



Tier 3 Geoenvironmental Risk Assessment Report

Land at Marryat Walk, Gaer, Newport

Prepared For: Castell Construction Limited

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Executive Summary

Site Location and Proposed Development	Castell Construction Limited (the client) is proposing the residential development of land off Marryat Walk in the Gaer area of Newport. TFW Group Limited (hereafter referred to as Terra Firma) has been commissioned by Castell Construction Limited (the Client) to undertake an assessment of the risk to the aquatic environment. Previous investigations at the site by Terra Firma has identified made ground to a depth of between 4.8m and 5.3m. The made ground is consistent with landfill and comprises firm and stiff brown sandy gravelly CLAY to 1.4m to 1.6m, over loose and medium dense greyish black ashy clayey gravelly SAND. The made ground contained concrete, brick, sandstone, mudstone, limestone, and fragments of wood, glass, metal and plastic. The proposed development comprising two-storey dwellings founded upon piles installed within the St Maughan's Formation will lie at the top of a slope. The slope falls by approximately 4m over a horizontal distance of 5m to 7m.			
Radon	No radon protective measures are required for new developments on the investigation site.			
Ground Conditions	Depth (m)		Thickness (m)	Stratum
	0.0 - 1.4/1.6		1.4-1.6	MADE GROUND. Grass over soft to stiff brown sandy gravelly CLAY . Gravel is concrete, brick, sandstone, mudstone, limestone. Contains glass, metal, plastic.
	1.4/1.6 - 4.8/5.3		3.2-3.9	MADE GROUND. Medium dense greyish black ashy clayey gravelly SAND . Gravel is concrete, brick, clinker, sandstone, limestone, mudstone. Contains glass, metal, plastic, wood. Possible asbestos cement sheets and hydrocarbon odour.
	4.8/5.3	-	5.5	Stiff reddish brown mottled greenish grey CLAY .
	5.5	-	13.0	Very weak Unweathered reddish brown mottled greenish grey MUDSTONE .
	13.0	-	14.5	Very weak partially weathered reddish brown mottled greenish grey MUDSTONE .
	13.0/14.5	-	15.5	1.0-2.5 Medium strong partially weathered partially friable reddish brown mottled greenish grey and purple MUDSTONE .
Ground Gas	It is recommended that 'Gas Characteristic Situation 2' (GS2) is applied to the site in line with recommendations provided in CIRIA C665.			
Contamination of Concern	The made ground on site has been found to contain contaminants above their generic assessment criteria (asbestos, arsenic, lead, nickel, PAHs, and petroleum hydrocarbons), and as discussed in the site investigation report from September 2020, remediation will therefore be required.			
	The groundwater assessment has identified copper, nickel and zinc slightly above their threshold concentrations.			
Mitigation Measures - Soil	Due to the presence of asbestos in the made ground, the advice of an asbestos specialist will be required.			
	Given the type and concentrations of contaminants identified in the made ground, an engineered cap and cover system is likely to be suitable for the affected areas of the site. The cover system is likely to comprise 600mm of suitable imported soil above a no-dig barrier. The no-dig barrier is likely to be constructed from a geogrid above a high visibility geotextile membrane.			
	The above recommendations should be confirmed in a remediation strategy following a remediation options appraisal in line with LCRM.			
Aquatic Environment	Groundwater testing has identified slightly elevated concentrations of copper, nickel, and zinc. The threshold values, which the contaminants have been compared to are for surface water bodies. The nearest surface water body is the River Ebbw, which located approximately 189m to the southwest. The guidelines used are therefore considered highly conservative when comparing the concentrations of metals in the groundwater at this site, and it is considered that the effects of attenuation and dilution will render the slightly elevated concentrations insignificant.			

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Drawing 01 Exploratory Hole Layout

SECTION 1 Introduction and Proposed Development

1.1 Introduction

Castell Construction Limited (the client) is proposing the residential development of land off Marryat Walk in the Gaer area of Newport.

TFW Group Limited (hereafter referred to as Terra Firma) has been commissioned by Castell Construction Limited (the Client) to undertake an assessment of the risk to the aquatic environment. The proposed layout is presented on **Drawing 01**.

Previous investigations at the site by Terra Firma has identified made ground to a depth of between 4.8m and 5.3m. The made ground is consistent with landfill and comprises firm and stiff brown sandy gravelly CLAY to 1.4m to 1.6m, over loose and medium dense greyish black ashy clayey gravelly SAND. The made ground contained concrete, brick, sandstone, mudstone, limestone, and fragments of wood, glass, metal and plastic. The proposed development comprising two-storey dwellings founded upon piles installed within the St Maughan's Formation will lie at the top of a slope. The slope falls by approximately 4m over a horizontal distance of 5m to 7m.

Contaminants of concern have been identified including, arsenic, lead, nickel, polycyclic aromatic hydrocarbons, petroleum hydrocarbons and asbestos. It was therefore recommended that the site be capped, comprising buildings, hardstanding, and landscaped areas by 600mm of suitable topsoil and subsoil above a no-dig barrier. It was also recommended that additional site investigation work is required to determine the risk to controlled waters, and the risk to human health from ground gas and hydrocarbon vapours.

The main objectives of the Tier 3 geoenvironmental assessment programme are:

- Investigate the potential environmental liabilities to controlled waters at the site associated with any contamination.
- Investigate the potential environmental liabilities at the site associated with ground gas and hydrocarbon vapours.
- Provide a summary of the environmental conditions at the site, together with any necessary further intrusive works and / or remediation works to render the site fit for its intended use

A list of previous investigations of the site is provided in **Table 1.1**.

Table 1.1 Summary of Previous Site Investigations and Assessment

Report Title	Reference	Date
Geotechnical & Geoenvironmental Desk Study: Proposed Residential Development at Marryat Walk, Gaer, Newport	16204	July 2020
Geotechnical & Geoenvironmental Site Investigation Report: Proposed Residential Development at Marryat Walk, Gaer, Newport	16204	September 2020
Rotary Borehole Investigation for Pile Design: Marryat Walk, Newport	TM/16204/RotaryBHs	14 th May 2024

To achieve the above objectives, Terra Firma carried out a field investigation to collect geoenvironmental data from selected locations.

1.2 Limitations and Exceptions of Investigation

The Client has requested that a Geoenvironmental Site Assessment (GSA) of controlled waters, ground gas, and hydrocarbon vapours be performed to enable the outlined main objectives.

The GSA was conducted, and this report has been prepared for the sole internal reliance of the client and their design and construction team. This report shall not be relied upon or transferred to any other parties without the express written authorisation of Terra Firma. If an unauthorised third party comes into possession of this report, they rely on it at their peril and the authors owe them no duty of care and skill. The report represents the findings and opinions of experienced geoenvironmental and geotechnical consultants. Terra Firma does not provide legal advice and the advice of lawyers may be required.

The subsurface geological profiles, any contamination and other plots are generalised by necessity and have been based on the information found at the locations of the exploratory holes and depths sampled and tested.

1.3 Quality Assurance

The quality and environmental aspects of the assessment and investigation comply with UKAS Accredited ISO 9001:2015 and ISO 14001:2015 standards.

SECTION 2 Review of Existing Data

2.1 Physical Setting and Current Site Use

The site is roughly rectangular in shape in an east to west orientation and located to the west of Marryat Walk. The site centres on an approximate National Grid Reference of 329440 186300 occupying a plan area of approximately 0.29 Hectares / 2,900m². The site location can be seen below in **Figure 2.1**.

The site comprises an area of rough vegetation in the eastern side of the site with areas of Japanese Knotweed present along the southern boundary. The western end of the site is covered by gravel and areas of concrete slabs. Immediately to the south is a rail line.

Most of the site is relatively flat with a very gentle slope in a southerly direction falling from approximately 25m A.O.D. in the north to 24m in the south. The slope then falls very steeply to the railway line below located at approximately 20m A.O.D. The surrounding area also falls to the south.

The surrounding area is dominated by residential development with an area of open land to the northeast.

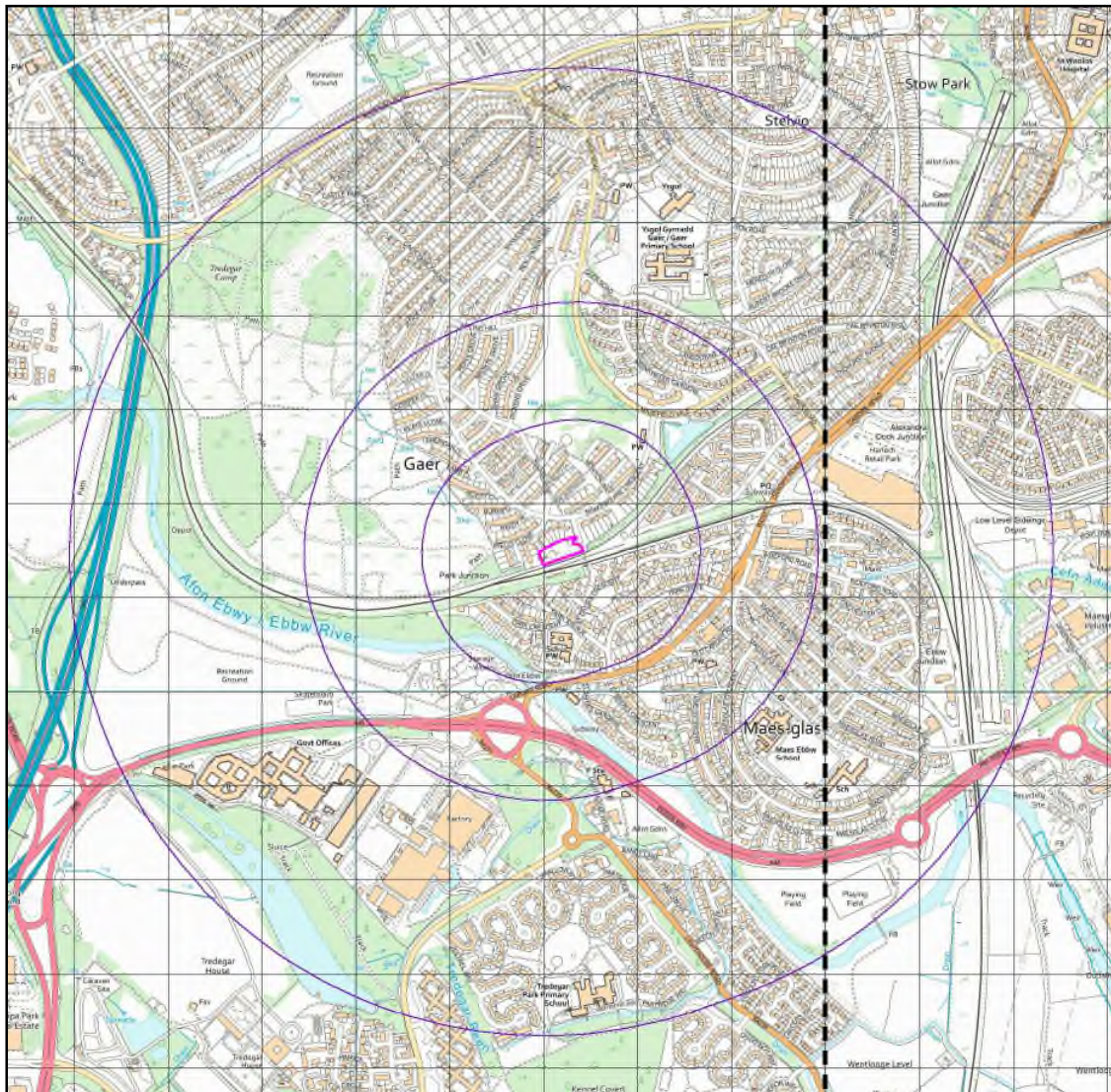


Figure 2.1 Site Location

2.2 Site History

The 1882-1884 map records the site lying in an area in which the topography has been reduced and small embankments are seen on the northern and western boundaries. The railway line that exists today was recorded along the site's southern boundary. No significant changes were recorded until the 1956 map, which shows modification to the topography along the northern boundary of the site with material used from the housing development to the north. This appeared to coincide with the construction of a large residential development to the north. The topography changed again by 1968, with most of the site becoming a plateau. Apart from dense vegetation, the site was unchanged until temporary buildings occupied the east part of the site sometime between 2000 and 2020. The site has remained unoccupied since.

2.3 Geological Setting

2.3.1 Geology

The 1:50,000 geological map (Sheet 249 Newport) and Envirocheck geology map of the area were consulted for geology underlying the site. The site is shown to be underlain by the St Maughans Formation which is Devonian in age. The BGS Lexicon of Named Rock Unit describes the member as "interbedded purple, brown and green sandstones and red mudstones with intraformational conglomerates containing calcrete clasts."

The dip of the bedrock is approximately 25° to the south.

The geological maps do not show the solid geology to be overlain by superficial deposits. However residual soils from the weathering of the bedrock are present.

In addition to this the site is likely to be overlain by reworked natural soils and or made ground associated with the site's former uses.

The underlying geology is not prone to dissolution and the risk of natural cavities in the bedrock is considered negligible.

Previous investigations at the site have recorded made ground to a depth of between 4.8m and 5.3m, underlain by a veneer of stiff reddish brown mottled greenish grey clay to 5.5m, passing into very weak reddish brown mottled greenish grey mudstone.

2.3.2 Mining

The site does not lie within the South Wales Coalfield and there are no recorded BGS mineral sites (e.g. quarries) within 100m of the site.

2.3.3 Radon

A radon report procured from the British Geological Survey confirms that no radon protection measures are required for new developments at the site. A copy of the report is presented in **Annex A**.

2.4 Hydrogeology and Hydrology

The nearest surface water feature to the site is identified 189m to the southwest and this corresponds with the Ebbw River. The Ebbw River is the dominant surface water feature in the area and flows in a south easterly direction.

The topography of the site and surrounding area is generally flat. Surface and shallow groundwater beneath the site is likely to flow in a southerly direction towards the Ebbw River.

Given the developed nature of the surrounding area surface water is likely to be collected by surface drainage systems.

