t	fg < 10.0	n/t
Toluene	M	ug/kg	10	fg < 10.0	n/t	fg < 10.0	n/t	fg < 10.0	n/t
Ethylbenzene	M	ug/kg	10	fg < 10.0	n/t	fg < 10.0	n/t	fg < 10.0	n/t
Xylenes	M	ug/kg	10	fg < 10.0	n/t	fg < 10.0	n/t	fg < 10.0	n/t
MTBE	N	ug/kg	10	fg < 10.0	n/t	fg < 10.0	n/t	fg < 10.0	n/t
Total BTEX	M	mg/kg	0.01	n/t	n/t	n/t	n/t	n/t	n/t
TPH CWG									
>C5-C6 Aliphatic	N	mg/kg	0.01	f < 0.01	n/t	f < 0.01	n/t	f < 0.01	n/t
>C6-C8 Aliphatic	N	mg/kg	0.01	f < 0.01	n/t	f < 0.01	n/t	f < 0.01	n/t
>C8-C10 Aliphatic	N	mg/kg	1	fg < 1.0	n/t	fg < 1.0	n/t	fg < 1.0	n/t
>C10-C12 Aliphatic	N	mg/kg	1	fg < 1.0	n/t	fg < 1.0	n/t	fg < 1.0	n/t
>C12-C16 Aliphatic	N	mg/kg	1	fg < 1.0	n/t	fg < 1.0	n/t	fg < 1.0	n/t
>C16-C21 Aliphatic	N	mg/kg	1	fg < 1.0	n/t	fg < 1.0	n/t	fg < 1.0	n/t
>C21-C35 Aliphatic	N	mg/kg	1	fg < 1.0	n/t	fg < 1.0	n/t	fg < 1.0	n/t
>C35-C40 Aliphatic	N	mg/kg	1	fg < 1.0	n/t	fg < 1.0	n/t	fg < 1.0	n/t
>C5-C7 Aromatic	N	mg/kg	0.01	f < 0.01	n/t	f < 0.01	n/t	f < 0.01	n/t
>C7-C8 Aromatic	N	mg/kg	0.01	f < 0.01	n/t	f < 0.01	n/t	f < 0.01	n/t
>C8-C10 Aromatic	N	mg/kg	1	fg < 1.0	n/t	fg < 1.0	n/t	fg < 1.0	n/t
>C10-C12 Aromatic	N	mg/kg	1	fg < 1.0	n/t	fg < 1.0	n/t	fg < 1.0	n/t
>C12-C16 Aromatic	N	mg/kg	1	fg < 1.0	n/t	fg < 1.0	n/t	fg < 1.0	n/t
>C16-C21 Aromatic	N	mg/kg	1	fg < 1.0	n/t	fg < 1.0	n/t	fg < 1.0	n/t
>C21-C35 Aromatic	N	mg/kg	1	fg < 1.0	n/t	fg < 1.0	n/t	fg < 1.0	n/t
>C35-C40 Aromatic	N	mg/kg	1	fg < 1.0	n/t	fg < 1.0	n/t	fg < 1.0	n/t
Total (>C5-C40) Ali/Aro	N	mg/kg	1	fg < 1.0	n/t	fg < 1.0	n/t	fg < 1.0	n/t
Total Petroleum Hydrocarbons									
Mineral Oil	U	mg/kg	5	fg < 5	n/t	fg < 5	n/t	fg < 5	n/t
PCB (ICES 7 congeners)									
PCB 28	M	mg/kg	0.01	< 0.01	n/t	< 0.01	n/t	< 0.01	n/t
PCB 52	M	mg/kg	0.01	< 0.01	n/t	< 0.01	n/t	< 0.01	n/t
PCB 101	M	mg/kg	0.01	< 0.01	n/t	< 0.01	n/t	< 0.01	n/t
PCB 118	M	mg/kg	0.01	< 0.01	n/t	< 0.01	n/t	< 0.01	n/t



Results Summary

Report No.: 19-21967

ELAB Reference	166556	166557	166559	166560	166562	166563
Customer Reference						
Sample ID						
Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Sample Location	BH4	BH4	BH5	BH5	BH6	BH6
Sample Depth (m)	0.30	1.00	1.00	2.00	1.00	1.90
Sampling Date	12/02/2019	12/02/2019	12/02/2019	12/02/2019	12/02/2019	12/02/2019

Determinand	Codes	Units	LOD						
PCB 153	M	mg/kg	0.01	< 0.01	n/t	< 0.01	n/t	< 0.01	n/t
PCB 138	M	mg/kg	0.01	< 0.01	n/t	< 0.01	n/t	< 0.01	n/t
PCB 180	M	mg/kg	0.01	< 0.01	n/t	< 0.01	n/t	< 0.01	n/t
PCB (Total of 7 Congeners)	M	mg/kg	0.03	< 0.03	n/t	< 0.03	n/t	< 0.03	n/t

Results Summary

Report No.: 19-21967

ELAB Reference	166501	166505	166509	166511	166514
Customer Reference					
Sample ID					
Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL
Sample Location	TP01	TP03	TP04	TP05	TP07
Sample Depth (m)	0.30	0.40	2.80	0.60	0.10
Sampling Date	12/02/2019	12/02/2019	13/02/2019	13/02/2019	14/02/2019

Determinand	Codes	Units	LOD					
VOC								
Heptane	N	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
Octane	N	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
Nonane	N	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
Benzene	M	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
Toluene	M	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
Ethylbenzene	M	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
m+p-xylene	M	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
o-xylene	M	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
cis-1,2-dichloroethene	M	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
1,1-Dichloroethane	M	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
Chloroform	M	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
Tetrachloromethane	M	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
1,1,1-Trichloroethane	M	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
Trichloroethylene	M	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
Tetrachloroethylene	M	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
1,1,1,2-Tetrachloroethane	M	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
1,1,2,2-Tetrachloroethane	M	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
Chlorobenzene	M	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
Bromobenzene	M	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
Bromodichloromethane	M	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
Methylethylbenzene	M	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
1,1-Dichloro-1-propene	M	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
Trans - 1-2 -dichloroethylene	N	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
2,2-Dichloropropane	N	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
Bromochloromethane	N	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
1,2-Dichloroethane	N	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
Dibromomethane	M	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
1,2-Dichloropropane	M	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
cis-1,3-Dichloro-1-propene	M	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
trans-1,3-Dichloro-1-propene	M	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
1,1,2-Trichloroethane	N	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
Dibromochloromethane	N	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
1,3-Dichloropropane	N	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
1,2-dibromoethane	M	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
Styrene	N	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
Propylbenzene	N	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
2-Chlorotoluene	N	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
1,2,4-Trimethylbenzene	N	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
4-Chlorotoluene	N	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
t-butylbenzene	N	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
1,3,5-Trimethylbenzene	N	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
1-methylpropylbenzene	N	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
p-cymene	N	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
1,3-Dichlorobenzene	N	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
Butylbenzene	N	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
1,2-Dibromo-3-chloropropane	N	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
Hexachlorobutadiene	N	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
1-2-3 - Trichlorobenzene	N	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
Naphthalene	N	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
1-2-4 - Trichlorobenzene	N	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
1,4-Dichlorobenzene	N	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
1,2-Dichlorobenzene	N	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
Bromoform	N	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0

Results Summary

Report No.: 19-21967

ELAB Reference	166522	166525	166534	166538	166541
Customer Reference					
Sample ID					
Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL
Sample Location	WS03	WS04	WS07	WS08	WS09
Sample Depth (m)	0.50	0.20	0.20	0.10	0.40
Sampling Date	19/02/2019	19/02/2019	19/02/2019	19/02/2019	19/02/2019

Determinand	Codes	Units	LOD					
VOC								
Heptane	N	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
Octane	N	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
Nonane	N	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
Benzene	M	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
Toluene	M	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
Ethylbenzene	M	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
m+p-xylene	M	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
o-xylene	M	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
cis-1,2-dichloroethene	M	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
1,1-Dichloroethane	M	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
Chloroform	M	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
Tetrachloromethane	M	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
1,1,1-Trichloroethane	M	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
Trichloroethylene	M	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
Tetrachloroethylene	M	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
1,1,1,2-Tetrachloroethane	M	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
1,1,2,2-Tetrachloroethane	M	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
Chlorobenzene	M	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
Bromobenzene	M	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
Bromodichloromethane	M	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
Methylethylbenzene	M	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
1,1-Dichloro-1-propene	M	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
Trans - 1-2 -dichloroethylene	N	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
2,2-Dichloropropane	N	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
Bromochloromethane	N	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
1,2-Dichloroethane	N	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
Dibromomethane	M	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
1,2-Dichloropropane	M	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
cis-1,3-Dichloro-1-propene	M	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
trans-1,3-Dichloro-1-propene	M	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
1,1,2-Trichloroethane	N	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
Dibromochloromethane	N	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
1,3-Dichloropropane	N	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
1,2-dibromoethane	M	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
Styrene	N	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
Propylbenzene	N	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
2-Chlorotoluene	N	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
1,2,4-Trimethylbenzene	N	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
4-Chlorotoluene	N	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
t-butylbenzene	N	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
1,3,5-Trimethylbenzene	N	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
1-methylpropylbenzene	N	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
p-cymene	N	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
1,3-Dichlorobenzene	N	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
Butylbenzene	N	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
1,2-Dibromo-3-chloropropane	N	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
Hexachlorobutadiene	N	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
1-2-3 - Trichlorobenzene	N	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
Naphthalene	N	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
1-2-4 - Trichlorobenzene	N	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
1,4-Dichlorobenzene	N	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
1,2-Dichlorobenzene	N	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
Bromoform	N	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0

Results Summary

Report No.: 19-21967

ELAB Reference	166543	166546	166551	166552	166553
Customer Reference					
Sample ID					
Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL
Sample Location	WS10	BH1	HD03	HD04	HD05
Sample Depth (m)	0.20	0.30	0.70	0.60	0.30
Sampling Date	19/02/2019	11/02/2019	18/02/2019	18/02/2019	18/02/2019

Determinand	Codes	Units	LOD					
VOC								
Heptane	N	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
Octane	N	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
Nonane	N	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
Benzene	M	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
Toluene	M	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
Ethylbenzene	M	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
m+p-xylene	M	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
o-xylene	M	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
cis-1,2-dichloroethene	M	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
1,1-Dichloroethane	M	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
Chloroform	M	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
Tetrachloromethane	M	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
1,1,1-Trichloroethane	M	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
Trichloroethylene	M	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
Tetrachloroethylene	M	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
1,1,1,2-Tetrachloroethane	M	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
1,1,2,2-Tetrachloroethane	M	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
Chlorobenzene	M	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
Bromobenzene	M	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
Bromodichloromethane	M	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
Methylethylbenzene	M	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
1,1-Dichloro-1-propene	M	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
Trans - 1-2 -dichloroethylene	N	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
2,2-Dichloropropane	N	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
Bromochloromethane	N	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
1,2-Dichloroethane	N	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
Dibromomethane	M	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
1,2-Dichloropropane	M	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
cis-1,3-Dichloro-1-propene	M	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
trans-1,3-Dichloro-1-propene	M	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
1,1,2-Trichloroethane	N	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
Dibromochloromethane	N	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
1,3-Dichloropropane	N	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
1,2-dibromoethane	M	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
Styrene	N	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
Propylbenzene	N	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
2-Chlorotoluene	N	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
1,2,4-Trimethylbenzene	N	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
4-Chlorotoluene	N	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
t-butylbenzene	N	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
1,3,5-Trimethylbenzene	N	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
1-methylpropylbenzene	N	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
p-cymene	N	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
1,3-Dichlorobenzene	N	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
Butylbenzene	N	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
1,2-Dibromo-3-chloropropane	N	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
Hexachlorobutadiene	N	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
1-2-3 - Trichlorobenzene	N	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
Naphthalene	N	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
1-2-4 - Trichlorobenzene	N	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
1,4-Dichlorobenzene	N	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
1,2-Dichlorobenzene	N	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
Bromoform	N	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0

Results Summary

Report No.: 19-21967

ELAB Reference	166554	166555	166556	166559	166562
Customer Reference					
Sample ID					
Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL
Sample Location	BH5	BH6	BH4	BH5	BH6
Sample Depth (m)	0.30	0.30	0.30	1.00	1.00
Sampling Date	18/02/2019	18/02/2019	12/02/2019	12/02/2019	12/02/2019

Determinand	Codes	Units	LOD					
VOC								
Heptane	N	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
Octane	N	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
Nonane	N	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
Benzene	M	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
Toluene	M	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
Ethylbenzene	M	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
m+p-xylene	M	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
o-xylene	M	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
cis-1,2-dichloroethene	M	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
1,1-Dichloroethane	M	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
Chloroform	M	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
Tetrachloromethane	M	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
1,1,1-Trichloroethane	M	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
Trichloroethylene	M	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
Tetrachloroethylene	M	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
1,1,1,2-Tetrachloroethane	M	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
1,1,2,2-Tetrachloroethane	M	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
Chlorobenzene	M	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
Bromobenzene	M	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
Bromodichloromethane	M	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
Methylethylbenzene	M	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
1,1-Dichloro-1-propene	M	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
Trans - 1-2 -dichloroethylene	N	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
2,2-Dichloropropane	N	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
Bromochloromethane	N	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
1,2-Dichloroethane	N	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
Dibromomethane	M	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
1,2-Dichloropropane	M	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
cis-1,3-Dichloro-1-propene	M	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
trans-1,3-Dichloro-1-propene	M	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
1,1,2-Trichloroethane	N	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
Dibromochloromethane	N	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
1,3-Dichloropropane	N	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
1,2-dibromoethane	M	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
Styrene	N	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
Propylbenzene	N	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
2-Chlorotoluene	N	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
1,2,4-Trimethylbenzene	N	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
4-Chlorotoluene	N	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
t-butylbenzene	N	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
1,3,5-Trimethylbenzene	N	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
1-methylpropylbenzene	N	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
p-cymene	N	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
1,3-Dichlorobenzene	N	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
Butylbenzene	N	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
1,2-Dibromo-3-chloropropane	N	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
Hexachlorobutadiene	N	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
1-2-3 - Trichlorobenzene	N	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
Naphthalene	N	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
1-2-4 - Trichlorobenzene	N	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
1,4-Dichlorobenzene	N	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
1,2-Dichlorobenzene	N	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
Bromoform	N	ug/kg	10	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0

Results Summary

Report No.: 19-21967

ELAB Reference	166501	166505	166509	166514	166522
Customer Reference					
Sample ID					
Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL
Sample Location	TP01	TP03	TP04	TP07	WS03
Sample Depth (m)	0.30	0.40	2.80	0.10	0.50
Sampling Date	12/02/2019	12/02/2019	13/02/2019	14/02/2019	19/02/2019

Determinand	Codes	Units	LOD					
SVOC								
Phenol	N	mg/kg	0.01	fg < 0.01	fg < 0.01	f < 0.01	< 0.01	< 0.01
Aniline	N	mg/kg	0.01	fg < 0.01	fg < 0.01	f < 0.01	< 0.01	< 0.01
Bis(2-chloroethyl)ether	N	mg/kg	0.01	fg < 0.01	fg < 0.01	f < 0.01	< 0.01	< 0.01
2-Chlorophenol	N	mg/kg	0.01	fg < 0.01	fg < 0.01	f < 0.01	< 0.01	< 0.01
1,3-Dichlorobenzene	N	mg/kg	0.01	fg < 0.01	fg < 0.01	f < 0.01	< 0.01	< 0.01
1,4-Dichlorobenzene	N	mg/kg	0.01	fg < 0.01	fg < 0.01	f < 0.01	< 0.01	< 0.01
Benzyl Alcohol	N	mg/kg	0.01	fg < 0.01	fg < 0.01	f < 0.01	< 0.01	< 0.01
1,2-Dichlorobenzene	N	mg/kg	0.01	fg < 0.01	fg < 0.01	f < 0.01	< 0.01	< 0.01
2-Methylphenol	N	mg/kg	0.01	fg < 0.01	fg < 0.01	f 0.10	< 0.01	< 0.01
Bis(2-chloroisopropyl)ether	N	mg/kg	0.01	fg < 0.01	fg < 0.01	f < 0.01	< 0.01	< 0.01
3 and 4-methylphenol	N	mg/kg	0.01	fg < 0.01	fg < 0.01	f 0.27	< 0.01	< 0.01
N-Nitrosodi-n-propylamine	N	mg/kg	0.01	fg < 0.01	fg < 0.01	f < 0.01	< 0.01	< 0.01
Hexachloroethane	N	mg/kg	0.01	fg < 0.01	fg < 0.01	f < 0.01	< 0.01	< 0.01
Nitrobenzene	N	mg/kg	0.01	fg < 0.01	fg < 0.01	f < 0.01	< 0.01	< 0.01
Isophorone	N	mg/kg	0.01	fg < 0.01	fg < 0.01	f < 0.01	< 0.01	< 0.01
2-Nitrophenol	N	mg/kg	0.01	fg < 0.01	fg < 0.01	f < 0.01	< 0.01	< 0.01
2,4-Dimethylphenol	N	mg/kg	0.01	fg < 0.01	fg < 0.01	f 0.24	< 0.01	< 0.01
Bis(2-chloroethoxy)methane	N	mg/kg	0.01	fg < 0.01	fg < 0.01	f < 0.01	< 0.01	< 0.01
2,4-Dichlorophenol	N	mg/kg	0.01	fg < 0.01	fg < 0.01	f < 0.01	< 0.01	< 0.01
1,3,5-Trichlorobenzene	N	mg/kg	0.01	fg < 0.01	fg < 0.01	f < 0.01	< 0.01	< 0.01
Naphthalene	N	mg/kg	0.01	fg 0.04	fg 0.07	f 0.10	0.12	0.01
3-Chloroaniline	N	mg/kg	0.01	fg < 0.01	fg < 0.01	f < 0.01	< 0.01	< 0.01
Hexachloro-1,3-butadiene	N	mg/kg	0.01	fg < 0.01	fg < 0.01	f < 0.01	< 0.01	< 0.01
4-Chloro-3-methylphenol	N	mg/kg	0.01	fg < 0.01	fg < 0.01	f < 0.01	< 0.01	< 0.01
2-Methylnaphthalene	N	mg/kg	0.01	fg 0.04	fg 0.08	f 0.52	0.07	< 0.01
1-Methylnaphthalene	N	mg/kg	0.01	fg 0.03	fg 0.06	f 0.47	0.06	< 0.01
Hexachlorocyclopentadiene	N	mg/kg	0.01	fg < 0.01	fg < 0.01	f < 0.01	< 0.01	< 0.01
2,4,6-Trichlorophenol	N	mg/kg	0.01	fg < 0.01	fg < 0.01	f < 0.01	< 0.01	< 0.01
2,4,5-Trichlorophenol	N	mg/kg	0.01	fg 0.01	fg < 0.01	f < 0.01	0.01	< 0.01
1-Chloronaphthalene	N	mg/kg	0.01	fg < 0.01	fg < 0.01	f < 0.01	< 0.01	< 0.01
2-Nitroaniline	N	mg/kg	0.01	fg < 0.01	fg < 0.01	f < 0.01	< 0.01	< 0.01

Results Summary

Report No.: 19-21967

ELAB Reference	166501	166505	166509	166514	166522
Customer Reference					
Sample ID					
Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL
Sample Location	TP01	TP03	TP04	TP07	WS03
Sample Depth (m)	0.30	0.40	2.80	0.10	0.50
Sampling Date	12/02/2019	12/02/2019	13/02/2019	14/02/2019	19/02/2019

Determinand	Codes	Units	LOD					
SVOC								
1,4-Dinitrobenzene	N	mg/kg	0.01	fg < 0.01	fg < 0.01	f < 0.01	< 0.01	< 0.01
Dimethyl phthalate	N	mg/kg	0.01	fg < 0.01	fg < 0.01	f < 0.01	< 0.01	< 0.01
1-3-dinitrobenzene	N	mg/kg	0.01	fg < 0.01	fg < 0.01	f < 0.01	< 0.01	< 0.01
2-6-dinitrotoluene	N	mg/kg	0.01	fg < 0.01	fg < 0.01	f < 0.01	< 0.01	< 0.01
Acenaphthylene	N	mg/kg	0.01	fg 0.01	fg 0.10	f 0.03	0.22	< 0.01
1,2-Dinitrobenzene	N	mg/kg	0.01	fg < 0.01	fg < 0.01	f < 0.01	< 0.01	< 0.01
3-Nitroaniline	N	mg/kg	0.01	fg < 0.01	fg < 0.01	f < 0.01	< 0.01	< 0.01
Acenaphthene	N	mg/kg	0.01	fg < 0.01	fg 0.02	f 0.02	0.07	< 0.01
4-nitrophenol	N	mg/kg	0.01	fg < 0.01	fg < 0.01	f < 0.01	< 0.01	< 0.01
Dibenzofuran	N	mg/kg	0.01	fg 0.03	fg 0.02	f 0.42	0.05	< 0.01
2,3,5,6-Tetrachlorophenol	N	mg/kg	0.01	fg < 0.01	fg < 0.01	f < 0.01	0.02	< 0.01
2,3,4,6-Tetrachlorophenol	N	mg/kg	0.01	fg < 0.01	fg < 0.01	f < 0.01	0.02	< 0.01
Diethyl phthalate	N	mg/kg	0.01	fg < 0.01	fg < 0.01	f < 0.01	< 0.01	< 0.01
1-chloro-4-phenoxybenzene	N	mg/kg	0.01	fg < 0.01	fg < 0.01	f < 0.01	< 0.01	< 0.01
Fluorene	N	mg/kg	0.01	fg < 0.01	fg 0.02	f 0.06	0.05	< 0.01
4-Nitroaniline	N	mg/kg	0.01	fg < 0.01	fg < 0.01	f < 0.01	< 0.01	< 0.01
Dinitro-o-cresol	N	mg/kg	0.01	fg < 0.01	fg < 0.01	f < 0.01	< 0.01	< 0.01
Diphenylamine	N	mg/kg	0.01	fg < 0.01	fg < 0.01	f < 0.01	< 0.01	< 0.01
Azobenzene	N	mg/kg	0.01	fg < 0.01	fg < 0.01	f < 0.01	< 0.01	< 0.01
1-bromo-4-phenoxybenzene	N	mg/kg	0.01	fg < 0.01	fg < 0.01	f < 0.01	< 0.01	< 0.01
Hexachlorobenzene	N	mg/kg	0.01	fg < 0.01	fg < 0.01	f < 0.01	< 0.01	< 0.01
Pentachlorophenol	N	mg/kg	0.01	fg 0.02	fg 0.02	f 0.02	0.03	< 0.01
Phenanthrene	N	mg/kg	0.01	fg 0.28	fg 0.11	f 2.11	0.60	< 0.01
Anthracene	N	mg/kg	0.01	fg 0.03	fg 0.06	f 0.28	0.36	< 0.01
Carbazole	N	mg/kg	0.01	fg < 0.01	fg < 0.01	f 0.02	0.13	< 0.01
Dibutyl phthalate	N	mg/kg	0.01	fg < 0.01	fg < 0.01	f < 0.01	< 0.01	< 0.01
Fluoranthene	N	mg/kg	0.01	fg 0.18	fg 0.84	f 0.51	2.24	< 0.01
Pyrene	N	mg/kg	0.01	fg 0.07	fg 0.96	f 0.38	2.06	< 0.01
Butyl benzyl phthalate	N	mg/kg	0.01	fg < 0.01	fg < 0.01	f < 0.01	< 0.01	< 0.01
Bis-2-ethylhexyladipate	N	mg/kg	0.01	fg < 0.01	fg < 0.01	f < 0.01	< 0.01	< 0.01
Butyl benzyl phthalate	N	mg/kg	0.01	fg < 0.01	fg < 0.01	f < 0.01	< 0.01	< 0.01
Benzo(a)anthracene	N	mg/kg	0.01	fg 0.01	fg 1.16	f 0.09	1.56	< 0.01
Chrysene	N	mg/kg	0.01	fg 0.03	fg 1.23	f 0.20	1.56	< 0.01
Bis(2-ethylhexyl)phthalate	N	mg/kg	0.01	fg < 0.01	fg < 0.01	f < 0.01	< 0.01	< 0.01
Benzo(b)fluoranthene	N	mg/kg	0.01	fg < 0.01	fg 1.47	f 0.04	1.48	< 0.01
Benzo(k)fluoranthene	N	mg/kg	0.01	fg 0.01	fg 1.45	f 0.04	1.82	< 0.01
Benzo(a)pyrene	N	mg/kg	0.01	fg < 0.01	fg 1.78	f 0.02	2.35	< 0.01
Indeno(1,2,3-cd)pyrene	N	mg/kg	0.01	fg < 0.01	fg 1.14	f 0.01	2.04	< 0.01
Dibenz(ah)anthracene	N	mg/kg	0.01	fg < 0.01	fg 0.47	f < 0.01	0.72	< 0.01
Benzo[g,h,i]perylene	N	mg/kg	0.01	fg 0.01	fg 1.32	f 0.02	2.74	< 0.01

Results Summary

Report No.: 19-21967

ELAB Reference	166546	166554	166556	166559	166562
Customer Reference					
Sample ID					
Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL
Sample Location	BH1	BH5	BH4	BH5	BH6
Sample Depth (m)	0.30	0.30	0.30	1.00	1.00
Sampling Date	11/02/2019	18/02/2019	12/02/2019	12/02/2019	12/02/2019

Determinand	Codes	Units	LOD					
SVOC								
Phenol	N	mg/kg	0.01	fg < 0.01	< 0.01	fg < 0.01	fg < 0.01	fg < 0.01
Aniline	N	mg/kg	0.01	fg < 0.01	< 0.01	fg < 0.01	fg < 0.01	fg < 0.01
Bis(2-chloroethyl)ether	N	mg/kg	0.01	fg < 0.01	< 0.01	fg < 0.01	fg < 0.01	fg < 0.01
2-Chlorophenol	N	mg/kg	0.01	fg < 0.01	< 0.01	fg < 0.01	fg < 0.01	fg < 0.01
1,3-Dichlorobenzene	N	mg/kg	0.01	fg < 0.01	< 0.01	fg < 0.01	fg < 0.01	fg < 0.01
1,4-Dichlorobenzene	N	mg/kg	0.01	fg < 0.01	< 0.01	fg < 0.01	fg < 0.01	fg < 0.01
Benzyl Alcohol	N	mg/kg	0.01	fg < 0.01	< 0.01	fg < 0.01	fg < 0.01	fg < 0.01
1,2-Dichlorobenzene	N	mg/kg	0.01	fg < 0.01	< 0.01	fg < 0.01	fg < 0.01	fg < 0.01
2-Methylphenol	N	mg/kg	0.01	fg < 0.01	< 0.01	fg < 0.01	fg < 0.01	fg < 0.01
Bis(2-chloroisopropyl)ether	N	mg/kg	0.01	fg < 0.01	< 0.01	fg < 0.01	fg < 0.01	fg < 0.01
3 and 4-methylphenol	N	mg/kg	0.01	fg 0.01	< 0.01	fg < 0.01	fg < 0.01	fg < 0.01
N-Nitrosodi-n-propylamine	N	mg/kg	0.01	fg < 0.01	< 0.01	fg < 0.01	fg < 0.01	fg < 0.01
Hexachloroethane	N	mg/kg	0.01	fg < 0.01	< 0.01	fg < 0.01	fg < 0.01	fg < 0.01
Nitrobenzene	N	mg/kg	0.01	fg < 0.01	< 0.01	fg < 0.01	fg < 0.01	fg < 0.01
Isophorone	N	mg/kg	0.01	fg < 0.01	< 0.01	fg < 0.01	fg < 0.01	fg < 0.01
2-Nitrophenol	N	mg/kg	0.01	fg < 0.01	< 0.01	fg < 0.01	fg < 0.01	fg < 0.01
2,4-Dimethylphenol	N	mg/kg	0.01	fg 0.03	< 0.01	fg < 0.01	fg < 0.01	fg < 0.01
Bis(2-chloroethoxy)methane	N	mg/kg	0.01	fg < 0.01	< 0.01	fg < 0.01	fg < 0.01	fg < 0.01
2,4-Dichlorophenol	N	mg/kg	0.01	fg < 0.01	< 0.01	fg < 0.01	fg < 0.01	fg < 0.01
1,3,5-Trichlorobenzene	N	mg/kg	0.01	fg < 0.01	< 0.01	fg < 0.01	fg < 0.01	fg < 0.01
Naphthalene	N	mg/kg	0.01	fg 0.09	0.02	fg 0.02	fg 0.02	fg 0.01
3-Chloroaniline	N	mg/kg	0.01	fg < 0.01	< 0.01	fg < 0.01	fg < 0.01	fg < 0.01
Hexachloro-1,3-butadiene	N	mg/kg	0.01	fg < 0.01	< 0.01	fg < 0.01	fg < 0.01	fg < 0.01
4-Chloro-3-methylphenol	N	mg/kg	0.01	fg < 0.01	< 0.01	fg < 0.01	fg < 0.01	fg < 0.01
2-Methylnaphthalene	N	mg/kg	0.01	fg 0.06	0.02	fg < 0.01	fg < 0.01	fg 0.01
1-Methylnaphthalene	N	mg/kg	0.01	fg 0.05	0.01	fg 0.01	fg 0.01	fg < 0.01
Hexachlorocyclopentadiene	N	mg/kg	0.01	fg < 0.01	< 0.01	fg < 0.01	fg < 0.01	fg < 0.01
2,4,6-Trichlorophenol	N	mg/kg	0.01	fg < 0.01	< 0.01	fg < 0.01	fg < 0.01	fg < 0.01
2,4,5-Trichlorophenol	N	mg/kg	0.01	fg < 0.01	< 0.01	fg < 0.01	fg < 0.01	fg < 0.01
1-Chloronaphthalene	N	mg/kg	0.01	fg < 0.01	< 0.01	fg < 0.01	fg < 0.01	fg < 0.01
2-Nitroaniline	N	mg/kg	0.01	fg < 0.01	< 0.01	fg < 0.01	fg < 0.01	fg < 0.01

Results Summary

Report No.: 19-21967

ELAB Reference	166546	166554	166556	166559	166562
Customer Reference					
Sample ID					
Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL
Sample Location	BH1	BH5	BH4	BH5	BH6
Sample Depth (m)	0.30	0.30	0.30	1.00	1.00
Sampling Date	11/02/2019	18/02/2019	12/02/2019	12/02/2019	12/02/2019

Determinand	Codes	Units	LOD					
SVOC								
1,4-Dinitrobenzene	N	mg/kg	0.01	fg < 0.01	< 0.01	fg < 0.01	fg < 0.01	fg < 0.01
Dimethyl phthalate	N	mg/kg	0.01	fg < 0.01	< 0.01	fg < 0.01	fg < 0.01	fg < 0.01
1-3-dinitrobenzene	N	mg/kg	0.01	fg < 0.01	< 0.01	fg < 0.01	fg < 0.01	fg < 0.01
2-6-dinitrotoluene	N	mg/kg	0.01	fg < 0.01	< 0.01	fg < 0.01	fg < 0.01	fg < 0.01
Acenaphthylene	N	mg/kg	0.01	fg 0.20	0.02	fg < 0.01	fg < 0.01	fg < 0.01
1,2-Dinitrobenzene	N	mg/kg	0.01	fg < 0.01	< 0.01	fg < 0.01	fg < 0.01	fg < 0.01
3-Nitroaniline	N	mg/kg	0.01	fg < 0.01	< 0.01	fg < 0.01	fg < 0.01	fg < 0.01
Acenaphthene	N	mg/kg	0.01	fg 0.65	< 0.01	fg < 0.01	fg < 0.01	fg < 0.01
4-nitrophenol	N	mg/kg	0.01	fg < 0.01	< 0.01	fg < 0.01	fg < 0.01	fg < 0.01
Dibenzofuran	N	mg/kg	0.01	fg 0.12	< 0.01	fg < 0.01	fg < 0.01	fg < 0.01
2,3,5,6-Tetrachlorophenol	N	mg/kg	0.01	fg < 0.01	< 0.01	fg < 0.01	fg < 0.01	fg < 0.01
2,3,4,6-Tetrachlorophenol	N	mg/kg	0.01	fg < 0.01	< 0.01	fg < 0.01	fg < 0.01	fg < 0.01
Diethyl phthalate	N	mg/kg	0.01	fg < 0.01	< 0.01	fg < 0.01	fg < 0.01	fg < 0.01
1-chloro-4-phenoxybenzene	N	mg/kg	0.01	fg < 0.01	< 0.01	fg < 0.01	fg < 0.01	fg < 0.01
Fluorene	N	mg/kg	0.01	fg 0.25	< 0.01	fg < 0.01	fg < 0.01	fg < 0.01
4-Nitroaniline	N	mg/kg	0.01	fg < 0.01	< 0.01	fg < 0.01	fg < 0.01	fg < 0.01
Dinitro-o-cresol	N	mg/kg	0.01	fg < 0.01	< 0.01	fg < 0.01	fg < 0.01	fg < 0.01
Diphenylamine	N	mg/kg	0.01	fg < 0.01	< 0.01	fg < 0.01	fg < 0.01	fg < 0.01
Azobenzene	N	mg/kg	0.01	fg < 0.01	< 0.01	fg < 0.01	fg < 0.01	fg < 0.01
1-bromo-4-phenoxybenzene	N	mg/kg	0.01	fg < 0.01	< 0.01	fg < 0.01	fg < 0.01	fg < 0.01
Hexachlorobenzene	N	mg/kg	0.01	fg < 0.01	< 0.01	fg < 0.01	fg < 0.01	fg < 0.01
Pentachlorophenol	N	mg/kg	0.01	fg < 0.01	0.03	fg < 0.01	fg < 0.01	fg 0.02
Phenanthrene	N	mg/kg	0.01	fg 1.37	0.03	fg < 0.01	fg < 0.01	fg < 0.01
Anthracene	N	mg/kg	0.01	fg 0.69	0.02	fg < 0.01	fg < 0.01	fg < 0.01
Carbazole	N	mg/kg	0.01	fg 0.15	< 0.01	fg < 0.01	fg < 0.01	fg < 0.01
Dibutyl phthalate	N	mg/kg	0.01	fg < 0.01	< 0.01	fg < 0.01	fg < 0.01	fg < 0.01
Fluoranthene	N	mg/kg	0.01	fg 14.1	0.17	fg < 0.01	fg < 0.01	fg < 0.01
Pyrene	N	mg/kg	0.01	fg 16.1	0.19	fg < 0.01	fg < 0.01	fg < 0.01
Butyl benzyl phthalate	N	mg/kg	0.01	fg < 0.01	< 0.01	fg < 0.01	fg < 0.01	fg < 0.01
Bis-2-ethylhexyladipate	N	mg/kg	0.01	fg < 0.01	< 0.01	fg < 0.01	fg < 0.01	fg < 0.01
Butyl benzyl phthalate	N	mg/kg	0.01	fg < 0.01	< 0.01	fg < 0.01	fg < 0.01	fg < 0.01
Benzo(a)anthracene	N	mg/kg	0.01	fg 6.68	0.15	fg < 0.01	fg < 0.01	fg < 0.01
Chrysene	N	mg/kg	0.01	fg 8.17	0.14	fg < 0.01	fg < 0.01	fg < 0.01
Bis(2-ethylhexyl)phthalate	N	mg/kg	0.01	fg < 0.01	< 0.01	fg < 0.01	fg < 0.01	fg < 0.01
Benzo(b)fluoranthene	N	mg/kg	0.01	fg 8.42	0.21	fg < 0.01	fg < 0.01	fg < 0.01
Benzo(k)fluoranthene	N	mg/kg	0.01	fg 7.14	0.18	fg < 0.01	fg < 0.01	fg < 0.01
Benzo(a)pyrene	N	mg/kg	0.01	fg 9.18	0.20	fg < 0.01	fg < 0.01	fg < 0.01
Indeno(1,2,3-cd)pyrene	N	mg/kg	0.01	fg 5.20	0.11	fg < 0.01	fg < 0.01	fg < 0.01
Dibenz(ah)anthracene	N	mg/kg	0.01	fg 2.43	0.05	fg < 0.01	fg < 0.01	fg < 0.01
Benzo[g,h,i]perylene	N	mg/kg	0.01	fg 6.28	0.13	fg < 0.01	fg < 0.01	fg < 0.01

Results Summary

Report No.: 19-21967

WAC Analysis

Elab Ref:	166550					Landfill Waste Acceptance Criteria Limits*		
Sample Date:	18/02/2019					Inert Waste Landfill	Stable Non-reactive Hazardous waste in non-hazardous Landfill	Hazardous Waste Landfill
Sample ID:	HD02							
Depth (m)	1.2							
Site:	Oaks Road, Wrexham							
Determinand		Code	Units					
Total Organic Carbon		N	%		0.39	3	5	6
Loss on Ignition		M	%		3.2	--	--	10
Total BTEX		M	mg/kg		< 0.01	6	--	--
Total PCBs (7 congeners)		M	mg/kg		< 0.03	1	--	--
TPH Total WAC		M	mg/kg		< 5	500	--	--
Total (of 17) PAHs		N	mg/kg		< 2	100	--	--
pH		M			8.2	--	>6	--
Acid Neutralisation Capacity		N	mol/kg		< 0.1	--	To evaluate	To evaluate

Eluate Analysis

		10:1	10:1	Limit values for compliance leaching test using BS EN 12457-2 at L/S 10 l/kg		
		mg/l	mg/kg			
Arsenic	N	< 0.005	< 0.05	0.5	2	25
Barium	N	0.024	0.24	20	100	300
Cadmium	N	< 0.001	< 0.01	0.04	1	5
Chromium	N	0.007	0.07	0.5	10	70
Copper	N	< 0.005	< 0.05	2	50	100
Mercury	N	< 0.005	< 0.01	0.01	0.2	2
Molybdenum	N	< 0.005	< 0.05	0.5	10	30
Nickel	N	< 0.001	< 0.05	0.4	10	40
Lead	N	< 0.001	< 0.05	0.5	10	50
Antimony	N	< 0.005	< 0.05	0.06	0.7	5
Selenium	N	< 0.005	< 0.05	0.1	0.5	7
Zinc	N	0.007	0.07	4	50	200
Chloride	N	< 5	< 50	800	15000	25000
Fluoride	N	< 5	< 10	10	150	500
Sulphate	N	6	60.60	1000	20000	50000
Total Dissolved Solids	N	97	973.00	4000	60000	100000
Phenol Index	N	< 0.01	< 0.10	1	-	-
Dissolved Organic Carbon	N	13.700	137.00	500	800	1000

Leach Test Information

pH	N	7.9				
Conductivity (uS/cm)	N	145				
Dry mass of test portion (g)		103.000				
Dry Matter (%)		85				
Moisture (%)		18				
Eluent Volume (ml)		979				

Results are expressed on a dry weight basis, after correction for moisture content where applicable

* Stated limits are for guidance only, and not for conformity assessment.

