

**PROPOSED RESIDENTIAL DEVELOPMENT  
GENE METALS, TREFOREST**

**WATERSTONE HOMES**

**ADDITIONAL GEO-ENVIRONMENTAL  
ASSESSMENT**

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ASSESSMENT**

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## SUMMARY

The further investigation has generally confirmed the previous Ground Model, in that the site is predominantly underlain by Made Ground, over fine-grained Glacial Diamicton and then bedrock. Across the entire site, the Made Ground was generally found to be thicker in the southern portions of each development platforms, where they appear to have been built up.

The additional leachate testing has indicated that there is leachable concentrations of several metals, polyaromatic hydrocarbons, semi-volatile and volatile organic compounds and petroleum hydrocarbons across the site. These are generally in line with those previously encountered in the October 2016 investigation.

Groundwater testing in five boreholes spread across the site has indicated that leachable levels of contamination identified in the leachate testing are generally not entering the groundwater. Additionally, surface water sampling of up and down stream points also suggest no contaminant loading.

Whilst isolated and marginal exceedances of copper, iron, cadmium, chromium, zinc, some polyaromatic hydrocarbons and petroleum hydrocarbons were measured in the groundwater, none were significantly elevated and there appears to be no clear or consistent link between leachate and groundwater results.

The site is situated in an area that has had a strong industrial past and groundwater below the site is likely to have been impacted during this industrial past. The slightly elevated levels of iron, copper, cadmium, chromium and zinc may be representative of natural fluxes in the groundwater chemistry. Upstream monitoring of the surface water showed elevated concentrations of iron, chromium, copper and zinc.

Given the relatively large distances to the River Taff, the main receptor, the concentrations encountered in the groundwater and surface water will likely disperse and dilute on its journey to the receptor and the risks are likely to be low.

The site is to undergo a remediation scheme that will reduce risks to end users (residents) from contamination at the site. The site betterment will remove sources of contamination and limit areas for infiltration and ultimately reduce risks to receptors.

Given the above, the testing has shown that the site is not significantly impacting groundwater or surface water.

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**GENERAL NOTES  
GENERAL GEOTECHNICAL CONSTRUCTION ADVICE**

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## 1.0 INTRODUCTION AND OBJECTIVES

### 1.1 Background

Waterstone Homes Ltd (hereafter known as the Client) are proposing to redevelop the subject site for residential purposes. The Earth Science Partnership Ltd (ESP) were instructed by the Client to undertake an additional geo-environmental investigation and assessment to further assess impacts to identified receptors from contamination previously identified on the site. The site location is shown on Figure 1.

The proposed development will comprise 34 one and two-storey residential properties with private gardens within three blocks. A development platform will be created in the centre of the site by cutting into the existing slopes by around 2 to 3m to the west, and filling over the lower lying areas in the east by up to 3m. Little or no level change will be realised in the centre of the site. Based on the above, we understand that the proposed structures would be classified as Geotechnical Category 2 (BS5930:2015).

ESP have previously completed several investigations at the site including:

- A Preliminary Geotechnical and Geo-environmental Assessment, which comprised a desk study and preliminary investigation (trail pitting), but no laboratory testing (ESP, 2015). Pertinent information from this preliminary assessment has been incorporated into this current report;
- A Geo-environmental and geotechnical assessment (ESP, 2016), which included trial pitting and laboratory testing, and gas monitoring. Pertinent information, such as the geo-environmental testing from this assessment has been incorporated into this current report; and
- A Ground Gas Addendum report (ESP 2017) which provided the results and recommendations to a period of gas monitoring.

### 1.2 Objective and Scope of Works

The objective of the investigation was to obtain further information on the contamination previously identified on the site and assess the impacts such contamination will have upon controlled waters given the proposed development and earthworks.

The scope of works therefore briefly comprised:

1. Further trial pitting across the site to collect samples for additional leachate geo-environmental testing;
2. The installation of five groundwater wells in rotary boreholes at the site;
3. Undertaking falling head testing within three boreholes to allow an assessment of the hydraulic conductivity;
4. Geoenvironmental testing of the groundwater;
5. The collection and analysis of samples of the stream up and downstream of the site; and
6. The collation of all data into a controlled waters risk assessment report, including a Level Three assessment of risks based on the Environment Agency RTM methodology.

The information gained from this assessment will be used to help the Client provide information to Natural Resources Wales to enable the Waste Permit on the site to be surrendered.

The contract was awarded on the basis of a competitive tender quotation. The terms of reference for the assessment are as laid down in the Earth Science Partnership proposal of 16<sup>th</sup> February 2017 (ref: Gene Metals 5902b.04a).

The investigation, monitoring and assessment was undertaken between April to July 2017.

### 1.3 Report Format

This report includes a summary of the previous desk study and work undertaken prior to this report (Section 2), and details of the investigation undertaken to Eurocode EC7 and BS5930:2015 (Section 3). The conceptual Ground Model is updated (Section 4) with new ground investigation data and includes the results of leachate, groundwater and surface water testing. Section 5 provides an updated discussion on the risk to groundwater following the further work and recommendations are provided in Section 6, which include previous recommendations made for the site.

### 1.4 Limitations of Report

This report represents the findings of the brief relating to the proposed end use and geotechnical category of structure(s) as detailed in Section 1.1. The brief did not require an assessment of the implications for any other end use or structures, nor is the report a comprehensive site characterisation and should not be construed as such. Should an alternative end use or structure be considered, the findings of the assessment should be re-examined relating to the new proposals.

Where preventative, ameliorative or remediation works are required, professional judgement will be used to make recommendations that satisfy the site specific requirements in accordance with good practice guidance.

Consultation with regulatory authorities will be required with respect to proposed works as there may be overriding regional or policy requirements which demand additional work to be undertaken. It should be noted that both regulations and their interpretation by statutory authorities are continually changing.