Deeper groundwater flow within the underlying bedrock will be controlled by the strata dip and any fractures or bedding planes within the rock units.

The hydraulic gradient will be at its steepest during periods of heavy rainfall and aquifer recharge.

The bedrock beneath the site has an aquifer designation of 'Secondary A'. These are "permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers".

There are no superficial deposits to consider.

Previous investigations have recorded groundwater inflows at 4.5m depth, rising to 3.9m after 10 minutes.

2.5 Waste

Previous investigations have identified an unlicensed landfill beneath the site.

There are no recorded historic or active landfill sites within 250m of the site.

There is one area of potentially infilled land located 75m to the southeast of the site corresponds with the 'old' gravel and sand pit. The historic maps have shown that houses were constructed on this area in the early 1990s and the risk of ground gas for this as a source is considered very low.

There are no potentially infilled water features within 250m of the site.

2.6 Recommended Additional Investigation

Due to the presence of thick made ground it was recommended that a program of gas monitoring be carried out. Due to the contamination on site it will also be necessary to undertake water monitoring to allow the collection of water samples. It is therefore recommended that 3No. groundwater and 3No. gas monitoring installations are installed.

Three rounds of groundwater monitoring should be carried out in the groundwater, and if present the perched groundwater. The groundwater bodies should be tested for a broad suite of contaminants including metals, metalloids, PAHs, and petroleum hydrocarbons.

The gas monitoring program should consist of six fortnightly visits with at least two readings taken over falling barometric pressures. The gas monitoring should test for the presence of carbon dioxide, methane and oxygen as well as any flow from the boreholes and the depth to water.

Due to the olfactory evidence of hydrocarbons vapour monitoring should be undertaken. It is recommended that a Photoionising Detector (PID) is used during the gas monitoring.

SECTION 3 Field Investigation

3.1 Site Works

A geoenvironmental site investigation comprising 6No. rotary boreholes monitoring was undertaken between the 23rd and 24th of October 2024.

Two rounds of groundwater sampling from the rotary boreholes were undertaken on the 7th and 20th of November 2024.

The fieldwork was supervised by Terra Firma, who logged the exploratory holes to the requirements of BS 5930:2015+A1:2020. The proposed locations of the exploratory holes were determined by Terra Firma in general accordance with BS 10175:2011+A2:2017 in order to assess the findings of the preliminary conceptual site model.

The ground levels and coordinates at each exploratory hole were established by Terra Firma using GPS techniques.

Boreholes reference BH03 to BH08 were formed using a track mounted rotary drilling rig. Dynamic sampling techniques were employed from surface to produce a continuous disturbed sample. Boreholes were monitored for groundwater ingress as drilling proceeded.

The boreholes to be utilised for the installation of groundwater monitoring wells were drilled to a depth of 20m, approximately 6m below the groundwater table. The boreholes utilised for the installation of gas monitoring wells were terminated at 3.0m.

On completion, boreholes were installed with slotted standpipes consisting of a 50mm ID HDPE slotted tube set in a granular filter zone and sealed above with a bentonite plug for the purposes of groundwater monitoring and sampling. Installations were protected at surface with an upstanding cover. Full installation details are recorded on the relevant logs.

The borehole logs are presented in **Annex A**.

The installations were tested for carbon dioxide, methane, oxygen, hydrogen sulphide and carbon monoxide using a gas analyser GA5000. Atmospheric pressure and gas flow were also recorded. Subsequent monitoring readings are presented in **Annex B**.

The installations were also monitored for volatile organic compounds (VOC) using photo-ionisation detector with a 10.6eV lamp. Monitoring readings are presented in **Annex B**.

Exploratory hole locations are shown on **Drawing 01**.

3.2 Ground Conditions

The ground conditions encountered by the exploratory holes in Phase 1 and Phase 2 works can in general be summarised as shown in **Table 3.1**.

Table 3.1 Summary of Typical Ground Conditions

Depth (m)			Thickness (m)	Stratum
0.0	-	1.4/1.6	1.4-1.6	MADE GROUND. Grass over soft to stiff brown sandy gravelly CLAY . Gravel is concrete, brick, sandstone, mudstone, limestone. Contains glass, metal, plastic.
1.4/1.6	-	4.8/5.3	3.2-3.9	MADE GROUND. Medium dense greyish black ashy clayey gravelly SAND . Gravel is concrete, brick, clinker, sandstone, limestone, mudstone. Contains glass,

				metal, plastic, wood. Possible asbestos cement sheets and hydrocarbon odour.
4.8/5.3	-	5.5	0.2-0.7	Stiff reddish brown mottled greenish grey CLAY .
5.5	-	13.0	7.5	Very weak unweathered reddish brown mottled greenish grey MUDSTONE .
13.0	-	14.5	1.5	Very weak partially weathered reddish brown mottled greenish grey MUDSTONE .
13.0/14.5	-	15.5	1.0-2.5	Medium strong partially weathered partially friable reddish brown mottled greenish grey and purple MUDSTONE .

3.3 Groundwater

Groundwater information recorded during the site investigation is summarised in **Table 3.2**.

Table 3.2 Groundwater Summary

Location	Depth (m)	Details
BH03	14.0	-
BH05	14.0	-
BH07	14.0	-

3.4 Installation Well Construction

Groundwater and gas well locations were selected on a non-targeted basis to characterise the groundwater and gas contamination status of the site. A triangular pattern was adopted.

Groundwater and gas installation well construction details are summarised in **Table 3.3**.

Table 3.3 Installation Well Summary

Location	Response Zone		Stratum
	From (m)	To (m)	
BH03	7.0	20.0	Mudstone
BH04	1.0	4.5	Made Ground
BH05	7.0	20.0	Mudstone
BH06	1.0	4.5	Made Ground
BH07	7.0	20.0	Mudstone
BH08	1.0	4.5	Made Ground

3.5 Laboratory Chemical Testing

3.5.1 Sampling Strategy

Groundwater sampling locations were selected on a non-targeted basis to characterise the contamination status of the site. A triangular sampling pattern was adopted.

Sample locations, depths and suspected/known contamination source targets are summarised in **Table 3.4**:

Table 3.4 Sample Locations, Depths and Targets

Location	Contamination Targets
BH01	Made ground/unlicensed tip
BH03	Made ground/unlicensed tip
BH05	Made ground/unlicensed tip

3.5.2 Groundwater Laboratory Analysis

Upon completion of site investigation works groundwater samples were collected from installation wells and submitted to the laboratories of Eurofins Chemtest. Samples were tested for the determinants listed in **Table 3.5**.

Table 3.5 Groundwater Laboratory Analysis

Metals & Metalloids	In-Organics	Organics	Others
Arsenic	Cyanide	Phenols	pH (acidity)
Cadmium	Sulphate	Petroleum Hydrocarbons	Hardness
Chromium III	Sulphide	PAH	Electrical Conductivity
Chromium VI			Oxygen Demands
Chromium			
Copper			
Lead			
Mercury			
Nickel			
Selenium			

The results are discussed in detail in **SECTION 4** and the laboratory test results certificates may be found in **Annex C**.

3.6 Groundwater Level

Groundwater samples were taken on three occasions between the 7th of November and the 6th of December 2024.

The depth to groundwater prior to sampling is presented in **Table 3.6**. The data suggests the groundwater falls steeply to the west/southwest, and toward the River Ebbw, located approximately 189m to the southwest.

Table 3.6 Groundwater Levels Prior to Groundwater Sampling

Location	Well head above OD (m)	Water Depth Below Ground Level (m) – Groundwater Sampling			Water Depth Above Ordnance Datum (m) – Groundwater Sampling		
		07/11/2024	19/11/2024	06/12/2024	07/11/2024	19/11/2024	06/12/2024
BH03	24.77	14.51	14.77	14.29	10.26	10.00	10.48
BH05	24.37	4.02	4.16	3.88	20.35	20.21	20.49
BH07	24.84	5.34	5.63	4.99	19.50	19.21	19.85

SECTION 4 Evaluation of Geoenvironmental Analytical Results

4.1 Assessment Methodology

Groundwater analytical results have been compared with available published guidelines in the Water Framework Directive (Standards and Classification) Directives (England and Wales) 2015 and Drinking Water Directive (98/83/EC).

4.1.1 Groundwater Test Results

Nine groundwater samples were collected from boreholes BH03, BH05, and BH07 over three rounds of groundwater sampling. The samples were tested for suite of inorganic and organic determinants. The results are summarised in **Table 4.1** and **Table 4.2**.

Table 4.1 Summary of Groundwater Chemical Test Results – Inorganics & Miscellaneous

Substance	Threshold Value (µg/l)	Source	Measured Concentrations (µg/l)		Number of Exceedances
			Minimum	Maximum	
Arsenic	50	WFD2	0.27	1.7	0
Cadmium	0.11	WFD1	<0.08	<0.11	0
Chromium	3.4*	WFD2	<0.50	<0.50	0
Copper	1.0	WFD2	0.52	1.5	3
Lead	1.2	WFD1	<0.50	<0.50	0
Mercury	0.07	WFD3	<0.01	<0.05	0
Nickel	4	WFD1	<0.5	5.9	1
Selenium	10	DWD	<0.5	0.71	0
Zinc	10.9	WFD2	2.9	12	2
Cyanide, Total	1.0	WFD2	<5	<50	BLDL
Sulphide	-	-	<5	<5	BLDL
Sulphate (mg/l)	400	BRE	6.8	49	0
pH	-	-	7.4	8.1	-
BOD (mg/l)	-	-	<4.0	4.2	-
COD (mg/l)	-	-	<10	17	-
Electrical Conductivity (uS/cm)	-	-	460	1000	-
Hardness (mg/l)	-	-	400	530	-

Notes:

WFD1 - Water Framework Directive – Inland Surface Waters (AA)

WFD2 - Water Framework Directive – Freshwater (Long Term Mean)

WFD3 - Water Framework Directive – Inland Surface Waters (MAC)

DWD – Drinking Water Directive

BRE – British Research Establishment

- No available guideline

* Conservative threshold for Chromium VI used

BLDL - Below laboratory detection limit

ALDL - Above laboratory detection limit

Table 4.2 Summary of Groundwater Chemical Test Results – Organics

Substance	Threshold Value (µg/l)	Source	Measured Concentrations (µg/l)		Number of Exceedances
			Minimum	Maximum	
Naphthalene	2	WFD1	<0.10	<0.10	0

Acenaphthylene	-	-	<0.10	<0.10	BLDL
Acenaphthene	-	-	<0.10	<0.10	BLDL
Fluorene	-	-	<0.10	<0.10	BLDL
Phenanthrene	-	-	<0.10	<0.10	BLDL
Anthracene	0.1	WFD1	<0.10	<0.10	0
Fluoranthene	0.0063	WFD1	<0.10	<0.10	BLDL
Pyrene	-	-	<0.10	<0.10	BLDL
Benzo(a)anthracene	-	-	<0.10	<0.10	BLDL
Chrysene	-	-	<0.10	<0.10	BLDL
Benzo(b)fluoranthene	0.017	WFD3	<0.10	<0.10	0
Benzo(k)fluoranthene	0.017	WFD3	<0.10	<0.10	0
Benzo(a)pyrene	0.00017	WFD1	<0.10	<0.10	BLDL
Indeno(123cd)pyrene	-	-	<0.10	<0.10	BLDL
Dibenzo(ah)anthracene	-	-	<0.10	<0.10	BLDL
Benzo(ghi)perylene	0.0082	WFD3	<0.10	<0.10	BLDL
TPH (C6-C40)	-	-	<10	<10	BLDL
Phenol	7.7	WFD2	<0.03	<0.03	0

Notes:

WFD1 - Water Framework Directive – Inland Surface Waters (AA)

WFD2 - Water Framework Directive – Freshwater (Long Term Mean)

WFD3 - Water Framework Directive – Inland Surface Waters (MAC)

- No available guideline

ALDL - Above laboratory detection limit

BLDL - Below laboratory detection limit

SECTION 5 Ground Gas Risk Assessment

5.1 Gas Risk Characterisation

5.1.1 Gas Source

The site is underlain by a significant thickness of made ground, and given its content appears to be an unlicensed landfill. Exploratory holes excavated at the site have recorded mostly inert material such as brick, concrete, glass, metal, ceramic, and ash. However rare timber and sporadic plastic bags of rubbish, tyres, plastic sheeting, litter, fabric, newspaper and plastic sheeting were also noted from 1.4m/2.0m to more than 3.5m in TP04, TP05, and TP06.

5.1.2 Gas Migration Pathways

A potential migration pathway exists directly from the made ground vertically through cracks in the building, and service entries. Soakaways can also act as a temporary reservoir where ground gas can build up and then migrate into nearby buildings. Piles are the proposed foundations for the dwellings. Piles can act as a preferential pathway for ground gas.

5.1.3 Potential Receptors

The site is to be developed for low-rise residential use, the most vulnerable receptor type.

5.1.4 Driving Forces

Pressure Driven Flow

Also known as advective flow. Pressure driven gas flow is typically the dominant force in most high-risk scenarios, driven by a differential pressure gradient between the source and receptor. The potential for, and effect of, falling atmospheric pressure, fluctuating groundwater levels, seasonal thermal gradients or confined gas generating sources, should be considered in this context.

Diffusive Flow

Diffusion is dependent on a concentration gradient of gas between two areas, where a high concentration area flows towards a lower concentration area. This scenario only presents a risk when gas migration is sustainable due to there being a constant source of gas able to maintain a constant concentration gradient. In tandem with pressure driven flow, diffusive flow may have a significant influence on overall gas risk, particularly when large void spaces have accumulated hazardous gas diffusively over a long time frame, which is then subsequently expelled suddenly under a pressure driven event.

5.2 Volatile Gasses

Hydrocarbon odours were detected during the trial pitting in September 2020. Petroleum hydrocarbons were also detected above their GAC for a residential development with plant uptake. On the 6No. occasions the wells were monitored, concentrations were recorded below detection limits of 0.1ppm. Consequently, it is recommended that measures to mitigate against hydrocarbon vapours are not required.