Results Summary

Report No.: 19-21967

WAC Analysis

Elab Ref:	166549					Landfill Waste Acceptance Criteria Limits*		
Sample Date:	18/02/2019					Inert Waste Landfill	Stable Non-reactive Hazardous waste in non-hazardous Landfill	Hazardous Waste Landfill
Sample ID:	HD02							
Depth (m)	0.5							
Site:	Oaks Road, Wrexham							
Determinand		Code	Units					
Total Organic Carbon		N	%		2.40	3	5	6
Loss on Ignition		M	%		4.5	--	--	10
Total BTEX		M	mg/kg		< 0.01	6	--	--
Total PCBs (7 congeners)		M	mg/kg		< 0.03	1	--	--
TPH Total WAC		M	mg/kg		11	500	--	--
Total (of 17) PAHs		N	mg/kg		7.0	100	--	--
pH		M			8.2	--	>6	--
Acid Neutralisation Capacity		N	mol/kg		< 0.1	--	To evaluate	To evaluate

Eluate Analysis

			10:1	10:1	Limit values for compliance leaching test using BS EN 12457-2 at L/S 10 l/kg		
			mg/l	mg/kg			
Arsenic		N	0.007	0.07	0.5	2	25
Barium		N	0.012	0.12	20	100	300
Cadmium		N	< 0.001	< 0.01	0.04	1	5
Chromium		N	0.006	0.06	0.5	10	70
Copper		N	0.006	0.06	2	50	100
Mercury		N	< 0.005	< 0.01	0.01	0.2	2
Molybdenum		N	< 0.005	< 0.05	0.5	10	30
Nickel		N	< 0.001	< 0.05	0.4	10	40
Lead		N	< 0.001	< 0.05	0.5	10	50
Antimony		N	< 0.005	< 0.05	0.06	0.7	5
Selenium		N	< 0.005	< 0.05	0.1	0.5	7
Zinc		N	0.006	0.06	4	50	200
Chloride		N	< 5	< 50	800	15000	25000
Fluoride		N	< 5	< 10	10	150	500
Sulphate		N	3	30.20	1000	20000	50000
Total Dissolved Solids		N	59	592.00	4000	60000	100000
Phenol Index		N	< 0.01	< 0.10	1	-	-
Dissolved Organic Carbon		N	14.000	140.00	500	800	1000

Leach Test Information

pH		N	8.1				
Conductivity (uS/cm)		N	88				
Dry mass of test portion (g)			103.000				
Dry Matter (%)			85				
Moisture (%)			17				
Eluent Volume (ml)			979				

Results are expressed on a dry weight basis, after correction for moisture content where applicable

* Stated limits are for guidance only, and not for conformity assessment.

Results Summary

Report No.: 19-21967

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WAC Analysis

Elab Ref:	166548					Landfill Waste Acceptance Criteria Limits*		
Sample Date:	18/02/2019					Inert Waste Landfill	Stable Non-reactive Hazardous waste in non-hazardous Landfill	Hazardous Waste Landfill
Sample ID:	HD01							
Depth (m)	0.3							
Site:	Oaks Road, Wrexham							
Determinand		Code	Units					
Total Organic Carbon		N	%		0.60	3	5	6
Loss on Ignition		M	%		3.3	--	--	10
Total BTEX		M	mg/kg		< 0.01	6	--	--
Total PCBs (7 congeners)		M	mg/kg		< 0.03	1	--	--
TPH Total WAC		M	mg/kg		< 5	500	--	--
Total (of 17) PAHs		N	mg/kg		< 2	100	--	--
pH		M			10.1	--	>6	--
Acid Neutralisation Capacity		N	mol/kg		< 0.1	--	To evaluate	To evaluate

Eluate Analysis

			10:1	10:1	Limit values for compliance leaching test using BS EN 12457-2 at L/S 10 l/kg		
			mg/l	mg/kg			
Arsenic		N	0.008	0.08	0.5	2	25
Barium		N	0.013	0.13	20	100	300
Cadmium		N	< 0.001	< 0.01	0.04	1	5
Chromium		N	0.006	0.06	0.5	10	70
Copper		N	0.012	0.12	2	50	100
Mercury		N	< 0.005	< 0.01	0.01	0.2	2
Molybdenum		N	0.008	0.08	0.5	10	30
Nickel		N	0.002	< 0.05	0.4	10	40
Lead		N	< 0.001	< 0.05	0.5	10	50
Antimony		N	0.020	0.20	0.06	0.7	5
Selenium		N	< 0.005	< 0.05	0.1	0.5	7
Zinc		N	0.005	0.05	4	50	200
Chloride		N	< 5	< 50	800	15000	25000
Fluoride		N	< 5	< 10	10	150	500
Sulphate		N	24	236.00	1000	20000	50000
Total Dissolved Solids		N	109	1090.00	4000	60000	100000
Phenol Index		N	< 0.01	< 0.10	1	-	-
Dissolved Organic Carbon		N	19.100	191.00	500	800	1000

Leach Test Information

pH		N	9.0				
Conductivity (uS/cm)		N	163				
Dry mass of test portion (g)			101.000				
Dry Matter (%)			81				
Moisture (%)			24				
Eluent Volume (ml)			956				

Results are expressed on a dry weight basis, after correction for moisture content where applicable

* Stated limits are for guidance only, and not for conformity assessment.

Results Summary

Report No.: 19-21967

WAC Analysis

Elab Ref:	166513					Landfill Waste Acceptance Criteria Limits*		
Sample Date:	13/02/2019					Inert Waste Landfill	Stable Non-reactive Hazardous waste in non-hazardous Landfill	Hazardous Waste Landfill
Sample ID:	TP06							
Depth (m)	0.6							
Site:	Oaks Road, Wrexham							
Determinand		Code	Units					
Total Organic Carbon		N	%		1.90	3	5	6
Loss on Ignition		M	%		1.8	--	--	10
Total BTEX		M	mg/kg		< 0.01	6	--	--
Total PCBs (7 congeners)		M	mg/kg		< 0.03	1	--	--
TPH Total WAC		M	mg/kg		< 5	500	--	--
Total (of 17) PAHs		N	mg/kg		< 2	100	--	--
pH		M			7.9	--	>6	--
Acid Neutralisation Capacity		N	mol/kg		< 0.1	--	To evaluate	To evaluate

Eluate Analysis

			10:1	10:1	Limit values for compliance leaching test using BS EN 12457-2 at L/S 10 l/kg		
			mg/l	mg/kg			
Arsenic		N	< 0.005	< 0.05	0.5	2	25
Barium		N	0.009	0.09	20	100	300
Cadmium		N	< 0.001	< 0.01	0.04	1	5
Chromium		N	0.008	0.08	0.5	10	70
Copper		N	< 0.005	< 0.05	2	50	100
Mercury		N	< 0.005	< 0.01	0.01	0.2	2
Molybdenum		N	< 0.005	< 0.05	0.5	10	30
Nickel		N	0.001	< 0.05	0.4	10	40
Lead		N	< 0.001	< 0.05	0.5	10	50
Antimony		N	< 0.005	< 0.05	0.06	0.7	5
Selenium		N	< 0.005	< 0.05	0.1	0.5	7
Zinc		N	0.007	0.07	4	50	200
Chloride		N	< 5	< 50	800	15000	25000
Fluoride		N	< 5	< 10	10	150	500
Sulphate		N	2	23.10	1000	20000	50000
Total Dissolved Solids		N	74	736.00	4000	60000	100000
Phenol Index		N	< 0.01	< 0.10	1	-	-
Dissolved Organic Carbon		N	13.200	132.00	500	800	1000

Leach Test Information

pH		N	7.2				
Conductivity (uS/cm)		N	110				
Dry mass of test portion (g)			101.000				
Dry Matter (%)			89				
Moisture (%)			13				
Eluent Volume (ml)			968				

Results are expressed on a dry weight basis, after correction for moisture content where applicable

* Stated limits are for guidance only, and not for conformity assessment.

Results Summary

Report No.: 19-21967

Asbestos Results

Analytical result only applies to the sample as submitted by the client. Any comments, opinions or interpretations (marked #) in this report are outside UKAS accreditation (Accreditation No2683). They are subjective comments only which must be verified by the client.

Elab No	Depth (m)	Clients Reference	Description of Sample Matrix #	Asbestos Identification	Gravimetric Analysis Total (%)	Gravimetric Analysis by ACM Type (%)	Free Fibre Analysis (%)	Total Asbestos (%)
166500	0.10	TP01	Brown soil, stones	No asbestos detected	n/t	n/t	n/t	n/t
166501	0.30	TP01	Brown soil, red-shale, stones	No asbestos detected	n/t	n/t	n/t	n/t
166504	0.15	TP03	Brown soil, stones	No asbestos detected	n/t	n/t	n/t	n/t
166505	0.40	TP03	Brown soil, stones, red-shale	No asbestos detected	n/t	n/t	n/t	n/t
166507	0.80	TP04	Brown soil, stones	No asbestos detected	n/t	n/t	n/t	n/t
166510	0.10	TP05	Brown soil, slate, plant-material, stones	No asbestos detected	n/t	n/t	n/t	n/t
166511	0.60	TP05	Brown soil, red-shale, stones, clinker	No asbestos detected	n/t	n/t	n/t	n/t
166514	0.10	TP07	Brown soil, stones, red-shale, clinker	No asbestos detected	n/t	n/t	n/t	n/t
166515	0.30	TP07	Brown sandy soil, red-shale, stones	No asbestos detected	n/t	n/t	n/t	n/t
166517	0.10	WS01	Brown soil, stones, plant-material	No asbestos detected	n/t	n/t	n/t	n/t
166518	0.50	WS01	Brown soil, stones	No asbestos detected	n/t	n/t	n/t	n/t
166522	0.50	WS03	Brown soil	No asbestos detected	n/t	n/t	n/t	n/t
166525	0.20	WS04	Brown sandy soil, red-shale, stones	No asbestos detected	n/t	n/t	n/t	n/t
166526	0.40	WS04	Brown soil, stones, shale	No asbestos detected	n/t	n/t	n/t	n/t
166528	0.10	WS05	Brown soil, stones, plant-material	No asbestos detected	n/t	n/t	n/t	n/t
166529	0.40	WS05	Brown soil (clay)	No asbestos detected	n/t	n/t	n/t	n/t
166531	0.10	WS06	Brown soil, stones	No asbestos detected	n/t	n/t	n/t	n/t
166532	0.50	WS06	Brown soil	No asbestos detected	n/t	n/t	n/t	n/t
166534	0.20	WS07	Brown soil, red-shale, stones	No asbestos detected	n/t	n/t	n/t	n/t
166538	0.10	WS08	Brown soil, stones	No asbestos detected	n/t	n/t	n/t	n/t
166541	0.40	WS09	Brown sandy soil stones, brick, clinker, organics	No asbestos detected	n/t	n/t	n/t	n/t
166543	0.20	WS10	Brown sandy soil stones, brick, clinker, organics	No asbestos detected	n/t	n/t	n/t	n/t
166546	0.30	BH1	Brown soil stones, organics	No asbestos detected	n/t	n/t	n/t	n/t
166548	0.30	HD01	Brown sandy soil stones, concrete, clinker	Chrysotile (fibre bundle)	< 0.001	Free fibre bundle (0.0000496% Chrysotile)	< 0.001	< 0.001
166549	0.50	HD02	Brown sandy soil stones, brick, clinker, shale	No asbestos detected	n/t	n/t	n/t	n/t
166550	1.20	HD02	Brown sandy soil stones,	No asbestos detected	n/t	n/t	n/t	n/t
166551	0.70	HD03	Brown soil stones	No asbestos detected	n/t	n/t	n/t	n/t
166552	0.60	HD04	Brown sandy soil stones,	No asbestos detected	n/t	n/t	n/t	n/t
166553	0.30	HD05	Brown sandy soil stones	No asbestos detected	n/t	n/t	n/t	n/t
166554	0.30	BH5	Brown soil stones, clinker	No asbestos detected	n/t	n/t	n/t	n/t
166555	0.30	BH6	Brown sandy soil stones, concrete, brick, clinker	No asbestos detected	n/t	n/t	n/t	n/t
166556	0.30	BH4	Brown soil stones	No asbestos detected	n/t	n/t	n/t	n/t
166557	1.00	BH4	Brown soil stones, clinker	No asbestos detected	n/t	n/t	n/t	n/t
166558	2.00	BH4	Brown soil stones	No asbestos detected	n/t	n/t	n/t	n/t
166559	1.00	BH5	Brown sandy soil stones, brick, clinker	No asbestos detected	n/t	n/t	n/t	n/t
166560	2.00	BH5	Brown soil stones	No asbestos detected	n/t	n/t	n/t	n/t
166562	1.00	BH6	Brown sandy soil stones, concrete, brick	No asbestos detected	n/t	n/t	n/t	n/t
166563	1.90	BH6	Brown sandy soil stones, concrete, brick	No asbestos detected	n/t	n/t	n/t	n/t

Method Summary

Report No.: 19-21967

Parameter	Codes	Analysis Undertaken On	Date Tested	Method Number	Technique
Soil					
TOT PAH (GC-FID)	N	As submitted sample	28/02/2019		GC-FID
pH	M	Air dried sample	28/02/2019	113	Electromeric
Acid Soluble Sulphate	U	Air dried sample	28/02/2019	115	Ion Chromatography
Total Petroleum Hydrocarbons in solids	U	As submitted sample	27/02/2019	117	GC-FID
Aqua regia extractable metals	M	Air dried sample	27/02/2019	118	ICPMS
W. Sol Metals	N	Air dried sample	28/02/2019	118	ICPMS
PCB (ICES 7 congeners)	M	Air dried sample	27/02/2019	120	GC-MS
Phenols in solids	N	As submitted sample	27/02/2019	121	HPLC
Loss on ignition at 450 deg C	M	Air dried sample	01/03/2019	129	Gravimetry
PAH (GC-FID)	M	As submitted sample	27/02/2019	133	GC-FID
SVOC in solids	N	As submitted sample	27/02/2019	167	GC-MS
Water soluble anions	M	Air dried sample	27/02/2019	172	Ion Chromatography
Low range Aliphatic hydrocarbons soil	N	As submitted sample	27/02/2019	181	GC-MS
Low range Aromatic hydrocarbons soil	N	As submitted sample	27/02/2019	181	GC-MS
VOC in solids	M	As submitted sample	27/02/2019	181	GC-MS
BTEX in solids	M	As submitted sample	27/02/2019	181A	GC-MS
Total cyanide	M	As submitted sample	27/02/2019	204	Colorimetry
Total organic carbon/Total sulphur	N	Air dried sample	27/02/2019	210	IR
Aliphatic hydrocarbons in soil	N	As submitted sample	27/02/2019	214	GC-FID
Aliphatic/Aromatic hydrocarbons in soil	N	As submitted sample	01/03/2019	214	GC-FID
Aromatic hydrocarbons in soil	N	As submitted sample	27/02/2019	214	GC-FID
Total organic carbon/Total sulphur	N	Air dried sample	27/02/2019	216	IR
Basic carbon banding in soil	N	As submitted sample	27/02/2019	218	GC-FID
Diesel range organics in soil	N	As submitted sample	01/03/2019	257	GC-FID
Asbestos identification	U	Air dried sample	27/02/2019	260	Microscopy
Soil organic matter	U	Air dried sample	04/03/2019	BS1377:P3	Titrimetry
Acid neutralisation capacity	N	Air dried sample	28/02/2019	737	
Asbestos identification	U	Air dried sample	27/02/2019	PMAN	Microscopy

Leachate

Tests marked N are not UKAS accredited

Report Information

Report No.: 19-21967

Key

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

Soil sample results are expressed on an air dried basis (dried at < 30°C)

ELAB are unable to provide an interpretation or opinion on the content of this report.

The results relate only to the items tested

PCB congener results may include any coeluting PCBs

Uncertainty of measurement for the determinands tested are available upon request

Unless otherwise stated, sample information has been provided by the client

Deviation Codes

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

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

Sample Retention and Disposal

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

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

Charges may apply to extended sample storage



2683



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THE ENVIRONMENTAL LABORATORY LTD

Analytical Report Number: 19-22004

Issue: 1

Date of Issue: 05/03/2019

Contact: Jimmy Thorburn

Customer Details: TerraConsult Ltd
Bold Business Centre
Unit 20, Bold Lane
St Helens
Merseyside
WA9 4TX

Quotation No: Q18-01061

Order No: PO-004578

Customer Reference: 4292

Date Received: 27/02/2019

Date Approved: 05/03/2019

Details: Oaks Road, Wrexham

Approved by:

Mike Varley, Technical Manager

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



Sample Summary

Report No.: 19-22004

Elab No.	Client's Ref.	Date Sampled	Date Scheduled	Description	Deviations
166765	TP08 1.50	14/02/2019	27/02/2019	Silty clayey loam	fg
166766	TP09 0.20	14/02/2019	27/02/2019	Silty loam	fg
166767	BH3 0.30	13/02/2019	27/02/2019	Silty clayey loam	fg
166768	BH3 1.00	13/02/2019	27/02/2019	Silty clayey loam	fg
166769	BH3 2.00	13/02/2019	27/02/2019	Clayey loam	fg
166770	BH3 3.00	13/02/2019	27/02/2019	Clayey loam	
166771	BH2 0.20	Not Provided	27/02/2019		a
166772	BH2 1.00	Not Provided	27/02/2019		a
166773	BH2 2.00	Not Provided	27/02/2019		a

Results Summary

Report No.: 19-22004

ELAB Reference	166765	166766	166767	166768	166769	166770
Customer Reference						
Sample ID						
Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Sample Location	TP08	TP09	BH3	BH3	BH3	BH3
Sample Depth (m)	1.50	0.20	0.30	1.00	2.00	3.00
Sampling Date	14/02/2019	14/02/2019	13/02/2019	13/02/2019	13/02/2019	13/02/2019

Determinand	Codes	Units	LOD						
Metals									
Arsenic	M	mg/kg	1	14.3	10.7	16.2	14.4	13.2	13.1
Cadmium	M	mg/kg	0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Chromium	M	mg/kg	5	52.6	37.9	52.8	50.3	45.4	50.5
Copper	M	mg/kg	5	29.8	19.9	34.0	28.4	24.6	26.9
Lead	M	mg/kg	5	27.7	63.8	4010	150	32.6	27.4
Mercury	M	mg/kg	0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Nickel	M	mg/kg	5	51.6	32.2	48.4	47.9	46.9	49.2
Selenium	M	mg/kg	1	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Zinc	M	mg/kg	5	98.3	92.6	97.6	95.1	83.9	90.4
Anions									
Water Soluble Sulphate	M	g/l	0.02	0.05	< 0.02	< 0.02	0.07	0.07	0.07
Inorganics									
Total Cyanide	M	mg/kg	1	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Acid Soluble Sulphate (SO4)	U	%	0.02	0.03	0.03	0.08	0.07	0.04	n/t
Miscellaneous									
Moisture Content	N	%	0.1	19.9	21.3	17.5	18.2	15.1	17.0
pH	M	pH units	0.1	7.7	8.1	8.3	8.4	8.7	8.7
Soil Organic Matter	U	%	0.1	0.6	5.3	1.3	0.6	0.5	0.3
Stones Content	N	%	0.1	< 0.1	24.0	< 0.1	< 0.1	< 0.1	< 0.1
Total Organic Carbon	N	%	0.01	0.31	2.2	2.3	0.84	0.28	0.21
Organics									
>C8-C10 BCB	N	mg/kg	1	f < 1.0	f < 1.0	fg < 1.0	fg < 1.0	fg < 1.0	n/t
>C10-C12 BCB	N	mg/kg	1	f < 1.0	f < 1.0	fg < 1.0	fg < 1.0	fg < 1.0	n/t
>C12-C16 BCB	N	mg/kg	1	f < 1.0	f < 1.0	fg < 1.0	fg < 1.0	fg < 1.0	n/t
>C16-C21 BCB	N	mg/kg	1	f < 1.0	f < 1.0	fg < 1.0	fg < 1.0	fg < 1.0	n/t
Diesel Range Organics (>C8-C21)	N	mg/kg	1	f < 1	f < 1	fg < 1	fg < 1	fg < 1	n/t
Phenols									
Total Monohydric Phenols	N	mg/kg	5	< 5	< 5	< 5	< 5	< 5	< 5
Polyaromatic hydrocarbons									
Naphthalene	M	mg/kg	0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Acenaphthylene	M	mg/kg	0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Acenaphthene	M	mg/kg	0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Fluorene	M	mg/kg	0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Phenanthrene	M	mg/kg	0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Anthracene	M	mg/kg	0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Fluoranthene	M	mg/kg	0.1	< 0.1	0.3	0.2	< 0.1	< 0.1	< 0.1
Pyrene	M	mg/kg	0.1	< 0.1	0.3	0.2	< 0.1	< 0.1	< 0.1
Benzo(a)anthracene	M	mg/kg	0.1	< 0.1	0.2	0.1	< 0.1	< 0.1	< 0.1
Chrysene	M	mg/kg	0.1	< 0.1	0.2	0.2	< 0.1	< 0.1	< 0.1
Benzo(b)fluoranthene	M	mg/kg	0.1	< 0.1	0.2	0.2	< 0.1	< 0.1	< 0.1
Benzo(k)fluoranthene	M	mg/kg	0.1	< 0.1	0.3	0.2	< 0.1	< 0.1	< 0.1
Benzo(a)pyrene	M	mg/kg	0.1	< 0.1	0.2	0.2	< 0.1	< 0.1	< 0.1
Indeno(1,2,3-cd)pyrene	M	mg/kg	0.1	< 0.1	0.1	0.1	< 0.1	< 0.1	< 0.1
Dibenzo(a,h)anthracene	M	mg/kg	0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Benzo[g,h,i]perylene	M	mg/kg	0.1	< 0.1	0.1	< 0.1	< 0.1	< 0.1	< 0.1
Coronene	N	mg/kg	0.1	< 0.1	0.2	0.1	< 0.1	< 0.1	< 0.1
Total PAH(16)	M	mg/kg	0.4	< 0.4	2.3	1.6	< 0.4	< 0.4	< 0.4

Results Summary

Report No.: 19-22004

ELAB Reference	166765	166766	166767	166768	166769	166770
Customer Reference						
Sample ID						
Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Sample Location	TP08	TP09	BH3	BH3	BH3	BH3
Sample Depth (m)	1.50	0.20	0.30	1.00	2.00	3.00
Sampling Date	14/02/2019	14/02/2019	13/02/2019	13/02/2019	13/02/2019	13/02/2019

Determinand	Codes	Units	LOD						
BTEX									
Benzene	M	ug/kg	10	fg < 10.0	fg < 10.0	fg < 10.0	fg < 10.0	fg < 10.0	n/t
Toluene	M	ug/kg	10	fg < 10.0	fg < 10.0	fg < 10.0	fg < 10.0	fg < 10.0	n/t
Ethylbenzene	M	ug/kg	10	fg < 10.0	fg < 10.0	fg < 10.0	fg < 10.0	fg < 10.0	n/t
Xylenes	M	ug/kg	10	fg < 10.0	fg < 10.0	fg < 10.0	fg < 10.0	fg < 10.0	n/t
MTBE	N	ug/kg	10	fg < 10.0	fg < 10.0	fg < 10.0	fg < 10.0	fg < 10.0	n/t
TPH CWG									
>C5-C6 Aliphatic	N	mg/kg	0.01	f < 0.01	f < 0.01	fg < 0.01	fg < 0.01	fg < 0.01	n/t
>C6-C8 Aliphatic	N	mg/kg	0.01	f < 0.01	f < 0.01	fg < 0.01	fg < 0.01	fg < 0.01	n/t
>C8-C10 Aliphatic	N	mg/kg	1	f < 1.0	f < 1.0	fg < 1.0	fg < 1.0	fg < 1.0	n/t
>C10-C12 Aliphatic	N	mg/kg	1	f < 1.0	f < 1.0	fg < 1.0	fg < 1.0	fg < 1.0	n/t
>C12-C16 Aliphatic	N	mg/kg	1	f < 1.0	f < 1.0	fg < 1.0	fg < 1.0	fg < 1.0	n/t
>C16-C21 Aliphatic	N	mg/kg	1	f < 1.0	f < 1.0	fg < 1.0	fg < 1.0	fg < 1.0	n/t
>C21-C35 Aliphatic	N	mg/kg	1	f 6.3	f 3.8	fg 1.6	fg < 1.0	fg < 1.0	n/t
>C35-C40 Aliphatic	N	mg/kg	1	f 3.9	f 2.1	fg < 1.0	fg < 1.0	fg < 1.0	n/t
>C5-C7 Aromatic	N	mg/kg	0.01	f < 0.01	f < 0.01	fg < 0.01	fg < 0.01	fg < 0.01	n/t
>C7-C8 Aromatic	N	mg/kg	0.01	f < 0.01	f < 0.01	fg < 0.01	fg < 0.01	fg < 0.01	n/t
>C8-C10 Aromatic	N	mg/kg	1	fg < 1.0	fg < 1.0	fg < 1.0	fg < 1.0	fg < 1.0	n/t
>C10-C12 Aromatic	N	mg/kg	1	f < 1.0	f < 1.0	fg < 1.0	fg < 1.0	fg < 1.0	n/t
>C12-C16 Aromatic	N	mg/kg	1	f < 1.0	f < 1.0	fg < 1.0	fg < 1.0	fg < 1.0	n/t
>C16-C21 Aromatic	N	mg/kg	1	f < 1.0	f < 1.0	fg < 1.0	fg < 1.0	fg < 1.0	n/t
>C21-C35 Aromatic	N	mg/kg	1	f 2.2	f 4.3	fg < 1.0	fg < 1.0	fg < 1.0	n/t
>C35-C40 Aromatic	N	mg/kg	1	f < 1.0	f < 1.0	fg < 1.0	fg < 1.0	fg < 1.0	n/t
Total (>C5-C40) Ali/Aro	N	mg/kg	1	f 12.5	f 10.3	fg 1.6	fg < 1.0	fg < 1.0	n/t
Total Petroleum Hydrocarbons									
Mineral Oil	U	mg/kg	5	f < 5	f < 5	fg < 5	fg < 5	fg < 5	n/t
PCB (ICES 7 congeners)									
PCB 28	M	mg/kg	0.01	n/t	n/t	< 0.01	n/t	n/t	n/t
PCB 52	M	mg/kg	0.01	n/t	n/t	< 0.01	n/t	n/t	n/t
PCB 101	M	mg/kg	0.01	n/t	n/t	< 0.01	n/t	n/t	n/t
PCB 118	M	mg/kg	0.01	n/t	n/t	< 0.01	n/t	n/t	n/t
PCB 153	M	mg/kg	0.01	n/t	n/t	< 0.01	n/t	n/t	n/t
PCB 138	M	mg/kg	0.01	n/t	n/t	< 0.01	n/t	n/t	n/t
PCB 180	M	mg/kg	0.01	n/t	n/t	< 0.01	n/t	n/t	n/t
PCB (Total of 7 Congeners)	M	mg/kg	0.03	n/t	n/t	< 0.03	n/t	n/t	n/t

Results Summary

Report No.: 19-22004

ELAB Reference	166766	166767	166768
Customer Reference			
Sample ID			
Sample Type	SOIL	SOIL	SOIL
Sample Location	TP09	BH3	BH3
Sample Depth (m)	0.20	0.30	1.00
Sampling Date	14/02/2019	13/02/2019	13/02/2019

Determinand	Codes	Units	LOD			
VOC						
Heptane	N	ug/kg	10	< 10.0	< 10.0	< 10.0
Octane	N	ug/kg	10	< 10.0	< 10.0	< 10.0
Nonane	N	ug/kg	10	< 10.0	< 10.0	< 10.0
Benzene	M	ug/kg	10	< 10.0	< 10.0	< 10.0
Toluene	M	ug/kg	10	< 10.0	< 10.0	< 10.0
Ethylbenzene	M	ug/kg	10	< 10.0	< 10.0	< 10.0
m+p-xylene	M	ug/kg	10	< 10.0	< 10.0	< 10.0
o-xylene	M	ug/kg	10	< 10.0	< 10.0	< 10.0
cis-1,2-dichloroethene	M	ug/kg	10	< 10.0	< 10.0	< 10.0
1,1-Dichloroethane	M	ug/kg	10	< 10.0	< 10.0	< 10.0
Chloroform	M	ug/kg	10	< 10.0	< 10.0	< 10.0
Tetrachloromethane	M	ug/kg	10	< 10.0	< 10.0	< 10.0
1,1,1-Trichloroethane	M	ug/kg	10	< 10.0	< 10.0	< 10.0
Trichloroethylene	M	ug/kg	10	< 10.0	< 10.0	< 10.0
Tetrachloroethylene	M	ug/kg	10	< 10.0	< 10.0	< 10.0
1,1,1,2-Tetrachloroethane	M	ug/kg	10	< 10.0	< 10.0	< 10.0
1,1,2,2-Tetrachloroethane	M	ug/kg	10	< 10.0	< 10.0	< 10.0
Chlorobenzene	M	ug/kg	10	< 10.0	< 10.0	< 10.0
Bromobenzene	M	ug/kg	10	< 10.0	< 10.0	< 10.0
Bromodichloromethane	M	ug/kg	10	< 10.0	< 10.0	< 10.0
Methylethylbenzene	M	ug/kg	10	< 10.0	< 10.0	< 10.0
1,1-Dichloro-1-propene	M	ug/kg	10	< 10.0	< 10.0	< 10.0
Trans - 1-2 -dichloroethylene	N	ug/kg	10	< 10.0	< 10.0	< 10.0
2,2-Dichloropropane	N	ug/kg	10	< 10.0	< 10.0	< 10.0
Bromochloromethane	N	ug/kg	10	< 10.0	< 10.0	< 10.0
1,2-Dichloroethane	N	ug/kg	10	< 10.0	< 10.0	< 10.0
Dibromomethane	M	ug/kg	10	< 10.0	< 10.0	< 10.0
1,2-Dichloropropane	M	ug/kg	10	< 10.0	< 10.0	< 10.0
cis-1,3-Dichloro-1-propene	M	ug/kg	10	< 10.0	< 10.0	< 10.0
trans-1,3-Dichloro-1-propene	M	ug/kg	10	< 10.0	< 10.0	< 10.0
1,1,2-Trichloroethane	N	ug/kg	10	< 10.0	< 10.0	< 10.0
Dibromochloromethane	N	ug/kg	10	< 10.0	< 10.0	< 10.0
1,3-Dichloropropane	N	ug/kg	10	< 10.0	< 10.0	< 10.0
1,2-dibromoethane	M	ug/kg	10	< 10.0	< 10.0	< 10.0
Styrene	N	ug/kg	10	< 10.0	< 10.0	< 10.0
Propylbenzene	N	ug/kg	10	< 10.0	< 10.0	< 10.0
2-Chlorotoluene	N	ug/kg	10	< 10.0	< 10.0	< 10.0
1,2,4-Trimethylbenzene	N	ug/kg	10	< 10.0	< 10.0	< 10.0
4-Chlorotoluene	N	ug/kg	10	< 10.0	< 10.0	< 10.0
t-butylbenzene	N	ug/kg	10	< 10.0	< 10.0	< 10.0
1,3,5-Trimethylbenzene	N	ug/kg	10	< 10.0	< 10.0	< 10.0
1-methylpropylbenzene	N	ug/kg	10	< 10.0	< 10.0	< 10.0
p-cymene	N	ug/kg	10	< 10.0	< 10.0	< 10.0
1,3-Dichlorobenzene	N	ug/kg	10	< 10.0	< 10.0	< 10.0
Butylbenzene	N	ug/kg	10	< 10.0	< 10.0	< 10.0
1,2-Dibromo-3-chloropropane	N	ug/kg	10	< 10.0	< 10.0	< 10.0
Hexachlorobutadiene	N	ug/kg	10	< 10.0	< 10.0	< 10.0
1-2-3 - Trichlorobenzene	N	ug/kg	10	< 10.0	< 10.0	< 10.0
Naphthalene	N	ug/kg	10	< 10.0	< 10.0	< 10.0
1-2-4 - Trichlorobenzene	N	ug/kg	10	< 10.0	< 10.0	< 10.0
1,4-Dichlorobenzene	N	ug/kg	10	< 10.0	< 10.0	< 10.0
1,2-Dichlorobenzene	N	ug/kg	10	< 10.0	< 10.0	< 10.0
Bromoform	N	ug/kg	10	< 10.0	< 10.0	< 10.0

Results Summary

Report No.: 19-22004

ELAB Reference	166766	166767
Customer Reference		
Sample ID		
Sample Type	SOIL	SOIL
Sample Location	TP09	BH3
Sample Depth (m)	0.20	0.30
Sampling Date	14/02/2019	13/02/2019