This report represents the findings and opinions of experienced geo-environmental and geotechnical specialists. Earth Science Partnership does not provide legal advice and the advice of lawyers may also be required.

Budget limitations meant that the scope of contamination testing, both soil and leachate testing was limited across the site.

This report does not update recommendations made in term of human health risk assessments and only updated the groundwater risk assessment, as detailed in Section 6.

### 1.5 Digital Copy of Report

This report is issued as a digital version only.

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## 2.0 SUMMARY OF SALIENT FINDINGS OF PREVIOUS ASSESSMENTS

### 2.1 Site Location and Description

The site is located on the western side of the village of Treforest, just to the south of Pontypridd in the County Borough of Rhondda Cynon Taff. The National Grid Reference of the centre of the site is 307850 189030. A Site Location Plan is presented as Figure 1 and comprises an irregular shaped parcel of land measuring 140m in length (east-west) and between 30 and 70m in width (north-south).

The site was used as the premises of Gene Metals (a metal recycling company). Recent and historical maps indicated that the site was formerly a scrap yard. The site was derelict during the 2015 and 2016 works and the skips that were present in the south-eastern margins had been removed by the time of the 2017 site works.

The site comprises three basic zones:

- **Zone A:** is the lowest lying area and is in the east of the site, at levels of between 97 and 100m OD and comprises a plateau covered with rough vegetation and loose gravel. The building that was located in this area (noted in the 2015 and 2016 visits) was now demolished.
- **Zone B:** forms the central plateau and remains undeveloped and covered with rough vegetation and a gravel surfacing. The building located in the eastern portion of this area in 2015 and 2016 was noted to have been demolished by the 2017 visit; the concrete floor slabs noted elsewhere in this area remain.
- **Zone C:** the western area is more elevated than the remainder of the site and comprises an undeveloped flat plateau area at around 105m OD in the south, with slopes up to around 109m OD in the north.

A stream is present in the west of the site (Zone C). It appears to flow from a culvert to the north, collecting in a pool, before being further culverted beneath the majority of the site. This culvert empties into a further pool outside the southern boundary, where the stream then enters a further culvert carrying it further downhill to the south-east.

### 2.2 Site History

The historical maps showed the site to have been developed with buildings between 1948 and 1959, the layout changed slightly and was first labelled as a scrap yard by 1989.

Iron and steel works, including railway sidings were present to the south and east of the site, and the maps indicate a quarry to have been located to the south, which became a tip in the 1970s.

### 2.3 Environmental Setting

The nearest major surface water feature to the site is the River Taff (classified as a Primary River) and flows from north to south approximately 490m to the east. A number of streams are also present in the area, including that crossing the western part of Zone C and are classified as Tertiary Rivers.

The glacial superficial deposits to the south of the site are classed as Unproductive Strata, whilst the bedrock underlying the site (the Brithdir Sandstone) is classed as Secondary A Aquifer. Secondary A Aquifers are sensitive to pollution and Unproductive Strata are the least sensitive in terms of pollution.

Information in previous assessments indicated that there are no surface water abstractions within 2km of the site.

Given the site setting, groundwater flow is likely to be toward the River Taff, toward the east.

Three pollution incidents were recorded to have occurred at the site, all on 7<sup>th</sup> July 2004. The incidents reportedly involved construction and demolition wastes and household wastes, and impacted water (minor), land (significant) and air (no impact). No further details were provided in the environmental data report previously obtained for the site.

Gene Metals was a scrap yard and was first registered in 1989, then as a metal recycling site (mixed MRS's) in March 1996, with an annual tonnage of waste of 4,000 tonnes. A sign above a previous building on site indicated that Gene Metals was operated under waste management license no. SY/03/94 issued by Taff Ely Borough Council.

As discussed in Section 2.1, the 2015 and 2016 site visits showed that skips were being stored on site in the south-eastern area. These skips were no longer present during the 2017 site visit. The skips contained building waste including furniture, plaster board, bricks, concrete, soil and plastic.

## 2.4 Pertinent Information from Previous Assessments

### 2.4.1 Geology

As discussed above, ESP have undertaken two previous phases of investigation at the site which comprised trial pitting, windowless sampling and soakaway testing. These investigations showed the site to be generally underlain by Made Ground, over fine-grained Glacial Diamicton and, commonly at relatively shallow depth, Coal Measures sandstone bedrock.

Overall, the Made Ground soils appeared to predominantly comprise materials used to raise lower lying site levels (e.g. the PFA in TP6, TP7, TP9, TP13, TP110 and TP112), as backfill behind retaining walls (e.g. the PFA in TP5 and WS1), or tipped materials containing substantial quantities of probable remnant scrap yard materials such as car parts, scrap metal, glass, tile, timber and brick. Buried car parts were evident across the site. Suspected slag gravel was identified in several pits, commonly as occasional fragments, but as a more substantial proportion of the soils in TP14, TP104 and TP114.

Sandstone bedrock was evident beneath all three zones, from generally at depths of between 1.0 and 2.0m, but much shallower in places, and less than 0.5m in several exploratory holes.

A layer of predominantly fine-grained glacial soils, generally between 0.5 and 1.0m in thickness (but less than 0.5m in places) was identified in most exploratory holes, but this was absent in several holes where the Made Ground lay directly above the weathered bedrock (TP102, TP106, TP110, TP111, TP113, WS2 and WS4).

### 2.4.2 Hydrogeology

Groundwater was not generally encountered within the previous exploratory holes. However, it was found in occasional exploratory holes as summarised in Table 1 below:

**Table 1:** Summary of groundwater ingress in the investigation

Hole ID	Zone	Stratum	Comment on groundwater encountered
TP109	A	Diamicton	Soils damp below a depth of 2.7m (top of Diamicton).
TP4	B	Diamicton	Slow inflow at 0.5m.
TP5	B	Diamicton	Slow inflow at 2.2m.
TP102	C	Sandstone bedrock	Slow inflow at 0.6m.
WS2	C	Made Ground	Slow inflow encountered at 0.7m during drilling. Standing water level recorded in well at 0.3m and 0.45m depth during monitoring visits V3 and V4 respectively.
WS5	C	Diamicton	Groundwater measured at a depth of 0.8m, upon completion of borehole. No noticeable strike during drilling.