5.3 Gas Screening Value

Three ground gas monitoring wells were installed in BH04, BH05, and BH08. Installation details are shown on the relevant log.

Six rounds of gas monitoring have been carried out. The installations were tested for carbon dioxide, methane, oxygen, carbon monoxide and hydrogen sulphide using a Gas Analyser GA2000/5000.

Recorded gas concentrations are summarised in **Table 5.1**.

Table 5.1 Measured Gas Concentration Summary

Gas	Minimum (% V/V)	Maximum (% V/V)
Methane	0.0	3.1
Carbon Dioxide	0.1	9.3
Oxygen	0.3	21.4

Methane levels peaked at 3.1% V/V. Carbon dioxide levels varied between 0.1% and 9.3% V/V. Oxygen concentrations varied between 0.3% and 21.4% V/V.

The gas flow rate from the boreholes was also assessed, a maximum flow rate of 0.1l/hr was recorded.

Based on a flow rate of 0.1 l/hr and the highest recorded carbon dioxide concentration of 9.3%, a gas screening value of 0.0093 l/hr is calculated, as follows:

$$(9.3/100) \times 0.1 = 0.0093 \text{ l/hr}$$

The results to date are presented in **Annex B**.

5.4 Conclusion

When this monitoring result is compared with Table 8.5 of CIRIA report C665, the site is classified as 'Gas Characteristic Situation 1' (CS1). However, as the peak methane has risen above 1%, peak carbon dioxide has risen consistently above 5%, and given the type of deposits beneath the site it is recommended that 'Gas Characteristic Situation 2' (GS2) is applied to the site in line with recommendations provided in CIRIA C665.

SECTION 6 Quantitative Risk Assessment

6.1 Contaminants of Concern

Contaminants identified as part of the investigation are summarised in **Table 6.1**, along with an interpretation of the likely contamination source. Where applicable, the contaminant, source relationship is based on the inferences made in the preliminary conceptual site model.

Table 6.1 Contaminants of Concern

Location	Round	Contaminant	Likely Source
BH03	Round 1 of 3	Copper	Unknown – although the concentrations of copper, nickel and zinc are recorded slightly above the WFD threshold for inland surface waters and freshwater, the concentrations are typical for an urban environment and most likely background levels for the surrounding area. Typical sources of these contaminants are included below, none of which apart from municipal waste have been recorded on, or in proximity of the site.
BH05	Round 1 of 3	Nickel	
BH03	Round 2 of 3	Copper	
BH05	Round 2 of 3	Zinc	
BH03	Round 3 of 3	Copper	
BH07	Round 3 of 3	Zinc	

Notes:

Sources of copper are widespread, and include but are not limited to industrial works, domestic wastewater, plumbing runoff from transport, and agriculture.

Nickel is used mainly in the production of stainless steels, nonferrous alloys, electroplating, batteries and in some pigments and electronic equipment. The main anthropogenic sources of nickel in water are from nickel production, metallurgical processes, combustion and incineration of fossil fuels, chemical and catalyst production, and discharges of industrial and municipal wastes.

Zinc sources can come from discharges of smelter slags, wastes, coal and bottom fly ash, mine tailings, and the use of products such as fertilisers and wood preservatives.

6.2 Pollutant Linkages

Based on the findings of the intrusive site investigation and identified contaminants, the preliminary conceptual site model has been revised. Significant pollutant linkages are tabulated in the refined conceptual site model **Table 6.2**. Identified pollutant linkages will require detailed risk assessment, appropriate mitigation or remedial measures.

Table 6.2 Refined Conceptual Site Model

Source	Pathway	Receptor
Made ground/ unlicensed landfill	P1 – Direct soil and dust ingestion P2 – Consumption of home grown produce P3 – Dermal contact P4 – Inhalation of dust and vapours P5 – Vertical migration of leachates (unsaturated zone) P6 – Horizontal and vertical migration of contaminants (saturated zone) P7 – Artificial contaminant pathway (borehole, pile, excavation etc) P8 – Surface run-off P9 – Plant uptake P10 – Horizontal and vertical migration of ground gasses and vapours P11 – Direct contact with construction materials P12 – Inhalation of asbestos fibres	R1 – Construction and maintenance workers R2 – Future site users (residents) R3 – Passers-by or neighbouring site users R4 – Groundwater (aquifer) R5 – Surface waters (river/lake) R6 – Area of public open space R7 – Construction materials (concrete/potable water pipes)

6.3 Conclusions of the Generic Quantitative Risk Assessment

The made ground on site has been found to contain contaminants above their generic assessment criteria (asbestos, arsenic, lead, nickel, PAHs, and petroleum hydrocarbons), and as discussed in the site investigation report from September 2020, remediation will therefore be required.

A Stage 2 Options Appraisal and Remediation Strategy should be carried out to confirm suitable mitigation measures.

The groundwater assessment has identified copper, nickel and zinc slightly above their threshold concentrations. Further detail is provided in **Section 6.4.2**.

6.4 Likely Remediation Solution

The following sections outline the likely mitigation and remedial measures suitable for the identified contamination and proposed development. Detailed methodology to achieve the measures must be prescribed in a Remediation Strategy Report and the results presented in a Validation Report upon their completion.

6.4.1 Human Health

6.4.1.1 Soil

Due to the presence of asbestos in the made ground, the advice of an asbestos specialist will be required and as a minimum the following precautions must be employed:

- Dust suppression and measures to dampen the material
- Suitable PPE for site workers
- Air monitoring on the site boundary
- Personal air monitors (for a time to determine actual personnel / fibre interaction)

In addition to the above it is best practise to clean down plant and change air filters on any plant used in the works with asbestos contaminated material.

Given the type and concentrations of contaminants identified in the made ground, an engineered cap and cover system is likely to be suitable for the affected areas of the site. The cover system is likely to comprise 600mm of suitable imported soil above a no-dig barrier. The no-dig barrier is likely to be constructed from a geogrid above a high visibility geotextile membrane.

The above recommendations should be confirmed in a remediation strategy following a remediation options appraisal in line with LCRM.

All imported soils must be validated as clean and suitable for use in accordance with 'Requirements for the Chemical Testing of Imported Soils for Various End Uses and Validation Cover Systems'.

For the specification of proposed new supply water pipes, the UK Water Industry Research publication 'Guidance for the Selection of Water Supply Pipes to be used in Brownfield Sites, must be consulted.

In accordance with EC Regulation 1272/2008 and Environment Agency Guidance WM3 soils destined for off-site disposal must be classified on the basis of their hazard phrases prior to disposal. Soils are classified as a mirror entry waste and must be classified on the basis of their specific chemical properties.

If during earthworks ground conditions are encountered that are markedly different to those found during the investigation, then the ground must be subject to additional sampling and testing and any necessary remedial measures designed and implemented before continuing with the works.

6.4.1.2 Ground Gas

To protect the future site users from identified ground gas, proposed structures will need to incorporate within its construction a suitable ground gas protection system. The ground gas protection system should be designed, verified, installed and validated in accordance with the British Standard 8485:2015+A1:2019 and CIRIA guidance C735:2014.

It is recommended that a specialist consultant is retained to prepare a risk assessed ground gas protection system Verification Plan for the proposed development. The Verification Plan will detail the required protection measures based on the perceived risk associated with the complexity of design, experience of the installer, size of the site and gas characteristic situation. The Verification Plan also details the step by step process and requirements to allow for the completion of a Validation Report. Terra Firma offer Verification and Validation services.

Validation of installed ground gas protection systems by an independent third party will be required upon completion of the development. Validation may only be achieved if processes prescribed in the Verification Plan are undertaken.

6.4.2 Aquatic Environment

Groundwater testing has identified slightly elevated concentrations of copper, nickel, and zinc. The threshold values, which the contaminants have been compared to are for surface water bodies. The nearest surface water body is the River Ebbw, which located approximately 189m to the southwest. The guidelines used are therefore considered highly conservative when comparing the concentrations of metals in the groundwater at this site, and the effects of attenuation and dilution will render the slightly elevated concentrations insignificant.

During the construction period, there is a risk to the environment/adjacent sites from de-watering, digging foundations, moving contaminated soil, drainage misconceptions, discharges to local surface waters or the ground, runoff from construction materials and/or exposed ground, wheel washings and oil or chemical spills.

The risk is considered to be negligible as any adverse effects will be easily preventable by due diligence to good construction practise and housekeeping in preventing surface runoff and the spillage of materials.

The basic measures that should be taken are as follows:

- Prepare a drainage plan and mark the manholes to prevent pollutants accidentally reaching the surface water sewers;
- Carry out any activities that could cause pollution in a designated, bunded area, away from rivers or boreholes. Where possible it should drain to the foul sewer;
- Use settlement ponds to remove silty water;
- Store all oils and chemicals in a fully bunded area to prevent leaks or spills;
- Get advice on whether you need an environmental permit and apply in good time

**ANNEX A
Radon Report**

Michael Watkins
T F W Group Ltd
Unit 5
Deryn Court
Wharfedale Road
Caerdydd
CF23 7HA

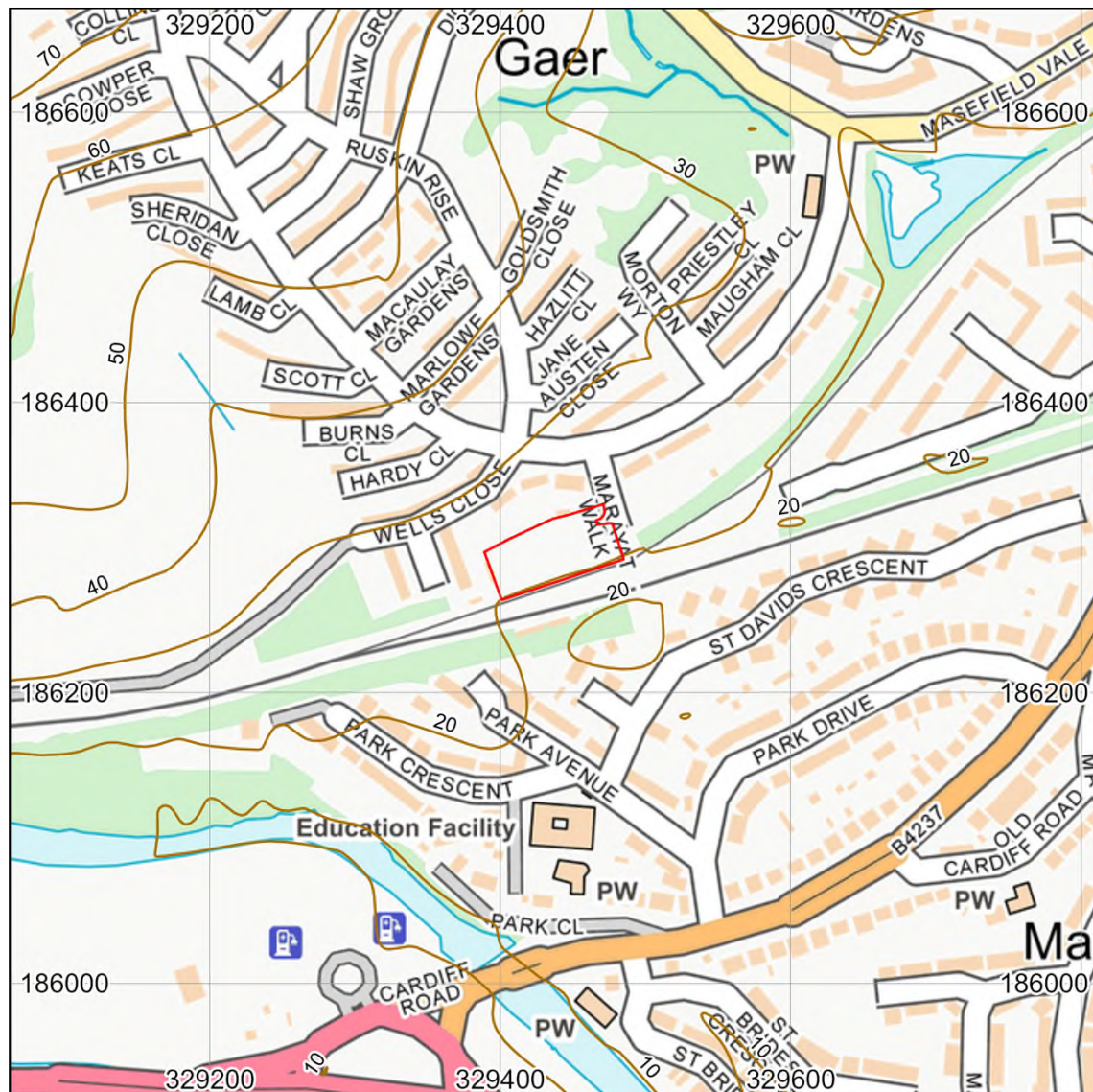
Radon Report

Advisory report on the requirement for radon protective measures in new buildings, conversions and extensions to existing buildings. The report also indicates whether a site is located within a radon Affected Area

Report Id: *BGS_342021/59341*

Client reference: 16204-MW

Search location



Contains OS data © Crown Copyright and database right 2025. OS OpenMap Local: Scale: 1:5 000 (1cm = 50 m)

Search location indicated in red

*This report describes a site located at National Grid Reference 329437, 186297.
Note that for sites of irregular shape, this point may lie outside the site boundary.
Where the client has submitted a site plan the assessment will be based on the area given.*

Radon Report: UK

When extensions are made to existing buildings in high radon areas, or new buildings are constructed in these areas, the Building Regulations for England, Wales, Scotland and Northern Ireland require that protective measures are taken against radon entering the building.

This report provides information on whether radon protective measures are required. Depending on the probability of buildings having high radon levels, the Regulations may require either:

1. No protective measures
2. Basic protective measures
3. Full protective measures

This is an advisory report on the requirement for radon protective measures in new buildings, conversions and extensions. The report also indicates whether a site is located within a radon Affected Area

Requirement for radon protective measures

The determination below follows advice in *BR211 Radon: Guidance on protective measures for new buildings (2023 edition)*, which also provides guidance on what to do if the result indicates that protective measures are required.