Determinand	Codes	Units	LOD		
SVOC					
Phenol	N	mg/kg	0.01	f < 0.01	fg < 0.01
Aniline	N	mg/kg	0.01	f < 0.01	fg < 0.01
Bis(2-chloroethyl)ether	N	mg/kg	0.01	f < 0.01	fg < 0.01
2-Chlorophenol	N	mg/kg	0.01	f < 0.01	fg < 0.01
1,3-Dichlorobenzene	N	mg/kg	0.01	f < 0.01	fg < 0.01
1,4-Dichlorobenzene	N	mg/kg	0.01	f < 0.01	fg < 0.01
Benzyl Alcohol	N	mg/kg	0.01	f < 0.01	fg < 0.01
1,2-Dichlorobenzene	N	mg/kg	0.01	f < 0.01	fg < 0.01
2-Methylphenol	N	mg/kg	0.01	f < 0.01	fg < 0.01
Bis(2-chloroisopropyl)ether	N	mg/kg	0.01	f < 0.01	fg < 0.01
3 and 4-methylphenol	N	mg/kg	0.01	f < 0.01	fg < 0.01
N-Nitrosodi-n-propylamine	N	mg/kg	0.01	f < 0.01	fg < 0.01
Hexachloroethane	N	mg/kg	0.01	f < 0.01	fg < 0.01
Nitrobenzene	N	mg/kg	0.01	f < 0.01	fg < 0.01
Isophorone	N	mg/kg	0.01	f < 0.01	fg < 0.01
2-Nitrophenol	N	mg/kg	0.01	f < 0.01	fg < 0.01
2,4-Dimethylphenol	N	mg/kg	0.01	f < 0.01	fg < 0.01
Bis(2-chloroethoxy)methane	N	mg/kg	0.01	f < 0.01	fg < 0.01
2,4-Dichlorophenol	N	mg/kg	0.01	f < 0.01	fg < 0.01
1,3,5-Trichlorobenzene	N	mg/kg	0.01	f < 0.01	fg < 0.01
Naphthalene	N	mg/kg	0.01	f 0.02	fg 0.02
3-Chloroaniline	N	mg/kg	0.01	f < 0.01	fg < 0.01
Hexachloro-1,3-butadiene	N	mg/kg	0.01	f < 0.01	fg < 0.01
4-Chloro-3-methylphenol	N	mg/kg	0.01	f < 0.01	fg < 0.01
2-Methylnaphthalene	N	mg/kg	0.01	f 0.01	fg 0.02
1-Methylnaphthalene	N	mg/kg	0.01	f < 0.01	fg 0.02
Hexachlorocyclopentadiene	N	mg/kg	0.01	f < 0.01	fg < 0.01
2,4,6-Trichlorophenol	N	mg/kg	0.01	f < 0.01	fg < 0.01
2,4,5-Trichlorophenol	N	mg/kg	0.01	f < 0.01	fg < 0.01
1-Chloronaphthalene	N	mg/kg	0.01	f < 0.01	fg < 0.01
2-Nitroaniline	N	mg/kg	0.01	f < 0.01	fg < 0.01
1,4-Dinitrobenzene	N	mg/kg	0.01	f < 0.01	fg < 0.01
Dimethyl phthalate	N	mg/kg	0.01	f < 0.01	fg < 0.01
1-3-dinitrobenzene	N	mg/kg	0.01	f < 0.01	fg < 0.01
2-6-dinitrotoluene	N	mg/kg	0.01	f < 0.01	fg < 0.01
Acenaphthylene	N	mg/kg	0.01	f 0.02	fg 0.01
1,2-Dinitrobenzene	N	mg/kg	0.01	f < 0.01	fg < 0.01
3-Nitroaniline	N	mg/kg	0.01	f < 0.01	fg < 0.01
Acenaphthene	N	mg/kg	0.01	f < 0.01	fg < 0.01
4-nitrophenol	N	mg/kg	0.01	f < 0.01	fg < 0.01
Dibenzofuran	N	mg/kg	0.01	f < 0.01	fg < 0.01
2,3,5,6-Tetrachlorophenol	N	mg/kg	0.01	f < 0.01	fg < 0.01
2,3,4,6-Tetrachlorophenol	N	mg/kg	0.01	f < 0.01	fg < 0.01
Diethyl phthalate	N	mg/kg	0.01	f < 0.01	fg < 0.01
1-chloro-4-phenoxybenzene	N	mg/kg	0.01	f < 0.01	fg < 0.01
Fluorene	N	mg/kg	0.01	f < 0.01	fg < 0.01
4-Nitroaniline	N	mg/kg	0.01	f < 0.01	fg < 0.01
Dinitro-o-cresol	N	mg/kg	0.01	f < 0.01	fg < 0.01
Diphenylamine	N	mg/kg	0.01	f < 0.01	fg < 0.01
Azobenzene	N	mg/kg	0.01	f < 0.01	fg < 0.01
1-bromo-4-phenoxybenzene	N	mg/kg	0.01	f < 0.01	fg < 0.01
Hexachlorobenzene	N	mg/kg	0.01	f < 0.01	fg < 0.01
Pentachlorophenol	N	mg/kg	0.01	f < 0.01	fg < 0.01

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Results Summary

Report No.: 19-22004

ELAB Reference	166766	166767
Customer Reference		
Sample ID		
Sample Type	SOIL	SOIL
Sample Location	TP09	BH3
Sample Depth (m)	0.20	0.30
Sampling Date	14/02/2019	13/02/2019

Determinand	Codes	Units	LOD		
SVOC					
Phenanthrene	N	mg/kg	0.01	f 0.03	fg 0.09
Anthracene	N	mg/kg	0.01	f 0.01	fg 0.03
Carbazole	N	mg/kg	0.01	f < 0.01	fg 0.01
Dibutyl phthalate	N	mg/kg	0.01	f < 0.01	fg < 0.01
Fluoranthene	N	mg/kg	0.01	f 0.13	fg 0.19
Pyrene	N	mg/kg	0.01	f 0.14	fg 0.17
Butyl benzyl phthalate	N	mg/kg	0.01	f < 0.01	fg < 0.01
Bis-2-ethylhexyladipate	N	mg/kg	0.01	f < 0.01	fg < 0.01
Butyl benzyl phthalate	N	mg/kg	0.01	f < 0.01	fg < 0.01
Benzo(a)anthracene	N	mg/kg	0.01	f 0.11	fg 0.12
Chrysene	N	mg/kg	0.01	f 0.13	fg 0.13
Bis(2-ethylhexyl)phthalate	N	mg/kg	0.01	f < 0.01	fg < 0.01
Benzo(b)fluoranthene	N	mg/kg	0.01	f 0.07	fg 0.09
Benzo(k)fluoranthene	N	mg/kg	0.01	f 0.14	fg 0.12
Benzo(a)pyrene	N	mg/kg	0.01	f 0.12	fg 0.11
Indeno(1,2,3-cd)pyrene	N	mg/kg	0.01	f 0.07	fg 0.07
Dibenz(ah)anthracene	N	mg/kg	0.01	f 0.04	fg 0.03
Benzo[g,h,i]perylene	N	mg/kg	0.01	f 0.10	fg 0.09



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Results Summary
Report No.: 19-22004

Asbestos Results

Analytical result only applies to the sample as submitted by the client. Any comments, opinions or interpretations (marked #)
in this report are outside UKAS accreditation (Accreditation No2683). They are subjective comments only which must be verified by the client.

Elab No	Depth (m)	Clients Reference	Description of Sample Matrix #	Asbestos Identification	Gravimetric Analysis Total (%)	Gravimetric Analysis by ACM Type (%)	Free Fibre Analysis (%)	Total Asbestos (%)
166765	1.50	TP08	Brown soil	No asbestos detected	n/t	n/t	n/t	n/t
166766	0.20	TP09	Brown soil, stones	No asbestos detected	n/t	n/t	n/t	n/t
166767	0.30	BH3	Brown soil, stones, clinker	No asbestos detected	n/t	n/t	n/t	n/t
166768	1.00	BH3	Brown soil, stones	No asbestos detected	n/t	n/t	n/t	n/t
166769	2.00	BH3	Brown soil, stones	No asbestos detected	n/t	n/t	n/t	n/t
166770	3.00	BH3	Brown soil	No asbestos detected	n/t	n/t	n/t	n/t

Method Summary

Report No.: 19-22004

Parameter	Codes	Analysis Undertaken On	Date Tested	Method Number	Technique
Soil					
pH	M	Air dried sample	01/03/2019	113	Electromeric
Acid Soluble Sulphate	U	Air dried sample	01/03/2019	115	Ion Chromatography
Total Petroleum Hydrocarbons in solids	U	As submitted sample	28/02/2019	117	GC-FID
Aqua regia extractable metals	M	Air dried sample	28/02/2019	118	ICPMS
PCB (ICES 7 congeners)	M	Air dried sample	28/02/2019	120	GC-MS
Phenols in solids	N	As submitted sample	28/02/2019	121	HPLC
PAH (GC-FID)	M	As submitted sample	28/02/2019	133	GC-FID
SVOC in solids	N	As submitted sample	28/02/2019	167	GC-MS
Water soluble anions	M	Air dried sample	28/02/2019	172	Ion Chromatography
Low range Aliphatic hydrocarbons soil	N	As submitted sample	05/03/2019	181	GC-MS
Low range Aromatic hydrocarbons soil	N	As submitted sample	05/03/2019	181	GC-MS
VOC in solids	M	As submitted sample	05/03/2019	181	GC-MS
BTEX in solids	M	As submitted sample	05/03/2019	181A	GC-MS
Total cyanide	M	As submitted sample	28/02/2019	204	Colorimetry
Total organic carbon/Total sulphur	N	Air dried sample	01/03/2019	210	IR
Aliphatic hydrocarbons in soil	N	As submitted sample	28/02/2019	214	GC-FID
Aliphatic/Aromatic hydrocarbons in soil	N	As submitted sample	05/03/2019	214	GC-FID
Aromatic hydrocarbons in soil	N	As submitted sample	28/02/2019	214	GC-FID
Basic carbon banding in soil	N	As submitted sample	28/02/2019	218	GC-FID
Diesel range organics in soil	N	As submitted sample	04/03/2019	257	GC-FID
Soil organic matter	U	Air dried sample	28/02/2019	BS1377:P3	Titrimetry
Asbestos identification	U	Air dried sample	28/02/2019	PMAN	Microscopy

Tests marked N are not UKAS accredited

Report Information

Report No.: 19-22004

Key

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

Soil sample results are expressed on an air dried basis (dried at < 30°C)

ELAB are unable to provide an interpretation or opinion on the content of this report.

The results relate only to the items tested

PCB congener results may include any coeluting PCBs

Uncertainty of measurement for the determinands tested are available upon request

Unless otherwise stated, sample information has been provided by the client

Deviation Codes

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

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

Sample Retention and Disposal

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

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

Charges may apply to extended sample storage

**Dominic Kennedy**

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Analytical Report Number : 19-32156

Replaces Analytical Report Number : 19-32156, issue no. 1

Project / Site name:	The Oaks	Samples received on:	08/03/2019
Your job number:	4292	Samples instructed on:	08/03/2019
Your order number:	PO-004650	Analysis completed by:	18/03/2019
Report Issue Number:	2	Report issued on:	18/03/2019
Samples Analysed:	9 water samples		

Signed:

Rexona Rahman
Head of Customer Services
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.



Analytical Report Number: 19-32156

Project / Site name: The Oaks

Your Order No: PO-004650

Lab Sample Number	1172900	1172901	1172902	1172903	1172904
Sample Reference	BH1D	BH6AD	BH7D	WS2	WS4
Sample Number	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Date Sampled	07/03/2019	07/03/2019	07/03/2019	07/03/2019	07/03/2019
Time Taken	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Water Analysis)	Units	Limit of detection	Accreditation Status		

General Inorganics

pH	pH Units	N/A	ISO 17025	7.1	7.3	7.1	7.1	7.4
Electrical Conductivity at 20 °C	µS/cm	10	ISO 17025	6500	3300	5600	1300	1400
Total Cyanide	µg/l	10	ISO 17025	< 10	< 10	< 10	< 10	< 10
Sulphate as SO ₄	µg/l	45	ISO 17025	3740000	2320000	3260000	285000	1160000
Sulphate as SO ₄	mg/l	0.045	ISO 17025	3740	2320	3260	285	1160
Chloride	mg/l	0.15	ISO 17025	770	230	510	48	170
Ammonium as NH ₄	µg/l	15	ISO 17025	1300	430	1400	730	300
Nitrate as N	mg/l	0.01	ISO 17025	1.15	1.24	1.29	0.81	0.85
Nitrate as NO ₃	mg/l	0.05	ISO 17025	5.11	5.48	5.70	3.60	3.76
Alkalinity	mgCaCO ₃ /l	3	ISO 17025	690	850	490	650	530
Hardness - Total	mgCaCO ₃ /l	1	ISO 17025	4290	1410	3080	522	1020

Total Phenols

Total Phenols (monohydric)	µg/l	10	ISO 17025	< 10	< 10	< 10	< 10	< 10
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Speciated PAHs

Naphthalene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Acenaphthylene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Acenaphthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Fluorene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Phenanthrene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Anthracene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Fluoranthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Pyrene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Benzo(a)anthracene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Chrysene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Benzo(b)fluoranthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Benzo(k)fluoranthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Benzo(a)pyrene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Indeno(1,2,3-cd)pyrene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Dibenz(a,h)anthracene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Benzo(ghi)perylene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01

Total PAH

Total EPA-16 PAHs	µg/l	0.16	ISO 17025	< 0.16	< 0.16	< 0.16	< 0.16	< 0.16
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Analytical Report Number: 19-32156

Project / Site name: The Oaks

Your Order No: PO-004650

Lab Sample Number	1172900	1172901	1172902	1172903	1172904
Sample Reference	BH1D	BH6AD	BH7D	WS2	WS4
Sample Number	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Date Sampled	07/03/2019	07/03/2019	07/03/2019	07/03/2019	07/03/2019
Time Taken	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Water Analysis)	Units	Limit of detection	Accreditation Status		

Heavy Metals / Metalloids

Arsenic (dissolved)	µg/l	1	ISO 17025	2.5	4.3	3.3	5.8	1.5
Boron (dissolved)	µg/l	10	ISO 17025	430	330	430	55	180
Cadmium (dissolved)	µg/l	0.08	ISO 17025	< 0.08	< 0.08	< 0.08	< 0.08	< 0.08
Calcium (dissolved)	mg/l	0.012	ISO 17025	720	140	570	120	86
Chromium (dissolved)	µg/l	0.4	ISO 17025	0.7	< 0.4	0.6	8.8	< 0.4
Copper (dissolved)	µg/l	0.7	ISO 17025	5.5	5.0	3.1	6.6	< 0.7
Lead (dissolved)	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	1.7	1.5
Magnesium (dissolved)	mg/l	0.005	ISO 17025	610	260	400	54	200
Mercury (dissolved)	µg/l	0.5	ISO 17025	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Nickel (dissolved)	µg/l	0.3	ISO 17025	11	3.5	8.3	3.9	2.7
Selenium (dissolved)	µg/l	4	ISO 17025	< 4.0	< 4.0	< 4.0	22	< 4.0
Zinc (dissolved)	µg/l	0.4	ISO 17025	87	14	74	16	1.4

Monoaromatics & Oxygenates

Benzene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Toluene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	30.2
Ethylbenzene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
p & m-xylene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
o-xylene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
MTBE (Methyl Tertiary Butyl Ether)	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0

Petroleum Hydrocarbons

TPH1 (C10 - C40)	µg/l	10	NONE	< 10	< 10	< 10	< 10	< 10
TPH-CWG - Aliphatic >C5 - C6	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
TPH-CWG - Aliphatic >C6 - C8	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
TPH-CWG - Aliphatic >C8 - C10	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
TPH-CWG - Aliphatic >C10 - C12	µg/l	10	NONE	< 10	< 10	< 10	< 10	< 10
TPH-CWG - Aliphatic >C12 - C16	µg/l	10	NONE	< 10	< 10	< 10	< 10	< 10
TPH-CWG - Aliphatic >C16 - C21	µg/l	10	NONE	< 10	< 10	< 10	< 10	< 10
TPH-CWG - Aliphatic >C21 - C35	µg/l	10	NONE	< 10	< 10	< 10	< 10	< 10
TPH-CWG - Aliphatic (C5 - C35)	µg/l	10	NONE	< 10	< 10	< 10	< 10	< 10
TPH-CWG - Aromatic >C5 - C7	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
TPH-CWG - Aromatic >C7 - C8	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	30
TPH-CWG - Aromatic >C8 - C10	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
TPH-CWG - Aromatic >C10 - C12	µg/l	10	NONE	< 10	< 10	< 10	< 10	< 10
TPH-CWG - Aromatic >C12 - C16	µg/l	10	NONE	< 10	< 10	< 10	< 10	< 10
TPH-CWG - Aromatic >C16 - C21	µg/l	10	NONE	< 10	< 10	< 10	< 10	< 10
TPH-CWG - Aromatic >C21 - C35	µg/l	10	NONE	< 10	< 10	< 10	< 10	< 10
TPH-CWG - Aromatic (C5 - C35)	µg/l	10	NONE	< 10	< 10	< 10	< 10	30



Analytical Report Number: 19-32156

Project / Site name: The Oaks

Your Order No: PO-004650

Lab Sample Number				1172900	1172901	1172902	1172903	1172904
Sample Reference				BH1D	BH6AD	BH7D	WS2	WS4
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Date Sampled				07/03/2019	07/03/2019	07/03/2019	07/03/2019	07/03/2019
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Water Analysis)	Units	Limit of detection	Accreditation Status					

VOCs

Chloromethane	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Chloroethane	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Bromomethane	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Vinyl Chloride	µg/l	1	NONE	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Trichlorofluoromethane	µg/l	1	NONE	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,1-Dichloroethene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,1,2-Trichloro-1,2,2-trifluoroethane	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Cis-1,2-dichloroethene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
MTBE (Methyl Tertiary Butyl Ether)	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,1-Dichloroethane	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
2,2-Dichloropropane	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Trichloromethane	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,1,1-Trichloroethane	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2-Dichloroethane	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,1-Dichloropropene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Trans-1,2-dichloroethene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Benzene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Tetrachloromethane	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2-Dichloropropane	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Trichloroethene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Dibromomethane	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Bromodichloromethane	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Cis-1,3-dichloropropene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Trans-1,3-dichloropropene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Toluene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	30.2
1,1,2-Trichloroethane	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,3-Dichloropropane	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Dibromochloromethane	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Tetrachloroethene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2-Dibromoethane	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Chlorobenzene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,1,1,2-Tetrachloroethane	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Ethylbenzene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
p & m-Xylene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Styrene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Tribromomethane	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
o-Xylene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,1,1,2-Tetrachloroethane	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Isopropylbenzene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Bromobenzene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
n-Propylbenzene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
2-Chlorotoluene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
4-Chlorotoluene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,3,5-Trimethylbenzene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
tert-Butylbenzene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2,4-Trimethylbenzene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
sec-Butylbenzene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,3-Dichlorobenzene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
p-Isopropyltoluene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2-Dichlorobenzene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,4-Dichlorobenzene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Butylbenzene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2-Dibromo-3-chloropropane	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2,4-Trichlorobenzene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Hexachlorobutadiene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2,3-Trichlorobenzene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0



Analytical Report Number: 19-32156

Project / Site name: The Oaks

Your Order No: PO-004650

Lab Sample Number	1172900	1172901	1172902	1172903	1172904
Sample Reference	BH1D	BH6AD	BH7D	WS2	WS4
Sample Number	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Date Sampled	07/03/2019	07/03/2019	07/03/2019	07/03/2019	07/03/2019
Time Taken	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Water Analysis)	Units	Limit of detection	Accreditation Status		

SVOCs

Aniline	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Phenol	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
2-Chlorophenol	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Bis(2-chloroethyl)ether	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
1,3-Dichlorobenzene	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
1,2-Dichlorobenzene	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
1,4-Dichlorobenzene	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Bis(2-chloroisopropyl)ether	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
2-Methylphenol	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Hexachloroethane	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Nitrobenzene	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
4-Methylphenol	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Isophorone	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
2-Nitrophenol	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
2,4-Dimethylphenol	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Bis(2-chloroethoxy)methane	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
1,2,4-Trichlorobenzene	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Naphthalene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
2,4-Dichlorophenol	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
4-Chloroaniline	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Hexachlorobutadiene	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
4-Chloro-3-methylphenol	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
2,4,6-Trichlorophenol	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
2,4,5-Trichlorophenol	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
2-Methylnaphthalene	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
2-Chloronaphthalene	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Dimethylphthalate	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
2,6-Dinitrotoluene	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Acenaphthylene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Acenaphthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
2,4-Dinitrotoluene	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Dibenzofuran	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
4-Chlorophenyl phenyl ether	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Diethyl phthalate	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
4-Nitroaniline	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Fluorene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Azobenzene	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Bromophenyl phenyl ether	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Hexachlorobenzene	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Phenanthrene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Anthracene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Carbazole	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Dibutyl phthalate	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Anthraquinone	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Fluoranthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Pyrene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Butyl benzyl phthalate	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Benzo(a)anthracene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Chrysene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Benzo(b)fluoranthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Benzo(k)fluoranthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Benzo(a)pyrene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Indeno(1,2,3-cd)pyrene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Dibenz(a,h)anthracene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Benzo(ghi)perylene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01

U/S = Unsuitable Sample I/S = Insufficient Sample



Analytical Report Number: 19-32156

Project / Site name: The Oaks

Your Order No: PO-004650

Lab Sample Number	1172905	1172906	1172907	1172908	
Sample Reference	WS5	WS7	WS9	WS10	
Sample Number	None Supplied	None Supplied	None Supplied	None Supplied	
Depth (m)	None Supplied	None Supplied	None Supplied	None Supplied	
Date Sampled	07/03/2019	07/03/2019	07/03/2019	07/03/2019	
Time Taken	None Supplied	None Supplied	None Supplied	None Supplied	
Analytical Parameter (Water Analysis)	Units	Limit of detection	Accreditation Status		

General Inorganics

pH	pH Units	N/A	ISO 17025	7.3	7.2	7.2	7.3	
Electrical Conductivity at 20 °C	µS/cm	10	ISO 17025	1900	6400	770	1300	
Total Cyanide	µg/l	10	ISO 17025	< 10	< 10	< 10	< 10	
Sulphate as SO ₄	µg/l	45	ISO 17025	784000	133000	119000	107000	
Sulphate as SO ₄	mg/l	0.045	ISO 17025	784	133	119	107	
Chloride	mg/l	0.15	ISO 17025	110	620	12	210	
Ammonium as NH ₄	µg/l	15	ISO 17025	400	< 15	320	200	
Nitrate as N	mg/l	0.01	ISO 17025	0.83	0.72	0.79	0.97	
Nitrate as NO ₃	mg/l	0.05	ISO 17025	3.66	3.17	3.49	4.30	
Alkalinity	mgCaCO ₃ /l	3	ISO 17025	220	820	280	490	
Hardness - Total	mgCaCO ₃ /l	1	ISO 17025	775	376	327	476	

Total Phenols

Total Phenols (monohydric)	µg/l	10	ISO 17025	< 10	< 10	< 10	< 10	
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Speciated PAHs

Naphthalene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	
Acenaphthylene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	
Acenaphthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	
Fluorene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	
Phenanthrene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	
Anthracene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	
Fluoranthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	
Pyrene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	
Benzo(a)anthracene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	
Chrysene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	
Benzo(b)fluoranthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	
Benzo(k)fluoranthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	
Benzo(a)pyrene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	
Indeno(1,2,3-cd)pyrene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	
Dibenz(a,h)anthracene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	
Benzo(ghi)perylene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	

Total PAH

Total EPA-16 PAHs	µg/l	0.16	ISO 17025	< 0.16	< 0.16	< 0.16	< 0.16	
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Analytical Report Number: 19-32156

Project / Site name: The Oaks

Your Order No: PO-004650

Lab Sample Number	1172905	1172906	1172907	1172908	
Sample Reference	WS5	WS7	WS9	WS10	
Sample Number	None Supplied	None Supplied	None Supplied	None Supplied	
Depth (m)	None Supplied	None Supplied	None Supplied	None Supplied	
Date Sampled	07/03/2019	07/03/2019	07/03/2019	07/03/2019	
Time Taken	None Supplied	None Supplied	None Supplied	None Supplied	
Analytical Parameter (Water Analysis)	Units	Limit of detection	Accreditation Status		

Heavy Metals / Metalloids

Arsenic (dissolved)	µg/l	1	ISO 17025	3.4	5.3	< 1.0	2.3	
Boron (dissolved)	µg/l	10	ISO 17025	150	41	36	95	
Cadmium (dissolved)	µg/l	0.08	ISO 17025	< 0.08	< 0.08	< 0.08	< 0.08	
Calcium (dissolved)	mg/l	0.012	ISO 17025	96	99	96	97	
Chromium (dissolved)	µg/l	0.4	ISO 17025	< 0.4	< 0.4	< 0.4	< 0.4	
Copper (dissolved)	µg/l	0.7	ISO 17025	1.2	1.0	1.4	4.2	
Lead (dissolved)	µg/l	1	ISO 17025	1.7	2.8	10	1.4	
Magnesium (dissolved)	mg/l	0.005	ISO 17025	130	31	21	57	
Mercury (dissolved)	µg/l	0.5	ISO 17025	< 0.5	< 0.5	< 0.5	< 0.5	
Nickel (dissolved)	µg/l	0.3	ISO 17025	3.3	2.1	11	1.8	
Selenium (dissolved)	µg/l	4	ISO 17025	< 4.0	< 4.0	< 4.0	< 4.0	
Zinc (dissolved)	µg/l	0.4	ISO 17025	4.5	12	14	5.5	

Monoaromatics & Oxygenates

Benzene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	
Toluene	µg/l	1	ISO 17025	12.9	< 1.0	8.8	< 1.0	
Ethylbenzene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	
p & m-xylene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	
o-xylene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	
MTBE (Methyl Tertiary Butyl Ether)	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	

Petroleum Hydrocarbons

TPH1 (C10 - C40)	µg/l	10	NONE	< 10	< 10	< 10	< 10	
TPH-CWG - Aliphatic >C5 - C6	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	
TPH-CWG - Aliphatic >C6 - C8	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	
TPH-CWG - Aliphatic >C8 - C10	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	
TPH-CWG - Aliphatic >C10 - C12	µg/l	10	NONE	< 10	< 10	< 10	< 10	
TPH-CWG - Aliphatic >C12 - C16	µg/l	10	NONE	< 10	< 10	< 10	< 10	
TPH-CWG - Aliphatic >C16 - C21	µg/l	10	NONE	< 10	< 10	< 10	< 10	
TPH-CWG - Aliphatic >C21 - C35	µg/l	10	NONE	< 10	< 10	< 10	< 10	
TPH-CWG - Aliphatic (C5 - C35)	µg/l	10	NONE	< 10	< 10	< 10	< 10	
TPH-CWG - Aromatic >C5 - C7	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	
TPH-CWG - Aromatic >C7 - C8	µg/l	1	ISO 17025	13	< 1.0	8.8	< 1.0	
TPH-CWG - Aromatic >C8 - C10	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	
TPH-CWG - Aromatic >C10 - C12	µg/l	10	NONE	< 10	< 10	< 10	< 10	
TPH-CWG - Aromatic >C12 - C16	µg/l	10	NONE	< 10	< 10	< 10	< 10	
TPH-CWG - Aromatic >C16 - C21	µg/l	10	NONE	< 10	< 10	< 10	< 10	
TPH-CWG - Aromatic >C21 - C35	µg/l	10	NONE	< 10	< 10	< 10	< 10	
TPH-CWG - Aromatic (C5 - C35)	µg/l	10	NONE	13	< 10	< 10	< 10	



Analytical Report Number: 19-32156

Project / Site name: The Oaks

Your Order No: PO-004650

Lab Sample Number	1172905	1172906	1172907	1172908	
Sample Reference	WS5	WS7	WS9	WS10	
Sample Number	None Supplied	None Supplied	None Supplied	None Supplied	
Depth (m)	None Supplied	None Supplied	None Supplied	None Supplied	
Date Sampled	07/03/2019	07/03/2019	07/03/2019	07/03/2019	
Time Taken	None Supplied	None Supplied	None Supplied	None Supplied	
Analytical Parameter (Water Analysis)	Units	Limit of detection	Accreditation Status		

VOCs

Chloromethane	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	
Chloroethane	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	
Bromomethane	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	
Vinyl Chloride	µg/l	1	NONE	< 1.0	< 1.0	< 1.0	< 1.0	
Trichlorofluoromethane	µg/l	1	NONE	< 1.0	< 1.0	< 1.0	< 1.0	
1,1-Dichloroethene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	
1,1,2-Trichloro-1,2,2-trifluoroethane	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	
Cis-1,2-dichloroethene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	
MTBE (Methyl Tertiary Butyl Ether)	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	
1,1-Dichloroethane	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	
2,2-Dichloropropane	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	
Trichloromethane	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	
1,1,1-Trichloroethane	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	
1,2-Dichloroethane	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	
1,1-Dichloropropene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	
Trans-1,2-dichloroethene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	
Benzene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	
Tetrachloromethane	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	
1,2-Dichloropropane	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	
Trichloroethene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	
Dibromomethane	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	
Bromodichloromethane	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	
Cis-1,3-dichloropropene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	
Trans-1,3-dichloropropene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	
Toluene	µg/l	1	ISO 17025	12.9	< 1.0	8.8	< 1.0	
1,1,2-Trichloroethane	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	
1,3-Dichloropropane	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	
Dibromochloromethane	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	
Tetrachloroethene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	
1,2-Dibromoethane	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	
Chlorobenzene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	
1,1,1,2-Tetrachloroethane	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	
Ethylbenzene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	
p & m-Xylene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	
Styrene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	
Tribromomethane	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	
o-Xylene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	
1,1,2,2-Tetrachloroethane	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	
Isopropylbenzene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	
Bromobenzene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	
n-Propylbenzene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	
2-Chlorotoluene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	
4-Chlorotoluene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	
1,3,5-Trimethylbenzene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	
tert-Butylbenzene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	
1,2,4-Trimethylbenzene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	
sec-Butylbenzene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	
1,3-Dichlorobenzene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	
p-Isopropyltoluene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	
1,2-Dichlorobenzene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	
1,4-Dichlorobenzene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	
Butylbenzene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	
1,2-Dibromo-3-chloropropane	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	
1,2,4-Trichlorobenzene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	
Hexachlorobutadiene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	
1,2,3-Trichlorobenzene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	



Analytical Report Number: 19-32156

Project / Site name: The Oaks

Your Order No: PO-004650

Lab Sample Number	1172905	1172906	1172907	1172908	
Sample Reference	WS5	WS7	WS9	WS10	
Sample Number	None Supplied	None Supplied	None Supplied	None Supplied	
Depth (m)	None Supplied	None Supplied	None Supplied	None Supplied	
Date Sampled	07/03/2019	07/03/2019	07/03/2019	07/03/2019	
Time Taken	None Supplied	None Supplied	None Supplied	None Supplied	
Analytical Parameter (Water Analysis)	Units	Limit of detection	Accreditation Status		

SVOCs

Aniline	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05	
Phenol	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05	
2-Chlorophenol	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05	
Bis(2-chloroethyl)ether	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05	
1,3-Dichlorobenzene	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05	
1,2-Dichlorobenzene	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05	
1,4-Dichlorobenzene	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05	
Bis(2-chloroisopropyl)ether	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05	
2-Methylphenol	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05	
Hexachloroethane	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05	
Nitrobenzene	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05	
4-Methylphenol	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05	
Isophorone	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05	
2-Nitrophenol	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05	
2,4-Dimethylphenol	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05	
Bis(2-chloroethoxy)methane	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05	
1,2,4-Trichlorobenzene	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05	
Naphthalene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	
2,4-Dichlorophenol	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05	
4-Chloroaniline	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05	
Hexachlorobutadiene	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05	
4-Chloro-3-methylphenol	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05	
2,4,6-Trichlorophenol	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05	
2,4,5-Trichlorophenol	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05	
2-Methylnaphthalene	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05	
2-Chloronaphthalene	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05	
Dimethylphthalate	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05	
2,6-Dinitrotoluene	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05	
Acenaphthylene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	
Acenaphthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	
2,4-Dinitrotoluene	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05	
Dibenzofuran	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05	
4-Chlorophenyl phenyl ether	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05	
Diethyl phthalate	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05	
4-Nitroaniline	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05	
Fluorene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	
Azobenzene	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05	
Bromophenyl phenyl ether	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05	
Hexachlorobenzene	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05	
Phenanthrene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	
Anthracene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	
Carbazole	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05	
Dibutyl phthalate	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05	
Anthraquinone	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05	
Fluoranthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	
Pyrene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	
Butyl benzyl phthalate	µg/l	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05	
Benzo(a)anthracene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	
Chrysene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	
Benzo(b)fluoranthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	
Benzo(k)fluoranthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	
Benzo(a)pyrene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	
Indeno(1,2,3-cd)pyrene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	
Dibenz(a,h)anthracene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	
Benzo(ghi)perylene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01	

U/S = Unsuitable Sample I/S = Insufficient Sample



Analytical Report Number : 19-32156

Project / Site name: The Oaks

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
Alkalinity in Water (by discrete analyser)	Determination of Alkalinity by discrete analyser (colorimetry). Accredited matrices: SW, PW, GW.	In house method based on MEWAM & USEPA Method 310.2.	L082-PL	W	ISO 17025
Ammonium as NH ₄ in water	Determination of Ammonium/Ammonia/Ammoniacal Nitrogen by the colorimetric salicylate/nitroprusside method. Accredited matrices SW, GW, PW.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L082-PL	W	ISO 17025
Boron in water	Determination of boron in water by acidification followed by ICP-OES. Accredited matrices: SW PW GW	In-house method based on MEWAM	L039-PL	W	ISO 17025
BTEX and MTBE in water (Monoaromatics)	Determination of BTEX and MTBE in water by headspace GC-MS. Accredited matrices: SW PW GW	In-house method based on USEPA8260	L073B-PL	W	ISO 17025
Chloride in water	Determination of Chloride colorimetrically by discrete analyser.	In house based on MEWAM Method ISBN 0117516260. Accredited matrices: SW, PW, GW.	L082-PL	W	ISO 17025
Electrical conductivity at 20oC of water	Determination of electrical conductivity in water by electrometric measurement. Accredited Matrices SW, GW, PW	In-house method	L031-PL	W	ISO 17025
Metals in water by ICP-OES (dissolved)	Determination of metals in water by acidification followed by ICP-OES. Accredited Matrices SW, GW, PW, PrW.(Al, Cu,Fe,Zn).	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.	L039-PL	W	ISO 17025
Monohydric phenols in water	Determination of phenols in water by continuous flow analyser. Accredited matrices: SW PW GW	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (skalar)	L080-PL	W	ISO 17025
Nitrate as N in water	Determination of nitrate by reaction with sodium salicylate and colorimetry. Accredited matrices SW, GW, PW.	In-house method based on Examination of Water and Wastewater & Polish Standard Method PN-82/C-04579.08,	L078-PL	W	ISO 17025
Nitrate in water	Determination of nitrate by reaction with sodium salicylate and colorimetry. Accredited matrices SW, GW, PW	In-house method based on Examination of Water and Wastewater & Polish Standard Method PN-82/C-04579.08,	L078-PL	W	ISO 17025
pH at 20oC in water (automated)	Determination of pH in water by electrometric measurement. Accredited matrices: SW PW GW	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L099-PL	W	ISO 17025
Semi-volatile organic compounds in water	Determination of semi-volatile organic compounds in leachate by extraction in dichloromethane followed by GC-MS.	In-house method based on USEPA 8270	L102B-PL	W	NONE
Speciated EPA-16 PAHs in water	Determination of PAH compounds in water by extraction in dichloromethane followed by GC-MS with the use of surrogate and internal standards. Accredited matrices: SW PW GW	In-house method based on USEPA 8270	L102B-PL	W	ISO 17025
Sulphate in water	Determination of sulphate in water by acidification followed by ICP-OES. Accredited matrices: SW PW GW, PrW.	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.	L039-PL	W	ISO 17025
Total cyanide in water	Determination of total cyanide by distillation followed by colorimetry. Accredited matrices: SW PW GW	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (Skalar)	L080-PL	W	ISO 17025
Total Hardness of water	Determination of hardness in waters by calculation from calcium and magnesium. Accredited Matrices SW, GW, PW.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L045-PL	W	ISO 17025
TPH1 (Waters)	Determination of dichloromethane extractable hydrocarbons in water by GC-MS.	In-house method	L070-PL	W	NONE

Iss No 19-32156-2 The Oaks 4292

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

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Analytical Report Number : 19-32156

Project / Site name: The Oaks

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
TPHCWG (Waters)	Determination of dichloromethane extractable hydrocarbons in water by GC-MS, speciation by interpretation.	In-house method	L070-PL	W	NONE
Volatile organic compounds in water	Determination of volatile organic compounds in water by headspace GC-MS. Accredited matrices: SW PW GW	In-house method based on USEPA8260	L073B-PL	W	ISO 17025

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 ID	Other_ID	Sample Type	Job	Sample Number	Sample Deviation Code	test_name	test_ref	Test Deviation code
BH1D		W	19-32156	1172900	c	Ammoniacal Nitrogen as N in water	L082-PL	c
BH1D		W	19-32156	1172900	c	Ammonium as NH4 in water	L082-PL	c
BH1D		W	19-32156	1172900	c	Electrical conductivity at 20oC of water	L031-PL	c
BH1D		W	19-32156	1172900	c	pH at 20oC in water (automated)	L099-PL	c
BH6AD		W	19-32156	1172901	c	Ammoniacal Nitrogen as N in water	L082-PL	c
BH6AD		W	19-32156	1172901	c	Ammonium as NH4 in water	L082-PL	c
BH6AD		W	19-32156	1172901	c	Electrical conductivity at 20oC of water	L031-PL	c
BH6AD		W	19-32156	1172901	c	pH at 20oC in water (automated)	L099-PL	c
BH7D		W	19-32156	1172902	c	Ammoniacal Nitrogen as N in water	L082-PL	c
BH7D		W	19-32156	1172902	c	Ammonium as NH4 in water	L082-PL	c
BH7D		W	19-32156	1172902	c	Electrical conductivity at 20oC of water	L031-PL	c
BH7D		W	19-32156	1172902	c	pH at 20oC in water (automated)	L099-PL	c
WS10		W	19-32156	1172908	c	Ammoniacal Nitrogen as N in water	L082-PL	c
WS10		W	19-32156	1172908	c	Ammonium as NH4 in water	L082-PL	c
WS10		W	19-32156	1172908	c	Electrical conductivity at 20oC of water	L031-PL	c
WS10		W	19-32156	1172908	c	pH at 20oC in water (automated)	L099-PL	c
WS2		W	19-32156	1172903	c	Ammoniacal Nitrogen as N in water	L082-PL	c
WS2		W	19-32156	1172903	c	Ammonium as NH4 in water	L082-PL	c
WS2		W	19-32156	1172903	c	Electrical conductivity at 20oC of water	L031-PL	c
WS2		W	19-32156	1172903	c	pH at 20oC in water (automated)	L099-PL	c
WS4		W	19-32156	1172904	c	Ammoniacal Nitrogen as N in water	L082-PL	c
WS4		W	19-32156	1172904	c	Ammonium as NH4 in water	L082-PL	c
WS4		W	19-32156	1172904	c	Electrical conductivity at 20oC of water	L031-PL	c
WS4		W	19-32156	1172904	c	pH at 20oC in water (automated)	L099-PL	c
WS5		W	19-32156	1172905	c	Ammoniacal Nitrogen as N in water	L082-PL	c
WS5		W	19-32156	1172905	c	Ammonium as NH4 in water	L082-PL	c
WS5		W	19-32156	1172905	c	Electrical conductivity at 20oC of water	L031-PL	c
WS5		W	19-32156	1172905	c	pH at 20oC in water (automated)	L099-PL	c
WS7		W	19-32156	1172906	c	Ammoniacal Nitrogen as N in water	L082-PL	c
WS7		W	19-32156	1172906	c	Ammonium as NH4 in water	L082-PL	c
WS7		W	19-32156	1172906	c	Electrical conductivity at 20oC of water	L031-PL	c
WS7		W	19-32156	1172906	c	pH at 20oC in water (automated)	L099-PL	c
WS9		W	19-32156	1172907	c	Ammoniacal Nitrogen as N in water	L082-PL	c
WS9		W	19-32156	1172907	c	Ammonium as NH4 in water	L082-PL	c
WS9		W	19-32156	1172907	c	Electrical conductivity at 20oC of water	L031-PL	c
WS9		W	19-32156	1172907	c	pH at 20oC in water (automated)	L099-PL	c

APPENDIX H

Laboratory Geotechnical Test Results



LABORATORY REPORT



4043

Contract Number: PSL19/1289

Report Date: 11 March 2019

Client's Reference:

Client Name: TerraConsult
Bold Business Centre
Bold Lane
Sutton
St Helens
WA9 4TX

For the attention of: Jimmy Thorburn

Contract Title: Oaks Road, Wrexham Industrial Estate

Date Received: 25/2/2019

Date Commenced: 25/2/2019

Date Completed: 11/3/2019

Notes: Opinions and Interpretations are outside the UKAS Accreditation

A copy of the Laboratory Schedule of accredited tests as issued by UKAS is attached to this report. This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced other than in full, without the prior written approval of the laboratory.