During subsequent monitoring, apart from Well WS2 (see Table 1 above), the wells installed in the boreholes remained dry.

### 2.4.3 Previous Contamination Findings

The previous investigations identified Made Ground of varying thicknesses across the site, containing a significant proportion of man-made materials including several items obviously originating from its former use as a scrap yard. Visual and olfactory evidence of hydrocarbon contamination has also been confirmed by the presence of elevated levels of volatile organic vapours measured using a PID (photo ionisation detector) on samples recovered from the trial pits and boreholes.

Laboratory testing identified levels of a number of determinands above the adopted assessment criteria both within the Made Ground soils and within leachate generated from these soils. The recorded exceedances by metals, petroleum hydrocarbons and most PAH compounds occurred in a limited number of the samples analysed (1 to 3 samples). However, the exceedances by dibenzo[ah]anthracene and several PCB congeners occurred in multiple samples (4 to 5 samples), and some exceedances were considerably above the respective GAC.

Amosite and chrysotile asbestos were identified in three of the samples of Made Ground analysed. However, given the significant proportion of old car parts and other scrap residue within the Made Ground across the site (much of which may have contained asbestos), we cannot discount, and strongly suspect that further so far unidentified asbestos containing materials are likely to be present within the shallow soils.

Unacceptably elevated levels of contaminants were identified in all exploratory holes analysed apart from TP104 (Zone C), WS4 and TP106 (Zone A), and TP101 and WS1 (Zone B).

Laboratory testing has also identified the leachable levels of cadmium, zinc, petroleum hydrocarbons and chloroform to be elevated above the assessment criteria designed to be protective of controlled waters only in a limited samples of the Made Ground (one or two samples). However, the levels of copper, PAH compounds and bis(2-ethylhexyl)phthalate were elevated in the majority/all the samples analysed.

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Many of the contaminants identified as being present within the Made Ground would be associated with the former use of the site as a scrap yard, e.g. petroleum hydrocarbons, asbestos, PAH compounds, metals. In particular, bis(2-ethylhexyl)phthalate (DEHP), which was identified within the leachate, is commonly found as a dielectric fluid in capacitors, and is likely to be present through leaks from capacitors recycled at the site. Chloroform, which was also found in the leachate, is a solvent used commonly as a cleaning agent.

## **3.0 EXPLORATORY INVESTIGATION**

### **3.1 Investigation Points**

#### **3.1.1 Introduction**

The intrusive investigation was undertaken between 3<sup>rd</sup> April and 5<sup>th</sup> April 2017 in accordance with BS5930:2015 and BS10175:2013, and was designed to further investigate the geo-environmental hazards identified in the previous phases of work (Section 2). It comprised trial pitting, rotary open hole drilling, monitoring and sampling of groundwater, surface water and geo-environmental testing of leachate and waters.

The exploratory holes were supervised and logged by an engineering geologist in general accordance with BS5930:2015.

Descriptions and depths of the strata encountered are presented on the trial pit and borehole records in Appendix A and B. Results of the falling head permeability testing are presented in Appendix C. The investigation point positions are shown on Figure 2.

The ground levels indicated on the investigation point records are approximate only and have been interpolated from the topographical survey provided by the Client (dwg. S9351 PR101). The ground levels on the investigation point records are approximate only and have been interpolated from the topographical survey.

The geo-environmental testing laboratory misinterpreted the schedule for the testing and as such did not correctly test the samples collected during the April 2017 investigation. It was therefore necessary to revisit site in July 2017 to collect further samples for leachate testing.

#### **3.1.2 Investigation Strategy**

The investigation strategy was designed by ESP and the works were carried out in accordance with BS10175:2013, taking into account the previous investigation findings. The investigation points were selected to maximise the information obtained on the extent, depth and nature of the Made Ground that is spread across the site.

Specific pits were excavated in areas not previously possible to investigate, such as the inspection pit inside the recently demolished building in Area A and further trial pits were excavated along the southern boundary of the site to provide further information for the Ground Model in this area.

Five deep boreholes were positioned as far apart as practicable on site to allow for any variations of groundwater level to be detected.

#### **3.1.3 Trial Pits**

15no. trial pits (TP201 to TP215) were excavated across the site on 3<sup>rd</sup> April 2017 using a wheeled, backacting hydraulic excavator. The trial pits were excavated to a maximum depth of 5m. Disturbed environmental samples were collected from the trial pits for laboratory testing. No man entry into the pits was undertaken. On completion, the trial pits were backfilled with arisings in layers compacted

with the excavator bucket. The arisings were left slightly proud of the adjacent surface to allow for future settlement.

As discussed in Section 3.1.1, due to a clerical error at the testing laboratory, the site had to be revisited to collect samples for leachate testing and the samples were collected by excavating a hand dug trial pit at the former location of the April 2017 trial pits.

The trial pit records are presented as Appendix A.

### 3.1.4 Rotary Open-hole Drillholes

5no. rotary percussive open-hole drillholes (BH201 to BH205), were constructed to a maximum depth of 33m between 3 and 6<sup>th</sup> April 2017. The ODEX 115 system of simultaneous drilling and casing was used in the superficial deposits and the drillhole records are presented as Appendix B.

At the commencement of each borehole, a service inspection pit was excavated by hand to a depth of 1.2m. The drillholes were constructed with the objective of locating groundwater, and upon encountering groundwater, they were drilled several metres below to ensure sufficient standpipe could be installed to allow for groundwater fluctuations.

During the drilling process, the rock chippings returned to the surface were described by the driller and the rate of progress monitored. It should be noted that, although adequate for identification purposes, the nature of the drilling method does not permit an accurate description of the strata.