Is the property in an area where radon protective measures are required for new buildings or extensions to existing ones as described in publication BR211 (2023 edition) Radon: Guidance on protective measures for new buildings?

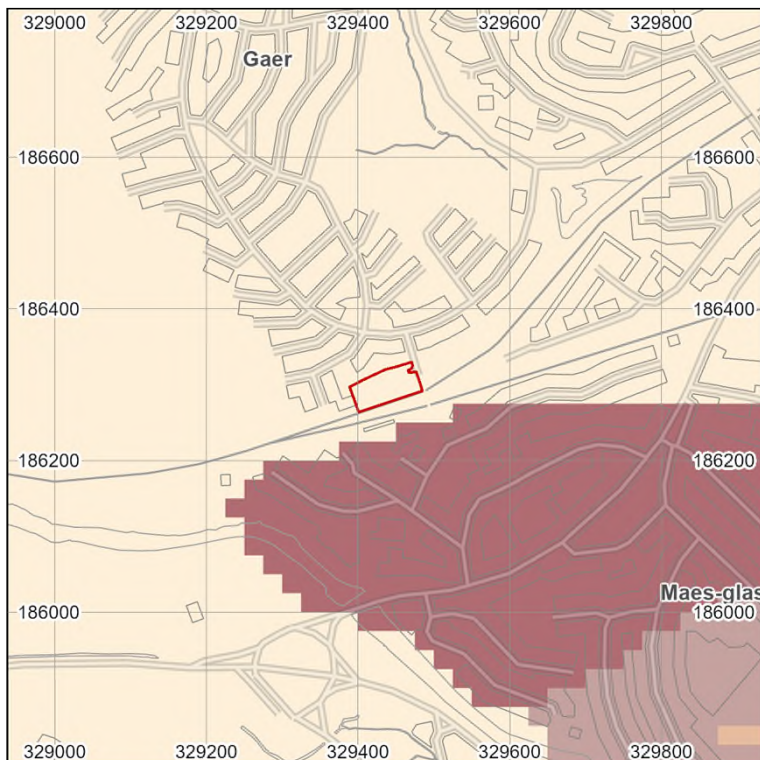
NO RADON PROTECTIVE MEASURES ARE REQUIRED FOR THE REPORT AREA.

More details of the protective measures required are available in *BR211 Radon: Guidance on protective measures for new buildings (2023 Edition)*.

Whether or not the radon level in a building is above or below the radon Action Level can only be established by having the building tested. The UKHSA provides a radon testing service which can be accessed at www.ukradon.org or by telephone (01235 822622).

If you require further information or guidance, you should contact your local authority building control officer or approved inspector.

Radon Affected Area



% Homes estimated to be at or above the action level
0-1%
1-3%
3-5%
5-10%
10-30%
30-100%

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Scale: 1:10 000 (1cm = 100 m)

Search area indicated in red

Is the property in a radon Affected Area as defined by the UK Health Security Agency (UKHSA) and if so what percentage of homes are estimated to be at or above the Action Level? NO

Additional Information

THE PROPERTY IS IN AN AREA WHERE LESS THAN 1% OF HOMES ARE ESTIMATED TO BE AT OR ABOVE THE ACTION LEVEL. THE PROPERTY IS NOT IN A RADON AFFECTED AREA.

The UKHSA recommends a radon 'Action Level' of 200 Becquerels per cubic metre of air (Bq m^{-3}) for the annual average of the radon gas concentration in a home. Where 1% or more of homes are estimated to be at or above the Action Level the area should be regarded as a radon Affected Area.

This report informs you whether the property is in a radon Affected Area and the percentage of homes that are estimated to be at or above the radon Action Level at this location. Being in an Affected Area does not necessarily mean there is a high radon level within the property; the only way to determine the radon level is to carry out a radon measurement.

The UKHSA advises that radon gas should be measured in all properties within radon Affected Areas and that homes with radon levels at or above the Action Level (200 Bq m⁻³) should be remediated. Householders with levels between the Target Level (100 Bq m⁻³) and Action Level should seriously consider reducing their radon level, especially if they are at greater risk, such as if they are current or ex smokers. Whether or not a home is in fact above or below the Action Level or Target Level can only be established by having the building tested. The UKHSA provides a validated radon testing service which can be accessed at www.ukradon.org.

The information in this report provides an answer to one of the standard legal enquiries on house purchase in England and Wales, known as Law Society CON29 Enquiries of the Local Authority (2016); 3.14 Radon Gas: Do records indicate that the property is in a “Radon Affected Area” as identified by the UKHSA. The data can also be used to advise house buyers and sellers in Scotland and Northern Ireland.

If you are buying a new build property in a Radon Affected Area, you should ask the builder whether radon protective measures were incorporated in the construction of the property.

If you are buying a currently occupied property in a radon Affected Area, you should ask the present owner whether radon levels have been measured in the property. If they have, ask whether the results were at or above the radon Action Level and if so, whether remedial measures were installed, radon levels were re-tested, and if the results of re-testing confirmed the effectiveness of the measures.

Further information on radon is available from the UKHSA at www.ukradon.org.

What is radon?

Radon is a naturally occurring radioactive gas, which is produced by the radioactive decay of radium which, in turn, is derived from the radioactive decay of uranium. Uranium is found in small quantities in all soils and rocks, although the amount varies from place to place. Radon released from rocks and soils is quickly diluted in the atmosphere. Concentrations in the open air are normally very low and do not present a hazard. Radon that enters enclosed spaces such as some buildings (particularly basements), caves, mines, and tunnels may reach high concentrations in some circumstances. The construction method and degree of ventilation will influence radon levels in individual buildings. A person's exposure to radon will also vary according to how particular buildings and spaces are used.

Inhalation of the radioactive decay products of radon gas increases the chance of developing lung cancer. If individuals are exposed to high concentrations for significant periods of time, there may be cause for concern. In order to limit the risk to individuals, the Government has adopted an Action Level for radon in homes of 200 becquerels per cubic metre (Bq m⁻³). The Government advises householders that, where the radon level is at or above the Action Level, measures should be taken to reduce the concentration.

Radon in workplaces

The Ionising Radiation Regulations 2017 require employers to take action when radon is present above a defined level in the workplace. Advice may be obtained from your local Health and Safety Executive Area Office or the Environmental Health Department of your local authority. The BRE publishes a guide (BR293): **Radon in the workplace**. BRE publications may be obtained from the BRE Bookshop, Tel: 01923 664262, email: bookshop@bre.co.uk website: www.brebookshop.com

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- The most appropriate techniques for copying original records are used, but there may be some loss of detail and dimensional distortion when such records are copied.
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- The topography shown on any map extracts is based on the latest OS mapping and is not necessarily the same as that used in the original compilation of the BGS geological map, and to which the geological linework available at that time was fitted.
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**Report issued by
BGS Enquiry Service**

**ANNEX B
Borehole Logs**

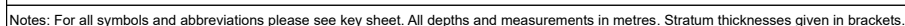
		Consulting Geotechnical, Geo-Environmental Engineers & Site Investigation Contractors		Cardiff Office 5 Deryn Court Wharfedale Road Pentwyn Cardiff CF23 7HA		Exeter Office The Slate Barn Lower Lowley Dunsford Exeter EX6 7BP		Portsmouth Office Technopole Kingston Crescent North End Portsmouth PO2 8FA		Borehole No. BH03 Sheet 1 of 2	
Project Name Marryat Walk				Project No. 16204		Date to				Hole Type RO	
Client Castell Construction Ltd				Co-ords E: 329408.49 N: 186287.34 L: 24.77		Water Strike Details Depth Strike After 20 mins Remarks 14.00 0.00				Logged By	
Contractor			Plant Used							Approved By	
										Scale 1:50	
Samples and Results			TCR SCR RQD	FI	Depth, (Thickness)	Level	Stratum Description			Legend	Well
Results	Type	Depth									
					(1.50)		MADE GROUND. Grass over soft brown sandy gravelly CLAY. Gravel is angular to subangular fine to coarse concrete, brick, sandstone, mudstone, limestone. Contains glass, metal, plastic. ()				
					1.50	23.27	MADE GROUND. Medium dense greyish black ashy clayey gravelly SAND. Gravel is angular to subangular fine to coarse concrete, brick, clinker, sandstone, limestone, mudstone. Contains glass, metal, plastic, wood. ()				
					(3.00)						
					4.50	20.27	Stiff reddish brown mottled greenish grey CLAY. ()				
					(1.50)						
					6.00	18.77	Reddish brown mottled greenish grey MUDSTONE. ()				
Remarks 1] Borehole terminated 20m depth. 2] On completion a 50mm standpipe (50mm) was installed to 20m depth. Slotted pipe with granular response zone from 6.0m-20.0m, solid standpipe with bentonite seal GL-6.0m, and a flush cover. 3] Groundwater recorded at 14.0m depth.											
Borehole Diameter Base Depth Diameter											
Notes: For all symbols and abbreviations please see key sheet. All depths and measurements in metres. Stratum thicknesses given in brackets.											

		Consulting Geotechnical, Geo-Environmental Engineers & Site Investigation Contractors Phone: 033 022 36380 Email: hello@tfwgroup.co.uk		Cardiff Office 5 Deryn Court Wharfedale Road Pentwyn Cardiff CF23 7HA		Exeter Office The Slate Barn Lower Lowley Dunsford Exeter EX6 7BP		Portsmouth Office Technopole Kingston Crescent North End Portsmouth PO2 8FA		Borehole No. BH03 Sheet 2 of 2						
Project Name Marryat Walk				Project No. 16204		Date to				Hole Type RO						
Client Castell Construction Ltd				Co-ords E: 329408.49 N: 186287.34 L: 24.77		Water Strike Details Depth Strike After 20 mins Remarks 14.00 0.00				Logged By						
Contractor			Plant Used							Approved By						
										Scale 1:50						
Samples and Results			TCR SCR RQD	FI	Depth, (Thickness)	Level	Stratum Description				Legend	Well				
Results	Type	Depth														
					11		Reddish brown mottled greenish grey MUDSTONE. ()									
					12											
					13 (14.00)											
					14											
					15											
					16											
					17											
					18											
					19											
					20.00	4.77					End of Borehole at 20.00m					
Remarks 1] Borehole terminated 20m depth. 2] On completion a 50mm standpipe (50mm) was installed to 20m depth. Slotted pipe with granular response zone from 6.0m-20.0m, solid standpipe with bentonite seal GL-6.0m, and a flush cover. 3] Groundwater recorded at 14.0m depth.											Borehole Diameter					
											Base Depth Diameter					
Notes: For all symbols and abbreviations please see key sheet. All depths and measurements in metres. Stratum thicknesses given in brackets.																

		Consulting Geotechnical, Geo-Environmental Engineers & Site Investigation Contractors		Cardiff Office 5 Deryn Court Wharfedale Road Pentwyn Cardiff CF23 7HA		Exeter Office The Slate Barn Lower Lowley Dunsford Exeter EX6 7BP		Portsmouth Office Technopole Kingston Crescent North End Portsmouth PO2 8FA		Borehole No. BH04 Sheet 1 of 1	
Project Name Marryat Walk				Project No. 16204		Date to				Hole Type RO	
Client Castell Construction Ltd				Co-ords E: 329427.41 N: 186293.90 L: 24.73		Water Strike Details Depth Strike After 20 mins Remarks				Logged By	
Contractor				Plant Used						Approved By	
										Scale 1:50	
Samples and Results			TCR SCR RQD	FI	Depth, (Thickness)	Level	Stratum Description			Legend	Well
Results	Type	Depth									
					(1.50)		MADE GROUND. Grass over soft brown sandy gravelly CLAY. Gravel is angular to subangular fine to coarse concrete, brick, sandstone, mudstone, limestone. Contains glass, metal, plastic. ()				
					1.50	23.23	MADE GROUND. Medium dense greyish black ashy clayey gravelly SAND. Gravel is angular to subangular fine to coarse concrete, brick, clinker, sandstone, limestone, mudstone. Contains glass, metal, plastic, wood. ()				
					(3.00)						
					4.50	20.23	Stiff reddish brown mottled greenish grey CLAY. ()				
					(1.50)						
					6.00	18.73	End of Borehole at 6.00m				
Remarks 1] Borehole terminated 6m depth. 2] On completion a 50mm standpipe (50mm) was installed to 3m depth. Slotted pipe with granular response zone from 1.0m-3.0m, solid standpipe with bentonite seal GL-1.0m, and a flush cover. 3] Groundwater inflows not recorded.											
Borehole Diameter Base Depth Diameter											
Notes: For all symbols and abbreviations please see key sheet. All depths and measurements in metres. Stratum thicknesses given in brackets.											

		Consulting Geotechnical, Geo-Environmental Engineers & Site Investigation Contractors		Cardiff Office 5 Deryn Court Wharfedale Road Pentwyn Cardiff CF23 7HA		Exeter Office The Slate Barn Lower Lowley Dunsford Exeter EX6 7BP		Portsmouth Office Technopole Kingston Crescent North End Portsmouth PO2 8FA		Borehole No. BH05 Sheet 1 of 2	
Project Name Marryat Walk				Project No. 16204		Date to				Hole Type RO	
Client Castell Construction Ltd				Co-ords E: 329460.43 N: 186302.91 L: 24.37		Water Strike Details Depth Strike After 20 mins Remarks 14.00 0.00				Logged By	
Contractor			Plant Used							Approved By	
										Scale 1:50	
Samples and Results			TCR SCR RQD	FI	Depth, (Thickness)	Level	Stratum Description			Legend	Well
Results	Type	Depth									
					(1.50)	1	MADE GROUND. Grass over soft brown sandy gravelly CLAY. Gravel is angular to subangular fine to coarse concrete, brick, sandstone, mudstone, limestone. Contains glass, metal, plastic. ()				
					1.50	22.87	MADE GROUND. Medium dense greyish black ashy clayey gravelly SAND. Gravel is angular to subangular fine to coarse concrete, brick, clinker, sandstone, limestone, mudstone. Contains glass, metal, plastic, wood. ()				
					(3.00)	3					
					4						
					4.50	19.87	Stiff reddish brown mottled greenish grey CLAY. ()				
					(1.50)	5					
					6.00	18.37	Reddish brown mottled greenish grey MUDSTONE. ()				
					7						
					8						
					9						
Remarks 1] Borehole terminated 20m depth. 2] On completion a 50mm standpipe (50mm) was installed to 20m depth. Slotted pipe with granular response zone from 6.0m-20.0m, solid standpipe with bentonite seal GL-6.0m, and a flush cover. 3] Groundwater recorded at 14.0m depth.							Borehole Diameter				
							Base Depth		Diameter		
Notes: For all symbols and abbreviations please see key sheet. All depths and measurements in metres. Stratum thicknesses given in brackets.											