Checked and Approved Signatories:

R Gunson
(Director)

L Knight
(Senior Technician)

A Watkins
(Director)

S Eyre
(Senior Technician)

R Berriman
(Quality Manager)

S Royle
(Laboratory Manager)

5 – 7 Hexthorpe Road, Hexthorpe,
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Page 1 of

SUMMARY OF LABORATORY SOIL DESCRIPTIONS

Hole Number	Sample Number	Sample Type	Top Depth m	Base Depth m	Description of Sample
BH01	6	D	1.70		Brown slightly gravelly sandy CLAY.
BH01	10	U	3.00		Very stiff brown slightly gravelly sandy CLAY.
BH01	13	D	4.00		Brown slightly gravelly sandy CLAY.
BH01	20	U	8.00		Very stiff brown slightly gravelly sandy CLAY.
BH02	5	U	1.20		Stiff brown mottled grey sandy CLAY.
BH02	9	D	2.00		Brown sandy CLAY.
BH02	13	D	3.80		Brown sandy CLAY.
BH02	15	U	5.00		Stiff brown sandy CLAY.
BH02	20	U	8.00		Firm brown slightly gravelly sandy CLAY.
BH02	24	D	10.50		Brown slightly gravelly sandy CLAY.
BH02	29	D	13.50		Brown slightly gravelly sandy CLAY.
BH03	5	U	1.20		Stiff brown slightly sandy CLAY.
BH03	12	U	3.00		Stiff brown sandy CLAY.
BH03	17	U	5.00		Very stiff brown sandy CLAY.
BH03	21	D	7.50		Brown slightly gravelly slightly sandy CLAY.
BH03	27	U	11.00		Stiff brown slightly gravelly slightly sandy CLAY.
BH04	5	U	1.20		Stiff brown slightly gravelly sandy CLAY.
BH04	9	D	2.00		Brown slightly gravelly sandy CLAY.
BH04	16	U	5.00		Stiff brown slightly gravelly sandy CLAY.



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Contract No:

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4292

SUMMARY OF LABORATORY SOIL DESCRIPTIONS

Hole Number	Sample Number	Sample Type	Top Depth m	Base Depth m	Description of Sample
BH04	22	D	8.50		Brown slightly gravelly sandy CLAY.
BH04	26	U	11.00		Stiff brown slightly gravelly sandy CLAY.
BH04	32	D	14.50		Brown slightly gravelly sandy CLAY.
BH05	5	U	1.20		Firm brown slightly gravelly sandy CLAY.
BH05	8	D	2.00		Brown slightly gravelly sandy CLAY.
BH05	10	U	3.00		Firm brown slightly gravelly sandy CLAY.
BH05	15	U	5.00		Brown slightly gravelly sandy CLAY.
BH05	20	U	8.00		Firm brown sandy CLAY.
BH05	27	D	12.00		Brown sandy CLAY.
BH05	31	D	14.50		Brown very sandy CLAY.
BH06A	2	U	3.00		Firm brown mottled grey sandy CLAY.
BH06A	7	U	5.00		Brown sandy CLAY.
BH06A	12	U	8.00		Stiff brown sandy CLAY.
BH06A	14	D	9.00		Brown sandy CLAY.
BH06A	21	D	13.50		Brown sandy CLAY.
BH07	6	D	1.70		Brown slightly gravelly sandy CLAY.
BH07	10	U	3.00		Stiff brown slightly gravelly sandy CLAY.
BH07	15	U	5.00		Stiff brown slightly gravelly sandy CLAY.
BH07	20	U	8.00		Brown slightly gravelly sandy CLAY.



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SUMMARY OF LABORATORY SOIL DESCRIPTIONS

[illegible]

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Contract No:

PSL19/1289

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4292

SUMMARY OF SOIL CLASSIFICATION TESTS

(BS1377 : PART 2 : 1990)

Hole Number	Sample Number	Sample Type	Top Depth m	Base Depth m	Moisture Content % Clause 3.2	Linear Shrinkage % Clause 6.5	Particle Density Mg/m ³ Clause 8.2	Liquid Limit % Clause 4.3/4	Plastic Limit % Clause 5.3	Plasticity Index % Clause 5.4	Passing .425mm %	Remarks
BH01	6	D	1.70		20							
BH01	10	U	3.00		20			48	23	25	95	Intermediate plasticity CI.
BH01	13	D	4.00		23							
BH02	5	U	1.20		22			51	24	27	100	High plasticity CH.
BH02	9	D	2.00		25							
BH02	13	D	3.80		21							
BH02	15	U	5.00		22			45	22	23	100	Intermediate plasticity CI.
BH02	24	D	10.50		25							
BH02	29	D	13.50		24							
BH03	5	U	1.20		25			56	25	31	100	High plasticity CH.
BH03	12	U	3.00		20			46	22	24	100	Intermediate plasticity CI.
BH03	21	D	7.50		27							
BH04	5	U	1.20		22			47	23	24	98	Intermediate plasticity CI.
BH04	9	D	2.00		22							
BH04	16	U	5.00		24			49	24	25	97	Intermediate plasticity CI.
BH04	22	D	8.50		23							
BH04	32	D	14.50		24							
BH05	8	D	2.00		24							
BH05	10	U	3.00		23			48	22	26	95	Intermediate plasticity CI.

SYMBOLS : NP : Non Plastic

* : Liquid Limit and Plastic Limit Wet Sieved.



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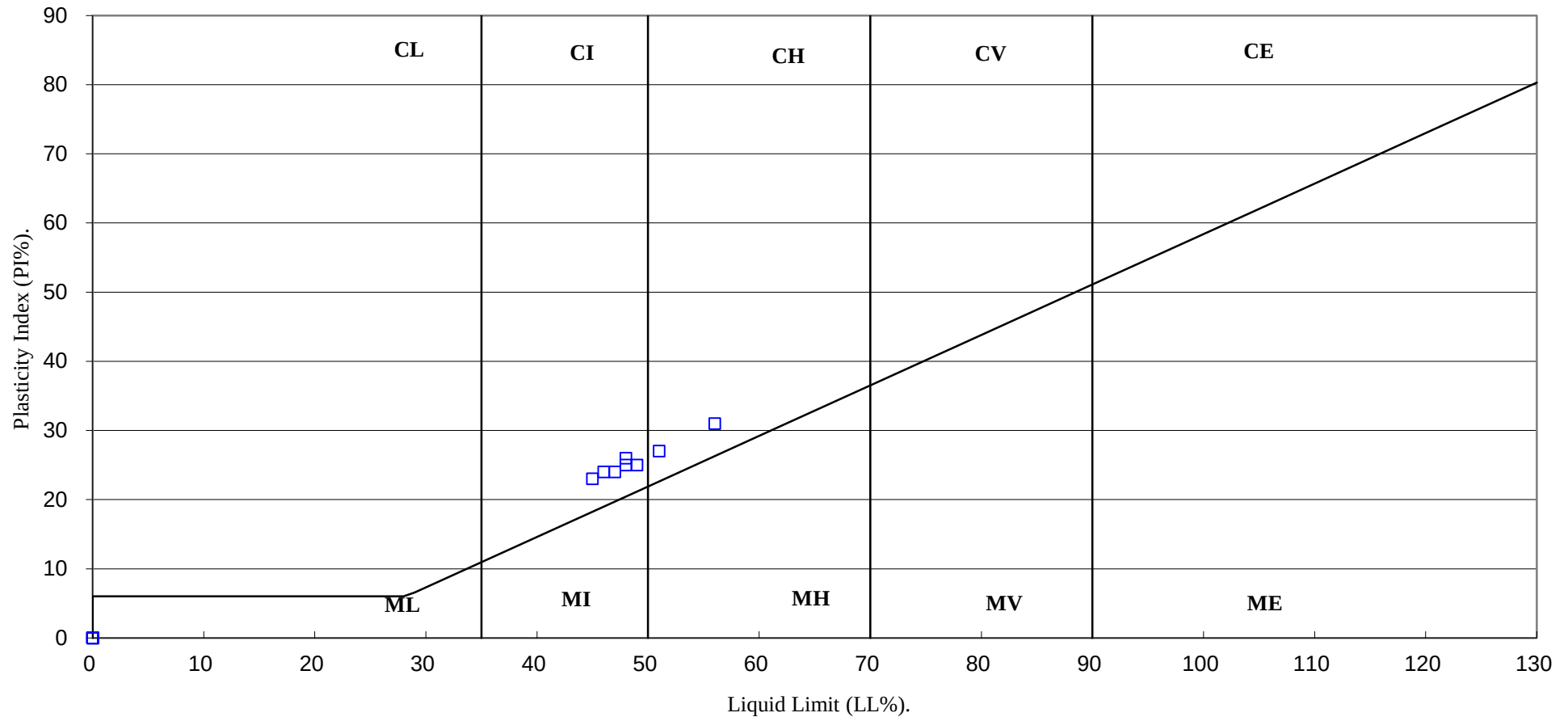
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PLASTICITY CHART FOR CASAGRANDE CLASSIFICATION.



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Contract No:

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Client Ref:

4292

SUMMARY OF SOIL CLASSIFICATION TESTS

(BS1377 : PART 2 : 1990)

Hole Number	Sample Number	Sample Type	Top Depth m	Base Depth m	Moisture Content % Clause 3.2	Linear Shrinkage % Clause 6.5	Particle Density Mg/m ³ Clause 8.2	Liquid Limit % Clause 4.3/4	Plastic Limit % Clause 5.3	Plasticity Index % Clause 5.4	Passing .425mm %	Remarks
BH05	15	U	5.00		23			48	22	26	98	Intermediate plasticity CI.
BH05	27	D	12.00		21							
BH05	31	D	14.50		16							
BH06A	2	U	3.00		24			47	23	24	100	Intermediate plasticity CI.
BH06A	7	U	5.00		25			48	23	25	100	Intermediate plasticity CI.
BH06A	14	D	9.00		25							
BH06A	21	D	13.50		22							
BH07	6	D	1.70		23							
BH07	20	U	8.00		21			45	22	23	97	Intermediate plasticity CI.
BH07	29	D	13.50		26							

SYMBOLS : NP : Non Plastic

* : Liquid Limit and Plastic Limit Wet Sieved.



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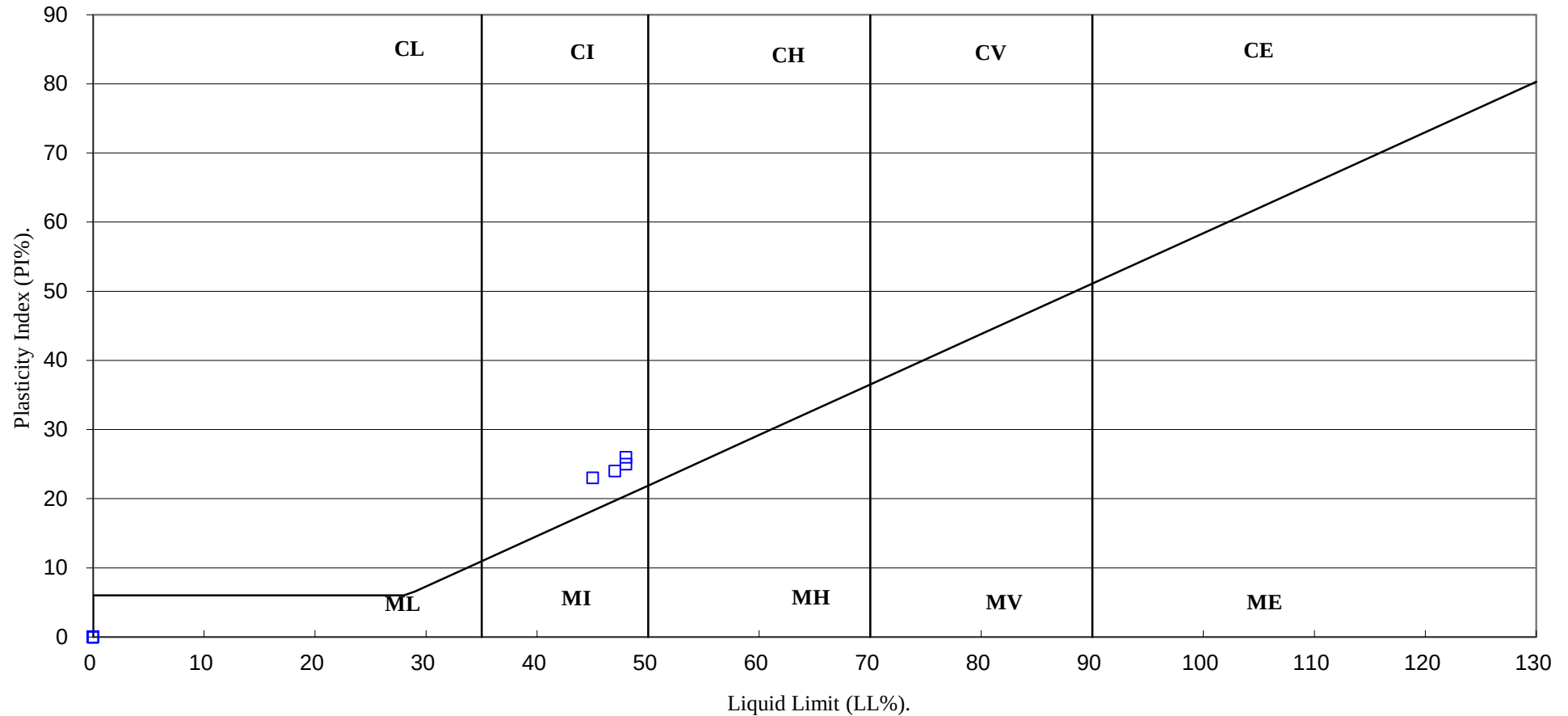
Contract No:

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Client Ref:

4292

PLASTICITY CHART FOR CASAGRANDE CLASSIFICATION.



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Oaks Rd, Wrexham Industrial Est

Contract No:

PSL19/1289

Client Ref:

4292

UNDRAINED SHEAR STRENGTH IN TRIAXIAL COMPRESSION

WITHOUT MEASUREMENT OF PORE PRESSURE

BS1377 : Part7 : 1990: Clause 8

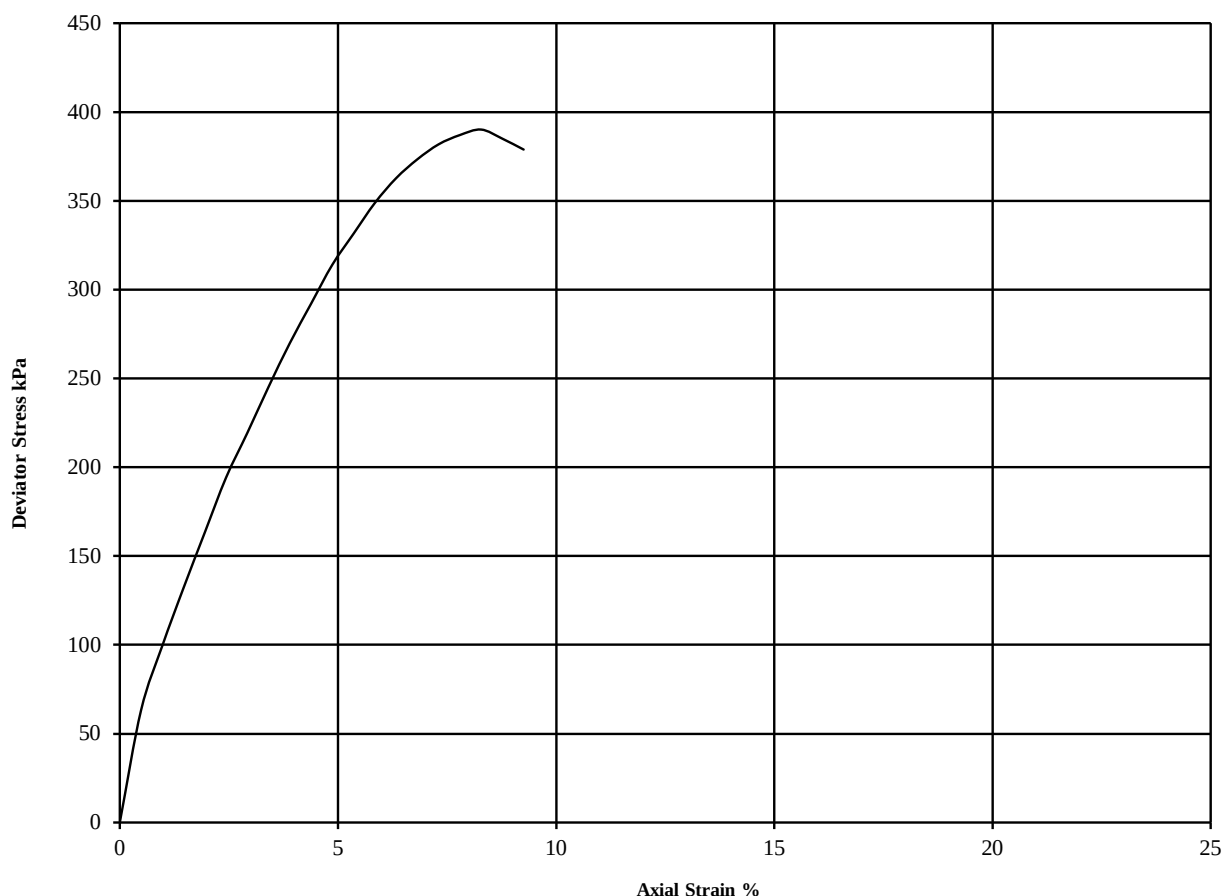
Hole Number: BH01

Top Depth (m): 3.00

Sample Number: 10

Base Depth (m):

Sample Type U



Diameter (mm):		102	Height (mm):		209	Test:	UU Single Stage		Remarks:
Specimen	Moisture Content (%)	Bulk Density (Mg/m ³)	Dry Density (Mg/m ³)	Cell Pressure (kPa)	Corr. Max. Deviator Stress (kPa)	Shear Strength Cu (kPa)	Failure Strain (%)	Mode of Failure	Undisturbed Sample Sample taken from top of tube Rate of strain = 2 %/min Latex Membrane used 0.2 mm thick, Correction applied 0.36 See summary of soil descriptions
1	20	2.13	1.77	60	390	195	8.3	Brittle	



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Professional Soils Laboratory

Oaks Rd, Wrexham Industrial Est

Contract No:

PSL19/1289

Client Ref:

4292

UNDRAINED SHEAR STRENGTH IN TRIAXIAL COMPRESSION

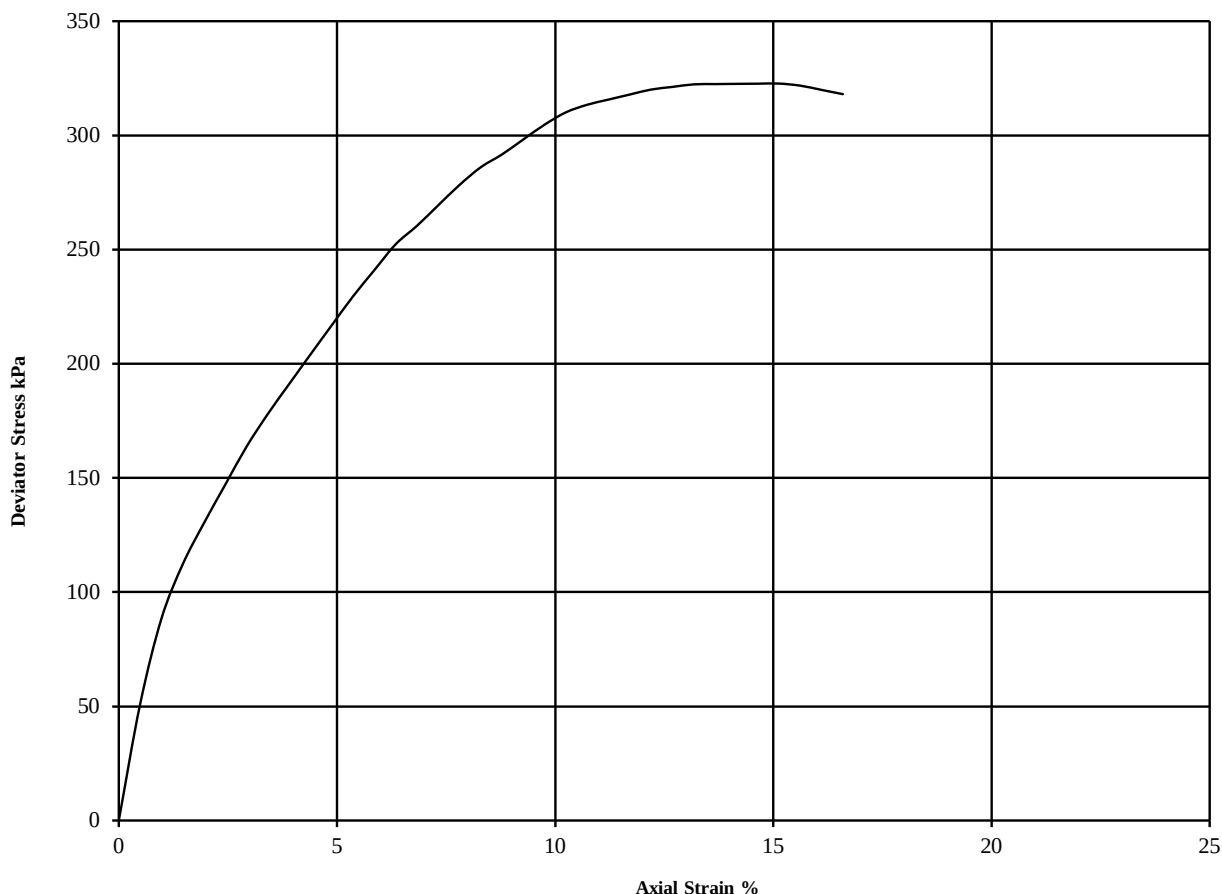
WITHOUT MEASUREMENT OF PORE PRESSURE

BS1377 : Part7 : 1990: Clause 8

Hole Number: BH01 **Top Depth (m):** 8.00

Sample Number: 20 **Base Depth (m):**

Sample Type U



Diameter (mm):		102	Height (mm):		209	Test:	UU Single Stage		Remarks:
Specimen	Moisture Content (%)	Bulk Density (Mg/m ³)	Dry Density (Mg/m ³)	Cell Pressure (kPa)	Corr. Max. Deviator Stress (kPa)	Shear Strength Cu (kPa)	Failure Strain (%)	Mode of Failure	Undisturbed Sample Sample taken from top of tube Rate of strain = 2 %/min Latex Membrane used 0.2 mm thick, Correction applied 0.34 See summary of soil descriptions
1	19	1.99	1.67	160	323	161	15.1	Plastic	

 4043		Oaks Rd, Wrexham Industrial Est		Contract No:
				PSL19/1289
				Client Ref:
				4292

UNDRAINED SHEAR STRENGTH IN TRIAXIAL COMPRESSION

WITHOUT MEASUREMENT OF PORE PRESSURE

BS1377 : Part7 : 1990: Clause 8

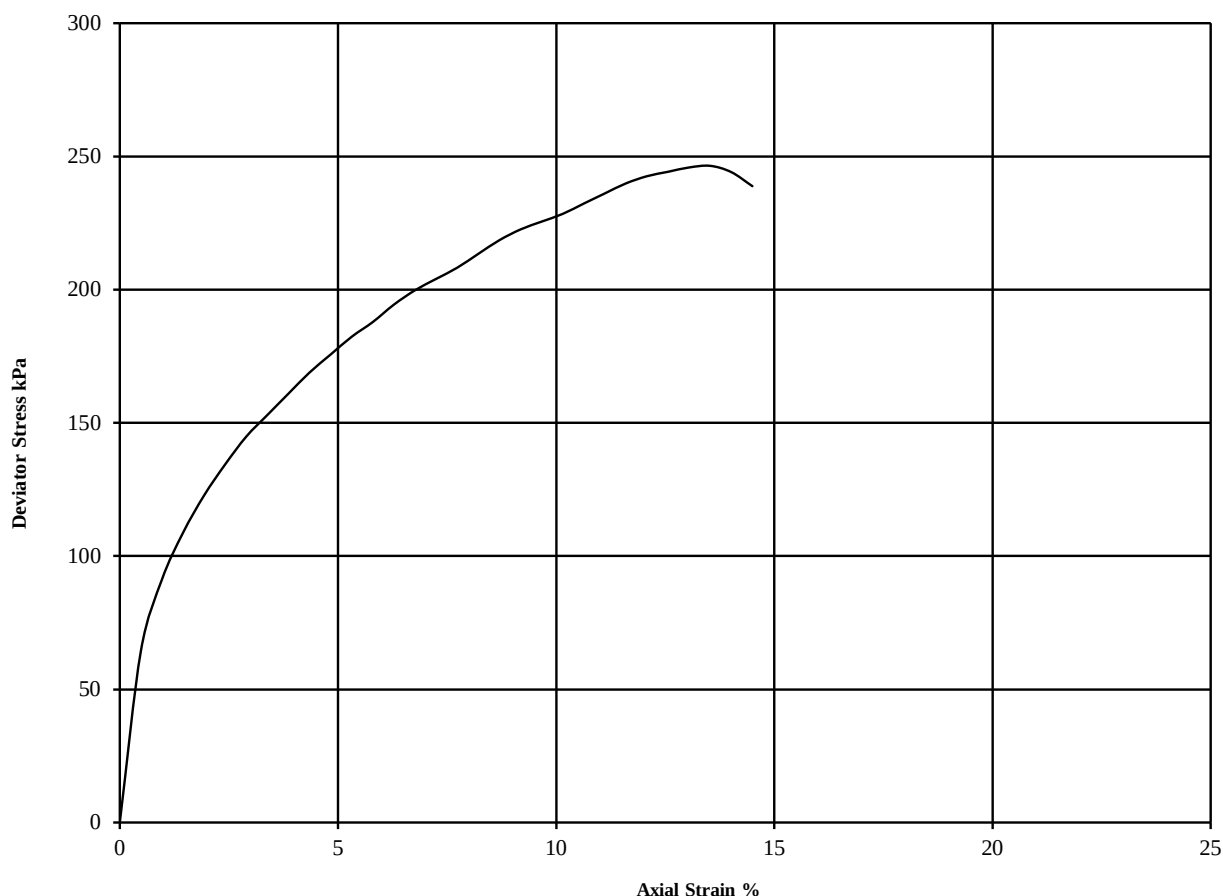
Hole Number: BH02

Top Depth (m): 1.20

Sample Number: 5

Base Depth (m):

Sample Type U



Diameter (mm):		101	Height (mm):		209	Test:	UU Single Stage		Remarks:
Specimen	Moisture Content (%)	Bulk Density (Mg/m ³)	Dry Density (Mg/m ³)	Cell Pressure (kPa)	Corr. Max. Deviator Stress (kPa)	Shear Strength Cu (kPa)	Failure Strain (%)	Mode of Failure	Undisturbed Sample Sample taken from top of tube Rate of strain = 2 %/min Latex Membrane used 0.2 mm thick, Correction applied 0.35 See summary of soil descriptions
1	22	2.09	1.70	24	246	123	13.5	Brittle	



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UNDRAINED SHEAR STRENGTH IN TRIAXIAL COMPRESSION

WITHOUT MEASUREMENT OF PORE PRESSURE

BS1377 : Part7 : 1990: Clause 8

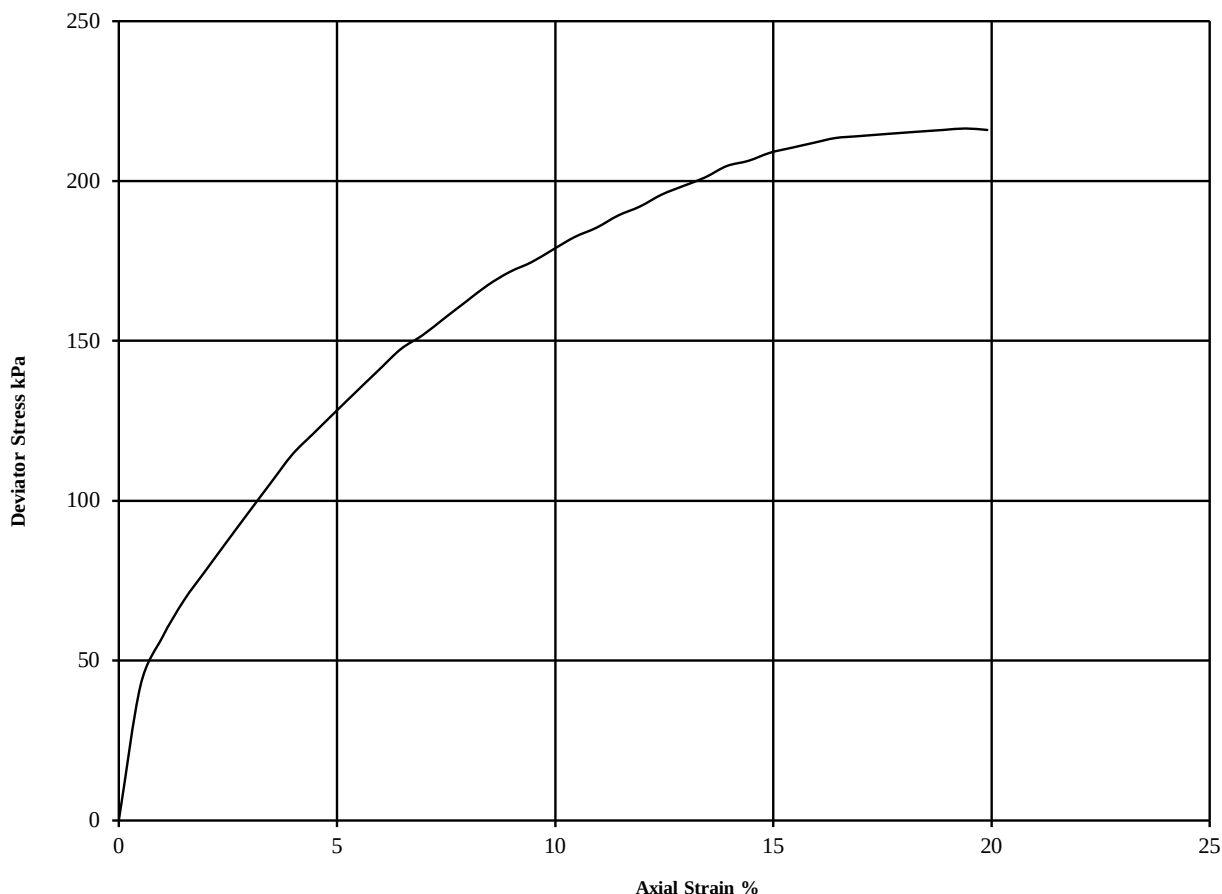
Hole Number: BH02

Top Depth (m): 5.00

Sample Number: 15

Base Depth (m):

Sample Type U



Diameter (mm):		103	Height (mm):		207	Test:	UU Single Stage		Remarks:
Specimen	Moisture Content (%)	Bulk Density (Mg/m ³)	Dry Density (Mg/m ³)	Cell Pressure (kPa)	Corr. Max. Deviator Stress (kPa)	Shear Strength Cu (kPa)	Failure Strain (%)	Mode of Failure	Undisturbed Sample Sample taken from top of tube Rate of strain = 2 %/min Latex Membrane used 0.2 mm thick, Correction applied 0.33 See summary of soil descriptions
1	22	2.06	1.69	100	$(\theta_1 - \theta_3)_f$	$\frac{1}{2}(\theta_1 - \theta_3)_f$	19.4	Plastic	



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BS1377 : Part7 : 1990: Clause 8