On completion, instrumentation was installed in boreholes as detailed in Section 3.2.1.

### 3.1.5 In-situ Permeability Tests

Variable head permeability testing was undertaken within the rotary drillholes at depths selected by ESP to determine the hydraulic conductivity of the bedrock at that depth. The testing was undertaken in accordance with BS5930 (2015) and BS EN ISO 22282-2 (2012).

The test depths and the strata tested are presented in Table 2 below:

**Table 2:** Permeability Testing Undertaken in Investigation

Borehole	Date of Test	Depth of Test	Test Stratum	Test Type <sup>1</sup>
BH202	04/04/2017	15m	Sandstone with mudstone	F
BH203	04/04/2017	15m	Sandstone with mudstone	F
BH204	05/04/2017	15m	Sandstone with mudstone	F
<b>Notes:</b>				
1. F: falling head test. R: rising head test. C: constant head.				
2. Details of strata tested shown on borehole records (Appendix B).				
3. Test results presented in Appendix C.				

In general terms for falling head tests, the prepared test section borehole was filled with clean water from a water bowser and the level to which the resulting water level falls is measured over time. The permeability is calculated using the methodology presented in BS EN ISO 22282-2 (2012). The test results and permeability calculations are presented in Appendix C.

## 3.2 Instrumentation

### 3.2.1. Groundwater Installations and Monitoring

A 50mm diameter HDPE standpipe was installed in selected boreholes to allow monitoring sampling of groundwater in accordance with BS ISO 5667-22 (2010) where groundwater sampling was envisaged. The wells, comprising slotted plastic pipe with a gravel surround (the response zone), bentonite seals above the response zone, and a lockable vandal proof cover, were installed in boreholes as detailed on the borehole records and summarised in Table 3 below.

**Table 3: Well Installations**

Well ID	Installation Type	Date of Installation	Response Zone depth	Response Zone Stratum	Level (mOD)
BH201	50 mm standpipe	03/04/2017	20.0 – 27.0m	Brithdir Sandstone	107.25
BH202	50 mm standpipe	04/04/2017	24.0 – 33.0m	Brithdir Sandstone <sup>2</sup>	101.85
BH203	50 mm standpipe	05/04/2017	24.0 – 33.0m	Brithdir Sandstone	101.97
BH204	50 mm standpipe	05/04/2017	24.0 – 33.0m	Brithdir Sandstone	98.65
BH205	50 mm standpipe	06/04/2017	24.0 – 33.0m	Brithdir Sandstone	96.65

**Notes on Table 3:**

1. Details of each monitoring well are presented on the individual borehole records (Appendix B).
2. Coal noted within the response zone of BH202 at a depth of 30.40 – 30.70m.
3. Levels interpolated from spot heights on topographic survey.

To date the installations have been monitored on three occasions between 4<sup>th</sup> May and 13<sup>th</sup> June 2017. The standpipe, piezometer and 50mm wells are monitored on a 'spot' basis, i.e. periodic visits to monitor groundwater levels at the time of the visit).

The results of the groundwater monitoring are summarised in Table 4.

**Table 4: Groundwater Monitoring**

Borehole ID	Depth to groundwater (m) (Level (mOD))		
	VISIT 1 04/05/2017	VISIT 2 01/06/2017	VISIT 3 13/06/2017
BH201	1.36	2.50	0.0 <sup>1</sup>
	(105.89)	(104.75)	(107.25)
BH202	0.7	1.30	0.1
	(101.15)	(100.55)	(101.75)
BH203	2.47	2.70	0.87
	(99.5)	(99.27)	(101.1)
BH204	4.9	7.15	6.49
	(93.75)	(91.5)	(92.16)
BH205	23.6	13	11.85
	(73.05)	(83.65)	(84.8)

**Notes:**

1. Groundwater level above ground level (in raised cover) and very slight (seepage) artesian flow noted.

### **3.3 Sampling Strategy**

#### **3.3.1 Soil Sampling**

Soil samples were collected from the exploratory holes as discussed in the previous sections. The sampling procedures were selected on the basis of the suitability for the laboratory testing proposed.

Sampling for soil and leachate contaminants was undertaken on a targeted basis, and where possible leachate testing was undertaken where contamination was identified in the trial pits (TP207 and TP210) or in areas that will remain after the proposed earthworks programme.

As discussed in Section 3.1.1, due to a clerical error at the testing laboratory, the samples schedule for leachate testing had to be collected again via hand dug trial pits in the exact location as the trial pits excavated in April 2017. Soil samples were collected from the hand dug trial pits as previously and the sampling procedures were selected on the basis of the suitability for the laboratory testing proposed. As the hand dug trial pits were excavated in the same location at the previous trial pits, and all encountered the same ground conditions, no additional logs have been generated to prevent duplication of data.

Environmental samples (denoted as E on the exploratory holes records) were collected for possible geo-environmental laboratory testing and generally comprised a plastic tub, an amber glass jar and an amber glass vial. The sample containers provided clean by the testing laboratory appropriate for the proposed testing to be scheduled. Immediately after collection the samples were placed in sealed cool boxes with ice packs where they remained during storage and transport to the laboratory.

#### **3.3.2 Groundwater Sampling**

In order to establish the groundwater quality beneath the site, samples of groundwater were collected from the installed wells on 4<sup>th</sup> May 2017, 1<sup>st</sup> June 2017 and 13<sup>th</sup> June 2017 in general accordance with BS ISO 5667-11 (2009). Prior to sampling, the wells were purged by the removal of three well volumes where practical, to obtain a water sample representative of the groundwater in the vicinity.

All groundwater samples taken for possible laboratory chemical analysis were collected in suitable clean containers provided by the testing laboratory for (e.g. clean polyethylene jars/bottles with fitted lids for routine soil testing, clear or amber glass bottles with screw on air-tight caps for organic contaminants, glass vials for volatile contaminants, etc.). Immediately after collection the samples were placed in sealed cool boxes with an ice pack where they remained during storage and transport to the laboratory.