		Consulting Geotechnical, Geo-Environmental Engineers & Site Investigation Contractors		Cardiff Office 5 Deryn Court Wharfedale Road Pentwyn Cardiff CF23 7HA		Exeter Office The Slate Barn Lower Lowley Dunsford Exeter EX6 7BP		Portsmouth Office Technopole Kingston Crescent North End Portsmouth PO2 8FA		Borehole No. BH05 Sheet 2 of 2								
Project Name Marryat Walk						Project No. 16204		Date to		Hole Type RO								
Client Castell Construction Ltd						Co-ords E: 329460.43 N: 186302.91 L: 24.37		Water Strike Details			Logged By							
Contractor						Plant Used		Depth Strike 14.00		After 20 mins 0.00		Remarks						
												Approved By						
												Scale 1:50						
Samples and Results			TCR SCR RQD	FI	Depth, (Thickness)	Level	Stratum Description					Legend	Well					
Results	Type	Depth																
					11		Reddish brown mottled greenish grey MUDSTONE. ()											
					12													
					13 (14.00)													
					14													
					15													
					16													
					17													
					18													
					19													
					20.00	4.37						End of Borehole at 20.00m						
Remarks												Borehole Diameter						
1] Borehole terminated 20m depth. 2] On completion a 50mm standpipe (50mm) was installed to 20m depth. Slotted pipe with granular response zone from 6.0m-20.0m, solid standpipe with bentonite seal GL-6.0m, and a flush cover. 3] Groundwater recorded at 14.0m depth.												Base Depth					Diameter	
Notes: For all symbols and abbreviations please see key sheet. All depths and measurements in metres. Stratum thicknesses given in brackets.																		



		Consulting Geotechnical, Geo-Environmental Engineers & Site Investigation Contractors		Cardiff Office 5 Deryn Court Wharfedale Road Pentwyn Cardiff CF23 7HA		Exeter Office The Slate Barn Lower Lowley Dunsford Exeter EX6 7BP		Portsmouth Office Technopole Kingston Crescent North End Portsmouth PO2 8FA		Borehole No. BH07 Sheet 1 of 2		
Project Name Marryat Walk				Project No. 16204		Date to				Hole Type RO		
Client Castell Construction Ltd				Co-ords E: 329425.85 N: 186303.11 L: 24.84		Water Strike Details Depth Strike After 20 mins Remarks 14.00 0.00				Logged By		
Contractor			Plant Used							Approved By		
										Scale 1:50		
Samples and Results			TCR SCR RQD	FI	Depth, (Thickness)	Level	Stratum Description				Legend	Well
Results	Type	Depth										
					(1.50)	1	MADE GROUND. Grass over soft brown sandy gravelly CLAY. Gravel is angular to subangular fine to coarse concrete, brick, sandstone, mudstone, limestone. Contains glass, metal, plastic. ()					
					1.50	23.34	MADE GROUND. Medium dense greyish black ashy clayey gravelly SAND. Gravel is angular to subangular fine to coarse concrete, brick, clinker, sandstone, limestone, mudstone. Contains glass, metal, plastic, wood. ()					
					(3.00)	3						
						4						
					4.50	20.34	Stiff reddish brown mottled greenish grey CLAY. ()					
					(1.50)	5						
					6.00	18.84	Reddish brown mottled greenish grey MUDSTONE. ()					
						6						
						7						
						8						
						9						
Remarks 1] Borehole terminated 20m depth. 2] On completion a 50mm standpipe (50mm) was installed to 20m depth. Slotted pipe with granular response zone from 6.0m-20.0m, solid standpipe with bentonite seal GL-6.0m, and a flush cover. 3] Groundwater recorded at 14.0m depth.							Borehole Diameter					
							Base Depth		Diameter			
Notes: For all symbols and abbreviations please see key sheet. All depths and measurements in metres. Stratum thicknesses given in brackets.												

		Consulting Geotechnical, Geo-Environmental Engineers & Site Investigation Contractors		Cardiff Office 5 Deryn Court Wharfedale Road Pentwyn Cardiff CF23 7HA		Exeter Office The Slate Barn Lower Lowley Dunsford Exeter EX6 7BP		Portsmouth Office Technopole Kingston Crescent North End Portsmouth PO2 8FA		Borehole No. BH07 Sheet 2 of 2		
Project Name Marryat Walk				Project No. 16204		Date to				Hole Type RO		
Client Castell Construction Ltd				Co-ords E: 329425.85 N: 186303.11 L: 24.84		Water Strike Details Depth Strike After 20 mins Remarks 14.00 0.00				Logged By		
Contractor			Plant Used							Approved By		
										Scale 1:50		
Samples and Results			TCR SCR RQD	FI	Depth, (Thickness)	Level	Stratum Description				Legend	Well
Results	Type	Depth										
					11		Reddish brown mottled greenish grey MUDSTONE. ()					
					12							
					13 (14.00)							
					14							
					15							
					16							
					17							
					18							
					19							
					20.00	4.84	End of Borehole at 20.00m					
Remarks 1] Borehole terminated 20m depth. 2] On completion a 50mm standpipe (50mm) was installed to 20m depth. Slotted pipe with granular response zone from 6.0m-20.0m, solid standpipe with bentonite seal GL-6.0m, and a flush cover. 3] Groundwater recorded at 14.0m depth.							Borehole Diameter					
							Base Depth		Diameter			
Notes: For all symbols and abbreviations please see key sheet. All depths and measurements in metres. Stratum thicknesses given in brackets.												

			Consulting Geotechnical, Geo-Environmental Engineers & Site Investigation Contractors Phone: 033 022 36380 Email: hello@tfwgroup.co.uk				Cardiff Office 5 Deryn Court Wharfedale Road Pentwyn Cardiff CF23 7HA			Exeter Office The Slate Barn Lower Lowley Dunsford Exeter EX6 7BP			Portsmouth Office Technopole Kingston Crescent North End Portsmouth PO2 8FA			Borehole No. BH08 Sheet 1 of 1	
Project Name Marryat Walk							Project No. 16204		Date to					Hole Type RO			
Client Castell Construction Ltd							Co-ords E: 329438.13 N: 186309.13 L: 24.72		Water Strike Details					Logged By			
Contractor									Depth Strike		After 20 mins		Remarks		Approved By		
Plant Used															Scale 1:50		
Samples and Results			TCR SCR RQD	FI	Depth, (Thickness)	Level	Stratum Description					Legend	Well				
Results	Type	Depth															
					(1.50)		MADE GROUND. Grass over soft brown sandy gravelly CLAY. Gravel is angular to subangular fine to coarse concrete, brick, sandstone, mudstone, limestone. Contains glass, metal, plastic. ()										
					1.50	23.22	MADE GROUND. Medium dense greyish black ashy clayey gravelly SAND. Gravel is angular to subangular fine to coarse concrete, brick, clinker, sandstone, limestone, mudstone. Contains glass, metal, plastic, wood. ()										
					(3.00)												
					4.50	20.22	Stiff reddish brown mottled greenish grey CLAY. ()										
					(1.46)												
					6.00	18.72	End of Borehole at 6.00m										
Remarks							Borehole Diameter										
1] Borehole terminated 6m depth. 2] On completion a 50mm standpipe (50mm) was installed to 3m depth. Slotted pipe with granular response zone from 1.0m-3.0m, solid standpipe with bentonite seal GL-1.0m, and a flush cover. 3] Groundwater inflows not recorded.							Base Depth		Diameter								
Notes: For all symbols and abbreviations please see key sheet. All depths and measurements in metres. Stratum thicknesses given in brackets.																	

ANNEX C
Ground Gas and PID Monitoring Results

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ANNEX D
Laboratory Groundwater Chemical Test Results



Amended Report

Report No.:	24-36422-2		
Initial Date of Issue:	14-Nov-2024	Date of Re-Issue:	04-Mar-2025
Re-Issue Details:	This report has been revised and directly supersedes 24-36422-1 in its entirety		
Client	Terra Firma		
Client Address:	5 Deryn Court Wharfedale Road Pentwyn Cardiff CF23 7HA		
Contact(s):	michael@terrafirmawales.co.uk; morgan@terrafirmawales.co.uk		
Project	16204 Marryat Walk		
Quotation No.:		Date Received:	08-Nov-2024
Order No.:	16204MP	Date Instructed:	08-Nov-2024
No. of Samples:	3		
Turnaround (Wkdays):	5	Results Due:	14-Nov-2024
Date Approved:	14-Nov-2024		
Approved By:			
Details:	David Smith, Technical Director		

For details about application of accreditation to specific matrix types, please refer to the Table at the back of this report

Results - Water

Project: 16204 Marryat Walk

Client: Terra Firma		Chemtest Job No.:				24-36422	24-36422	24-36422
Quotation No.:		Chemtest Sample ID.:				1892412	1892413	1892414
Order No.: 16204MP		Client Sample Ref.:				1	2	3
		Client Sample ID.:				BH03W1	BH05W1	BH07W1
		Sample Location:				BH03	BH05	BH07
		Sample Type:				WATER	WATER	WATER
		Sample Sub Type:						
		Top Depth (m):				16.0	15.0	17.00
		Date Sampled:				07-Nov-2024	07-Nov-2024	07-Nov-2024
		Time Sampled:				12:00	12:00	12:00
Determinand	HWOL Code	Accred.	SOP	Units	LOD			
pH at 20C		U	1010		4.0	8.1	8.0	8.1
Electrical Conductivity at 25C		U	1020	µS/cm	1.0	720	740	460
Biochemical Oxygen Demand		N	1090	mg O2/l	4.0	< 4.0	< 4.0	< 4.0
Chemical Oxygen Demand		U	1100	mg O2/l	10	< 10	14	14
Sulphate		U	1220	mg/l	1.0	19	49	6.8
Cyanide (Total) Low-Level		N	1300	mg/l	0.0050	< 0.0050	< 0.0050	< 0.0050
Sulphide		N	1325	mg/l	0.050	< 0.050	< 0.050	< 0.050
Hardness		N	1415	mg/l	1.0	460	440	530
Arsenic (Dissolved)		U	1455	µg/l	0.20	0.45	1.7	0.77
Cadmium (Dissolved)		U	1455	µg/l	0.11	< 0.11	< 0.11	< 0.11
Chromium (Dissolved)		U	1455	µg/l	0.50	< 0.50	< 0.50	< 0.50
Copper (Dissolved)		U	1455	µg/l	0.50	1.1	0.66	0.75
Nickel (Dissolved)		U	1455	µg/l	0.50	1.3	5.9	< 0.50
Lead (Dissolved)		U	1455	µg/l	0.50	< 0.50	< 0.50	< 0.50
Selenium (Dissolved)		U	1455	µg/l	0.50	< 0.50	< 0.50	< 0.50
Zinc (Dissolved)		U	1455	µg/l	2.5	7.9	5.4	3.8
Mercury Low Level		U	1460	µg/l	0.010	< 0.010	< 0.010	< 0.010
Chromium (Trivalent)		N	1490	µg/l	20	< 20	< 20	< 20
Chromium (Hexavalent)		U	1490	µg/l	20	< 20	< 20	< 20
Total TPH >C6-C40	EH_1D_Total	U	1670	µg/l	10	< 10	< 10	< 10
Aliphatic TPH >C5-C6	EH_2D_AL_#1	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10
Aliphatic TPH >C6-C8	EH_2D_AL_#1	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10
Aliphatic TPH >C8-C10	EH_2D_AL_#1	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10
Aliphatic TPH >C10-C12	EH_2D_AL_#1	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10
Aliphatic TPH >C12-C16	EH_2D_AL_#1	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10
Aliphatic TPH >C16-C21	EH_2D_AL_#1	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10
Aliphatic TPH >C21-C35	EH_2D_AL_#1	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10
Aliphatic TPH >C35-C44	EH_2D_AL_#1	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10
Total Aliphatic Hydrocarbons	EH_2D_AL_#1	N	1675	µg/l	5.0	< 5.0	< 5.0	< 5.0
Aromatic TPH >C5-C7	EH_2D_AR_#1	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10
Aromatic TPH >C7-C8	EH_2D_AR_#1	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10
Aromatic TPH >C8-C10	EH_2D_AR_#1	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10
Aromatic TPH >C10-C12	EH_2D_AR_#1	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10
Aromatic TPH >C12-C16	EH_2D_AR_#1	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10
Aromatic TPH >C16-C21	EH_2D_AR_#1	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10
Aromatic TPH >C21-C35	EH_2D_AR_#1	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10