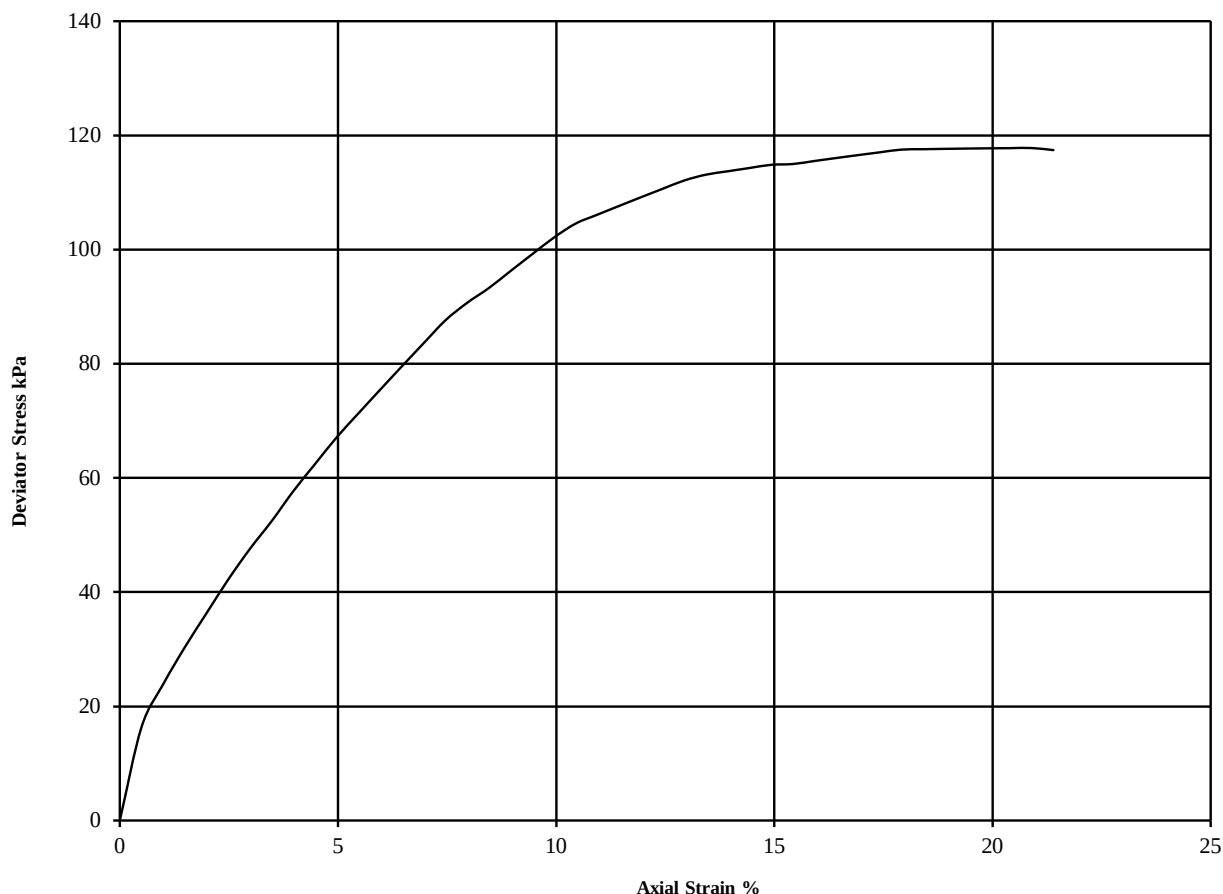
Hole Number: BH02

Top Depth (m): 8.00

Sample Number: 20

Base Depth (m):

Sample Type U



Diameter (mm):		103	Height (mm):		207	Test:	UU Single Stage		Remarks:
Specimen	Moisture Content (%)	Bulk Density (Mg/m ³)	Dry Density (Mg/m ³)	Cell Pressure (kPa)	Corr. Max. Deviator Stress (kPa)	Shear Strength Cu (kPa)	Failure Strain (%)	Mode of Failure	Undisturbed Sample Sample taken from top of tube Rate of strain = 2 %/min Latex Membrane used 0.2 mm thick, Correction applied 0.33 See summary of soil descriptions
1	24	2.05	1.65	160	$(\theta_1 - \theta_3)_f$	$\frac{1}{2}(\theta_1 - \theta_3)_f$	20.9	Plastic	



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BS1377 : Part7 : 1990: Clause 8

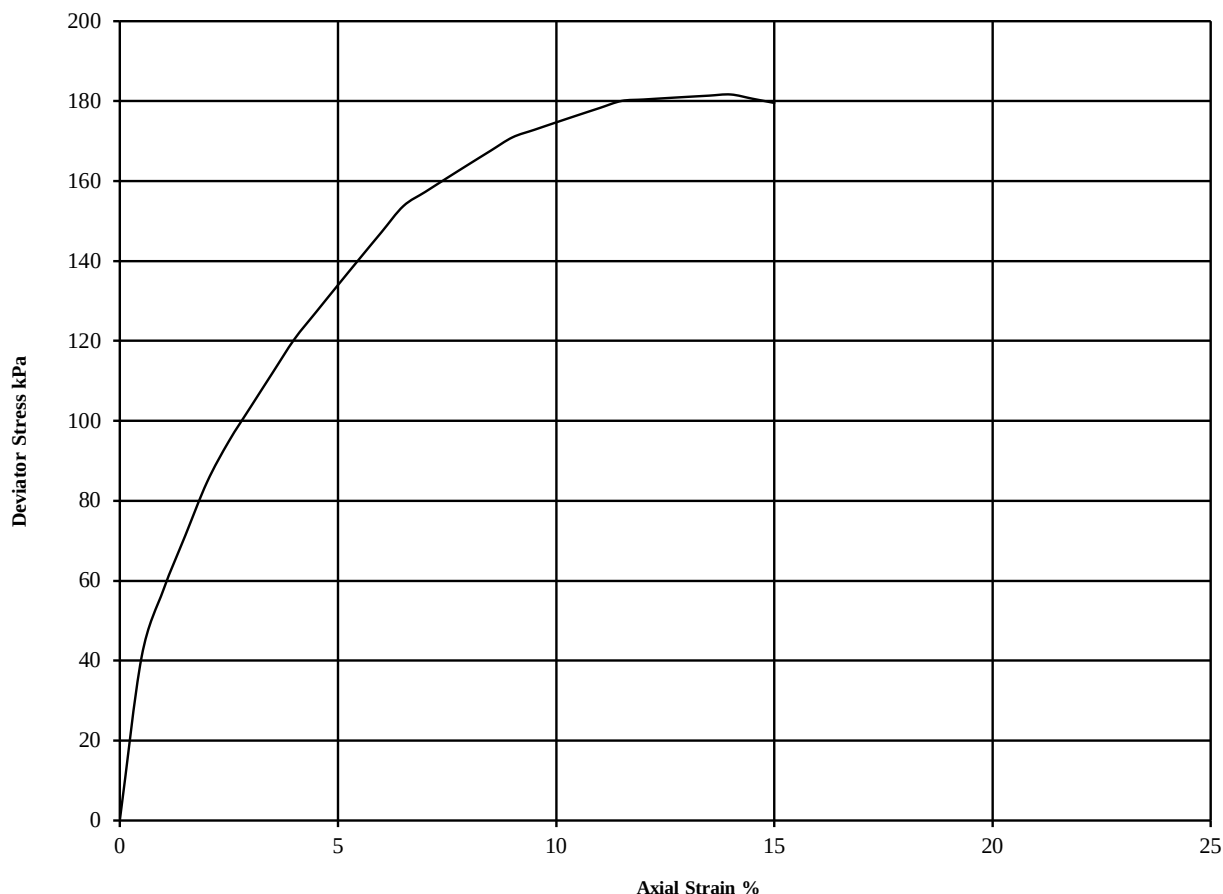
Hole Number: BH03

Top Depth (m): 1.20

Sample Number: 5

Base Depth (m):

Sample Type U



Diameter (mm):		38	Height (mm):		76	Test:	UU Single Stage		Remarks:
Specimen	Moisture Content (%)	Bulk Density (Mg/m ³)	Dry Density (Mg/m ³)	Cell Pressure (kPa)	Corr. Max. Deviator Stress (kPa)	Shear Strength Cu (kPa)	Failure Strain (%)	Mode of Failure	Undisturbed Sample Sample taken from top of tube Rate of strain = 2 %/min Latex Membrane used 0.2 mm thick, Correction applied 0.79 See summary of soil descriptions
1	25	1.98	1.59	24	($\theta_1 - \theta_3$) _f	$\frac{1}{2}(\theta_1 - \theta_3)$ _f	14.0	Plastic	



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BS1377 : Part7 : 1990: Clause 8

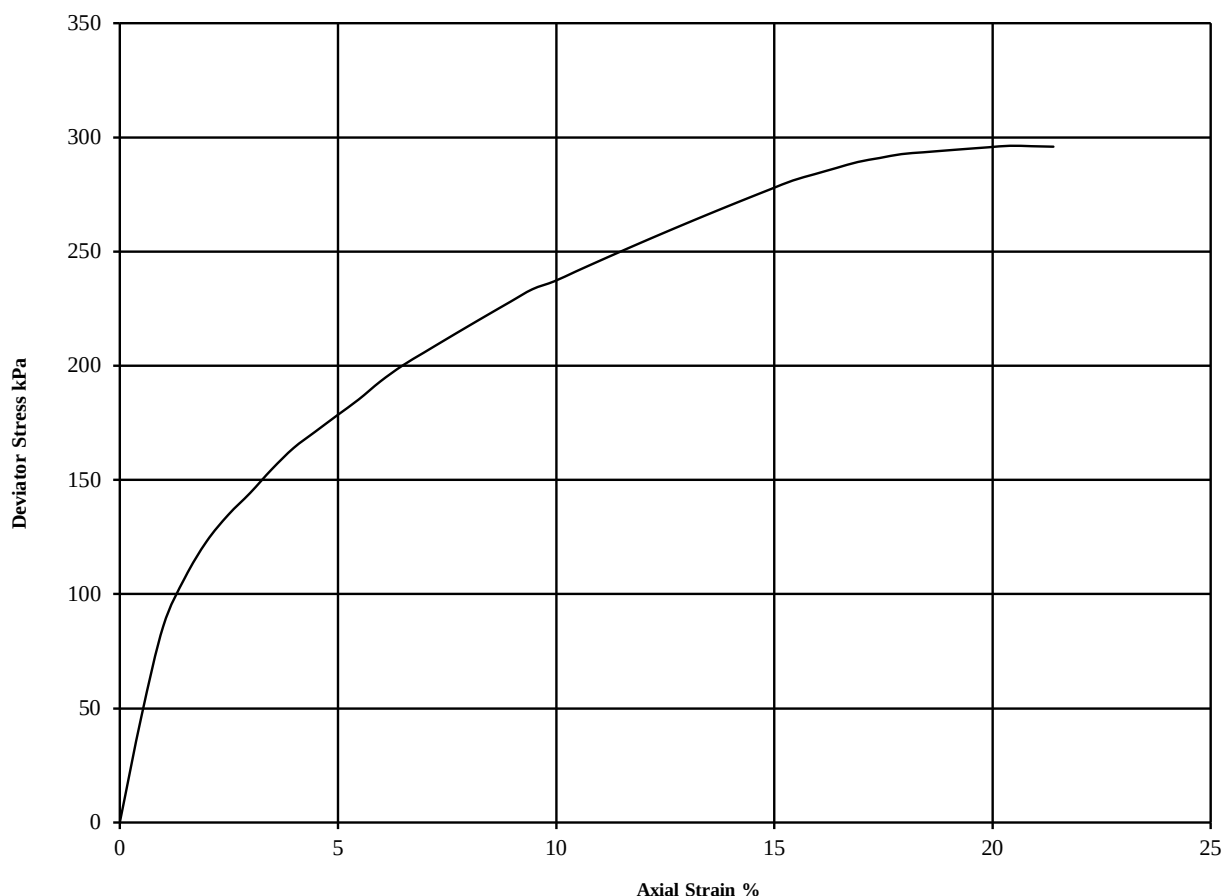
Hole Number: BH03

Top Depth (m): 3.00

Sample Number: 12

Base Depth (m):

Sample Type U



Diameter (mm):		103	Height (mm):		207	Test:	UU Single Stage		Remarks:
Specimen	Moisture Content (%)	Bulk Density (Mg/m ³)	Dry Density (Mg/m ³)	Cell Pressure (kPa)	Corr. Max. Deviator Stress (kPa)	Shear Strength Cu (kPa)	Failure Strain (%)	Mode of Failure	Undisturbed Sample Sample taken from top of tube Rate of strain = 2 %/min Latex Membrane used 0.2 mm thick, Correction applied 0.33 See summary of soil descriptions
				θ_3	$(\theta_1 - \theta_3)_f$	$\frac{1}{2}(\theta_1 - \theta_3)_f$			
1	20	2.07	1.72	60	296	148	20.4	Plastic	



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BS1377 : Part7 : 1990: Clause 8

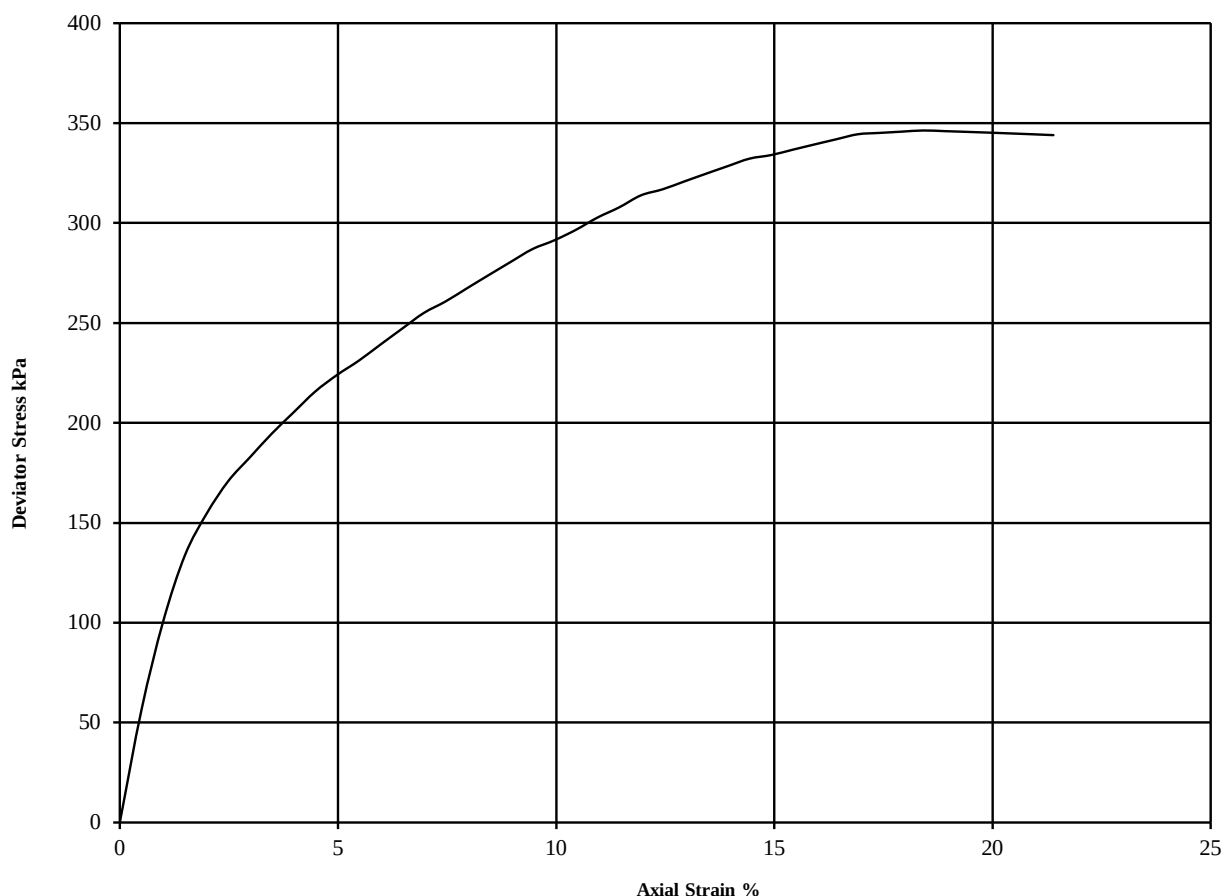
Hole Number: BH03

Top Depth (m): 5.00

Sample Number: 17

Base Depth (m):

Sample Type U



Diameter (mm):		103	Height (mm):		207	Test:	UU Single Stage		Remarks:
Specimen	Moisture Content (%)	Bulk Density (Mg/m ³)	Dry Density (Mg/m ³)	Cell Pressure (kPa)	Corr. Max. Deviator Stress (kPa)	Shear Strength Cu (kPa)	Failure Strain (%)	Mode of Failure	Undisturbed Sample Sample taken from top of tube Rate of strain = 2 %/min Latex Membrane used 0.2 mm thick, Correction applied 0.33 See summary of soil descriptions
1	21	2.08	1.72	100	346	173	18.4	Plastic	



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BS1377 : Part7 : 1990: Clause 8

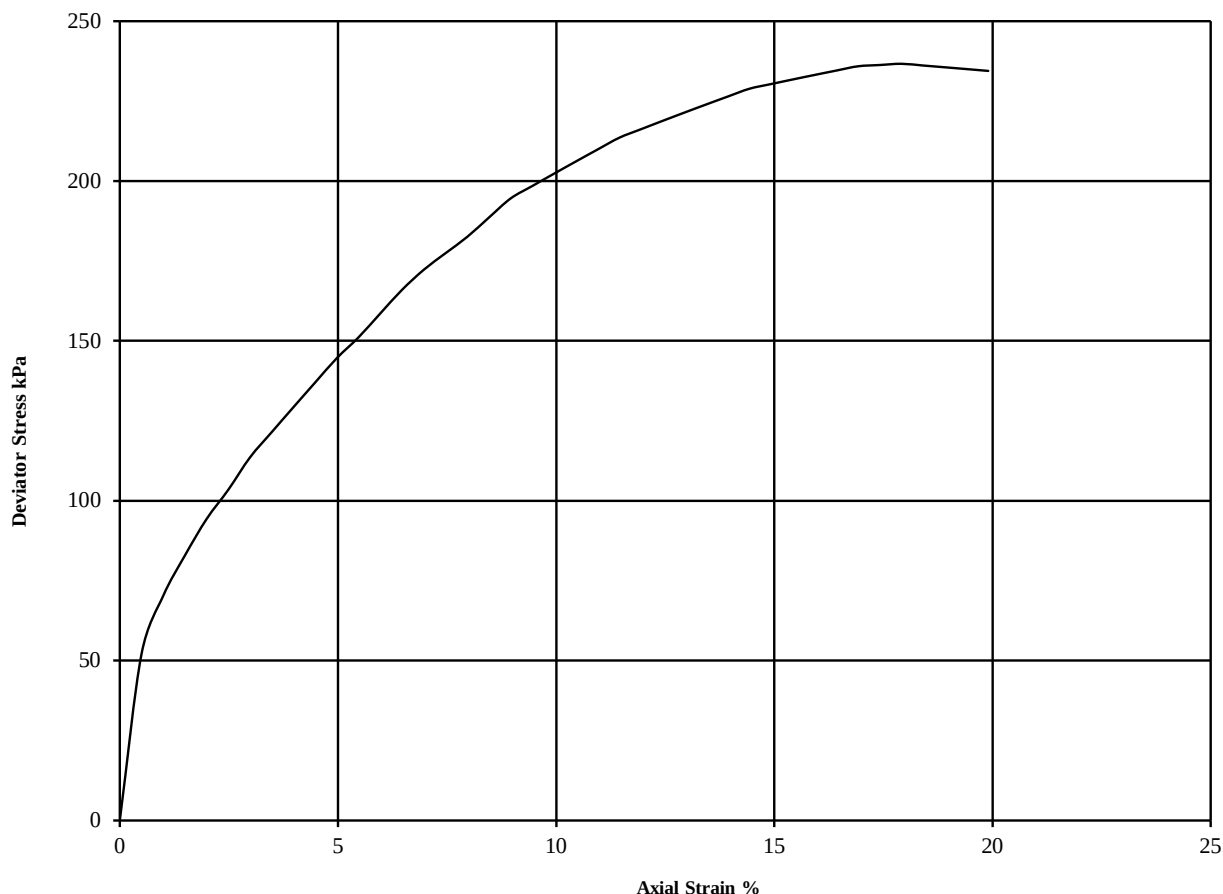
Hole Number: BH03

Top Depth (m): 11.00

Sample Number: 27

Base Depth (m):

Sample Type U



Diameter (mm):		103	Height (mm):		207	Test:	UU Single Stage		Remarks:
Specimen	Moisture Content (%)	Bulk Density (Mg/m ³)	Dry Density (Mg/m ³)	Cell Pressure (kPa)	Corr. Max. Deviator Stress (kPa)	Shear Strength Cu (kPa)	Failure Strain (%)	Mode of Failure	Undisturbed Sample Sample taken from top of tube Rate of strain = 2 %/min Latex Membrane used 0.2 mm thick, Correction applied 0.34 See summary of soil descriptions
1	24	2.00	1.62	220	$(\theta_1 - \theta_3)_f$	$\frac{1}{2}(\theta_1 - \theta_3)_f$	17.9	Plastic	



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BS1377 : Part7 : 1990: Clause 8

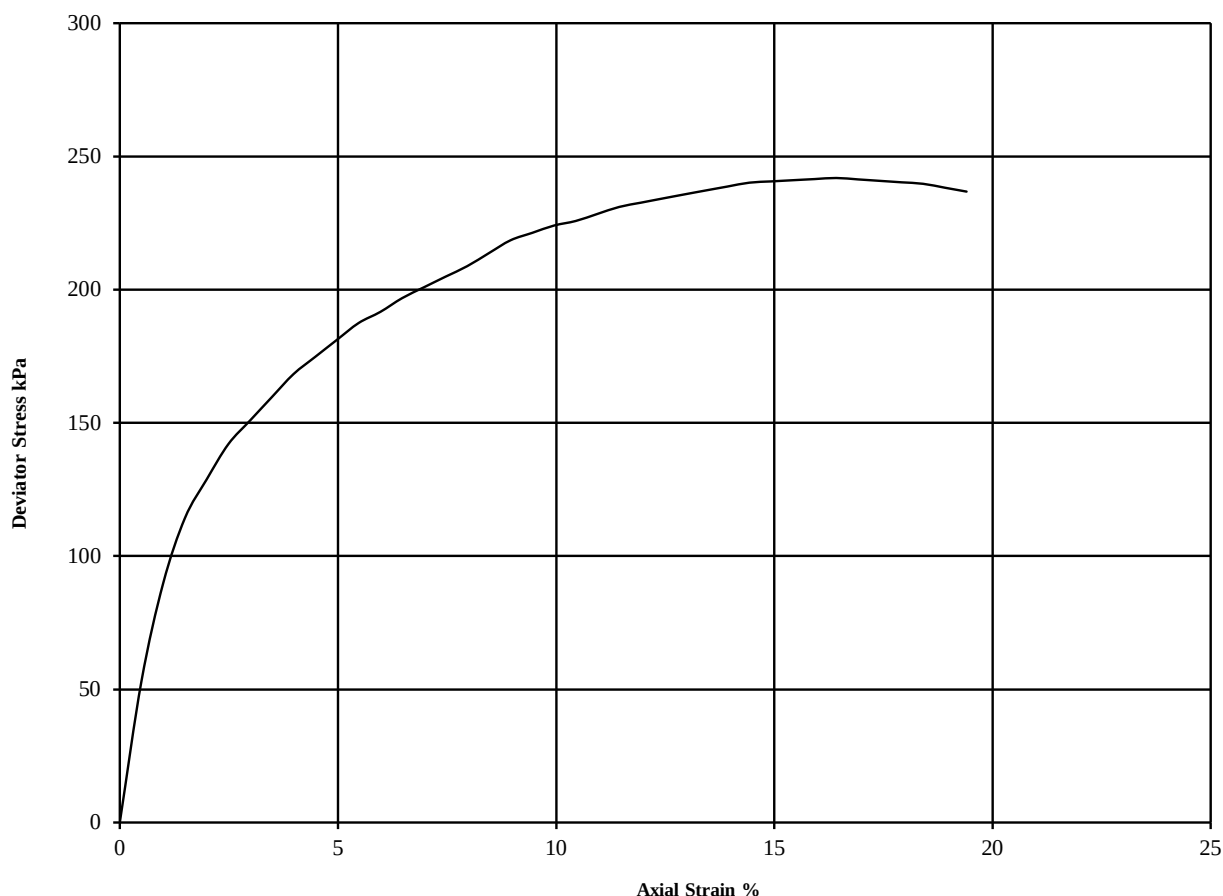
Hole Number: BH04

Top Depth (m): 1.20

Sample Number: 5

Base Depth (m):

Sample Type U



Diameter (mm):		103	Height (mm):		207	Test:	UU Single Stage		Remarks:
Specimen	Moisture Content (%)	Bulk Density (Mg/m ³)	Dry Density (Mg/m ³)	Cell Pressure (kPa)	Corr. Max. Deviator Stress (kPa)	Shear Strength Cu (kPa)	Failure Strain (%)	Mode of Failure	Undisturbed Sample Sample taken from top of tube Rate of strain = 2 %/min Latex Membrane used 0.2 mm thick, Correction applied 0.34 See summary of soil descriptions
				θ_3	$(\theta_1 - \theta_3)_f$	$\frac{1}{2}(\theta_1 - \theta_3)_f$			
1	22	2.05	1.69	24	242	121	16.4	Plastic	



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BS1377 : Part7 : 1990: Clause 8

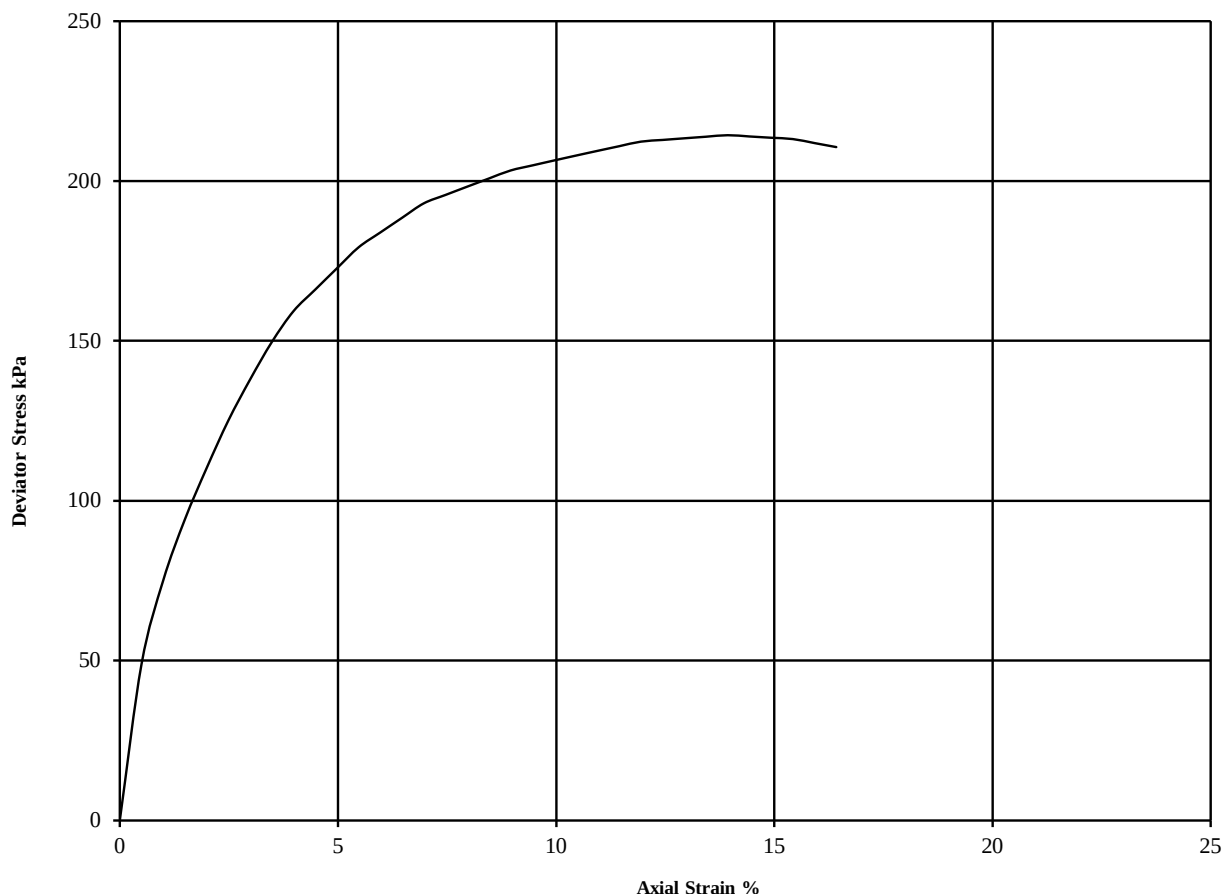
Hole Number: BH04

Top Depth (m): 5.00

Sample Number: 16

Base Depth (m):

Sample Type U



Diameter (mm):		103	Height (mm):		207	Test:	UU Single Stage		Remarks:
Specimen	Moisture Content (%)	Bulk Density (Mg/m ³)	Dry Density (Mg/m ³)	Cell Pressure (kPa)	Corr. Max. Deviator Stress (kPa)	Shear Strength Cu (kPa)	Failure Strain (%)	Mode of Failure	Undisturbed Sample Sample taken from top of tube Rate of strain = 2 %/min Latex Membrane used 0.2 mm thick, Correction applied 0.34 See summary of soil descriptions
				θ_3	$(\theta_1 - \theta_3)_f$	$\frac{1}{2}(\theta_1 - \theta_3)_f$			
1	24	2.03	1.63	100	214	107	13.9	Plastic	



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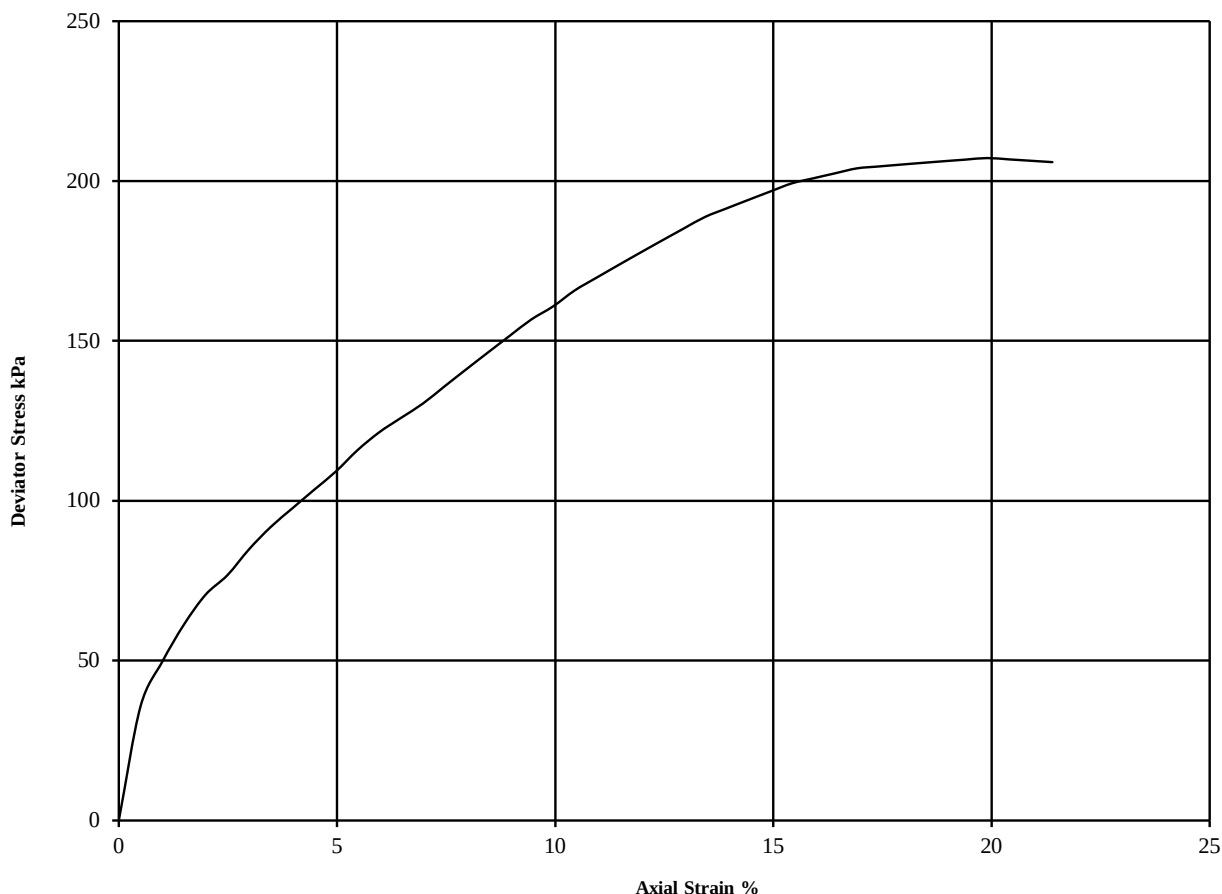
Hole Number: BH04

Top Depth (m): 11.00

Sample Number: 26

Base Depth (m):

Sample Type U



Diameter (mm):		103	Height (mm):		207	Test:	UU Single Stage		Remarks:
Specimen	Moisture Content (%)	Bulk Density (Mg/m ³)	Dry Density (Mg/m ³)	Cell Pressure (kPa)	Corr. Max. Deviator Stress (kPa)	Shear Strength Cu (kPa)	Failure Strain (%)	Mode of Failure	Undisturbed Sample Sample taken from top of tube Rate of strain = 2 %/min Latex Membrane used 0.2 mm thick, Correction applied 0.33 See summary of soil descriptions
1	24	2.02	1.63	220	$(\theta_1 - \theta_3)_f$	$\frac{1}{2}(\theta_1 - \theta_3)_f$	19.9	Plastic	

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			Client Ref:
			4292

UNDRAINED SHEAR STRENGTH IN TRIAXIAL COMPRESSION

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BS1377 : Part7 : 1990: Clause 8

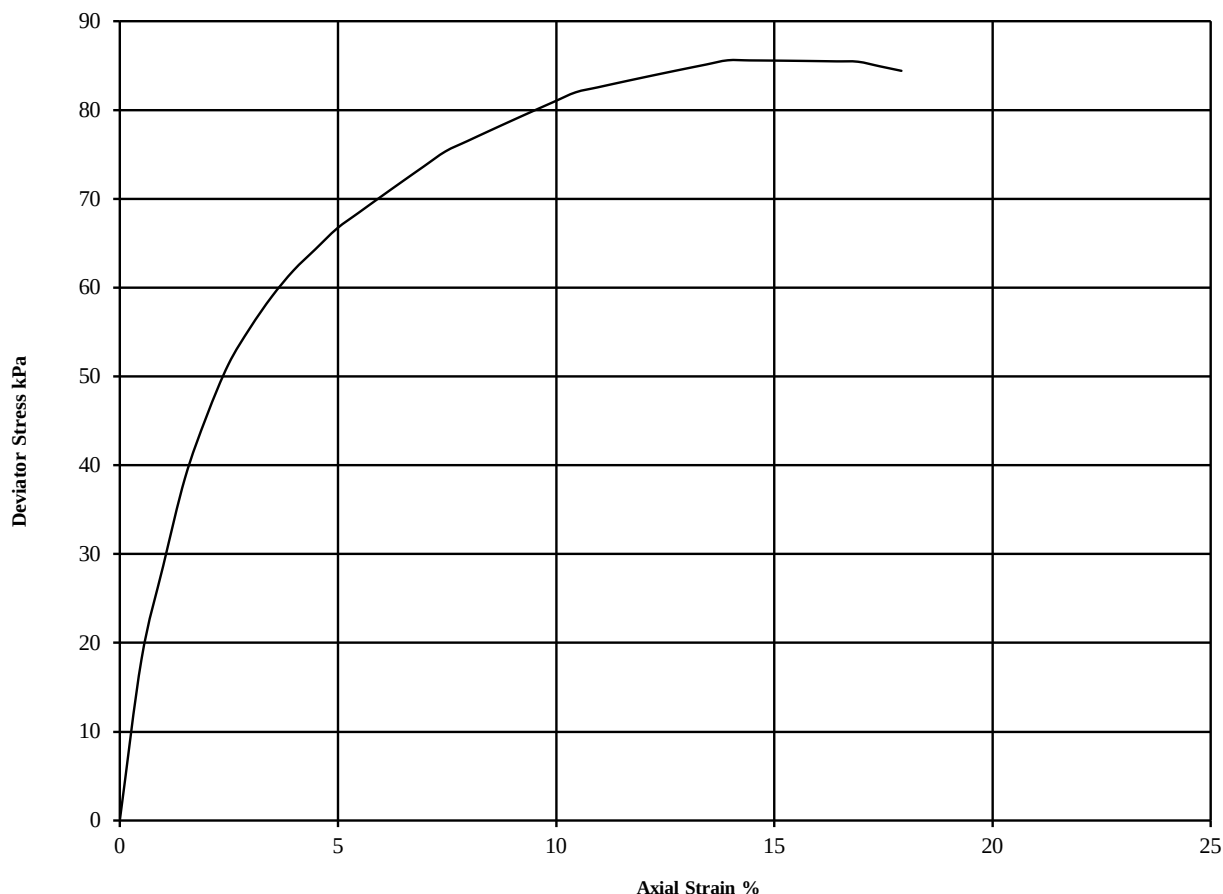
Hole Number: BH05

Top Depth (m): 1.20

Sample Number: 5

Base Depth (m):