#### **3.3.3 Surface Water Sampling**

Samples of surface water (Upstream and Downstream) were collected from a stream running northwest – southeast, across the northwest boundary of the site on 4<sup>th</sup> May 2017 and 13<sup>th</sup> June 2017 in general accordance with BS ISO 5667-6 (2014). Water sample Upstream was collected at the upstream boundary of the site and Downstream at the closest point accessible to the site, this was approximately 150m from the site, however, the stream is culverted from the site to the monitoring point and is therefore considered to be representative for the purposes of this assessment. The

sampling locations are shown on Figure 4. The comparison of these values will allow an assessment of the potential impact on the surface water that may originate at the site.

All surface water samples collected for laboratory chemical analysis were collected in suitable clean containers provided by the testing laboratory for (e.g. clean polyethylene jars/bottles with fitted lids for routine soil testing, clear or amber glass bottles with screw on air-tight caps for organic contaminants, glass vials for volatile contaminants, etc.). Immediately after collection the samples were placed in sealed cool boxes with an ice pack where they remained during storage and transport to the laboratory.

### 3.4 Evidence of Site Hazards Found During Site Works

#### 3.4.1 Site Evidence of Contamination

As previously encountered, Made Ground was encountered across the site, with direct visual or olfactory evidence of contamination identified in the exploratory holes as summarised in Table 5.

**Table 5: Site Evidence for Contamination**

Hole ID	Stratum	Comment on contamination encountered
TP207	Brithdir Sandstone	Hydrocarbon staining in one corner of the trial pit between 1.3m and 1.6m. Slight hydrocarbon odour in the groundwater at 1.5m.
TP210	Glacial Diamicton	Slight hydrocarbon odour in the groundwater at 0.9m. At 0.85m, hydrocarbon staining in the trial pit. To 0.9m, metal, plastic, concrete and wood fragments are present, as well as decayed vegetation.

#### 3.4.2 Geo-environmental Laboratory Testing

Laboratory testing has been undertaken to identify the levels of selected contaminants within samples of soil, leachate generated from shallow soils, groundwater, and surface water on and in the vicinity of the site.

The geo-environmental analyses were carried out by a UKAS accredited testing laboratory with detection limits being generally compatible with the relevant guideline values adopted in the assessment.

#### 3.4.3 Leachate Samples

In order to allow an assessment of the potential pollution risks to controlled waters, samples of leachate have been generated from five samples of Made Ground soil, a single sample from Glacial Diamicton and a further two samples from weathered Brithdir Sandstone. The leachate preparation was carried out in accordance with the guidance given in the National Rivers Authority (NRA) R&D Note 301 (1994).

The resulting leachate was analysed for the following determinands:

- Arsenic, barium, beryllium, boron, cadmium, total chromium, copper, iron, lead, mercury, nickel, selenium, vanadium, zinc;
- Total monohydric phenols;
- Cyanide, pH value;

- US EPA 16 polycyclic aromatic hydrocarbon (PAH) compounds;
- Petroleum hydrocarbons (CWG ali/aro carbon banded C<sub>5</sub> to C<sub>35</sub>);
- Volatile organic compounds (including chlorinated solvents);
- Semi-volatile organic compounds (SVOCs).
- Polychlorinated biphenyls (PCBs, Euro 7);

The results of the leachate tests are presented in Appendix D.

#### 3.4.4 Groundwater Samples

In order to allow an assessment of the potential pollution risks to controlled waters, samples of groundwater recovered from selected wells have been analysed for the following determinands:

- Arsenic, barium, beryllium, boron, cadmium, total chromium, copper, iron, lead, mercury, nickel, selenium, vanadium, zinc;
- US EPA 16 polycyclic aromatic hydrocarbon (PAH) compounds;
- Total monohydric phenols;
- Cyanide, pH value;
- Petroleum hydrocarbons (CWG ali/aro carbon banded C<sub>5</sub> to C<sub>35</sub>); and
- Volatile organic compounds (including chlorinated solvents);

To allow the selection of the appropriate assessment criteria in assessment, the hardness (concentration of calcium carbonate) of the water within the stream has also analysed via a sample of river water collected from the site running northwest-southeast in the northwest margins of the site.

The results of the above groundwater analyses are presented in Appendix E.

#### 3.4.5 Surface Water Samples

In order to allow an assessment of the potential pollution risks to the stream on site and possibly associated River Taff, samples of surface water recovered from the stream have been analysed for the following determinands:

- Arsenic, barium, beryllium, boron, cadmium, total chromium, copper, iron, lead, mercury, nickel, selenium, vanadium, zinc;
- US EPA 16 polycyclic aromatic hydrocarbon (PAH) compounds;
- Total monohydric phenols;
- Cyanide, pH value;
- Petroleum hydrocarbons (CWG ali/aro carbon banded C<sub>5</sub> to C<sub>35</sub>);
- Volatile organic compounds (including chlorinated solvents);

The surface water analysis also allows a more thorough investigation into whether the rivers and streams in the vicinity polluted further upstream (of the site), which we anticipate would indicate that the site in question is not the main source of contamination or pollution in the vicinity. Contrary, such an assessment may highlight that the site is the major source of pollution here and would require further remediation.

Samples of surface water collected during two visits on 4<sup>th</sup> May and 13<sup>th</sup> June 2017 have been analysed and the results are presented in Appendix E.



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## 4.0 DEVELOPMENT OF THE REVISED CONCEPTUAL MODEL

### 4.1 Geology

The additional exploratory holes have generally confirmed the previous Ground Model, in that, the site is predominantly underlain by Made Ground, over fine-grained Glacial Diamicton and then bedrock. Across the entire site, the Made Ground was generally found to be thicker in the southern portions of each zone, where the development platforms appear to have been built up, conversely, bedrock was found generally shallow in the northern portions of each zone.