Results - Water

Project: 16204 Marryat Walk

Client: Terra Firma		Chemtest Job No.:		24-36422	24-36422	24-36422
Quotation No.:		Chemtest Sample ID.:		1892412	1892413	1892414
Order No.: 16204MP		Client Sample Ref.:		1	2	3
		Client Sample ID.:		BH03W1	BH05W1	BH07W1
		Sample Location:		BH03	BH05	BH07
		Sample Type:		WATER	WATER	WATER
		Sample Sub Type:				
		Top Depth (m):		16.0	15.0	17.00
		Date Sampled:		07-Nov-2024	07-Nov-2024	07-Nov-2024
		Time Sampled:		12:00	12:00	12:00
Determinand	HWOL Code	Accred.	SOP	Units	LOD	
Aromatic TPH >C35-C44	EH_2D_AR_#1	N	1675	µg/l	0.10	< 0.10
Total Aromatic Hydrocarbons	EH_2D_AR_#1	N	1675	µg/l	5.0	< 5.0
Total Petroleum Hydrocarbons	EH_2D_Total_#1	N	1675	µg/l	10	< 10
Naphthalene		U	1800	µg/l	0.10	< 0.10
Acenaphthylene		U	1800	µg/l	0.10	< 0.10
Acenaphthene		U	1800	µg/l	0.10	< 0.10
Fluorene		U	1800	µg/l	0.10	< 0.10
Phenanthrene		U	1800	µg/l	0.10	< 0.10
Anthracene		U	1800	µg/l	0.10	< 0.10
Fluoranthene		U	1800	µg/l	0.10	< 0.10
Pyrene		U	1800	µg/l	0.10	< 0.10
Benzo[a]anthracene		U	1800	µg/l	0.10	< 0.10
Chrysene		U	1800	µg/l	0.10	< 0.10
Benzo[b]fluoranthene		U	1800	µg/l	0.10	< 0.10
Benzo[k]fluoranthene		U	1800	µg/l	0.10	< 0.10
Benzo[a]pyrene		U	1800	µg/l	0.10	< 0.10
Indeno(1,2,3-c,d)Pyrene		U	1800	µg/l	0.10	< 0.10
Dibenz(a,h)Anthracene		U	1800	µg/l	0.10	< 0.10
Benzo[g,h,i]perylene		U	1800	µg/l	0.10	< 0.10
Total Of 16 PAH's		U	1800	µg/l	2.0	< 2.0
Resorcinol		U	1920	mg/l	0.0050	< 0.0050
Phenol		U	1920	mg/l	0.0050	< 0.0050
Cresols		U	1920	mg/l	0.0050	< 0.0050
Xylenols		U	1920	mg/l	0.0050	< 0.0050
1-Naphthol		N	1920	mg/l	0.0050	< 0.0050
Trimethylphenols		U	1920	mg/l	0.0050	< 0.0050
Total Phenols		U	1920	mg/l	0.030	< 0.030

Test Methods

SOP	Title	Parameters included	Method summary	Water Accred.
1010	pH Value of Waters	pH at 20°C	pH Meter	RE PW TE TS PL DW GW
1020	Electrical Conductivity and Total Dissolved Solids (TDS) in Waters	Electrical Conductivity at 25°C and Total Dissolved Solids (TDS) in Waters	Conductivity Meter	TE LE SW GW
1090	Biochemical Oxygen Demand	Biochemical Oxygen demand (BOD)	Colorimetric determination of dissolved oxygen in seeded sample after 5 days incubation at 20°C.	
1100	Chemical Oxygen Demand	Chemical Oxygen demand (COD)	Dichromate oxidation of organic matter in sample followed by colorimetric determination of residual Cr[VI].	TE TS LE GW
1220	Anions, Alkalinity & Ammonium in Waters	Fluoride; Chloride; Nitrite; Nitrate; Total; Oxidisable Nitrogen (TON); Sulfate; Phosphate; Alkalinity; Ammonium	Automated colorimetric analysis using 'Aquakem 600' Discrete Analyser.	RE PW PL LE DW GW
1300	Cyanides & Thiocyanate in Waters	Free (or easy liberatable) Cyanide; total Cyanide; complex Cyanide; Thiocyanate	Continuous Flow Analysis.	
1325	Sulphide in Waters	Sulphides	Automated colorimetric analysis by 'Aquakem 600' Discrete Analyser using N,N-dimethyl-pphenylenediamine.	PL LE GW
1415	Cations in Waters by ICP-MS	Sodium; Potassium; Calcium; Magnesium	Direct determination by inductively coupled plasma - mass spectrometry (ICP-MS).	RE PW PL SW DW GW
1455	Metals in Waters by ICP-MS	Metals, including: Antimony; Arsenic; Barium; Beryllium; Boron; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Tin; Vanadium; Zinc	Filtration of samples followed by direct determination by inductively coupled plasma mass spectrometry (ICP-MS).	RE PW PL SW DW GW
1460	Mercury low-level in Waters by AFS	Mercury	Atomic Fluorescence Spectrometry, with collimated UV source, wavelength 253.7 nm.	PL GW
1490	Hexavalent Chromium in Waters	Chromium [VI]	Automated colorimetric analysis by 'Aquakem 600' Discrete Analyser using 1,5-diphenylcarbazide.	PL GW
1670	Total Petroleum Hydrocarbons (TPH) in Waters by GC-FID	TPH (C6–C40); optional carbon banding, e.g. 3-band – GRO, DRO & LRO	Pentane extraction / GC FID detection	PL GW
1675	TPH Aliphatic/Aromatic split in Waters by GC-FID(cf. Texas Method 1006 / TPH CWG)	Aliphatics: >C5–C6, >C6–C8, >C8– C10, >C10–C12, >C12–C16, >C16–C21, >C21–C35, >C35– C44 Aromatics: >C5–C7, >C7–C8, >C8– C10, >C10–C12, >C12–C16, >C16– C21, >C21– C35, >C35– C44	Pentane extraction / GCxGC FID detection	
1800	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Waters by GC-MS	Acenaphthene; Acenaphthylene; Anthracene; Benzo[a]Anthracene; Benzo[a]Pyrene; Benzo[b]Fluoranthene; Benzo[ghi]Perylene; Benzo[k]Fluoranthene; Chrysene; Dibenzo[ah]Anthracene; Fluoranthene; Fluorene; Indeno[123cd]Pyrene; Naphthalene; Phenanthrene; Pyrene	Pentane extraction / GCMS detection	PL GW SW
1920	Phenols in Waters by HPLC	Phenolic compounds including: Phenol, Cresols, Xylenols, Trimethylphenols Note: Chlorophenols are excluded.	Determination by High Performance Liquid Chromatography (HPLC) using electrochemical detection.	PL GW

Report Information

Key

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

This report shall not be reproduced except in full, and only with the prior approval of the laboratory.

Any comments or interpretations are outside the scope of UKAS accreditation.

The Laboratory is not accredited for any sampling activities and reported results relate to the samples 'as received' at the laboratory.

Uncertainty of measurement for the determinands tested are available upon request .

None of the results in this report have been recovery corrected.

All results are expressed on a dry weight basis.

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

For all other tests the samples were dried at $\leq 30^{\circ}\text{C}$ prior to analysis.

All Asbestos testing is performed at the indicated laboratory .

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

NEW_ASB	Eurofins Chemtest Limited, 11 Depot Road, Newmarket, CB8 0AL
DURHAM	Eurofins Chemtest Limited, Unit A North Wing, Prospect Business Park, Crookhall Lane, Consett, Co Durham, DH8 7PW

Sample Deviation Codes

As a result of any of the below deviations applying, the test results may be unreliable

A - Date of sampling not supplied

B - Sample age exceeds stability time (sampling to extraction)

C - Sample not received in appropriate containers

D - Broken Container

E - The required amount of sample for analysis was not received

H - Appropriate cooling measures were not taken for sample transportation

Sample Retention and Disposal

All soil samples will be retained for a period of 30 days from the date of receipt.

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

Charges may apply to extended sample storage.

Report Information

Water Sample Category Key for Accreditation

DW - Drinking Water
GW - Ground Water
LE - Land Leachate
NA - Not Applicable
PL - Prepared Leachate
PW - Processed Water
RE - Recreational Water
SA - Saline Water
SW - Surface Water
TE - Treated Effluent
TS - Treated Sewage
UL - Unspecified Liquid

Clean Up Codes

NC - No Clean Up
MC - Mathematical Clean Up
FC - Florisil Clean Up

HWOL Acronym System

HS - Headspace analysis
EH - Extractable hydrocarbons – i.e. everything extracted by the solvent
CU - Clean-up – e.g. by Florisil, silica gel
1D - GC – Single coil gas chromatography
Total - Aliphatics & Aromatics
AL - Aliphatics only
AR - Aromatic only
2D - GC-GC – Double coil gas chromatography
#1 - EH_2D_Total but with humics mathematically subtracted
#2 - EH_2D_Total but with fatty acids mathematically subtracted
+ - Operator to indicate cumulative e.g. EH+EH_Total or EH_CU+HS_Total

Asbestos Tests LOD = LOQ

Limit of Detection = Limit of Quantification for asbestos results only

If you require extended retention of samples, please email your requirements to:
customerservices@chemtest.com



Amended Report

Report No.:	24-38711-2		
Initial Date of Issue:	02-Dec-2024	Date of Re-Issue:	04-Mar-2025
Re-Issue Details:	This report has been revised and directly supersedes 24-38711-1 in its entirety		
Client	Terra Firma		
Client Address:	5 Deryn Court Wharfedale Road Pentwyn Cardiff CF23 7HA		
Contact(s):	michael@terrafirmawales.co.uk; morgan@terrafirmawales.co.uk		
Project	16204 Marryat Walk		
Quotation No.:		Date Received:	26-Nov-2024
Order No.:	16204MPW2	Date Instructed:	26-Nov-2024
No. of Samples:	3		
Turnaround (Wkdays):	5	Results Due:	02-Dec-2024
Date Approved:	02-Dec-2024		
Approved By:			
Details:	David Smith, Technical Director		

For details about application of accreditation to specific matrix types, please refer to the Table at the back of this report

Results - Water

Project: 16204 Marryat Walk

Client: Terra Firma		Chemtest Job No.:				24-38711	24-38711	24-38711
Quotation No.:		Chemtest Sample ID.:				1900845	1900846	1900847
Order No.: 16204MPW2		Client Sample Ref.:				1	2	3
		Client Sample ID.:				BH03W	BH05W	BH07W
		Sample Location:				BH03	BH05	BH07
		Sample Type:				WATER	WATER	WATER
		Sample Sub Type:						
		Top Depth (m):				16.00	7.00	8.00
		Date Sampled:				20-Nov-2024	20-Nov-2024	20-Nov-2024
		Time Sampled:				12:00	12:00	12:00
Determinand	HWOL Code	Accred.	SOP	Units	LOD			
pH at 20C		U	1010		4.0	7.7	7.9	7.7
Electrical Conductivity at 25C		U	1020	µS/cm	1.0	820	1000	940
Biochemical Oxygen Demand		N	1090	mg O2/l	4.0	[B] < 4.0	[B] < 4.0	[B] < 4.0
Chemical Oxygen Demand		U	1100	mg O2/l	10	< 10	12	14
Sulphate		U	1220	mg/l	1.0	11	42	14
Cyanide (Total) Low-Level		N	1300	mg/l	0.0050	< 0.0050	< 0.0050	< 0.0050
Sulphide		N	1325	mg/l	0.050	< 0.050	< 0.050	< 0.050
Hardness		N	1415	mg/l	1.0	440	490	510
Arsenic (Dissolved)		U	1455	µg/l	0.20	0.28	0.82	0.77
Cadmium (Dissolved)		U	1455	µg/l	0.11	< 0.11	< 0.11	< 0.11
Chromium (Dissolved)		U	1455	µg/l	0.50	< 0.50	< 0.50	< 0.50
Copper (Dissolved)		U	1455	µg/l	0.50	1.5	0.74	0.94
Nickel (Dissolved)		U	1455	µg/l	0.50	1.6	3.5	1.5
Lead (Dissolved)		U	1455	µg/l	0.50	< 0.50	< 0.50	< 0.50
Selenium (Dissolved)		U	1455	µg/l	0.50	0.71	< 0.50	< 0.50
Zinc (Dissolved)		U	1455	µg/l	2.5	5.1	12	2.9
Mercury Low Level		U	1460	µg/l	0.010	< 0.010	< 0.010	< 0.010
Chromium (Trivalent)		N	1490	µg/l	20	[B] < 20	[B] < 20	[B] < 20
Chromium (Hexavalent)		U	1490	µg/l	20	[B] < 20	[B] < 20	[B] < 20
Total TPH >C6-C40	EH_1D_Total	U	1670	µg/l	10	< 10	< 10	< 10
Aliphatic TPH >C5-C6	EH_2D_AL_#1	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10
Aliphatic TPH >C6-C8	EH_2D_AL_#1	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10
Aliphatic TPH >C8-C10	EH_2D_AL_#1	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10
Aliphatic TPH >C10-C12	EH_2D_AL_#1	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10
Aliphatic TPH >C12-C16	EH_2D_AL_#1	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10
Aliphatic TPH >C16-C21	EH_2D_AL_#1	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10
Aliphatic TPH >C21-C35	EH_2D_AL_#1	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10
Aliphatic TPH >C35-C44	EH_2D_AL_#1	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10
Total Aliphatic Hydrocarbons	EH_2D_AL_#1	N	1675	µg/l	5.0	< 5.0	< 5.0	< 5.0
Aromatic TPH >C5-C7	EH_2D_AR_#1	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10
Aromatic TPH >C7-C8	EH_2D_AR_#1	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10
Aromatic TPH >C8-C10	EH_2D_AR_#1	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10
Aromatic TPH >C10-C12	EH_2D_AR_#1	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10
Aromatic TPH >C12-C16	EH_2D_AR_#1	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10
Aromatic TPH >C16-C21	EH_2D_AR_#1	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10
Aromatic TPH >C21-C35	EH_2D_AR_#1	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10