Sample Type U



Diameter (mm):		103	Height (mm):		207	Test:	UU Single Stage		Remarks:
Specimen	Moisture Content (%)	Bulk Density (Mg/m ³)	Dry Density (Mg/m ³)	Cell Pressure (kPa)	Corr. Max. Deviator Stress (kPa)	Shear Strength Cu (kPa)	Failure Strain (%)	Mode of Failure	Undisturbed Sample Sample taken from top of tube Rate of strain = 2 %/min Latex Membrane used 0.2 mm thick, Correction applied 0.34 See summary of soil descriptions
				θ_3	$(\theta_1 - \theta_3)_f$	$\frac{1}{2}(\theta_1 - \theta_3)_f$			
1	24	2.01	1.62	24	86	43	13.9	Plastic	



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BS1377 : Part7 : 1990: Clause 8

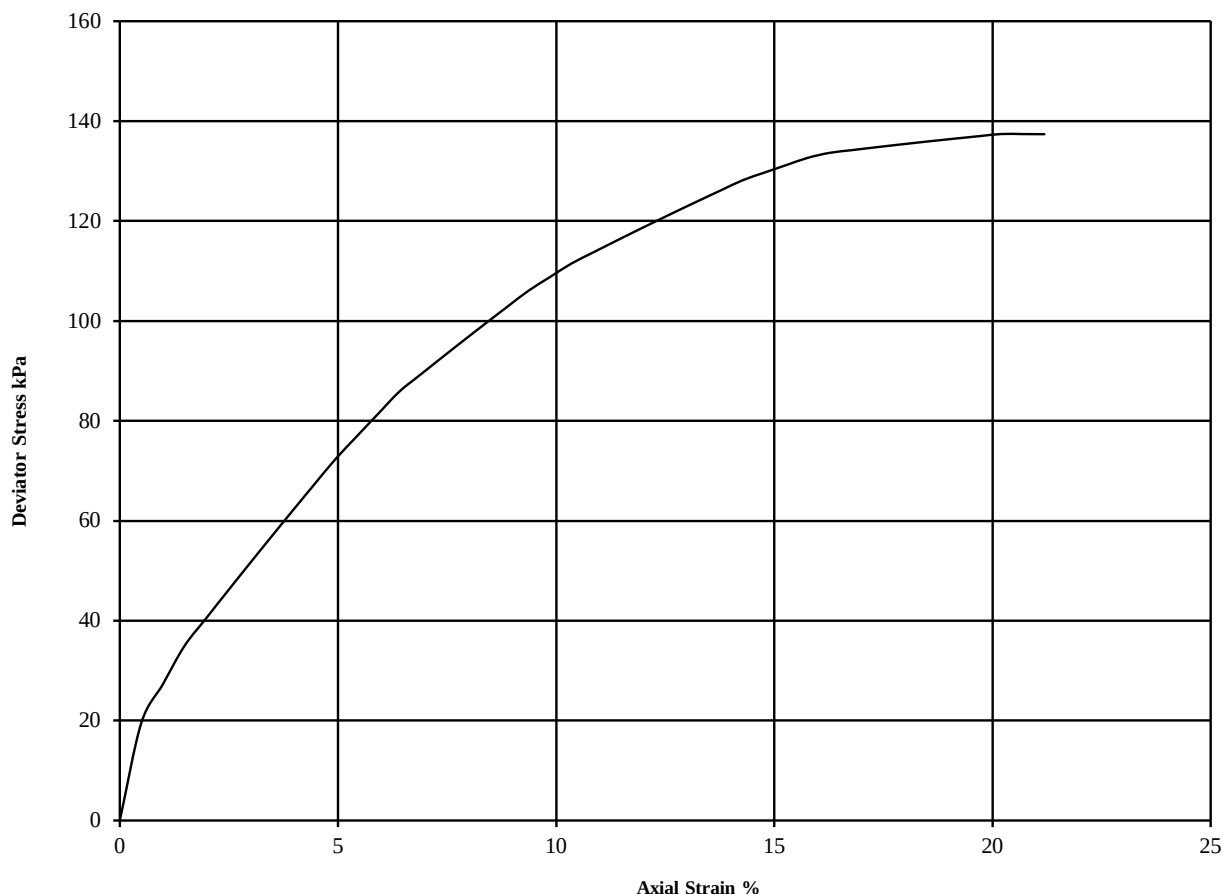
Hole Number: BH05

Top Depth (m): 3.00

Sample Number: 10

Base Depth (m):

Sample Type U



Diameter (mm):		102	Height (mm):		207	Test:	UU Single Stage		Remarks:
Specimen	Moisture Content (%)	Bulk Density (Mg/m ³)	Dry Density (Mg/m ³)	Cell Pressure (kPa)	Corr. Max. Deviator Stress (kPa)	Shear Strength Cu (kPa)	Failure Strain (%)	Mode of Failure	Undisturbed Sample Sample taken from top of tube Rate of strain = 2 %/min Latex Membrane used 0.2 mm thick, Correction applied 0.33 See summary of soil descriptions
				θ_3	$(\theta_1 - \theta_3)_f$	$\frac{1}{2}(\theta_1 - \theta_3)_f$			
1	23	2.08	1.68	60	137	69	20.2	Plastic	



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BS1377 : Part7 : 1990: Clause 8

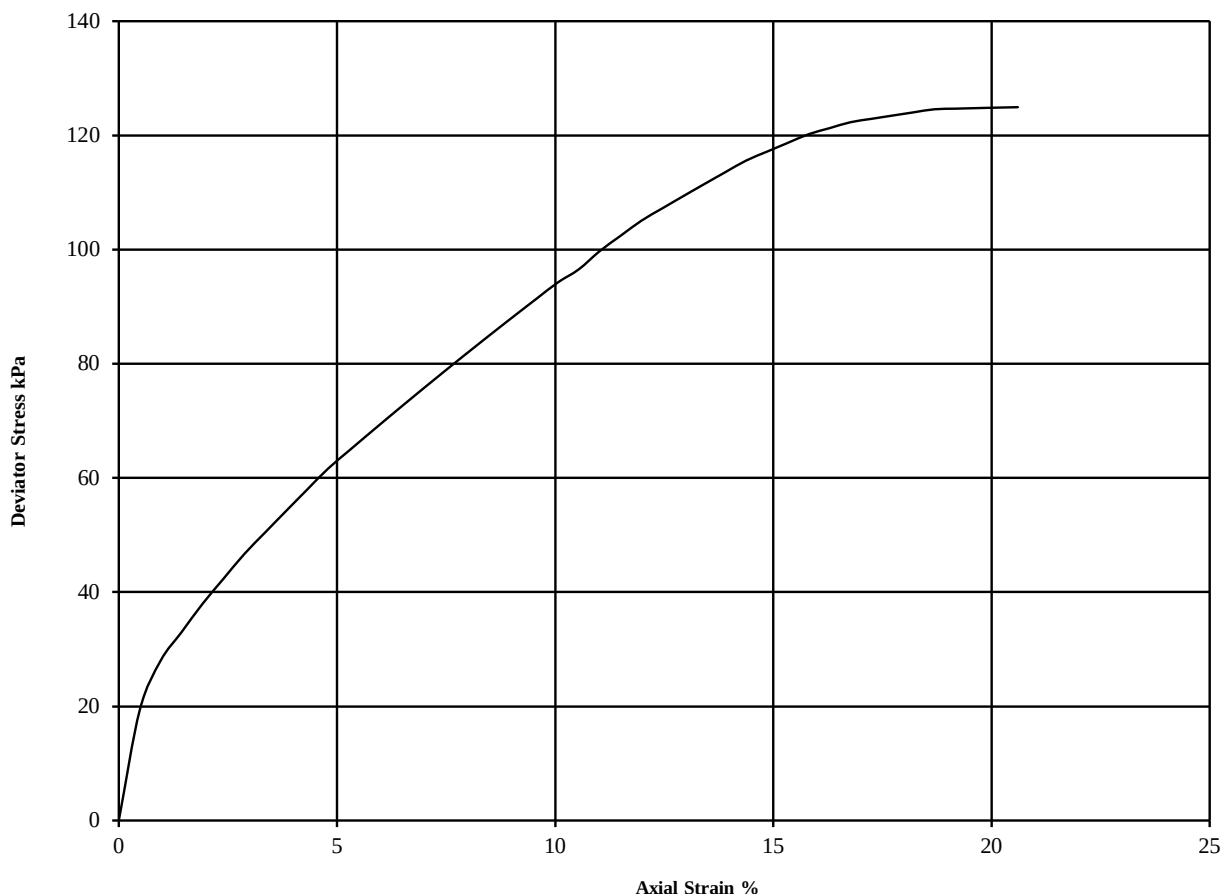
Hole Number: BH05

Top Depth (m): 8.00

Sample Number: 20

Base Depth (m):

Sample Type U



Diameter (mm):		99	Height (mm):		206	Test:	UU Single Stage		Remarks:
Specimen	Moisture Content (%)	Bulk Density (Mg/m ³)	Dry Density (Mg/m ³)	Cell Pressure (kPa)	Corr. Max. Deviator Stress (kPa)	Shear Strength Cu (kPa)	Failure Strain (%)	Mode of Failure	Undisturbed Sample Sample taken from top of tube Rate of strain = 2 %/min Latex Membrane used 0.2 mm thick, Correction applied 0.34 See summary of soil descriptions
1	24	2.06	1.67	160	125	62	20.6	Plastic	



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BS1377 : Part7 : 1990: Clause 8

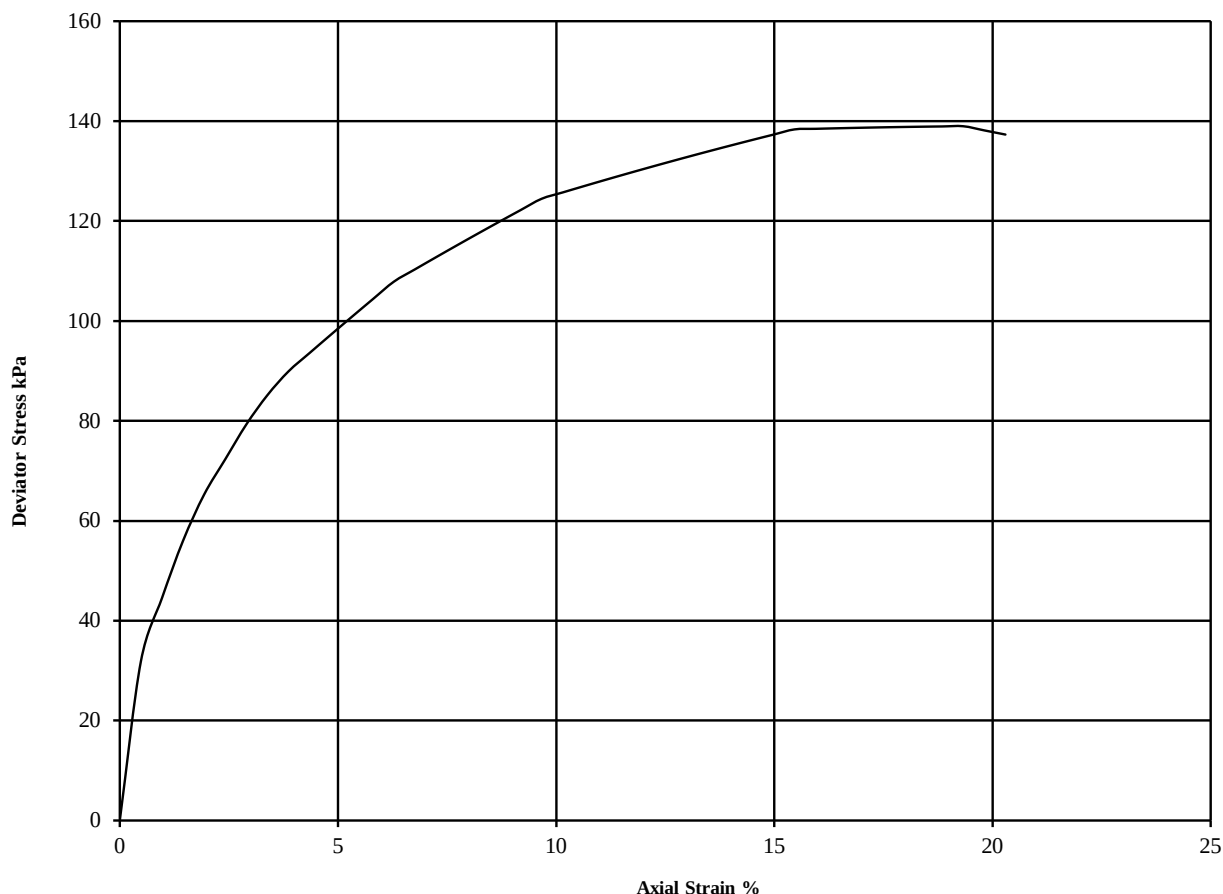
Hole Number: BH06A

Top Depth (m): 3.00

Sample Number: 2

Base Depth (m):

Sample Type U



Diameter (mm):		101	Height (mm):		209	Test:	UU Single Stage		Remarks:
Specimen	Moisture Content (%)	Bulk Density (Mg/m ³)	Dry Density (Mg/m ³)	Cell Pressure (kPa)	Corr. Max. Deviator Stress (kPa)	Shear Strength Cu (kPa)	Failure Strain (%)	Mode of Failure	Undisturbed Sample Sample taken from top of tube Rate of strain = 2 %/min Latex Membrane used 0.2 mm thick, Correction applied 0.34 See summary of soil descriptions
1	24	2.01	1.63	60	$(\theta_1 - \theta_3)_f$	$\frac{1}{2}(\theta_1 - \theta_3)_f$	19.3	Plastic	



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BS1377 : Part7 : 1990: Clause 8

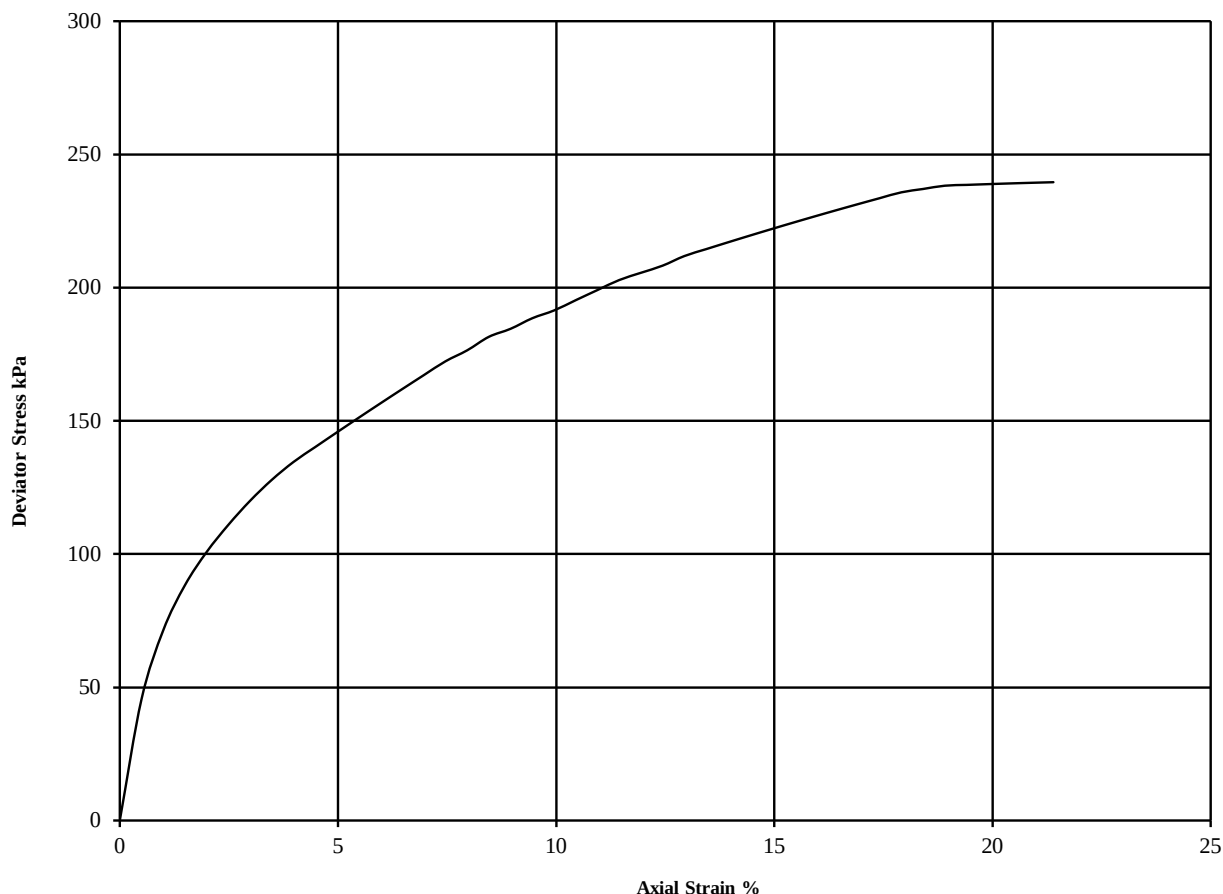
Hole Number: BH06A

Top Depth (m): 8.00

Sample Number: 12

Base Depth (m):

Sample Type U



Diameter (mm):		103	Height (mm):		207	Test:	UU Single Stage		Remarks:
Specimen	Moisture Content (%)	Bulk Density (Mg/m ³)	Dry Density (Mg/m ³)	Cell Pressure (kPa)	Corr. Max. Deviator Stress (kPa)	Shear Strength Cu (kPa)	Failure Strain (%)	Mode of Failure	Undisturbed Sample Sample taken from top of tube Rate of strain = 2 %/min Latex Membrane used 0.2 mm thick, Correction applied 0.33 See summary of soil descriptions
				θ_3	$(\theta_1 - \theta_3)_f$	$\frac{1}{2}(\theta_1 - \theta_3)_f$			
1	25	2.02	1.61	160	240	120	21.4	Plastic	



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BS1377 : Part7 : 1990: Clause 8

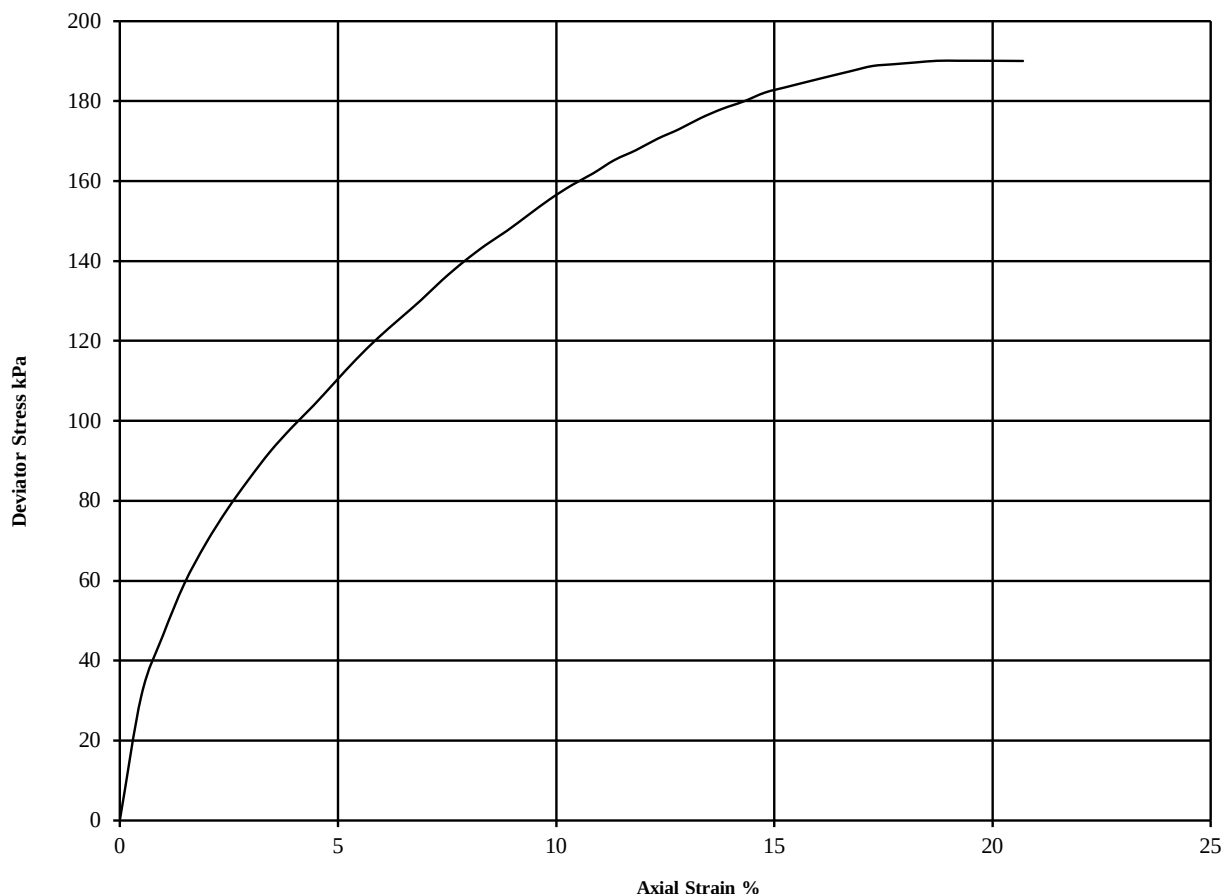
Hole Number: BH07

Top Depth (m): 3.00

Sample Number: 10

Base Depth (m):

Sample Type U



Diameter (mm):		103	Height (mm):		209	Test:	UU Single Stage		Remarks:
Specimen	Moisture Content (%)	Bulk Density (Mg/m ³)	Dry Density (Mg/m ³)	Cell Pressure (kPa)	Corr. Max. Deviator Stress (kPa)	Shear Strength Cu (kPa)	Failure Strain (%)	Mode of Failure	Undisturbed Sample Sample taken from top of tube Rate of strain = 2 %/min Latex Membrane used 0.2 mm thick, Correction applied 0.33 See summary of soil descriptions
				θ_3	$(\theta_1 - \theta_3)_f$	$\frac{1}{2}(\theta_1 - \theta_3)_f$			
1	22	2.07	1.70	60	190	95	19.2	Plastic	



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BS1377 : Part7 : 1990: Clause 8

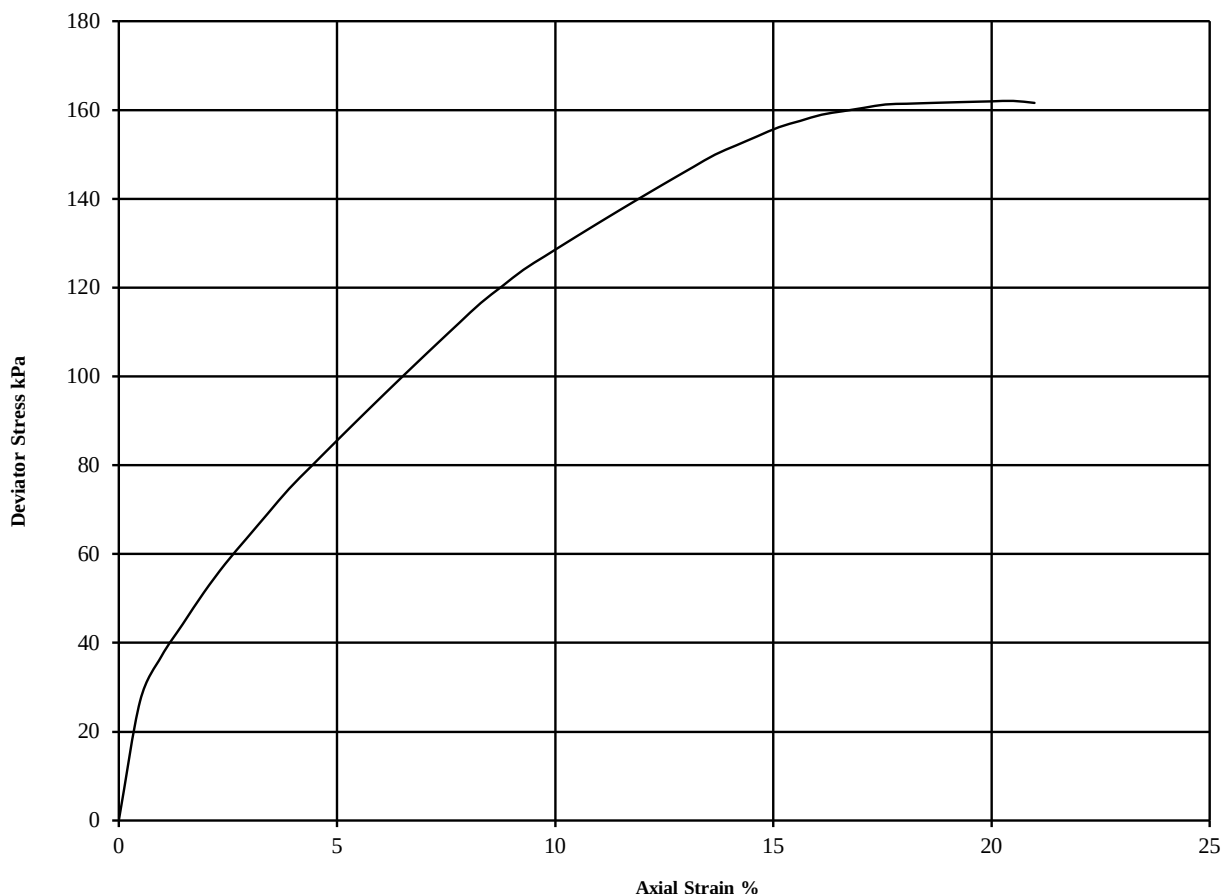
Hole Number: BH07

Top Depth (m): 5.00

Sample Number: 15

Base Depth (m):

Sample Type U



Diameter (mm):		102	Height (mm):		209	Test:	UU Single Stage		Remarks:
Specimen	Moisture Content (%)	Bulk Density (Mg/m ³)	Dry Density (Mg/m ³)	Cell Pressure (kPa)	Corr. Max. Deviator Stress (kPa)	Shear Strength Cu (kPa)	Failure Strain (%)	Mode of Failure	Undisturbed Sample Sample taken from top of tube Rate of strain = 2 %/min Latex Membrane used 0.2 mm thick, Correction applied 0.33 See summary of soil descriptions
1	22	2.11	1.73	100	$(\theta_1 - \theta_3)_f$	$\frac{1}{2}(\theta_1 - \theta_3)_f$	20.5	Plastic	



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Client Ref:

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UNDRAINED SHEAR STRENGTH IN TRIAXIAL COMPRESSION

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BS1377 : Part7 : 1990: Clause 8

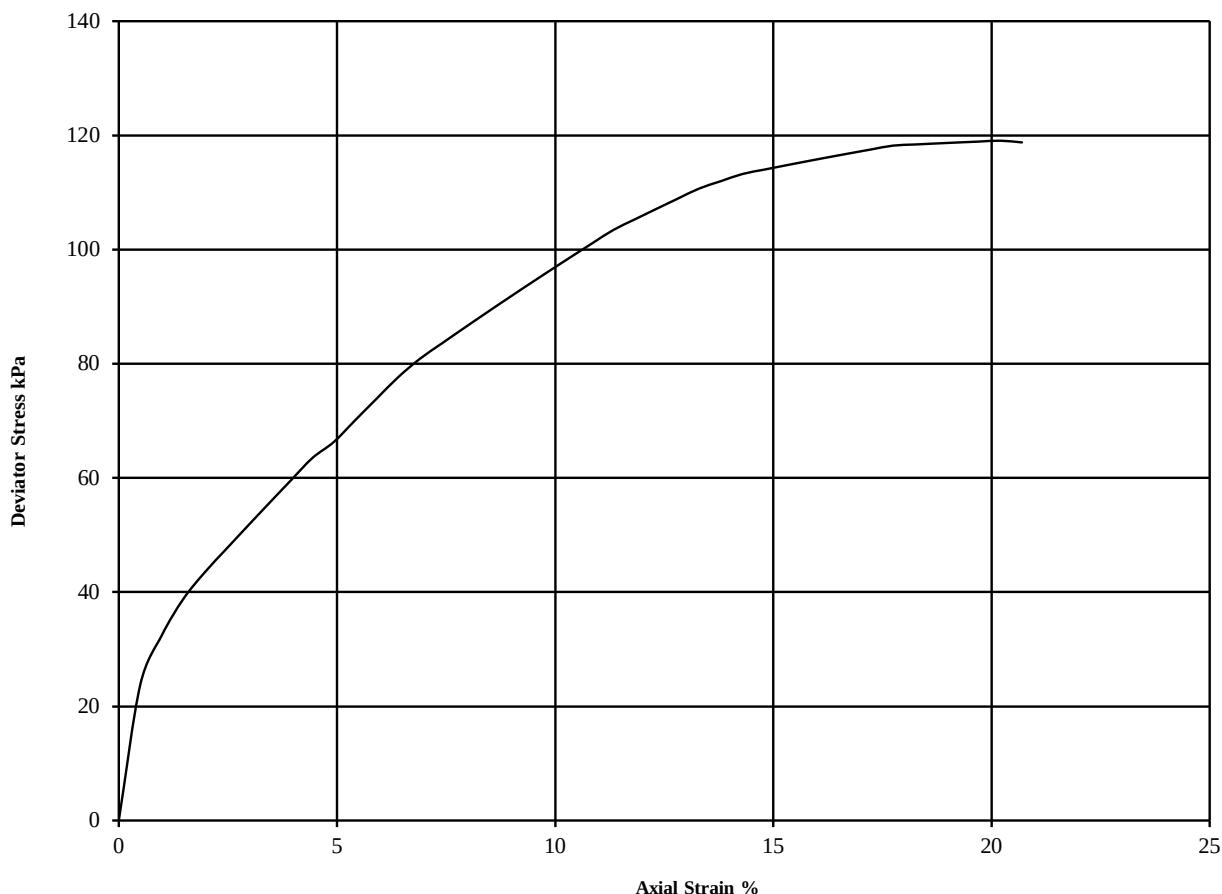
Hole Number: BH07

Top Depth (m): 11.00

Sample Number: 25

Base Depth (m):

Sample Type U



Diameter (mm):		103	Height (mm):		209	Test:	UU Single Stage		Remarks:
Specimen	Moisture Content (%)	Bulk Density (Mg/m ³)	Dry Density (Mg/m ³)	Cell Pressure (kPa)	Corr. Max. Deviator Stress (kPa)	Shear Strength Cu (kPa)	Failure Strain (%)	Mode of Failure	Undisturbed Sample Sample taken from top of tube Rate of strain = 2 %/min Latex Membrane used 0.2 mm thick, Correction applied 0.33 See summary of soil descriptions
1	25	2.06	1.64	220	$(\theta_1 - \theta_3)_f$	$\frac{1}{2}(\theta_1 - \theta_3)_f$	20.2	Plastic	