**Made Ground:** the Made Ground across all three zones was highly variable, however, generally comprised dark grey, grey or black, very clayey, sandy, gravelly cobbles or sandy, cobbly clayey gravel, or sandy gravelly clay with fragments of sandstone brick, plastic, glass, pipe, timber, metal and tile. Other man-made items within the Made Ground included slag, boulders of concrete, clinker, batteries, car tyres and other car parts.

TP213 and TP214 were excavated in the presumed vehicle inspection pits and infill in TP213 comprised black and dark brown clayey cobbly gravelly sand with fragments of brick, metal, slag, concrete, wood, metal and plastic. Made Ground in TP214 comprised loose blocks of breeze blocks, metal bars and bricks. The base and sides of these pits appeared to be intact and the trial pit did not excavate through the base or sides of the inspection pit. Dark grey to black water with an oily sheen at the base of the inspection pit in TP214 prevented a visual examination of the pit base.

The base of the Made Ground was not proved in Trial Pit No 211.

**Glacial Diamicton:** where encountered, the Glacial Diamicton generally comprised light brown, silt, clay, sand and gravel, soft or soft to firm in consistency where fine-grained. Sandstone cobbles were present in areas.

**Coal Measures bedrock:** initially comprised grey and reddish brown gravel of subangular to angular, medium to coarse grained sandstone blocks, with numerous angular sandstone cobbles and boulders. Bedrock was not encountered in trial pits TP109 and TP212.

## 4.2 Hydrogeology

### 4.2.1 Groundwater Bodies

The investigation did identify groundwater within the trial pits and rotary open drilling boreholes.

The groundwater conditions identified in the investigation are summarised in Table 6 below:

**Table 6:** Summary of groundwater ingress in the investigation

Hole ID	Stratum	Comment on groundwater encountered
TP201	Made Ground	Slow inflow at a depth of 0.3m, at the base of the Made Ground.
TP202	Brithdir Sandstone	Slow inflow at a depth of 0.9m, at base of Glacial Diamicton.
TP204	Made Ground	Seepage at a depth of 0.3m within the Made Ground.
TP207	Brithdir Sandstone	Seepage at 1.5m, with slight hydrocarbon odour in water.
TP210	Glacial Diamicton	Seepage at 0.9m at base of Glacial Diamicton with slight hydrocarbon odour in the water.
TP214	Made Ground	Water in base of the inspection pit, at a depth of 1.1m.
TP215	Made Ground	Initially fast, becoming moderate inflow at 1.1m, between Made Ground and till boundary.
BH201	Brithdir Sandstone	Water encountered at 23.90m.
BH202	Brithdir Sandstone	Water encountered at 27.50m.
BH203	Brithdir Sandstone	Water encountered at 28.00m.
BH204	Brithdir Sandstone	Water encountered at 28.80m.
BH205	Brithdir Sandstone	Water encountered at 28.40m.

Based on the above findings and the Conceptual Ground Model, we consider that the main groundwater body beneath the site is within the Brithdir Sandstone bedrock at depths below 20m. However, there is also evidence of a perched groundwater horizon across much of the site.

Groundwater monitoring has also shown artesian groundwater conditions, notably BH201.

### 4.2.2 Hydraulic Gradient

The results of the groundwater monitoring of installed wells have been used to plot a hydraulic gradient to determine the flow direction of the groundwater passing beneath the site. Interpolated groundwater contours show groundwater to be flowing to a east-southeast direction, as shown on Figure 3.

The hydraulic gradient has been calculated using the groundwater monitoring data and maximum value obtained was 0.315 and the minimum was 0.2.

## 4.3 Risk to Controlled Waters – Updated Assessment

### 4.3.1 Previous Assessment and Rational

The previous contamination testing results were compared to assessment criteria appropriate to the controlled water receptors in the area.

The Preliminary Risk Assessment (ESP, 2016) identified that the following controlled water receptors are potentially at risk from contamination originating at the site:

- The groundwater within the Coal Measures bedrock which is classified as a Secondary A aquifer, where the groundwater could be abstracted for potable use in the future; and
- The water within the River Taff, located some 500m to the east of the site, but connected by the culvert that crosses the site.

The previous assessment suggested that the most vulnerable receptor with regards to leachable and mobile contamination would be the surface water within the stream in the west of the site which, based on previous monitoring in the wells appeared to be in hydraulic connection with groundwater in Well WS2. Our assessment has, therefore, concentrated on this receptor. However, for completeness, we have also extended the assessment to include the groundwater beneath the site.

In order to assess the potential impact on the surface water receptors in the area, the levels of contaminants have been compared to the Environmental Quality Standards (EQS) published by the European Union (2008). For the purposes of this assessment, the Annual Average (AA) EQS have been adopted which represent the acceptable levels of a contaminant over an annual period. For some metals (e.g. cadmium, copper and zinc), the EQS are dependent on the hardness of the receptor water body. Analysis has shown the water in the local surface water (sampled on site) to have a hardness of 9mg/l CaCO<sub>3</sub>. Therefore, EQS values appropriate for this hardness have been adopted where applicable.

In order to assess the potential risk to groundwater beneath the site, the results of the testing have been compared to the Threshold Values (TV) published by the Environment Agency (2010) which consider the potential impact of contaminants within the groundwater on surface waters. Where no TV has been published, the Prescribed Concentration Values (PCV) of the Water Supply (Water Quality) Regulations (WSR, 2010), which relate to the use of groundwater as a potable resource have been tentatively adopted as the assessment criteria. Where no TV or PCV are published for a compound, the World Health Organisation (WHO) guidelines for drinking waters have been adopted.

There are currently no EU or UK guidelines for ethylbenzene and the World Health Organisation criteria (WHO, 2011) has been adopted for this compound. Similarly, with the exception of the BTEX compounds, there are no published assessment criteria for petroleum hydrocarbons within controlled waters. The Environment Agency have previously stipulated an assessment criteria of 10µg/l for all bands of petroleum hydrocarbons, and this has been used tentatively as the assessment criteria. However, it should be appreciated that this only represents a preliminary, broad-brush appraisal of the levels of contamination present and an exceedance does not necessarily define an unacceptable risk.