Results - Water

Project: 16204 Marryat Walk

Client: Terra Firma		Chemtest Job No.:		24-38711	24-38711	24-38711
Quotation No.:		Chemtest Sample ID.:		1900845	1900846	1900847
Order No.: 16204MPW2		Client Sample Ref.:		1	2	3
		Client Sample ID.:		BH03W	BH05W	BH07W
		Sample Location:		BH03	BH05	BH07
		Sample Type:		WATER	WATER	WATER
		Sample Sub Type:				
		Top Depth (m):		16.00	7.00	8.00
		Date Sampled:		20-Nov-2024	20-Nov-2024	20-Nov-2024
		Time Sampled:		12:00	12:00	12:00
Determinand	HWOL Code	Accred.	SOP	Units	LOD	
Aromatic TPH >C35-C44	EH_2D_AR_#1	N	1675	µg/l	0.10	< 0.10
Total Aromatic Hydrocarbons	EH_2D_AR_#1	N	1675	µg/l	5.0	< 5.0
Total Petroleum Hydrocarbons	EH_2D_Total_#1	N	1675	µg/l	10	< 10
Naphthalene		U	1800	µg/l	0.10	< 0.10
Acenaphthylene		U	1800	µg/l	0.10	< 0.10
Acenaphthene		U	1800	µg/l	0.10	< 0.10
Fluorene		U	1800	µg/l	0.10	< 0.10
Phenanthrene		U	1800	µg/l	0.10	< 0.10
Anthracene		U	1800	µg/l	0.10	< 0.10
Fluoranthene		U	1800	µg/l	0.10	< 0.10
Pyrene		U	1800	µg/l	0.10	< 0.10
Benzo[a]anthracene		U	1800	µg/l	0.10	< 0.10
Chrysene		U	1800	µg/l	0.10	< 0.10
Benzo[b]fluoranthene		U	1800	µg/l	0.10	< 0.10
Benzo[k]fluoranthene		U	1800	µg/l	0.10	< 0.10
Benzo[a]pyrene		U	1800	µg/l	0.10	< 0.10
Indeno(1,2,3-c,d)Pyrene		U	1800	µg/l	0.10	< 0.10
Dibenz(a,h)Anthracene		U	1800	µg/l	0.10	< 0.10
Benzo[g,h,i]perylene		U	1800	µg/l	0.10	< 0.10
Total Of 16 PAH's		U	1800	µg/l	2.0	< 2.0
Resorcinol		U	1920	mg/l	0.0050	< 0.0050
Phenol		U	1920	mg/l	0.0050	< 0.0050
Cresols		U	1920	mg/l	0.0050	< 0.0050
Xylenols		U	1920	mg/l	0.0050	< 0.0050
1-Naphthol		N	1920	mg/l	0.0050	< 0.0050
Trimethylphenols		U	1920	mg/l	0.0050	< 0.0050
Total Phenols		U	1920	mg/l	0.030	< 0.030

Deviations

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

Sample:	Sample Ref:	Sample ID:	Sample Location:	Sampled Date:	Deviation Code(s):	Containers Received:
1900845	1	BH03W	BH03	#####	B	Coloured Winchester 1000ml
1900845	1	BH03W	BH03	#####	B	EPA Vial 40ml
1900845	1	BH03W	BH03	#####	B	Plastic Bottle 1000ml
1900846	2	BH05W	BH05	#####	B	Coloured Winchester 1000ml
1900846	2	BH05W	BH05	#####	B	EPA Vial 40ml
1900846	2	BH05W	BH05	#####	B	Plastic Bottle 1000ml
1900847	3	BH07W	BH07	#####	B	Coloured Winchester 1000ml
1900847	3	BH07W	BH07	#####	B	EPA Vial 40ml
1900847	3	BH07W	BH07	#####	B	Plastic Bottle 1000ml

Test Methods

SOP	Title	Parameters included	Method summary	Water Accred.
1010	pH Value of Waters	pH at 20°C	pH Meter	RE PW TE TS PL DW GW
1020	Electrical Conductivity and Total Dissolved Solids (TDS) in Waters	Electrical Conductivity at 25°C and Total Dissolved Solids (TDS) in Waters	Conductivity Meter	TE LE SW GW
1090	Biochemical Oxygen Demand	Biochemical Oxygen demand (BOD)	Colorimetric determination of dissolved oxygen in seeded sample after 5 days incubation at 20°C.	
1100	Chemical Oxygen Demand	Chemical Oxygen demand (COD)	Dichromate oxidation of organic matter in sample followed by colorimetric determination of residual Cr[VI].	TE TS LE GW
1220	Anions, Alkalinity & Ammonium in Waters	Fluoride; Chloride; Nitrite; Nitrate; Total; Oxidisable Nitrogen (TON); Sulfate; Phosphate; Alkalinity; Ammonium	Automated colorimetric analysis using 'Aquakem 600' Discrete Analyser.	RE PW PL LE DW GW
1300	Cyanides & Thiocyanate in Waters	Free (or easy liberatable) Cyanide; total Cyanide; complex Cyanide; Thiocyanate	Continuous Flow Analysis.	
1325	Sulphide in Waters	Sulphides	Automated colorimetric analysis by 'Aquakem 600' Discrete Analyser using N,N-dimethyl-pphenylenediamine.	PL LE GW
1415	Cations in Waters by ICP-MS	Sodium; Potassium; Calcium; Magnesium	Direct determination by inductively coupled plasma - mass spectrometry (ICP-MS).	RE PW PL SW DW GW
1455	Metals in Waters by ICP-MS	Metals, including: Antimony; Arsenic; Barium; Beryllium; Boron; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Tin; Vanadium; Zinc	Filtration of samples followed by direct determination by inductively coupled plasma mass spectrometry (ICP-MS).	RE PW PL SW DW GW
1460	Mercury low-level in Waters by AFS	Mercury	Atomic Fluorescence Spectrometry, with collimated UV source, wavelength 253.7 nm.	PL GW
1490	Hexavalent Chromium in Waters	Chromium [VI]	Automated colorimetric analysis by 'Aquakem 600' Discrete Analyser using 1,5-diphenylcarbazide.	PL GW
1670	Total Petroleum Hydrocarbons (TPH) in Waters by GC-FID	TPH (C6–C40); optional carbon banding, e.g. 3-band – GRO, DRO & LRO	Pentane extraction / GC FID detection	PL GW
1675	TPH Aliphatic/Aromatic split in Waters by GC-FID(cf. Texas Method 1006 / TPH CWG)	Aliphatics: >C5–C6, >C6–C8, >C8– C10, >C10–C12, >C12–C16, >C16–C21, >C21–C35, >C35– C44Aromatics: >C5–C7, >C7–C8, >C8– C10, >C10–C12, >C12–C16, >C16– C21, >C21– C35, >C35– C44	Pentane extraction / GCxGC FID detection	
1800	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Waters by GC-MS	Acenaphthene; Acenaphthylene; Anthracene; Benzo[a]Anthracene; Benzo[a]Pyrene; Benzo[b]Fluoranthene; Benzo[ghi]Perylene; Benzo[k]Fluoranthene; Chrysene; Dibenzo[ah]Anthracene; Fluoranthene; Fluorene; Indeno[123cd]Pyrene; Naphthalene; Phenanthrene; Pyrene	Pentane extraction / GCMS detection	PL GW SW
1920	Phenols in Waters by HPLC	Phenolic compounds including: Phenol, Cresols, Xylenols, Trimethylphenols Note: Chlorophenols are excluded.	Determination by High Performance Liquid Chromatography (HPLC) using electrochemical detection.	PL GW

Report Information

Key

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

This report shall not be reproduced except in full, and only with the prior approval of the laboratory.

Any comments or interpretations are outside the scope of UKAS accreditation.

The Laboratory is not accredited for any sampling activities and reported results relate to the samples 'as received' at the laboratory.

Uncertainty of measurement for the determinands tested are available upon request .

None of the results in this report have been recovery corrected.

All results are expressed on a dry weight basis.

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

For all other tests the samples were dried at $\leq 30^{\circ}\text{C}$ prior to analysis.

All Asbestos testing is performed at the indicated laboratory .

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

NEW_ASB Eurofins Chemtest Limited, 11 Depot Road, Newmarket, CB8 0AL

DURHAM Eurofins Chemtest Limited, Unit A North Wing, Prospect Business Park, Crookhall Lane, Consett, Co Durham, DH8 7PW

Sample Deviation Codes

As a result of any of the below deviations applying, the test results may be unreliable

A - Date of sampling not supplied

B - Sample age exceeds stability time (sampling to extraction)

C - Sample not received in appropriate containers

D - Broken Container

E - The required amount of sample for analysis was not received

H - Appropriate cooling measures were not taken for sample transportation

Sample Retention and Disposal

All soil samples will be retained for a period of 30 days from the date of receipt.

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

Charges may apply to extended sample storage.

Report Information

Water Sample Category Key for Accreditation

DW - Drinking Water
GW - Ground Water
LE - Land Leachate
NA - Not Applicable
PL - Prepared Leachate
PW - Processed Water
RE - Recreational Water
SA - Saline Water
SW - Surface Water
TE - Treated Effluent
TS - Treated Sewage
UL - Unspecified Liquid

Clean Up Codes

NC - No Clean Up
MC - Mathematical Clean Up
FC - Florisil Clean Up

HWOL Acronym System

HS - Headspace analysis
EH - Extractable hydrocarbons – i.e. everything extracted by the solvent
CU - Clean-up – e.g. by Florisil, silica gel
1D - GC – Single coil gas chromatography
Total - Aliphatics & Aromatics
AL - Aliphatics only
AR - Aromatic only
2D - GC-GC – Double coil gas chromatography
#1 - EH_2D_Total but with humics mathematically subtracted
#2 - EH_2D_Total but with fatty acids mathematically subtracted
+ - Operator to indicate cumulative e.g. EH+EH_Total or EH_CU+HS_Total

Asbestos Tests LOD = LOQ

Limit of Detection = Limit of Quantification for asbestos results only

If you require extended retention of samples, please email your requirements to:
customerservices@chemtest.com



Amended Report

Report No.:	24-40319-2		
Initial Date of Issue:	13-Dec-2024	Date of Re-Issue:	04-Mar-2025
Re-Issue Details:	This report has been revised and directly supersedes 24-40319-1 in its entirety		
Client	Terra Firma		
Client Address:	5 Deryn Court Wharfedale Road Pentwyn Cardiff CF23 7HA		
Contact(s):	michael@terrafirmawales.co.uk; ruth@terrafirmawales.co.uk		
Project	Marryat Walk		
Quotation No.:		Date Received:	09-Dec-2024
Order No.:	16204	Date Instructed:	09-Dec-2024
No. of Samples:	3		
Turnaround (Wkdays):	5	Results Due:	13-Dec-2024
Date Approved:	13-Dec-2024		
Approved By:			
Details:	David Smith, Technical Director		

For details about application of accreditation to specific matrix types, please refer to the Table at the back of this report

Results - Water

Project: Marryat Walk

Client: Terra Firma		Chemtest Job No.:				24-40319	24-40319	24-40319
Quotation No.:		Chemtest Sample ID.:				1906887	1906888	1906889
Order No.: 16204		Client Sample Ref.:				BH03	BH05	BH07
		Client Sample ID.:				BH03	BH05	BH07
		Sample Type:				WATER	WATER	WATER
		Sample Sub Type:						
		Date Sampled:				06-Dec-2024	06-Dec-2024	06-Dec-2024
		Time Sampled:				12:00	12:00	12:00
Determinand	HWOL Code	Accred.	SOP	Units	LOD			
pH at 20C		U	1010		4.0	8.0	7.9	7.4
Electrical Conductivity at 25C		U	1020	µS/cm	1.0	720	790	870
Biochemical Oxygen Demand		N	1090	mg O2/l	4.0	[B] < 4.0	[B] < 4.0	[B] 4.2
Chemical Oxygen Demand		U	1100	mg O2/l	10	< 10	< 10	17
Sulphate		U	1220	mg/l	1.0	22	48	12
Cyanide (Total)		U	1300	mg/l	0.050	< 0.050	< 0.050	< 0.050
Sulphide		N	1325	mg/l	0.050	< 0.050	< 0.050	< 0.050
Total Hardness as CaCO3		U	1270	mg/l	15	400	510	500
Arsenic (Dissolved)		U	1455	µg/l	0.20	0.27	0.52	1.1
Boron (Dissolved)		U	1455	µg/l	10.0	150	180	67
Chromium (Dissolved)		U	1455	µg/l	0.50	< 0.50	< 0.50	< 0.50
Copper (Dissolved)		U	1455	µg/l	0.50	1.3	0.52	0.77
Mercury (Dissolved)		U	1455	µg/l	0.05	< 0.05	< 0.05	< 0.05
Nickel (Dissolved)		U	1455	µg/l	0.50	1.7	2.7	1.8
Lead (Dissolved)		U	1455	µg/l	0.50	< 0.50	< 0.50	< 0.50
Selenium (Dissolved)		U	1455	µg/l	0.50	< 0.50	< 0.50	< 0.50
Zinc (Dissolved)		U	1455	µg/l	2.5	5.7	7.7	12
Cadmium (Dissolved)		N	1455	µg/l	0.08	< 0.08	< 0.08	< 0.08
Chromium (Trivalent)		N	1490	µg/l	20	< 20	< 20	< 20
Chromium (Hexavalent)		U	1490	µg/l	20	< 20	< 20	< 20
Total TPH >C6-C40	EH_1D_Total	U	1670	µg/l	10	< 10	< 10	< 10
Aliphatic TPH >C5-C6	EH_2D_AL_#1	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10
Aliphatic TPH >C6-C8	EH_2D_AL_#1	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10
Aliphatic TPH >C8-C10	EH_2D_AL_#1	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10
Aliphatic TPH >C10-C12	EH_2D_AL_#1	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10
Aliphatic TPH >C12-C16	EH_2D_AL_#1	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10
Aliphatic TPH >C16-C21	EH_2D_AL_#1	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10
Aliphatic TPH >C21-C35	EH_2D_AL_#1	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10
Aliphatic TPH >C35-C44	EH_2D_AL_#1	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10
Total Aliphatic Hydrocarbons	EH_2D_AL_#1	N	1675	µg/l	5.0	< 5.0	< 5.0	< 5.0
Aromatic TPH >C5-C7	EH_2D_AR_#1	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10
Aromatic TPH >C7-C8	EH_2D_AR_#1	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10
Aromatic TPH >C8-C10	EH_2D_AR_#1	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10
Aromatic TPH >C10-C12	EH_2D_AR_#1	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10
Aromatic TPH >C12-C16	EH_2D_AR_#1	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10
Aromatic TPH >C16-C21	EH_2D_AR_#1	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10
Aromatic TPH >C21-C35	EH_2D_AR_#1	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10
Aromatic TPH >C35-C44	EH_2D_AR_#1	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10