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APPENDIX I

Summary of Chemical Test Results of Soil Samples

Analyte	Limit of Detection	Statistical Analysis																				SGV / GAC		SGV / GAC	pCASL		pCASL	LQM/CIH SAUL	LQM/CIH SAUL																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																		
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		TP01	TP01	TP02	TP02	TP03	TP03	TP03	TP04	TP04	TP04	TP05	TP05	TP05	TP06	TP06	TP07	TP07	TP07	WS01	WS01	WS01	WS02	WS02	WS03	WS03	WS03	TP707	TP707	TP708	TP709	TP710	n	Standard Deviation	Minimum	Average	Maximum	Maximum	Commercial & Industrial 1+ Screening Threshold	Pass / Fail	Source of Screening Criteria	Source of Toxicological Data	Commercial	Pass / Fail	Source of Screening Criteria	Source of Toxicological Data	Commercial	Pass / Fail	Source of Screening Criteria	Source of Toxicological Data	Commercial	Pass / Fail	Source of Screening Criteria	Source of Toxicological Data																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																									
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Deviation	Minimum	Average	Maximum	Maximum	TP01	TP01	TP02	TP02	TP03	TP03	TP03	TP04	TP04	TP05	TP05	TP06	TP06	TP07	TP07	TP07	WS01	WS01	WS01	WS02	WS02	WS03	WS03	WS03	TP707	TP707	TP708	TP709	TP710	n	Standard Deviation	Minimum	Average	Maximum	Maximum	TP01	TP01	TP02	TP02	TP03	TP03	TP03	TP04	TP04	TP05	TP05	TP06	TP06	TP07	TP07	TP07	WS01	WS01	WS01	WS02	WS02	WS03	WS03	WS03	TP707	TP707	TP708	TP709	TP710	n	Standard Deviation	Minimum	Average	Maximum	Maximum	TP01	TP01	TP02	TP02	TP03	TP03	TP03	TP04	TP04	TP05	TP05	TP06	TP06	TP07	TP07	TP07	WS01	WS01	WS01	WS02	WS02	WS03	WS03	WS03	TP707	TP707	TP708	TP709	TP710	n	Standard Deviation	Minimum	Average	Maximum	Maximum	TP01	TP01	TP02	TP02	TP03	TP03	TP03	TP04	TP04	TP05	TP05	TP06	TP06	TP07	TP07	TP07	WS01	WS01	WS01	WS02	WS02	WS03	WS03	WS03	TP707	TP707	TP708	TP709	TP710	n	Standard 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Deviation	Minimum	Average	Maximum	Maximum	TP01	TP01	TP02	TP02	TP03	TP03	TP03	TP04	TP04	TP05	TP05	TP06	TP06	TP07	TP07	TP07	WS01	WS01	WS01	WS02	WS02	WS03	WS03	WS03	TP707	TP707	TP708	TP709	TP710	n	Standard Deviation	Minimum	Average	Maximum	Maximum	TP01	TP01	TP02	TP02	TP03	TP03	TP03	TP04	TP04	TP05	TP05	TP06	TP06	TP07	TP07	TP07	WS01	WS01	WS01	WS02	WS02	WS03	WS03	WS03	TP707	TP707	TP708	TP709	TP710	n	Standard Deviation	Minimum	Average	Maximum	Maximum	TP01	TP01	TP02	TP02	TP03	TP03	TP03	TP04	TP04	TP05	TP05	TP06	TP06	TP07	TP07	TP07	WS01	WS01	WS01	WS02	WS02	WS03	WS03	WS03	TP707	TP707	TP708	TP709	TP710	n	Standard Deviation	Minimum	Average	Maximum	Maximum	TP01	TP01	TP02	TP02	TP03	TP03	TP03	TP04	TP04	TP05	TP05	TP06	TP06	TP07	TP07	TP07	WS01	WS01	WS01	WS02	WS02	WS03	WS03	WS03	TP707	TP707	TP708	TP709	TP710	n	Standard Deviation	Minimum	Average	Maximum	Maximum	TP01	TP01	TP02	TP02	TP03	TP03	TP03	TP04	TP04	TP05	TP05	TP06	TP06	TP07	TP07	TP07	WS01	WS01	WS01	WS02	WS02	WS03	WS03	WS03	TP707	TP707	TP708	TP709	TP710	n	Standard Deviation	Minimum	Average	Maximum	Maximum	TP01	TP01	TP02	TP02	TP03	TP03	TP03	TP04	TP04	TP05	TP05	TP06	TP06	TP07	TP07	TP07	WS01	WS01	WS01	WS02	WS02	WS03	WS03	WS03	TP707	TP707	TP708	TP709	TP710	n	Standard Deviation	Minimum	Average	Maximum	Maximum	TP01	TP01	TP02	TP02	TP03	TP03	TP03	TP04	TP04	TP05	TP05	TP06	TP06	TP07	TP07	TP07	WS01	WS01	WS01	WS02	WS02	WS03	WS03	WS03	TP707	TP707	TP708	TP709	TP710	n	Standard Deviation	Minimum	Average	Maximum	Maximum	TP01	TP01	TP02	TP02	TP03	TP03	TP03	TP04	TP04	TP05	TP05	TP06	TP06	TP07	TP07	TP07	WS01	WS01	WS01	WS02	WS02	WS03	WS03	WS03	TP707	TP707	TP708	TP709	TP710	n	Standard Deviation	Minimum	Average	Maximum	Maximum	TP01	TP01	TP02	TP02	TP03	TP03	TP03	TP04	TP04	TP05	TP05	TP06	TP06	TP07	TP07	TP07	WS01	WS01	WS01	WS02	WS02	WS03	WS03	WS03	TP707	TP707	TP708	TP709	TP710	n	Standard Deviation	Minimum	Average	Maximum	Maximum	TP01	TP01	TP02	TP02	TP03	TP03	TP03	TP04	TP04	TP05	TP05	TP06	TP06	TP07	TP07	TP07	WS01	WS01	WS01	WS02	WS02	WS03	WS03	WS03	TP707	TP707	TP708	TP709	TP710	n	Standard Deviation	Minimum	Average	Maximum	Maximum	TP01	TP01	TP02	TP02	TP03	TP03	TP03	TP04	TP04	TP05	TP05	TP06	TP06	TP07	TP07	TP07	WS01	WS01	WS01	WS02	WS02	WS03	WS03	WS03	TP707	TP707	TP708	TP709	TP710	n	Standard Deviation	Minimum	Average	Maximum	Maximum	TP01	TP01	TP02	TP02	TP03	TP03	TP03	TP04	TP04	TP05	TP05	TP06	TP06	TP07	TP07	TP07	WS01	WS01	WS01	WS02	WS02	WS03	WS03	WS03	TP707	TP707	TP708	TP709	TP710	n	Standard Deviation	Minimum	Average	Maximum	Maximum	TP01	TP01	TP02	TP02	TP03	TP03	TP03	TP04	TP04	TP05	TP05	TP06	TP06	TP07	TP07	TP07	WS01	WS01	WS01	WS02	WS02	WS03	WS03	WS03	TP707	TP707	TP708	TP709	TP710	n	Standard Deviation	Minimum	Average	Maximum	Maximum	TP01	TP01	TP02	TP02	TP03	TP03	TP03	TP04	TP04	TP05	TP05	TP06	TP06	TP07	TP07	TP07	WS01	WS01	WS01	WS02	WS02	WS03	WS03	WS03	TP707	TP707	TP708	TP709	TP710	n	Standard Deviation	Minimum	Average	Maximum	Maximum	TP01	TP01	TP02	TP02	TP03	TP03	TP03	TP04	TP04	TP05	TP05	TP06	TP06	TP07	TP07	TP07	WS01	WS01	WS01	WS02	WS02	WS03	WS03	WS03	TP707	TP707	TP708	TP709	TP710	n	Standard Deviation	Minimum	Average	Maximum	Maximum	TP01	TP01	TP02	TP02	TP03	TP03	TP03	TP04	TP04	TP05	TP05	TP06	TP06	TP07	TP07	TP07	WS01	WS01	WS01	WS02	WS02	WS03	WS03	WS03	TP707	TP707	TP708	TP709	TP710	n	Standard Deviation	Minimum	Average	Maximum	Maximum	TP01	TP01	TP02	TP02	TP03	TP03	TP03	TP04	TP04	TP05	TP05	TP06	TP06	TP07	TP07	TP07	WS01	WS01	WS01	WS02	WS02	WS03	WS03	WS03	TP707	TP707	TP708	TP709	TP710	n	Standard Deviation	Minimum	Average	Maximum	Maximum	TP01	TP01	TP02	TP02	TP03	TP03	TP03	TP04	TP04	TP05	TP05	TP06	TP06	TP07	TP07	TP07	WS01	WS01	WS01	WS02	WS02	WS03	WS03	WS03	TP707	TP707	TP708	TP709	TP710	n	Standard Deviation	Minimum	Average	Maximum	Maximum	TP01	TP01	TP02	TP02	TP03	TP03	TP03	TP04	TP04	TP05	TP05	TP06	TP06	TP07	TP07	TP07	WS01	WS01	WS01	WS02	WS02	WS03	WS03	WS03	TP707	TP707	TP708	TP709	TP710	n	Standard Deviation	Minimum	Average	Maximum	Maximum	TP01	TP01	TP02	TP02	TP03	TP03	TP03	TP04	TP04	TP05	TP05	TP06	TP06	TP07	TP07	TP07	WS01	WS01	WS01	WS02	WS02	WS03	WS03	WS03	TP707	TP707	TP708	TP709	TP710	n	Standard Deviation	Minimum	Average	Maximum	Maximum	TP01	TP01	TP02	TP02	TP03	TP03	TP03	TP04	TP04	TP05	TP05	TP06	TP06	TP07	TP07	TP07	WS01	WS01	WS01	WS02	WS02	WS03	WS03	WS03	TP707	TP707	TP708	TP709	TP710	n	Standard Deviation	Minimum	Average	Maximum	Maximum	TP01	TP01	TP02	TP02	TP03	TP03	TP03	TP04	TP04	TP05	TP05	TP06	TP06	TP07	TP07	TP07	WS01	WS01	WS01	WS02	WS02	WS03	WS03	WS03	TP707	TP707	TP708	TP709	TP710	n	Standard Deviation	Minimum	Average	Maximum	Maximum	TP01	TP01	TP02	TP02	TP03	TP03	TP03	TP04	TP04	TP05	TP05	TP06	TP06	TP07	TP07	TP07	WS01	WS01	WS01	WS02	WS02	WS03	WS03	WS03	TP707	TP707	TP708	TP709	TP710	n	Standard Deviation	Minimum	Average	Maximum	Maximum	TP01	TP01	TP02	TP02	TP03	TP03	TP03	TP04	TP04	TP05	TP05	TP06	TP06	TP07	TP07	TP07	WS01	WS01	WS01	WS02	WS02	WS03	WS03	WS03	TP707	TP707	TP708	TP709	TP710	n	Standard Deviation	Minimum	Average	Maximum	Maximum	TP01	TP01	TP02	TP02	TP03	TP03	TP03	TP04	TP04	TP05	TP05	TP06	TP06	TP07	TP07	TP07	WS01	WS01	WS01	WS02	WS02	WS03	WS03	WS03	TP707	TP707	TP708	TP709	TP710	n	Standard Deviation	Minimum	Average	Maximum	Maximum	TP01	TP01	TP02	TP02	TP03	TP03	TP03	TP04	TP04	TP05	TP05	TP06	TP06	TP07	TP07	TP07	WS01	WS01	WS01	WS02	WS02	WS03	WS03	WS03	TP707	TP707	TP708	TP709	TP710	n	Standard Deviation	Minimum	Average	Maximum	Maximum	TP01	TP01	TP02	TP02	TP03	TP03	TP03	TP04	TP04	TP05	TP05	TP06	TP06	TP07	TP07	TP07	WS01	WS01	WS01	WS02	WS02	WS03	WS03	WS03	TP707	TP707	TP708	TP709	TP710	n	Standard Deviation	Minimum	Average	Maximum	Maximum	TP01	TP01	TP02	TP02	TP03	TP03	TP03	TP04	TP04	TP05	TP05	TP06	TP06	TP07	TP07	TP07	WS01	WS01	WS01	WS02	WS02	WS03	WS03	WS03	TP707	TP707	TP708	TP709	TP710	n	Standard Deviation	Minimum	Average	Maximum	Maximum	TP01	TP01	TP02	TP02	TP03	TP03	TP03	TP04	TP04	TP05	TP05	TP06	TP06	TP07	TP07	TP07	WS01	WS01	WS01	WS02	WS02	WS03	WS03	WS03	TP707	TP707	TP708	TP709	TP710	n	Standard Deviation	Minimum	Average	Maximum	Maximum	TP01	TP01	TP02	TP02	TP03	TP03	TP03	TP04	TP04	TP05	TP05	TP06	TP06	TP07	TP07	TP07	WS01	WS01	WS01	WS02	WS02	WS03	WS03	WS03	TP707	TP707	TP708	TP709	TP710	n	Standard Deviation	

	Below Detection Limits.
	Exceeded GAC/SGV
	Exceeded pCASL / S4ULs
	Assessment criteria for pH, Subhlide and Sulphate are not based on human health. Sulphate criteria assumes DS-1 ACEC classification for concrete.
Notes	
1.	Generic Qualitative Assessment Criteria have been used where appropriate based on the current CLEA 1.06 Model (default values, sandy loam 1%SOM). Where no CLEA generic guideline value has been calculated no assessment has been made. The results presented show maximum and mean concentrations. This is to provide a reasonable prediction of the range of data rather than to provide any detailed statistical appraisal.
2.	Results lower than detection limit are shaded in grey.
3.	When the test result is recorded as being less than the detection limit, the result used for the analysis is the detection limit.
4.	Cyanide (total) in the absence of a GQAC based on current CLEA 1.06 Model, the AtRisk Soil Value for Cyanide (free) has been used.
5.	For metals, where an SGV has been published, this value has been used. Note that the published SGVs do not include the residential without plant uptake scenario. CLEA v1.06 has therefore been used to derive GACs for this scenario. For organics, CLEA v1.06 has been used (as the SGV assumes 6% SOM)
6.	pCASL based on adjusted toxicology and exposure assumptions
7.	pCASL for benzene assumes 6% SOM

Site: The Oaks, Wrexham

CHEMICAL STATISTICAL ANALYSIS - based on CLEA v1.06 (Sandy Loam 1% SOM)

TerraConsult

Job No: 4292

Analyte	Limit of Detection	Statistical Analysis																				SGV / GAC		SGV / GAC		pC4SL		pC4SL		LQM/ClEH S4UL		LQM/ClEH S4UL																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																				
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Site: The Oaks, Wrexham

CHEMICAL STATISTICAL ANALYSIS - based on CLEA v1.06 (Sandy Loam 1% SOM)

TerraConsult

Job No: 4292

Analyte	Limit of Detection																	Statistical Analysis				SGV / GAC		SGV / GAC		pC4SL		pC4SL		LQM/CIEH SAUL		LQM/CIEH SAUL																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																										
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02/19	12/02/19	12/02/19	12/02/19	12/02/19	12/02/19	12/02/19	12/02/19	12/02/19	12/02/19	12/02/19	12/02/19	12/02/19	12/02/19	12/02/19	12/02/19	12/02/19	12/02/19	12/02/19	12/02/19	12/02/19	12/02/19	12/02/19	12/02/19	12/02/19	12/02/19	12/02/19	12/02/19	12/02/19	12/02/19	12/02/19	12/02/19	12/02/19	12/02/19	12/02/19	12/02/19	12/02/19	12/02/19	12/02/19	12/02/19	12/02/19	12/02/19	12/02/19	12/02/19	12/02/19	12/02/19	12/02/19	12/02/19	12/02/19	12/02/19	12/02/19	12/02/19	12/02/19	12/02/19	12/02/19	12/02/19	12/02/19	12/02/19	12/02/19	12/02/19	12/02/19	12/02/19	12/02/19	12/02/19	12/02/19	12/02/19	12/02/19	12/02/19	12/02/19	12/02/19	12/02/19	12/02/19	12/02/19	12/02/19	12/02/19	12/02/19	12/02/19	12/02/19	12/02/19	12/02/19	12/02/19	12/02/19	12/02/19	12/02/19	12/02/19	12/02/19	12/02/19	12/02/19	12/02/19	12/02/19	12/02/19	12/02/19	12/02/19	12/02/19</

APPENDIX J

Summary of Chemical Test Results of Water & Leachate Samples

Site: The Oaks, Wrexham

TerraConsult

Summary of Water Analysis - Net 1 Screening					Groundwater monitoring									
Sample Location	Units	Drinking Water Standard	EQS Freshwater	Other	BH1D	BH6AD	BH7D	WS2	WS4	WS5	WS7	WS9	WS10	
					07/03/19	07/03/19	07/03/19	07/03/19	07/03/19	07/03/19	07/03/19	07/03/19	07/03/19	
Water Quality														
pH	pH units	-	-	-	7.1	7.3	7.1	7.1	7.4	7.3	7.2	7.2	7.3	
Electrical Conductivity	uS/cm	-	-	-	6500	3300	5600	1300	1400	1900	6400	770	1300	
Metals														
Arsenic	ug/l	10	50	50	2.5	4.3	3.3	5.8	1.5	3.4	5.3	1	2.3	
Boron	ug/l	1000	2000	-	430	330	430	55	180	150	41	36	95	
Cadmium	ug/l	5	5	5	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	
Chromium (Total)	ug/l	50	200*	-	0.7	0.4	0.6	8.8	0.4	0.4	0.4	0.4	0.4	
Copper	ug/l	2000	28*	28	5.5	5.0	3.1	6.6	0.7	1.2	1.0	1.4	4.2	
Iron	ug/l	200	1000	-	-	-	-	-	-	-	-	-	-	
Lead	ug/l	25	125*	-	1.0	1.0	1.0	1.7	1.5	1.7	2.8	10.0	1.4	
Manganese	ug/l	50	-	500	-	-	-	-	-	-	-	-	-	
Mercury	ug/l	1	1	-	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.5	
Nickel	ug/l	20	150*	200	11	3.5	8.3	3.9	2.7	3.3	2.1	11	1.8	
Selenium	ug/l	10	-	10	4	4	4	22	4	4	4	4	4	
Zinc	ug/l	5000	250*	500	87	14	74	16	1.4	4.5	12	14	5.5	
Calcium	ug/l	250	-	-	720	140	570	120	86	96	99	96	97	
Cations (Dissolved)														
Calcium	mg/l	250	-	-	720	140	570	120	86	96	99	96	97	
Magnesium	mg/l	-	-	-	610	260	400	54	200	130	31	21	57	
Inorganic														
Alkalinity (as CaCO3)	mg/l	-	-	-	690	850	490	650	530	220	820	280	490	
Hardness (as CaCO3)	mg/l	-	-	-	4290	1410	3080	522	1020	775	376	327	476	
Chloride	mg/l	250	250	250	770	230	610	48	170	110	620	12	210	
Nitrate as N	mg/l	50.00	50.00	50.00	1.15	1.24	1.29	0.81	0.85	0.83	0.72	0.79	0.97	
Sulphate (as SO4)	mg/l	250	400	250	3740	2320	3260	285	1160	784	133	119	107	
Unionized Ammonia as N**	mg/l	-	0.025	1.50	0.0068	0.0013	0.0026	0.0013	0.0011	0.0012	-	0.0007	0.0006	
Ammonium (as NH4)	ug/l	500	1000	-	1300	430	1400	730	300	400	15	320	200	
Total Cyanide	ug/l	50	5	70	10	10	10	10	10	10	10	10	10	
Organics														
Phenol	ug/l	-	46	300	10	10	10	10	10	10	10	10	10	
PAH														
Naphthalene	ug/l	10 ^(B)	10	10	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	
Acenaphthylene	ug/l	-	-	-	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	
Acenaphthene	ug/l	-	-	-	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	
Fluorene	ug/l	-	-	-	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	
Phenanthrene	ug/l	-	-	-	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	
Anthracene	ug/l	-	0.40	-	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	
Fluoranthene	ug/l	-	1.00	0.10	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	
Pyrene	ug/l	-	-	-	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	
Benzo[a]anthracene	ug/l	-	-	-	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	
Chrysene	ug/l	-	-	-	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	
Benzo[b]fluoranthene	ug/l	-	0.03	-	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	
Benzo[k]fluoranthene	ug/l	-	0.03	-	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	
Benzo[a]pyrene	ug/l	0.01	0.10	0.70	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	
Indeno[1,2,3-cd]pyrene	ug/l	-	-	-	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	
dibenzo[a,h]anthracene	ug/l	-	-	-	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	
Benzo[ghi]perylene	ug/l	-	0.002	-	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	
Total EPA-16 PAHs	ug/l	-	-	-	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	
TPH														
Mineral Oil (C10 - C40)	ug/l	10	-	-	10	10	10	10	10	10	10	10	10	
Aliphatic >C5 - C6	ug/l	1	-	-	1	1	1	1	1	1	1	1	1	
Aliphatic >C6 - C8	ug/l	1	-	-	1	1	1	1	1	1	1	1	1	
Aliphatic >C8 - C10	ug/l	1	-	-	1	1	1	1	1	1	1	1	1	
Aliphatic >C10 - C12	ug/l	10	-	-	10	10	10	10	10	10	10	10	10	
Aliphatic >C12 - C16	ug/l	10	-	-	10	10	10	10	10	10	10	10	10	
Aliphatic >C16 - C21	ug/l	10	-	-	10	10	10	10	10	10	10	10	10	
Aliphatic >C21 - C34	ug/l	10	-	-	10	10	10	10	10	10	10	10	10	
Aliphatic (C5 - C34)	ug/l	10	-	-	10	10	10	10	10	10	10	10	10	
Aromatic >C5 - C7	ug/l	1	-	-	1	1	1	1	1	1	1	1	1	
Aromatic >C7 - C8	ug/l	1	-	-	1	1	1	1	30	13	1	8.8	1	
Aromatic >C8 - C10	ug/l	1	-	-	1	1	1	1	1	1	1	1	1	
Aromatic >C10 - C12	ug/l	10	-	-	10	10	10	10	10	10	10	10	10	
Aromatic >C12 - C16	ug/l	10	-	-	10	10	10	10	10	10	10	10	10	
Aromatic >C16 - C21	ug/l	10	-	-	10	10	10	10	10	10	10	10	10	
Aromatic >C21 - C35	ug/l	10	-	-	10	10	10	10	10	10	10	10	10	
Aromatic (C5 - C35)	ug/l	10	-	-	10	10	10	10	30	13	10	10	10	
Total TPH (C5 - C35)	ug/l	10	-	-	-	-	-	-	-	-	-	-	-	
BTEX														
Benzene	ug/l	1	30	10	1	1	1	1	1	1	1	1	1	
Toluene	ug/l	-	50	700	1	1	1	1	30.2	12.9	1	8.8	1	
EthylBenzene	ug/l	-	-	300	1	1	1	1	1	1	1	1	1	
M/P Xylene	ug/l	-	30	500	1	1	1	1	1	1	1	1	1	
O Xylene	ug/l	-	30	500	1	1	1	1	1	1	1	1	1	
VOC - All below detection limit														
SVOC														
Bis (2-chloroethyl) ether	ug/l	-	-	-	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	
2-Chlorophenol	ug/l	-	50	-	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	
1,3-Dichlorobenzene	ug/l	-	-	-	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	
1,4-Dichlorobenzene	ug/l	-	-	300	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	
1,2-Dichlorobenzene	ug/l	-	-	1000	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	
Bis (2-chloroisopropyl) ether	ug/l	-	-	-	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	
2-methyl phenol	ug/l	-	-	-	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	
Hexachloroethane	ug/l	-	-	-	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	
Nitrobenzene	ug/l	-	-	-	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	
Isophorone	ug/l	-	-	-	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	

Job No: 4292

Site: The Oaks, Wrexham

TerraConsult

Summary of Water Analysis - Tier 1 Screening

Sample Location	Units	Drinking Water Standard	EQS Freshwater	Other	Groundwater monitoring									
					BH1D	BH6AD	BH7D	WS2	WS4	WS5	WS7	WS9	WS10	
					07/03/19	07/03/19	07/03/19	07/03/19	07/03/19	07/03/19	07/03/19	07/03/19	07/03/19	
2-Nitrophenol	ug/l	-	-	-	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	
2,4-Dimethylphenol	ug/l	-	-	-	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	
Bis (2-chloroethoxy) methane	ug/l	-	-	-	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	
2,4-Dichlorophenol	ug/l	-	20	-	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	
1,2,4-Trichlorobenzene	ug/l	-	-	-	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	
4-Chloroaniline	ug/l	-	-	-	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	
Hexachlorobutadiene	ug/l	-	0.6	0.6	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	
4-Chloro-3-methylphenol	ug/l	-	40	-	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	
2-Methylnaphthalene	ug/l	-	-	-	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	
2,4,6-Trichlorophenol	ug/l	-	-	0.2	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	
2,4,5-Trichlorophenol	ug/l	-	-	-	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	
2-Chloronaphthalene	ug/l	-	-	-	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	
2-Nitroaniline	ug/l	-	-	-	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	
Dimethyl phthalate	ug/l	-	-	4000	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	
2,6-Dinitrotoluene	ug/l	-	-	-	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	
Dibenzofuran	ug/l	-	-	-	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	
2,4-Dinitrotoluene	ug/l	-	-	-	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	
Diethyl phthalate	ug/l	-	-	1000	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	
4-Chlorophenyl phenylether	ug/l	-	-	-	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	
4-Nitroaniline	ug/l	-	-	-	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	
Azobenzene	ug/l	-	-	-	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	
Hexachlorobenzene	ug/l	-	0.03	0.05	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	
Carbazole	ug/l	-	-	-	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	
Butyl benzylphthalate	ug/l	-	-	100	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	

Note:

Fail: Above UK EQS

Fail: Above UK DWS

Result below Detection Limit

* EQS for substances based on >100-150 mg/l CaCO3 Hardness band and Cyprinid designation for receiving water

** Calculated from ammoniacal nitrogen and pH results using an assumed water temperature of 10 degrees.

Total of 4 Drinking Water Standard PAHs: Benzo[b]fluoranthene, Benzo[k]fluoranthene, Indeno[1,2,3-cd]pyrene, Benzo[ghi]perylene

- - Instrument failure

APPENDIX K

Current Guidance for Ground Gas Risk Assessment

Current Guidance for Ground Gas Risk Assessment

Origin of Ground and Landfill Gases

When carrying out a ground gas risk assessment for permanent ground gases (e.g. methane and carbon dioxide), the origin or source of the gases is important as potential risks will vary depending on the source. This Appendix relates to the risk of the two main ground gases of concern: methane and carbon dioxide, and does not apply to other ground gases (e.g. radon or vapours from hydrocarbon spills). Methane and carbon dioxide are major constituents of landfill gas but can also occur from a variety of anthropogenic and natural sources, as summarised in Table G1 below:

Table G1. Potential Sources of Ground Gases		
Gas	Source	Comments
Landfill Gas	Anaerobic decomposition of degradable waste within landfill sites. Typically 60% methane and 40% carbon dioxide during methanogenic phase.	Composition varies over time, particularly in early stages. Contains a range of minor constituents (particularly carbon monoxide and hydrogen sulphide).
Landfill Associated Gases	- Anaerobic degradation of leachate external to the site; - Degassing of dissolved gases in groundwater; - Evolution of gases following interaction between leachate and groundwater	Can result in secondary (external) production of methane or carbon dioxide.
Made Ground	Anaerobic degradation of organic components	Very variable depending on source
Sewer Gas, Cess Pits	Anaerobic degradation of organic components of sewage producing methane and carbon dioxide.	Often characterised by hydrogen sulphide odour.
Mains Gas	Leakage from underground pipework or storage tanks. Mainly methane but often contains higher alkanes.	An odouriser is added to permit detection of leaks. Typically 90% CH ₄ , but 1 to 27% C ₂ -C ₄ alkanes, May also contain other trace gases e.g. CO, helium and CO ₂ (from degradation of CH ₄ in the ground).
Other Anthropogenic Sources	- Degradation of leaked or spilled hydrocarbons or other industrial chemicals; - Anaerobic degradation of organic contaminants in groundwaters (e.g. silage liquor); - Reactions between monitoring well construction components and environment; - Burial grounds/cemeteries.	Hydrocarbon spillages often have an „oily“ odour. Fuel spillages common – Petrol or Diesel and can contain a wide range of VOC“s. Can degrade to produce methane / carbon dioxide.
Alluvium / Marsh / Peat Gas	Anaerobic microbial degradation of organic material (usually waterlogged vegetation / peat). Often associated with the presence of alluvial deposits or dredgings.	
Geogenic Gas	Natural seepages of carbon dioxide and hydrocarbon gases derived from geologic sources such as coal seams and deep oil / gas source formations. Can be present in solution in groundwaters.	Methane most common but can contain carbon dioxide and higher alkanes.
Mine Gases	Various types. Most common is “fire damp” with high methane, produced by the desorption of gas trapped in coal. “Black damp” (Stythe gas) with high carbon dioxide and denser than air. “White damp” is high in carbon monoxide.	Methane most common. Can contain higher alkanes, carbon dioxide and carbon monoxide. Often low in oxygen.
Natural Shallow Ground Gas	Various types - high carbon dioxide formed by subsurface aerobic activity leading to depleted oxygen and elevated carbon dioxide; - chemical degradation of rocks (e.g. carbonates) producing carbon dioxide; - carbon dioxide production in root zone of soils by plants.	Gases can be emitted from ground under falling barometric pressure conditions.

This Appendix concentrates on the assessment of risk from methane and carbon dioxide. This Appendix does not provide guidance for the assessment of risk when other gases are present due to „Other Sources“ from the above table (particularly organic compounds such as BTEX and VOC“s or for the risk from radon or hydrogen sulphide).

To determine the origin of the gas a range of factors must be considered together, including;

1. Proximity of likely sources;
2. Ground conditions (geology, hydrogeology, anthropogenic pathways etc);
3. Properties of gases present including:
 - Chemical composition;
 - Physical properties;
 - Ratios of components e.g. methane : carbon dioxide.
4. Timeframe of activities such as infilling periods, capping works, installation of gas control systems etc.

Identification of the originating source may be problematic given that there may be more than one source present and trace gas analysis may be required. Identification of the sources of the gases encountered during monitoring is usually carried out through a process of eliminating the most unlikely potential sources (given the site setting) and selecting those which are the more likely candidates.

Hazards Associated with Presence of Ground Gases

Methane gas is combustible and potentially explosive. When the concentration of methane in air is between the limits of 5.0%v/v and 15.0%v/v an explosive mixture is formed. The Lower Explosive Limit (LEL) of methane is 5.0%v/v, which is equivalent to 100% LEL. The 15.0%v/v limit is known as the Upper Explosive Limit (UEL), but concentrations above this level cannot be assumed to represent safe concentrations. Further, the LEL and UEL will vary (up and down) depending upon the proportion of other gases (including oxygen). However, the fact that methane is a colourless, odourless gas means that there is no simple indicator of the presence of the gas until such a time as explosive limits are reached and an incident occurs. Methane is lighter than air and has a low toxicity. However, at high concentrations it can result in asphyxiation due to oxygen displacement.

Carbon dioxide is a colourless, odourless gas, which, although non-flammable, is both toxic and an asphyxiant. As carbon dioxide is denser than air, it will collect in low points and depressions. The UK Health & Safety Executive (HSE) has published information relating to concentrations of carbon dioxide that humans may be exposed to, which uses concentrations contained in the Control of Substances Hazardous to Health Regulations 2002 (as amended). These are the Long Term Occupational Exposure Limit (LTOEL, 8 hour period) and the Short Term Occupational Exposure Limit (STOEL, 15 minute period), which are 0.5% and 1.5% carbon dioxide, respectively.

Parameters Influencing the Rate of Ground Gas Production

Figure G2 is taken from EA guidance document LFTGN 03 illustrates typical ground gas generation curves from biodegradable materials:

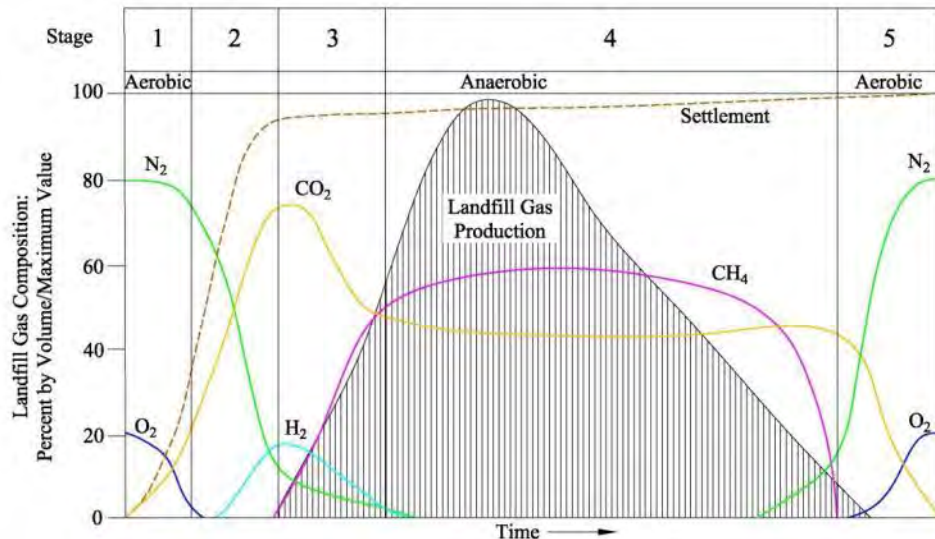


Figure G2. Idealised Representation of Landfill Gas Generation.

The production of methane and carbon dioxide at a landfill site may be expected to be considerable and ongoing. Concentrations of methane will eventually decrease, followed by concentrations of carbon dioxide, but the duration and rate of gas production can vary markedly between sites. Five distinct phases of gas production occur during the process which are, in order of event (as marked on Figure G2), as follows:

1. An aerobic phase involving oxygen depletion and temperature increase through aerobic respiration;
2. The establishment of anaerobic conditions and the evolution of carbon dioxide and hydrogen through acidogenic activity;
3. Commencement of methanogenic activity; the establishment of populations of methanogenic bacteria;
4. A phase of stable methanogenic activity, which may go on for many tens of years;
5. A phase of decreasing methanogenic activity, representing depletion of the organic material and a return to aerobic conditions.

The time scale for the return to the normal ground gas concentrations will be highly variable, depending upon the types and quantities of materials present. In addition, the optimum parameters influencing the rate of decomposition and ground gas production within the ground at a site are as follows:

- High water content with adequate rainfall and water infiltration to provide moisture content between approximately 20 to 26%;
- Conditions that either are or are very close to anaerobic;
- High proportion of biodegradable materials;
- A pH between 6.5 and 8.5, ideally verging slightly on the acidic between pH 6 to 7;
- Temperature between 25°C and 55°C;
- The ratio of the biochemical and chemical oxygen demands (BOD:COD);
- High permeability;
- Small particle size, as finer subsurface materials possess a greater surface area to provide a growing „face“ for the micro-organisms but high fines levels reduces permeability and reduces decomposition rate.

For this reason, it is vital that sources of methane and carbon dioxide are identified prior to the commencement of any work on a construction site, and that the ground gas regime is characterised at the worst temporal conditions a site may experience. From this, a risk assessment is carried out to identify the risk at the site from ground gases so that suitable protection measures can be designed and incorporated into a development to prevent a dangerous build-up of gas occurring.

Factors Influencing the Migration and Behaviour of Ground Gases

There are many factors that influence the migration of ground gases which can affect the risk from a gassing source:

- driving force – pressure differential along a pathway, diffusion and dissolved in solution;
- meteorological conditions – short term and seasonal conditions including atmospheric pressure changes (e.g. rapidly falling pressure causes gas to expand increasing emission rates), rainfall, frozen ground and thawing, temperature;
- geological and groundwater conditions – these can have the over-riding influence on the direction/pathways and quantity of migrating gas;
- anthropogenic influences – man-made pathways include mine shafts, service runs/drains, foundation piles, underground voids/pits/basements, foundation/building design/construction

Guidance Documents

Currently in the UK, there are no statutory threshold limits for hazardous gases in the ground as site specific variables mean that standard threshold values cannot be applied. The published guidance relating to development of sites where methane and carbon dioxide are present has been produced in response to building projects on or close to landfill sites, as both gases are principal constituents of landfill gas. Much of the historic guidance that has been produced on gas risk assessment focused on landfill sites and as a result there has previously been a lack of clarity when relating the process to gas conditions on non-landfill sites.

Statutory guidance regarding methane in the ground has previously taken a limiting concentration of 1.0 % by volume methane (equal to 20% of the lower explosive limit of methane in air) above which necessary actions will be appropriate. For carbon dioxide the limiting recommended trigger was 1.5 % by volume (the Long Term Exposure Limit for carbon dioxide). Above these concentrations the Building Regulations Approved Document C (1992) stated that consideration should be given to whether actions may be appropriate, whilst more specific solutions would be likely to be necessary at concentrations greater than 5% by volume of carbon dioxide (Building Regulations Approved Document C, 1992). However, the latest fully revised version of Approved Document C (DoE, 2004) no longer endorses this approach and instead requires the use of a risk-based approach in interpreting the findings of a gas monitoring survey. Further, the latest EA documentation on landfill gas (LFTGN 03, 2004) continues to sanction the use of a risk-based approach through a structured approach to the assessment of ground gases and links with the risk assessment process outlined within CLR 11 for soil contaminants.

With the above in mind, recent guidance has been produced in 2006 and 2007 with the aim of providing up to date advice in relation to residential and commercial development. The guidance does not address issues associated with gas derived from landfills, for this refer to “*Guidance on the Management of Landfill Gas*” (Environment Agency 2004) for an overview.

Recent guidance relevant to gas assessments for residential and commercial development includes;

- **Wilson et al. (CIRIA C665, December 2007) “Assessing Risks Posed by Hazardous Ground Gases for Buildings.”**

This document provides up to date advice on all aspects of ground gas risk assessment such as investigation, monitoring programmes, data collection and interpretation. The guidance presents separate methodologies for the characterisation of:

- **All development types except low rise housing with gardens and for Low Rise Buildings without a 150mm void (Situation A) (Table 8.5 CIRIA C665)**
and;

- **Low rise housing with gardens with a 150mm ventilated sub-floor void** (Situation B) (Table 8.7 CIRIA C665)
(See below for further explanation of the methods of characterisation)
- **Boyle and Witherington (NHBC / RSK Group, Report 10627-R01(04) January 2007) “Guidance on the Evaluation of Development Proposals on Sites where Methane and Carbon Dioxide are Present.”**
This document presents the “Traffic Lights System” detailed below and is relevant only for low rise properties (e.g. bungalows and town houses) that have a ventilated sub-floor void (i.e. Situation B as described in CIRIA C665).
- **Wilson and Card (CIEH, expected 2011) “Ground Gas Handbook for Designers and Regulators”**
This document is expected to provide practical guidance on ground gas assessments and the design and evaluation of protection measures.
- **British Standard (BS 8485+A1, January 2019) “Code of Practice for the Design of Protective Measures for Methane and Carbon Dioxide Ground Gases for New Buildings”**
This document provides an overview of gas characterisation and assessment. The Standard is intended to be used by designers of gas protection measures and regulators involved in the assessment of design solutions. The Standard provides a framework in line with CLR11 allowing designers to judge the adequacy of ground gas and related site investigation data. The document provides an approach to determine appropriate ground gas parameters that can be used to identify a range of possible construction solutions mitigating against the presence of ground gas on a development site.

Each of these documents continues to highlight the importance of, and give further guidance towards, carrying out a tiered risk-based decision-making process in accord with government policy on dealing with contamination from historic or natural sources and highlight the importance of the Conceptual Model in site characterisation. These documents also stress the importance that the assessor should be confident that the ground gas monitoring results are representative of the likely worse case ground gas regime on a site and that the data collected from the site is sufficient. With this in mind, CIRIA C665 sets out ideal monitoring periods as below.

Idealised Frequency and Period of Monitoring (after Table 5.5a and 5.5b, CIRIA C665)						
		Generation Potential of Source				
		Very Low	Low	Moderate	High	Very High
Sensitivity of Development	Low (Commercial)	4/1	6/2	6/3	12/6	12/12
	Moderate (Flats)	6/2	6/3	9/6	12/12	24/24
	High (Residential with Gardens)	6/3	9/6	12/6	24/12	24/24
Notes						
1. First number is the number of readings and the second is the minimum period in months (e.g. 6/2 – six sets of readings over two months).						
2. At least two sets of readings must be at low (preferably under 1,000 mb) and falling pressure.						
3. High sensitivity end use on high or very high hazard site will not normally be acceptable unless the source is treated to reduce gassing potential.						

Before the latest guidance, good practice for site characterisation had been based upon the method proposed by Wilson and Card (1999). CIRIA C665 (2007) effectively supersedes Wilson and Card (1999) and includes a modified version of the Wilson and Card method (Tables 8.5, 8.6 and Box 8.1). Gas

concentrations and flow rates for either methane and/or carbon dioxide measured at a site to „Characteristic Situations.“ Appropriate protection measures are selected from Table 8.6 (if using modified Wilson & Card method) and from Box 8.4 from CIRIA C665 (if using the NHBC traffic lights method). Throughout the risk assessment process, strong regard must be given to the nature of the gassing source, the flow rates and the estimated surface emissions. Note that certain protection measures are stated in CIRIA Report 149 that are now considered wholly inappropriate to certain developments and consequently should not be used without modification. Throughout the process, it is important to remember that these tables are not intended to be used as a definitive design tool and have been prepared to show the typical scope of measures for gas control.

Both the NHBC (2007) and CIRIA (2007) guidance documents and BS 8485+A1 (2019) propose that both ground gas concentrations and flow rates are used to calculate the limiting gas well gas volume flow rates for methane and carbon dioxide, based on the ground gas conditions monitored for during the worse-case temporal conditions. This limiting gas well volume flow rate is termed the Gas Screening Value (GSV, note that this was termed borehole gas volume flow), and is calculated as follows:

$$\text{GSV (l/hr)} = \frac{[\text{gas well gas concentration (\%v/v)}] \times [\text{gas well flow rate (l/hr)}]}{100}$$

These GSVs are then compared to generic „Traffic Lights“ contained within the NHBC guidance, which present typical maximum gas concentrations and limiting GSV's, for „Situation B Development“ (Low rise housing with gardens).