The actual assessment criteria adopted are shown in the following table, and further details on them can be found in the respective published documents.

Contaminants within controlled waters have been classed as Priority Substances, Priority Harmful Substances, and Non-Priority Substances by the European Union. Priority Harmful Substances are those toxic substances which are persistent and bio-accumulate and whose emissions are to be eliminated or phased out in time. Priority Substances are those toxic substances whose emissions are to be reduced progressively over time. Whilst the Non-Priority Substances comprise the remaining contaminants analysed in this assessment. Some contaminants analysed in this assessment are currently under consideration for inclusion within the Priority Harmful category.

### 4.3.2 Results of Previous Leachate Assessment (2016)

The previous samples selected for leachate testing comprised Made Ground from across the site and the results and their comparison to the relevant assessment criteria are presented in Table 7 below, based on the surface waters being the most vulnerable receptor.

**Table 7: Controlled Waters Risk Assessment – Previous Leachate Results 2016**

Compound	Range Recorded	EQS - AA	TV - PCV	Exceedances
<b>Metals and Semi-metals:</b>				
Arsenic <sup>4</sup>	0.29 - 1.4µg/l	50µg/l	51.6µg/l (TV)	None of 8
Boron <sup>4</sup>	<100 - 170µg/l	-	1000µg/l (PCV)	None of 8
Cadmium <sup>1,6</sup>	<0.03 - <b>0.22µg/l</b>	<0.08µg/l	0.2µg/l (TV)	<b>1 of 8</b> <b>(both EQS &amp; TV)</b>
Chromium <sup>4,5</sup>	<0.25 - 0.89µg/l	4.7µg/l	5µg/l (TV)	None of 8
Copper <sup>4,6</sup>	0.7 - <b>2.6µg/l</b>	1µg/l	10.1µg/l (TV)	<b>6 of 8 (EQS)</b> None of 8 (TV)
Lead <sup>2</sup>	<0.09 - 2.4µg/l	7.2µg/l	7.3µg/l (TV)	None of 8
Mercury <sup>1</sup>	<0.01µg/l	0.05µg/l	1µg/l (PCV)	None of 8
Nickel <sup>3</sup>	<0.5 - 4.3µg/l	20µg/l	20.2µg/l (TV)	None of 8
Selenium <sup>4</sup>	0.29 - 0.85µg/l	-	10µg/l (PCV)	None of 8
Zinc <sup>4,6</sup>	2.7 - <b>30µg/l</b>	8µg/l	75.8µg/l (TV)	<b>2 of 8 (EQS)</b> None of 8 (TV)
<b>Polyaromatic Hydrocarbon Compounds</b>				
Anthracene <sup>1</sup>	<0.01 - <b>0.36µg/l</b>	0.1µg/l	0.1µg/l (TV)	<b>4 of 8</b> <b>(both EQS &amp; TV)</b>
Benzo[a]pyrene <sup>1</sup>	<b>0.02 - 0.56µg/l</b>	0.05µg/l	0.01µg/l (PCV)	<b>8 of 8</b> <b>(both EQS &amp; PCV)</b>
Sum BbF & BkF <sup>1</sup>	<b>0.05 - 1.01µg/l</b>	0.03µg/l	-	<b>8 of 8 (EQS)</b>
Sum BghiP & IDP <sup>1</sup>	<b>0.05 - 0.74µg/l</b>	0.002µg/l	-	<b>8 of 8 (EQS)</b>
Sum BbF, BkF, BghiP & IDP	0.1 - <b>1.75µg/l</b>	-	0.1µg/l (PCV)	<b>7 of 8 (EQS)</b>
Naphthalene <sup>2</sup>	<0.01 - 0.98µg/l	2.4µg/l	2.4µg/l (TV)	None of 8
Fluoranthene <sup>3</sup>	0.04 - <b>1.1µg/l</b>	0.1µg/l	0.1µg/l (TV)	<b>4 of 8</b> <b>(both EQS &amp; TV)</b>
<b>Petroleum Hydrocarbon Compounds</b>				
Benzene <sup>3</sup>	<1.0µg/l	10µg/l	10.1µg/l (TV)	None of 8
Toluene <sup>4</sup>	<1.0µg/l	50µg/l	50.5µg/l (TV)	None of 8
Ethylbenzene <sup>4</sup>	<1.0µg/l	-	300µg/l (WHO)	None of 8
Xylene <sup>4</sup>	<1.0µg/l	30µg/l	30.3µg/l (TV)	None of 8
TPH C <sub>5</sub> -C <sub>10</sub> (GRO) <sup>4</sup>	<0.1 - 0.7µg/l	10µg/l (EA)	10µg/l (EA)	None of 8
TPH C <sub>10</sub> -C <sub>21</sub> (DRO) <sup>4</sup>	<1 - <b>32.7µg/l</b>	10µg/l (EA)	10µg/l (EA)	<b>1 of 8</b> <b>(both EQS &amp; TV)</b>
TPH C <sub>21</sub> -C <sub>40</sub> (LORO) <sup>4</sup>	<1 - <b>51µg/l</b>	10µg/l (EA)	10µg/l (EA)	<b>1 of 8</b> <b>(both EQS &amp; TV)</b>
<b>Miscellaneous</b>				
Cyanide <sup>4</sup>	<40µg/l	1µg/l	50µg/l (PCV)	None of 8
Phenol <sup>4</sup>	<0.5 - 0.8µg/l	7.7µg/l	15.2µg/l (TV)	None of 8
Chloroform <sup>4</sup>	<1 - <b>4µg/l</b>	-	2.5µg/l (TV)	<b>2 of 8 (TV)</b>
Bis(2-ethylhexyl)phthalate (DEHP) <sup>2</sup>	<1 - <b>16µg/l</b>	1.3µg/l	8µg/l (WHO)	<b>5 of 8 (EQS)</b> <b>1 of 8(WHO)</b>
Bis(2-ethylhexyl)ester <sup>4</sup>	7.4 - 15µg/l	20µg/l	8µg/l (WHO)	None of 8
pH	7.1 - 7.6	-	6.5 - 9.5 (PCV)	None of 8