Results - Water

Project: Marryat Walk

Client: Terra Firma		Chemtest Job No.:				24-40319	24-40319	24-40319
Quotation No.:		Chemtest Sample ID.:				1906887	1906888	1906889
Order No.: 16204		Client Sample Ref.:				BH03	BH05	BH07
		Client Sample ID.:				BH03	BH05	BH07
		Sample Type:				WATER	WATER	WATER
		Sample Sub Type:						
		Date Sampled:				06-Dec-2024	06-Dec-2024	06-Dec-2024
		Time Sampled:				12:00	12:00	12:00
Determinand	HWOL Code	Accred.	SOP	Units	LOD			
Total Aromatic Hydrocarbons	EH_2D_AR_#1	N	1675	µg/l	5.0	< 5.0	< 5.0	< 5.0
Total Petroleum Hydrocarbons	EH_2D_Total_#1	N	1675	µg/l	10	< 10	< 10	< 10
Naphthalene		U	1800	µg/l	0.10	< 0.10	< 0.10	< 0.10
Acenaphthylene		U	1800	µg/l	0.10	< 0.10	< 0.10	< 0.10
Acenaphthene		U	1800	µg/l	0.10	< 0.10	< 0.10	< 0.10
Fluorene		U	1800	µg/l	0.10	< 0.10	< 0.10	< 0.10
Phenanthrene		U	1800	µg/l	0.10	< 0.10	< 0.10	< 0.10
Anthracene		U	1800	µg/l	0.10	< 0.10	< 0.10	< 0.10
Fluoranthene		U	1800	µg/l	0.10	< 0.10	< 0.10	< 0.10
Pyrene		U	1800	µg/l	0.10	< 0.10	< 0.10	< 0.10
Benzo[a]anthracene		U	1800	µg/l	0.10	< 0.10	< 0.10	< 0.10
Chrysene		U	1800	µg/l	0.10	< 0.10	< 0.10	< 0.10
Benzo[b]fluoranthene		U	1800	µg/l	0.10	< 0.10	< 0.10	< 0.10
Benzo[k]fluoranthene		U	1800	µg/l	0.10	< 0.10	< 0.10	< 0.10
Benzo[a]pyrene		U	1800	µg/l	0.10	< 0.10	< 0.10	< 0.10
Indeno(1,2,3-c,d)Pyrene		U	1800	µg/l	0.10	< 0.10	< 0.10	< 0.10
Dibenz(a,h)Anthracene		U	1800	µg/l	0.10	< 0.10	< 0.10	< 0.10
Benzo[g,h,i]perylene		U	1800	µg/l	0.10	< 0.10	< 0.10	< 0.10
Total Of 16 PAH's		U	1800	µg/l	2.0	< 2.0	< 2.0	< 2.0
Total Phenols		U	1920	mg/l	0.030	< 0.030	< 0.030	< 0.030

Deviations

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

Sample:	Sample Ref:	Sample ID:	Sample Location:	Sampled Date:	Deviation Code(s):	Containers Received:
1906887	BH03	BH03		#####	B	Coloured Winchester 1000ml
1906887	BH03	BH03		#####	B	EPA Vial 40ml
1906887	BH03	BH03		#####	B	Plastic Bottle 1000ml
1906888	BH05	BH05		#####	B	Coloured Winchester 1000ml
1906888	BH05	BH05		#####	B	EPA Vial 40ml
1906888	BH05	BH05		#####	B	Plastic Bottle 1000ml
1906889	BH07	BH07		#####	B	Coloured Winchester 1000ml
1906889	BH07	BH07		#####	B	EPA Vial 40ml
1906889	BH07	BH07		#####	B	Plastic Bottle 1000ml

Test Methods

SOP	Title	Parameters included	Method summary	Water Accred.
1010	pH Value of Waters	pH at 20°C	pH Meter	RE PW TE TS PL DW GW
1020	Electrical Conductivity and Total Dissolved Solids (TDS) in Waters	Electrical Conductivity at 25°C and Total Dissolved Solids (TDS) in Waters	Conductivity Meter	TE LE SW GW
1090	Biochemical Oxygen Demand	Biochemical Oxygen demand (BOD)	Colorimetric determination of dissolved oxygen in seeded sample after 5 days incubation at 20°C.	
1100	Chemical Oxygen Demand	Chemical Oxygen demand (COD)	Dichromate oxidation of organic matter in sample followed by colorimetric determination of residual Cr[VI].	TE TS LE GW
1220	Anions, Alkalinity & Ammonium in Waters	Fluoride; Chloride; Nitrite; Nitrate; Total; Oxidisable Nitrogen (TON); Sulfate; Phosphate; Alkalinity; Ammonium	Automated colorimetric analysis using 'Aquakem 600' Discrete Analyser.	RE PW PL LE DW GW
1270	Total Hardness of Waters	Total hardness	Calculation applied to calcium and magnesium results, expressed as mg l-1 CaCO3 equivalent.	RE PW PL SW DW GW
1300	Cyanides & Thiocyanate in Waters	Free (or easy liberatable) Cyanide; total Cyanide; complex Cyanide; Thiocyanate	Continuous Flow Analysis.	GW
1325	Sulphide in Waters	Sulphides	Automated colorimetric analysis by 'Aquakem 600' Discrete Analyser using N,N-dimethyl-pphenylenediamine.	PL LE GW
1455	Metals in Waters by ICP-MS	Metals, including: Antimony; Arsenic; Barium; Beryllium; Boron; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Tin; Vanadium; Zinc	Filtration of samples followed by direct determination by inductively coupled plasma mass spectrometry (ICP-MS).	RE PW PL SW DW GW
1490	Hexavalent Chromium in Waters	Chromium [VI]	Automated colorimetric analysis by 'Aquakem 600' Discrete Analyser using 1,5-diphenylcarbazine.	PL GW
1670	Total Petroleum Hydrocarbons (TPH) in Waters by GC-FID	TPH (C6–C40); optional carbon banding, e.g. 3-band – GRO, DRO & LRO	Pentane extraction / GC FID detection	PL GW
1675	TPH Aliphatic/Aromatic split in Waters by GC-FID(cf. Texas Method 1006 / TPH CWG)	Aliphatics: >C5–C6, >C6–C8, >C8– C10, >C10–C12, >C12–C16, >C16–C21, >C21–C35, >C35– C44 Aromatics: >C5–C7, >C7–C8, >C8– C10, >C10–C12, >C12–C16, >C16– C21, >C21– C35, >C35– C44	Pentane extraction / GCxGC FID detection	
1800	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Waters by GC-MS	Acenaphthene; Acenaphthylene; Anthracene; Benzo[a]Anthracene; Benzo[a]Pyrene; Benzo[b]Fluoranthene; Benzo[ghi]Perylene; Benzo[k]Fluoranthene; Chrysene; Dibenz[ah]Anthracene; Fluoranthene; Fluorene; Indeno[123cd]Pyrene; Naphthalene; Phenanthrene; Pyrene	Pentane extraction / GCMS detection	PL GW SW
1920	Phenols in Waters by HPLC	Phenolic compounds including: Phenol, Cresols, Xylenols, Trimethylphenols Note: Chlorophenols are excluded.	Determination by High Performance Liquid Chromatography (HPLC) using electrochemical detection.	PL GW

Report Information

Key

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

This report shall not be reproduced except in full, and only with the prior approval of the laboratory.

Any comments or interpretations are outside the scope of UKAS accreditation.

The Laboratory is not accredited for any sampling activities and reported results relate to the samples 'as received' at the laboratory.

Uncertainty of measurement for the determinands tested are available upon request .

None of the results in this report have been recovery corrected.

All results are expressed on a dry weight basis.

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

For all other tests the samples were dried at $\leq 30^{\circ}\text{C}$ prior to analysis.

All Asbestos testing is performed at the indicated laboratory .

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

NEW_ASB Eurofins Chemtest Limited, 11 Depot Road, Newmarket, CB8 0AL

DURHAM Eurofins Chemtest Limited, Unit A North Wing, Prospect Business Park, Crookhall Lane, Consett, Co Durham, DH8 7PW

Sample Deviation Codes

As a result of any of the below deviations applying, the test results may be unreliable

A - Date of sampling not supplied

B - Sample age exceeds stability time (sampling to extraction)

C - Sample not received in appropriate containers

D - Broken Container

E - The required amount of sample for analysis was not received

H - Appropriate cooling measures were not taken for sample transportation

Sample Retention and Disposal

All soil samples will be retained for a period of 30 days from the date of receipt.

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

Charges may apply to extended sample storage.

Report Information

Water Sample Category Key for Accreditation

DW - Drinking Water
GW - Ground Water
LE - Land Leachate
NA - Not Applicable
PL - Prepared Leachate
PW - Processed Water
RE - Recreational Water
SA - Saline Water
SW - Surface Water
TE - Treated Effluent
TS - Treated Sewage
UL - Unspecified Liquid

Clean Up Codes

NC - No Clean Up
MC - Mathematical Clean Up
FC - Florisil Clean Up

HWOL Acronym System

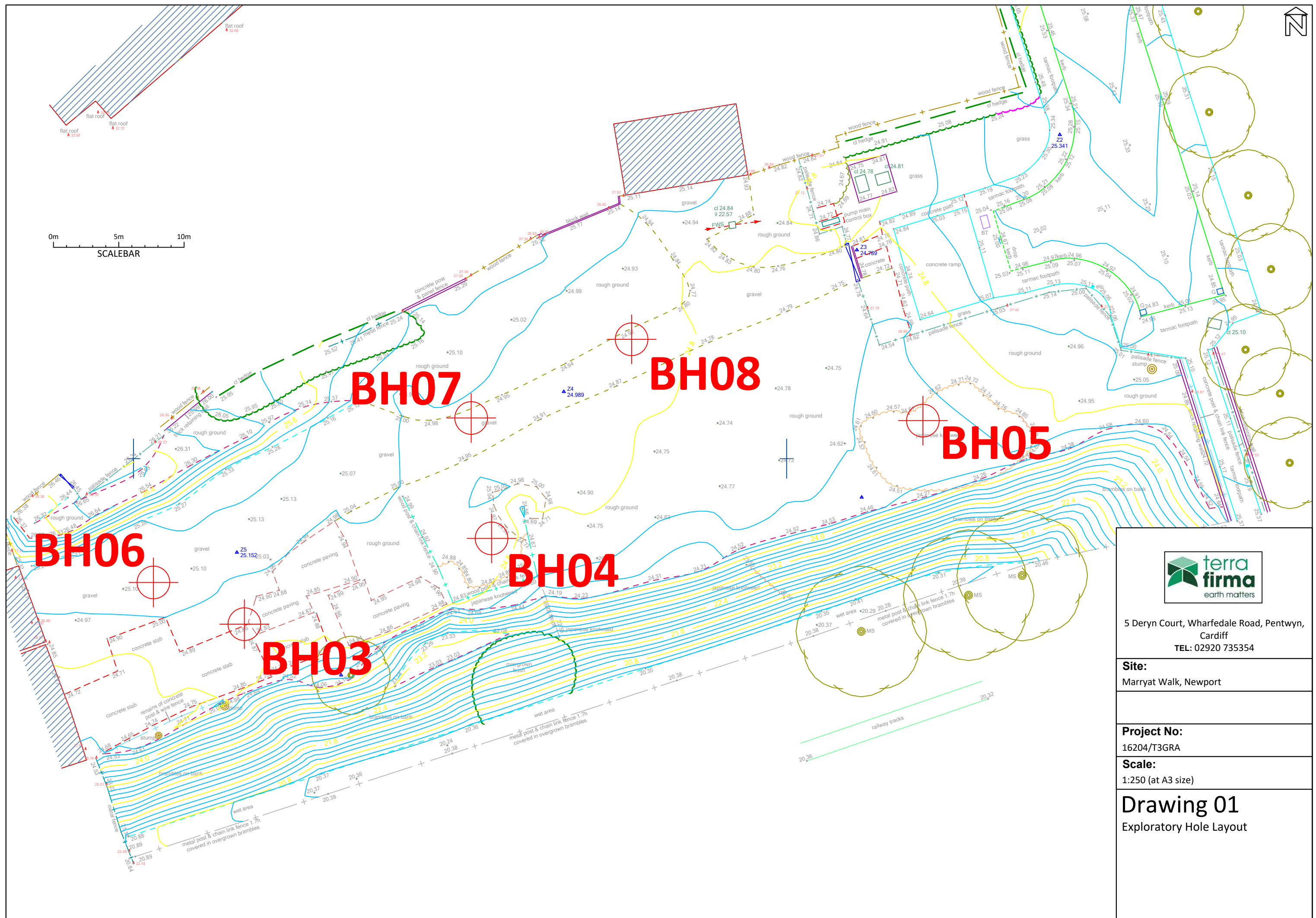
HS - Headspace analysis
EH - Extractable hydrocarbons – i.e. everything extracted by the solvent
CU - Clean-up – e.g. by Florisil, silica gel
1D - GC – Single coil gas chromatography
Total - Aliphatics & Aromatics
AL - Aliphatics only
AR - Aromatic only
2D - GC-GC – Double coil gas chromatography
#1 - EH_2D_Total but with humics mathematically subtracted
#2 - EH_2D_Total but with fatty acids mathematically subtracted
+ - Operator to indicate cumulative e.g. EH+EH_Total or EH_CU+HS_Total

Asbestos Tests LOD = LOQ

Limit of Detection = Limit of Quantification for asbestos results only

If you require extended retention of samples, please email your requirements to:
customerservices@chemtest.com

DRAWINGS



5 Deryn Court, Wharfedale Road, Pentwyn,
Cardiff
TEL: 02920 735354

Site:
Marryat Walk, Newport

Project No:
16204/T3GRA

Scale:
1:250 (at A3 size)

Drawing 01
Exploratory Hole Layout



Terra Firma (Wales) Ltd. 5 Deryn Court, Wharfedale Road, Pentwyn, Cardiff CF23 7HA
Tel: 029 2073 5354 **Fax:** 029 2073 5433 **Email:** info@terrafirmawales.co.uk www.terrafirmawales.co.uk