Table 8.7 NHBC Traffic light system for 150 mm void				
Traffic Light	Methane ¹		Carbon Dioxide ²	
	Typical max concentration ³ (%) by volume)	Gas Screening Value ^{2,4} (litres/hour)	Typical max concentration ³ (%) by volume)	Gas Screening Value ^{2,4} (litres/hour)
Green				
Amber 1	1	0.13	5	0.78
	5	0.63	10	1.6
Amber 2				
Red	20	1.60	30	3.10
Notes: 1. The worst-case ground gas regime identified on the site, either methane or carbon dioxide, at the worst-case temporal conditions that the site may be expected to encounter will be the decider as to what Traffic Light is allocated; 2. Borehole Gas Volume Flow Rate, in litres per hour as defined in Wilson and Card (1999), is the borehole flow rate multiplied by the concentration in the air stream of the particular gas being considered; 3. The Typical Maximum Concentrations can be exceeded in certain circumstances should the Conceptual Site Model indicate it is safe to do so; 4. The Gas Screening Value thresholds should not generally be exceeded without the completion of a detailed ground gas risk assessment taking into account site-specific conditions.				

Box 8.4 of CIRIA C665 Gas protection measures for low-rise housing development based upon allocated NHBC Traffic light (Boyle and Witherington, 2007)	
Traffic Light Classification	Protection Measures Required
Green	Negligible gas regime identified and gas protection measures are not considered necessary.
Amber 1	Low to intermediate gas regime identified, which requires low-level gas protection measures, comprising a membrane and ventilated sub-floor void to create a permeability contrast to limit the ingress of gas into buildings. Gas protection measures should be as prescribed in BRE Report 414. Ventilation of the sub-floor void should facilitate a minimum of one complete volume change per 24 hours.
Amber 2	Intermediate to high gas regime identified, which requires high-level gas protection measures, comprising a membrane and ventilated sub-floor void to create a permeability contrast to prevent the ingress of gas into buildings. Gas protection measures should be as prescribed in BRE Report 414. Membranes should always be fitted by a specialist Contractor. As with Amber 1, ventilation of the sub-floor void should facilitate a minimum of one complete volume change per 24 hours. Certification that these passive protection measures have been installed correctly should be provided.
Red	High gas regime identified. It is considered that standard residential housing would not normally be acceptable without a further Gas Risk Assessment and/or possible remedial mitigation measures to reduce and/or remove the source of gas.

For a „Situation A Development“ (All development except low rise housing with gardens), the GSV value is used to derive the appropriate Characteristic Situation from Table 8.5 of CIRIA C665 (below):

Table 8.5 from CIRIA C665 Modified Wilson and Card Classification					
Characteristic Situation (CIRIA R149)	Comparable Partners in Technology gas Regime (see Box 8.2)	Risk Classification	Gas Screening Value (CH₄ or CO₂) (l/hr)¹	Additional Factors	Typical Source of Generation
1	A	Very low risk	<0.07	Typically methane ≤ 1% and/or carbon dioxide ≤ 5%. Otherwise consider increase to Situation 2	Natural soils with low organic content "Typical" made ground
2	B	Low risk	<0.7	Borehole air flow rate not to exceed 70l/hr. Otherwise consider increase to characteristic Situation 3	Natural soil, high peat/organic content. "Typical" made ground
3	C	Moderate risk	<3.5		Old landfill, inert waste, mine working flooded
4	D	Moderate to high risk	<15	Quantitative risk assessment required to evaluate scope of protective measures.	Mine working susceptible to flooding, completed landfill (WMP 26B criteria)
5	E	High risk	<70		Mine working unflooded inactive with shallow workings near surface
6	F	Very high risk	>70		Recent landfill site

It was intended in CIRIA C665 that the characteristic situation allocated to the development from the table above would then be used in Table 8.6 of CIRIA C665 in order to determine the level of gas protection the development requires. However, BS8485:2015 superseded this document and a different set of mitigation standards were put forward.

The recommended minimum gas protection score (points) be selected based on the building type (Table 3 which defines four building types) and the ground gas Characteristic Situation as detailed in Table 4 of BS8485:2015+A1:2019 (see below).

The first step in the decision making process is to obtain the level of gas protection necessary in the range 0 to 7.5 from Table 4. Then a combination of structural barriers (Table 5) ventilation protection measures (Table 6) and/or gas resistant membranes (Table 8) should be chosen to meet that requirement. The level of gas protection necessary should take into account the characteristic gas situation and a number of other factors. The whole decision making process should be made transparent, where all parties can see the approach being taken, can understand the various steps and decisions made and be confident that a risk-assessed solution has been designed and installed commensurate with the construction and site constraints.

Where the gas Characteristic Situation is 4 or more (and for NHBC Red situations according to CIRIA C665), the site requires a comprehensive risk assessment to confirm the scope of protection measures. These are higher risk sites and reliance on Table 4 alone is not sufficient.

BS8485:2015+A1:2019 Table 3 Building Types				
	Type A	Type B	Type C	Type D
Ownership	Private	Private or commercial/ public, possible multiple	Commercial / public	Commercial / industrial
Control (change of use, structural alterations, ventilation)	None	Some but not all	Full	Full
Room sizes	Small	Small / medium	Small to large	Large industrial / retail park style

BS8485:2015+A1:2019 Table 4 Gas Protection Score by CS and Type of Building				
CS	Required Gas Protection			
	High risk	Medium risk		Low risk
	Type A	Type B	Type C	Type D
1	0	0	0	0
2	3.5	3.5	2.5	1.5
3	4.5	4	3	2.5
4	6.5 ^(A)	5.5 ^(A)	4.5	3.5
5	(B)	6 ^(A)	5.5	4.5
6	(B)	(B)	(B)	6
a)	Residential building should not be built on CS4 or higher sites unless the type of construction or site circumstances allow additional levels of protection to be incorporated, e.g. high-performance ventilation or pathway intervention measures, and an associated sustainable system of management of maintenance of the gas control system, e.g. in institutional and/or fully serviced contractual situations.			
b)	The gas hazard is too high for this empirical method to be used to define the gas protection measures			
NOTE 3 The NHBC has published guidance for use on residential developments, which utilise an alternative classification ("traffic light") system. This guidance typically applies to Type A buildings utilising beam and block floor constructions with clear void ventilation. The design choice variables are limited to decisions relating to the membrane specification and verification recommendations (see Table 7). Designers utilising this system would therefore need to refer to NHBC to assess compliance for specific recommendations [see 8485:2015 for further on this note] NOTE 4 The method of selecting the combination of these types of protection is given in section 7.2 of BS8485:2015. Once type of measures has been decided, the detailed design and specification of the measures should be undertaken (section 7.3)				

Section 7.2 defines the order of selecting protective measures. The first choice is provided by structural barriers as defined in Table 5.

BS8485+A1:2019 Table 5 Gas protection scores for structural barriers		
PROTECTION ELEMENT/SYSTEM	SCORE	COMMENTS
Floor and substructure design		
Floor slabs		
Block and beam floor slab	0	<i>General – score conditional that breaches of slab are sealed</i>
Cast in situ ground-bearing floor slab (with only nominal mesh reinforcement)	0.5	
Cast in situ monolithic reinforced ground-bearing raft or reinforced cast in situ suspended floor slab with minimal penetrations (with only nominal mesh reinforcement)	1 or 1.5	<i>To achieve 1.5, raft or suspended slab to be well reinforced to prevent cracking and minimal penetrations</i>
Basement floor and walls to BS 8102:2009, Grade 2 waterproofing – See notes in BS8485:2015+A1:2019	2	
Basement floor and walls to BS 8102:2009, Grade 3 waterproofing - See notes in BS8485:2015+A1:2019	2.5	<i>Conditional that waterproofing is not based on geosynthetic clay liner</i>

Ventilation methods are detailed in Table 6, and points can only be gained from using one of the five types

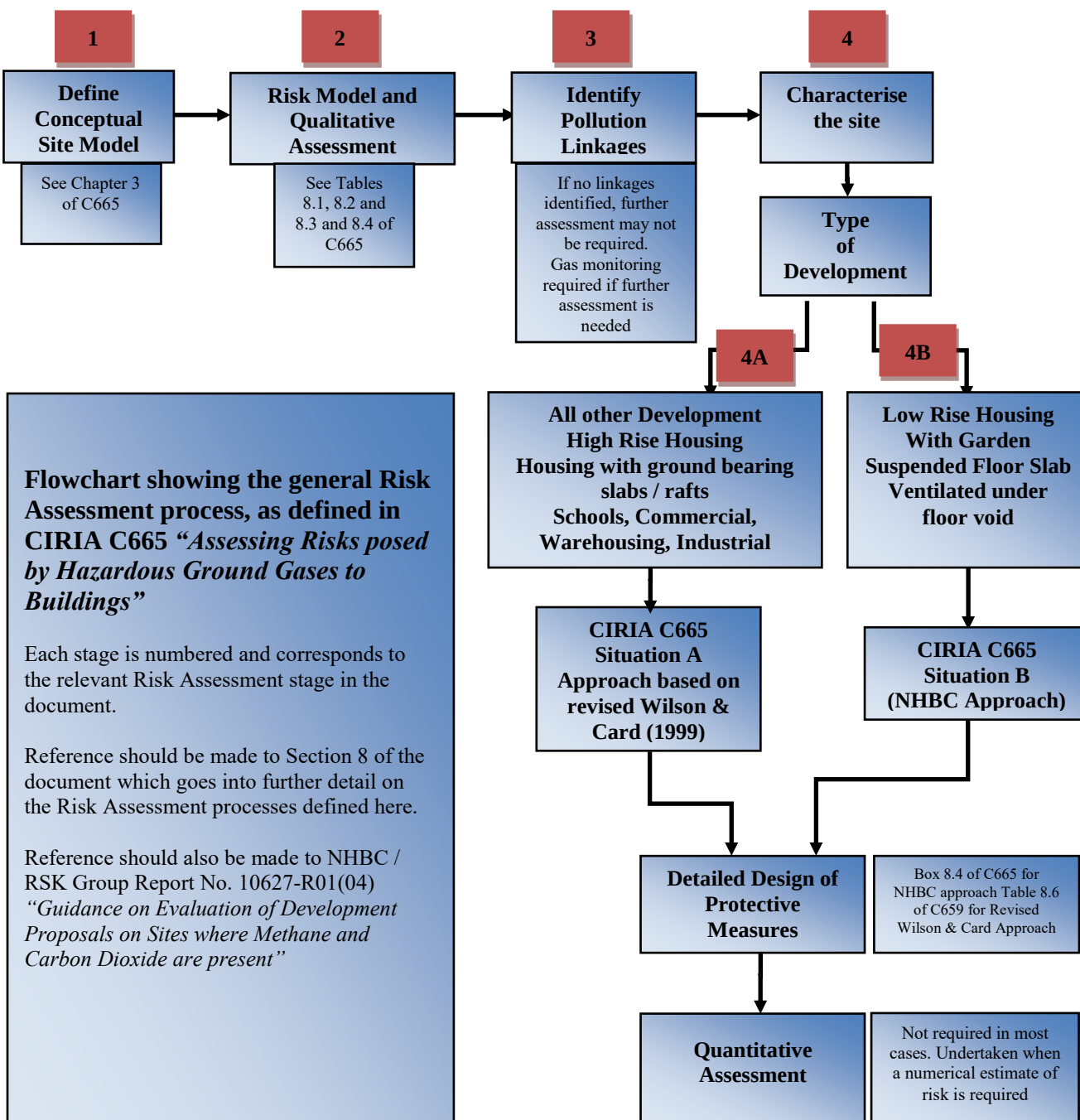
BS8485:2015+A1:2019 Table 6 Gas Protection Scores for Ventilation Protection Measures		
PROTECTION ELEMENT/SYSTEM	SCORE	COMMENTS
a) Pressure relief pathway (usually formed by low fines gravel or with a thin geocomposite blanket with strips terminating in a gravel trench external to the building)	0.5	<i>Whenever possible, a pressure pathway relief pathway (as a minimum) should be installed in all gas protection measures systems. If a layer has a low permeability and/or is not terminating in a venting trench (or similar), then the score is zero.</i>
b) Passive sub floor dispersal layer Very good performance Good performance Media used to provide the dispersal layer are: • Clear void • Polystyrene void forming blanket • Geocomposite void former blanket • No-fines gravel layer with gas drains • No-fines gravel layer	2.5 1.5	<i>Performance criteria shown in Fig B.6 and B.7 of BS 8484:2015.[See Annex B]</i>
c) Active dispersal layer, usually comprising fans with active abstraction (suction) from a subfloor dilution layer, with roof level vents. The dilution layer may comprise a clear void or be formed of geocomposite or polystyrene void formers	1.5 to 2.5	<i>This system relies on continued serviceability of the pumps, therefore alarm and response systems should be in place. [See Annex B].</i>
d) Active positive pressurisation by the creation of a blanket of external fresh air beneath the building floor slab by pumps supplying air to points across the central footprint of the building into a permeable layer, usually formed of a thin geocomposite blanket	1.5 to 2.5	<i>This system relies on continued operation of the pumps, therefore alarm and response systems should be in place. [See Annex B].</i>
e) Ventilated car park (floor slab of occupied part of the building under consideration is underlain by a basement or undercroft)	4	<i>Assumes car park is vented, designed to Building Regulations 2000, Approved Document F.</i>

Membrane methods are detailed in Table 7.

BS8485:2015+A1:2019 Table 7 Gas protection score for gas resistant membrane		
PROTECTION ELEMENT/SYSTEM	SCORE	COMMENTS
Gas resistant membrane meeting all of the following criteria: • Sufficiently impervious to gases with a methane gas transmission rate <40.0 ml/day/m²/atm (average) for sheet and joints (tested in accordance with BS ISO 15105-1 manometric method) • Sufficiently durable to remain serviceable for the anticipated life of the building and duration of gas emissions; • Sufficiently strong to withstand in-service stresses (eg settlement if placed below a floor slab); • Sufficiently strong to withstand the installation process and following trades until covered (eg penetration from steel fibres in fibre reinforced concrete, dropping tools etc); and to withstand in-service stresses (e.g. settlement if placed below a floor slab) • capable, after installation, of providing a complete barrier to the entry of the relevant gas; and • verified in accordance with CIRIA C735	2	<i>The performance of membranes is heavily dependent on the quality and design of the installation, resistance to damage after installation, and the integrity of joints. If a membrane is installed that does not meet the criteria, then the score is zero.</i>
See notes in BS8485:2015+A1:2019 regarding membrane requirements		

For a site which is impacted by migratory gases from an off-source, the development may be protected by imposing pathway intervention methods, which if successfully validated, could also remove the need for further analysis. It is essential that the gas regime in these circumstances has been fully characterised and that the only source impacting the site is located off site and that the pathway is clearly defined and its interception equally proven before construction commences. Pathway intervention methods may include vertical membrane installations, venting trenches, rows of stone columns, activated trenches and various proprietary systems. These systems are particularly relevant to domestic housing where there is limited scope for foundation type solutions.

Following the choice of protection measures, detailed design should be entered into [Section 8 of BS 8485:2015+A1:2019].



APPENDIX L

Summary of Guidance for Classification of Soil as a Waste Material

Guidance for Classification of Soil for Off Site Disposal at a Landfill Site

Many site developments create a portion of excess soils and Made Ground which if not re-usable, are required to be disposed off-site at a suitably licensed landfill site. The regulations and associated guidance published by the Environment Agency is relatively complex and lengthy. This guidance provides a summary of the following documents which should be referred to when assessing soil (and common constituents found within Made Ground on remediation sites) for off-site disposal:

- Guidance for Waste destined for disposal in landfills: Interpretation of the Waste Acceptance Requirements of the Landfill (England and Wales) Regulations 2002 (as amended) (EA, 2004);
- Guidance on Sampling and Testing of Wastes to Meet Landfill Waste Acceptance Procedures (EA, April 2005);
- WM3 - Hazardous Waste: Interpretation of the Definition and Classification of Hazardous Wastes (EA, May 2015);
- European Regulation No 1272/2008 on Classification, Labelling and Packaging of Substances 2015 (CLP 2015);
- Guidance on Waste Destined for Disposal in Landfill (EA, June 2006);
- Treatment of Non-hazardous wastes for Landfill (EA, February 2007).

It is important to distinguish between the waste classification system and the designation of materials as "suitable for use" on site. A material may be retained on site for an appropriate end use if that end-use is clearly designated and that a site-specific risk assessment ensures that it does not pose a risk to human health or controlled waters. However, if this material is excavated and sent for disposal, the material is then subject to waste management regulations and the two systems cannot be directly correlated. It is therefore important to note that classifying a material as hazardous (should it be excavated and become a waste) does not necessarily indicate that it might not be suitable to be kept on site for re-use. Separate guidance in the form of a Code of Practice (CL:AIRE Version 2, 2011) has been developed jointly between the development industry and the Environment Agency to provide best practice when assessing whether materials are wastes or not, and for determining when waste can cease to be waste for a particular use.

In accordance with the current waste regulations (or Landfill Directive, as they are more commonly known), from 30th October 2007 all waste materials produced from construction sites have to be pre-treated prior to disposal. Pre-treatment includes waste minimisation, recovery (e.g. separation of demolition waste to be used as hardcore) and separation of materials into different waste categories (e.g. separate inert waste from hazardous waste etc). Mixing of different waste types shall be avoided and intentional mixing of inert materials with hazardous waste to „dilute it“ and hence change its waste classification, is illegal.

The current waste regulations (based on the EU landfill directive) introduced a two tier classification system for waste materials, defining them as either being hazardous or non-hazardous. Landfills are licensed to take wastes based on a three tier classification system with the non- hazardous waste divided into two sub-categories:

- Non-Hazardous - inert;
- Non-Hazardous - non-hazardous;
- Hazardous.

Waste materials are categorised with a six figure numeric code in the European Waste Catalogue. Commonly found construction and demolition wastes including excavated soil from contaminated sites and Made Ground with their waste codes are summarised below (this is not a comprehensive list):

Waste Code	What is it?	Likely Waste Category–		
		Inert Waste	Non-Hazardous	Hazardous Waste
17 01 01 Concrete	Concrete, possibly with reinforcement (from Construction & Demolition)	✓		
17 01 02 Bricks		✓		
17 01 06* Mixtures of concrete, bricks, tiles & ceramics containing dangerous substances	These are not normally considered hazardous but if they are contaminated (e.g. by asbestos) then could be hazardous – see comment above			✓
17 01 07 Mixtures of concrete, bricks, tiles & ceramics other than those in 17 01 06	This is mixed inerts c.f. 17 09 04	✓		
17 05 03* soils and stones containing dangerous substances				✓
17 05 04 soils and stones other than those mentioned in 17 05 03	Soil and stones only (excluding top soil, peat, soil and stones from contaminated sites)	✓		
17 06 05* Construction materials containing asbestos	e.g. corrugated asbestos sheeting			✓
17 08 02 Gypsum-based construction materials other than those mentioned in 17 08 01	Plaster & plasterboard (although specific disposal requirements are required for high sulphate waste – see EA guidance „Understanding the Landfill Directive“ version 1.0 March 2010.		✓	
17 09 01* Construction & demolition wastes containing mercury				✓
17 09 02* Construction & demolition wastes containing PCBs	Waste with more than 50 mg/kg of PCB"s are hazardous			✓
17 09 03* Other mixed construction & demolition wastes containing dangerous substances	Broad range of potentially (see notes below – if asterisk the waste is hazardous) hazardous wastes			✓
17 09 04 Mixed construction & demolition wastes other than those mentioned in 17 09 01, 17 09 02 & 17 09 03	Mixed inerts with soil, tarmac, cables, vegetation, plaster, etc. (this waste can only be considered inert if it passes the waste acceptance criteria identified in the regulations).	✓	✓	
Note: all wastes with an asterisk code are hazardous regardless of whether they are mirror or absolute entries in the EWC list the decision to with regard to composition must come before applying the code for mirror entries.				

Some materials are classified as Inert Waste based in its origin (e.g. 17 01 01 Concrete, or glass) without any requirement for laboratory chemical analysis.

However, most soils will require laboratory testing to confirm whether they are classified as Hazardous Waste. The protocol for assessing these materials and the appropriate threshold values is complicated and are set out in the Environment Agency's "Technical Guidance WM3 Hazardous Waste – Interpretation of the Definition and Classification of Hazardous Waste" (2015). If the test results for the waste indicates that it is not hazardous then further analysis of the waste is required to determine whether it is Inert Waste. If the waste does not meet the criteria for either Hazardous or Inert, then it is by default classified as Non-hazardous Waste.

As an alternative location to landfills for off-site disposal of inert and non-hazardous waste, there are a number of sites which have Waste Permit Exemptions that can accept certain categories of inert and non-hazardous wastes. Additionally some quarries can accept certain types of wastes to be used for quarry restoration material. For both alternatives to disposal at landfill sites the material still requires chemical testing as these sites have site specific acceptance criteria for wastes. It should also be noted that these types of site do not incur landfill tax.

Waste Categorisation

The process of determining the category of wastes is a three stage process:

- Stage 1 – is the waste either Hazardous or Inert by definition without the requirement for chemical analysis (if it is then Stages 2 and 3 are not required);
- Stage 2 - Waste characterisation;
- Stage 3 - WAC classification.

Waste characterisation determines if a waste is hazardous or not. Excavated soil is characterised using a system based on the contaminants present and their hazardous properties. The system uses total concentrations of the contaminants. Thresholds (as a percentage of the waste) have been set for the various hazardous properties.

Fourteen hazardous properties together with other scenarios where material could cause a hazard have been defined:

- Hazardous properties: explosive, oxidising, highly flammable/flammable, irritant, harmful, toxic, carcinogenic, corrosive, infectious, toxic for reproduction, mutagenic and ecotoxic;
- Substances which can release toxic/very toxic gases in contact with water, acid or air;
- Substances which, after disposal, can yield another substance, e.g. a leachate, which possesses any of the above hazardous properties.

Some of the hazardous properties are sub-divided e.g. there are three categories of carcinogenic, mutagenic and toxic for reproduction substances. The hazardous properties were originally defined in the European Hazardous Waste Directive 91/689/EC. Should a waste contain a contaminant with one or more of the listed hazardous properties at a concentration equal to or above the threshold value for the particular property, then the waste is hazardous. The hazardous properties of a wide range of chemicals are sourced from CLP 2015.

There are many reasons why waste soil is classified as being hazardous but the majority of reasons can be divided into the following four groups:

- Hydrocarbons – this is probably the most common reason for the hazardous classification of soils. For most soils hydrocarbon analysis will be required for both Polycyclic Aromatic Hydrocarbons (PAH) and speciated Petroleum Hydrocarbons (PHCs) but depending on the site's history other groups of organic contaminants may also be included in any analysis suite for soil samples;
- Metals – Particularly sites from former metal processing or mining sites and also some types of ash have metal concentrations that are sufficiently high to characterise materials requiring disposal as hazardous waste.
- Asbestos;
- Anions – e.g. sulphate in plasterboard (there are special disposal requirements for high sulphate waste and specific WAC requirements); it is possible that sulphate salts of metals

and semi-metals could make the waste hazardous – the sulphate concentration could possibly be significant under H12, H13 and H14.

The characterisation of wastes with significant metal concentrations involves some processing of the analysis data. The chemical analysis results for inorganic substances are generally reported as total concentrations e.g. total lead, total arsenic, total sulphate etc. However, CLP 2015 deals with the hazardous properties of actual compounds e.g. lead sulphate, arsenic pentoxide, nickel carbonate. Therefore, the total metal results have to be converted into assessed chemical analysis results for the compound most likely to be present in the soil samples. For example, if the sample contains high total lead concentrations and high sulphate concentrations, then the lead is likely to be present in the soil as lead sulphate. The most likely compounds can often be determined from a desk study or previous site uses. If the site has been derelict for a number of years, consideration should be given as to whether water soluble compounds should or should not be chosen, as rainfall could have removed them from the soil (this does not apply if the soil has been taken from below under a concrete slab etc). Chemical knowledge and common sense needs to be used in choosing a suitable compound.

If no data is available, then a worst case scenario has to be assumed and the most hazardous compound likely to be present has to be chosen. For example, metal chromates (lead chromate, nickel chromate) are often the most hazardous compounds formed by many metals, but if the chromium concentrations in the soil are low, chromates are unlikely to be present. It should also be noted that for many of the hazard categories, the cumulative hazard from different compounds is added (e.g. add the concentrations of the copper, lead and zinc compounds together to assess the Hazard Category H14 Ecotoxicity).

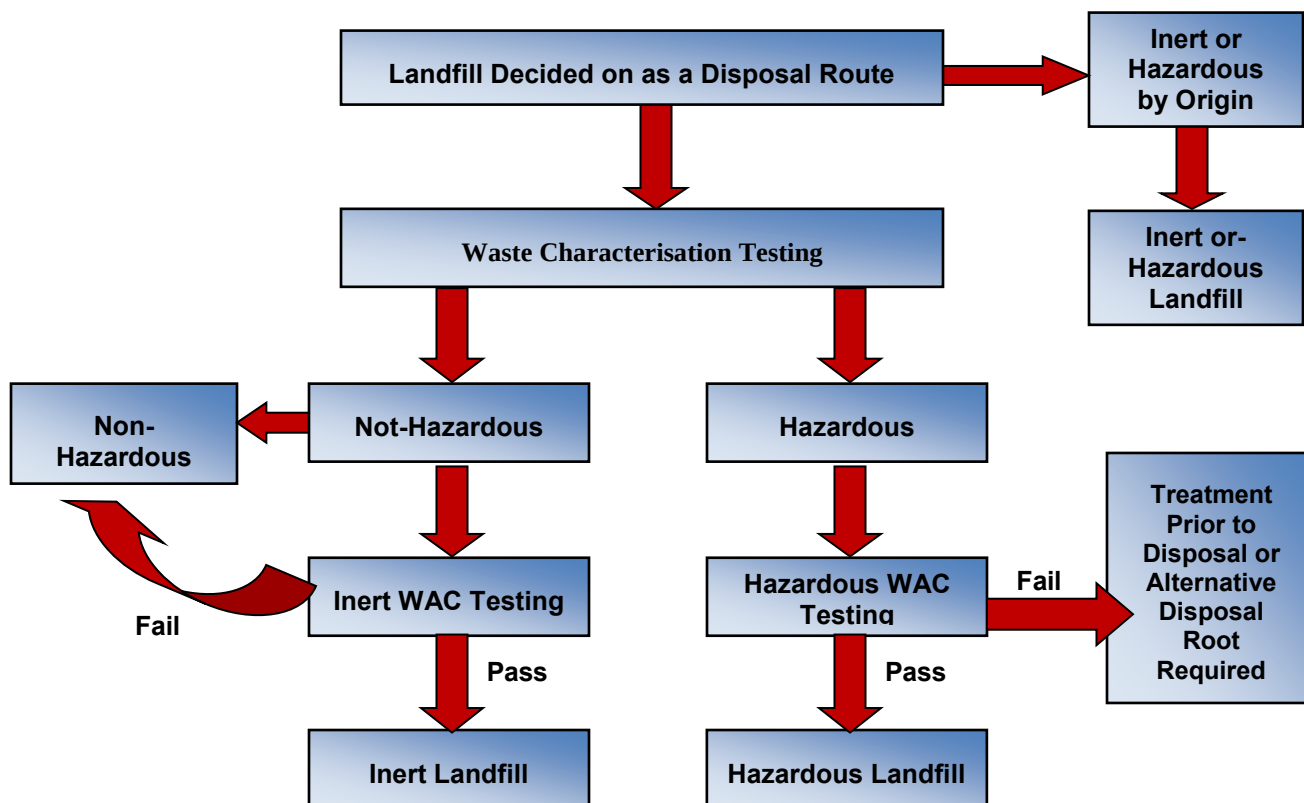
If the results of the above assessment determine that the waste is hazardous, it must then be analysed for the Waste Acceptance Criteria (WAC) analysis contained within appropriate Environmental Permitting Regulations (this comprises mainly leachate but also analysis for TOC and Loss on ignition). WAC limit values have been set for the listed determinands. If any of the determinands exceed their limit value, the waste must be pre-treated to reduce concentrations to below the limit values before the waste may be disposed of at a landfill site licensed to take hazardous waste.

For waste classified as not being hazardous, then there are two options available. Currently, waste correctly characterised as not being hazardous may be disposed of without WAC testing to a non-hazardous landfill. Alternatively WAC testing for Inert Waste can be carried out (this is similar to the list for hazardous waste with the addition of PAH's, BTEX and Mineral Oil). If the results pass the Inert WAC criteria it can be disposed of at an Inert Waste Landfill. If any of the WAC test results exceed the Inert WAC criteria the waste has to be disposed at a non-hazardous landfill. There are WAC limits for non-hazardous waste set for pH and TOC. If these two criteria are not met then the waste must be pre-treated to so that it meets the criteria before it can be disposed.

If materials fail the WAC criteria it may be possible to pre-treat the waste on-site or be taken to a soil treatment centre for pre-treatment to reduce the soil's hazardous properties (e.g. by bioremediation of hydrocarbons).

It should be noted that in order to dispose of Hazardous Waste, the site must register as a producer of Hazardous Waste with the Environment Agency. When disposing of waste materials to landfill sites the appropriate Duty of Care Waste Transfer procedures must be followed.

Landfilled Waste Decision Tree



Inert By Origin

EA paper "Waste Acceptance at Landfills - Guidance on waste acceptance procedures and criteria" indicates that 'Inert' wastes listed as acceptable at a landfill for inert waste without testing, if: "they are single stream waste of a single waste type (although different waste types from the list may be accepted together if they are from a single source); and there is no suspicion of contamination and they do not contain other material or substances such as metals, asbestos, plastics, chemicals, etc to an extent which increases the risk associated with the waste sufficiently to justify their disposal in other classes of landfill." Therefore based on the findings of a suitable desk study natural soils and other materials can be classified as inert without testing based on knowledge of the origin of the waste and confirmatory visual inspection without testing, It must be free of anthropogenic materials (unless it is from a suitably certified waste stream).

Landfill Tax

It should be noted that HM Revenue and Customs (HMRC) classify wastes for tax purposes using a different scheme to the three fold landfill EU Landfill Directive scheme (i.e. the hazardous, non-hazardous and inert). HMRC have a two-fold system for landfill tax: inactive and active. The Standard Landfill Tax for 2019/30 is £91.35/T and applies to all wastes unless they qualify for the reduced rate of landfill tax of £2.90/T. The wastes that qualify for the reduced rate of Landfill Tax are set out in The Landfill Tax (Qualifying Material) Order 2011 with supplementary information on the interpretation of these regulations in HMRC "Notice LFT1 – A General Guide to Landfill Tax" (May 2012) and HMRC Briefing Notes 15/12 and 18/12.

APPENDIX M

Unforeseen Ground Contamination

Unforeseen Ground Contamination

There is the potential for areas of previously unexpected contamination to be present, as is the case with any “brownfield” site. Any significant quantities of asbestos, significant ashy soils, unusual, brightly coloured or significantly oily or odorous material should be considered in this category. If unexpected contamination is found the following procedures should be adhered to:

1. All site works at the position of the suspected contamination will cease.
2. A suitably trained geo-environmental specialist should assess the visual and olfactory observations of the condition of the ground and the extent of contamination and the Client and the Local Authority should be informed of the discovery. Should the contamination be likely to affect controlled waters the Environment Agency shall also be informed.
3. The suspected contaminated material will be investigated and tested appropriately in accordance with the assessed risks. The investigation works will be carried out in the presence of a suitably qualified geo-environmental engineer. The investigation works shall commence to recover samples for testing and, using visual and olfactory observations of the condition of the ground, delineate the area over which contaminated materials are present.
4. The unexpected contaminated material will either be left in situ or be stockpiled whilst testing is carried out and suitable assessments completed to determine whether the material can be re-used on site or requires to be disposed as appropriate.
5. Where the material is left in situ awaiting results it will be reburied or covered with plastic sheeting.
6. Where the potentially contaminated material is to be temporarily stockpiled it will either be placed either on a prepared surface of Glacial Till, or on 2000 gauge Visqueen sheeting (or other impermeable surface) and covered to prevent dust and odour emissions.
7. Any areas where unexpected visual or olfactory ground contamination will be surveyed, a photographic record kept and testing results incorporated into the Verification Report.
8. A photographic record will be made of relevant observations.
9. The testing suite will be determined by the independent geo-environmental specialist on the basis of visual and olfactory observations.
10. Test results will be compared against current assessment criteria suitable for the future use of the area of the site affected.
11. The results of the investigation and testing of any suspect unexpected contamination will be used to determine the relevant actions. After consultation with the Local Authority and if necessary the Environment Agency, materials should either be:
 - re-used in areas where test results indicate that it meets compliance targets so it can be reused without treatment; or
 - treatment of material on site to meet compliance targets so it can be reused; or
 - removal from site to a treatment centre or to a suitably licensed landfill or permitted treatment facility.
12. Verification Report will be produced for the work.

Asbestos

Asbestos cement products and asbestos fibres have not been encountered in the soils at the site, but based on the age of the Made Ground material containing asbestos could be expected to be encountered. If non-notifiable asbestos (e.g. chrysotile asbestos cement board) is encountered in excavations then it will be dealt with in accordance with the Control of Asbestos Regulations 2012 (CAR 2012) and the HSE's ACoP for asbestos (2013). Finding non-notifiable asbestos is a very common occurrence on brownfield sites and is a relatively low risk activity and can be dealt with as a matter of routine. Therefore it is not proposed that the Council will be notified but an appropriate record will be kept of confirmatory testing and disposal. This will be included in remediation verification reports.

If suspect notifiable asbestos is encountered then the Council and the HSE will be notified. An appropriate action plan will be agreed with the Council and the HSE in accordance with CAR 2012. The action plan will include the preparation of the Risk Assessment and Plan of Work in accordance with CAR and other statutory requirements including:

- Site mobilisation;
- Excavation methodology;
- Handling, movement and storage on site of excavation arisings;
- Any processing of excavation arisings containing ACMs;
- Movement and placement of arisings to final destination;
- Placing of cover system over soils with and ACMs remaining on site;
- Off-site disposal of ACMs;
- Licences;
- PPE & RPE;
- Dust and fibre monitoring.

Potential mitigation measures that would be required include:

- Ensuring works are carried out by suitably trained and experienced personnel with working with asbestos;
- Site investigation and risk assessment;
- Removal or treatment of asbestos hotspots;
- Use of PPE and RPE by construction workers; and
- Compliance monitoring.

Unexpected Tanks

No buried underground fuel storage tanks have been encountered during the site investigation works; however, there remains a low risk that tanks are present on site. Should an underground tank be encountered, operations should cease in the area. Additionally there may be pipework associated with these tanks which could have oily residues. The following procedures are to be adhered to if tanks and pipework are identified:

1. All site works at the position of the tanks/pipework should stop.
2. A description of the tank should be made by the geo-environmental engineer including; condition and surround, along with visual and olfactory observations should any contents in the tank be apparent. A photographic record will also be made of relevant observations.
3. The tank's position and depth should be determined and marked on a plan of the site.
4. The independent geo-environmental engineer will inform Client and the Local Authority.
5. During the presence of the independent geo-environmental engineer, investigation works should be undertaken to obtain samples of any liquid or sludge contents and to establish dimensions of the tank.
6. Testing will be determined on the basis of visual and olfactory observations by independent geo-environmental engineer.
7. Test results will be compared against current assessment criteria and proposals for disposal of any contents determined in agreement with the appropriate Regulatory Parties.
8. Emptying the tank and disposal of contents to a suitable licenced disposal facility.
9. Degassing and removal of the tank by a suitably qualified contractor will be required, and a Naked Flame Certificate should be provided.
10. Once the tank has been emptied in accordance with the above proposals, it is to be removed for disposal to a licensed waste management facility. Copies of the relevant waste consignment notes are to be kept and included in the Verification Report.
11. Excavation and remediation of any contaminated soils around the tank will be carried out.
12. Samples of the base and sides of the resultant hole will be sampled and supervised by the independent geo-environmental engineer to confirm whether risks to human health or controlled waters.

All of the above information will be incorporated into the Verification Report and submitted to the regulatory parties, the Local Authority and the Environment Agency where groundwater may potentially have been impacted.



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