**Table 7: Controlled Waters Risk Assessment - Leachate Results 2016 (cont.)**

**Key to Table 7:**

EQS-AA – Environmental Quality Standard (surface waters) - Annual Average.	PCV – Prescribed Concentration Value (drinking water).
TV – Threshold Value (groundwater)	EA – Environment Agency defined value.
WHO – World Health Organisation Value (drinking water)	BkF – Benzo[k]fluoranthene
BbF – Benzo[b]fluoranthene	IDP – indeno [123-cd]pyrene
BghiP – benzo[ghi]pyrene	

**Notes to Table 7:**

1. Priority Harmful substance.
2. Priority substance under consideration as Priority Harmful
3. Priority substance
4. Non-priority substance.
5. Assessment Criteria for Chromium VI.
6. EQS dependent on hardness of water in receptor.

The previous leachate samples were also tested for PCBs, volatile organic and semi-volatile organic compounds. All were identified at levels below their detection limits apart from the volatile organic compound chloroform and the semi-volatile organic compounds bis(2-ethylhexyl)ester and bis(2-ethylhexyl)phthalate.

Many of the contaminants previously analysed were below the assessment criteria; however, leachable levels of cadmium, zinc, petroleum hydrocarbons and chloroform were found to be elevated above the assessment criteria in limited samples of Made Ground (one or two samples). The levels of copper, PAH compounds and bis(2-ethylhexyl)phthalate were elevated in the majority/all the samples analysed.

**4.3.3 Results of 2017 Leachate Assessment**

An additional eight samples of soil were scheduled for leachate testing and comprised five Made Ground samples, a single sample of glacial Diamicton and two from soils of the weathered bedrock. The results of the 2017 leachate testing and their comparison to the relevant assessment criteria are presented in Table 8 below, which for completeness includes the previous leachate testing information.

**Table 8:** Controlled Waters Risk Assessment – 2017 Results

Compound	Range Recorded	EQS - AA	TV - PCV	Exceedances
<b>Metals and Semi-metals:</b>				
Arsenic <sup>4</sup>	0.24 – 0.73µg/l	50µg/l	51.6µg/l (TV)	None of 8
Boron <sup>4</sup>	<100 - 470µg/l	-	1000µg/l (PCV)	None of 8
Cadmium <sup>1,6</sup>	<0.03 - 0.05µg/l	<0.08µg/l	0.2µg/l (TV)	None of 8
Chromium <sup>4,5</sup>	<0.25 µg/l	4.7µg/l	5µg/l (TV)	None of 8
Copper <sup>4,6</sup>	0.7 – <b>4.2µg/l</b>	1µg/l	10.1µg/l (TV)	<b>6 of 8 (EQS)</b> None of 8 (TV)
Lead <sup>2</sup>	0.21 – 0.97µg/l	7.2µg/l	7.3µg/l (TV)	None of 8
Mercury <sup>1</sup>	<0.01 - 0.02µg/l	0.05µg/l	1µg/l (PCV)	None of 8
Nickel <sup>3</sup>	<0.5 – 3.5µg/l	20µg/l	20.2µg/l (TV)	None of 8
Selenium <sup>4</sup>	<0.25 – 1.7µg/l	-	10µg/l (PCV)	None of 8
Zinc <sup>4,6</sup>	2.3 – 7.3µg/l	8µg/l	75.8µg/l (TV)	None of 8
<b>Polyaromatic Hydrocarbon Compounds</b>				
Anthracene <sup>1</sup>	<0.01 - 0.03µg/l	0.1µg/l	0.1µg/l (TV)	None of 8
Benzo[a]pyrene <sup>1</sup>	<0.01 - <b>0.07µg/l</b>	0.05µg/l	0.01µg/l (PCV)	<b>1 of 8 (EQS &amp; TV)</b>
Sum BbF & BkF <sup>1</sup>	<0.01 – <b>0.12µg/l</b>	0.03µg/l	-	<b>1 of 8 (EQS)</b>
Sum BghiP & IDP <sup>1</sup>	<0.01 – <b>0.21µg/l</b>	0.002µg/l	-	<b>3 of 8 (EQS)</b>
Sum BbF, BkF, BghiP & IDP	<0.01 - <b>0.33µg/l</b>	-	0.1µg/l (PCV)	<b>1 of 8 (EQS)</b>
Naphthalene <sup>2</sup>	<0.01µg/l	2.4µg/l	2.4µg/l (TV)	None of 8
Fluoranthene <sup>3</sup>	<0.01 – 0.06µg/l	0.1µg/l	0.1µg/l (TV)	None of 8
<b>Petroleum Hydrocarbon Compounds</b>				
Benzene <sup>3</sup>	<1.0µg/l	10µg/l	10.1µg/l (TV)	None of 8
Toluene <sup>4</sup>	<1.0µg/l	50µg/l	50.5µg/l (TV)	None of 8
Ethylbenzene <sup>4</sup>	<1.0µg/l	-	300µg/l (WHO)	None of 8
Xylene <sup>4</sup>	<1.0µg/l	30µg/l	30.3µg/l (TV)	None of 8
TPH C <sub>5</sub> -C <sub>10</sub> (GRO) <sup>4</sup>	<0.6 - <0.14µg/l	10µg/l (EA)	10µg/l (EA)	None of 8
TPH C <sub>10</sub> -C <sub>21</sub> (DRO) <sup>4</sup>	<6 – <b>28.6µg/l</b>	10µg/l (EA)	10µg/l (EA)	<b>1 of 8</b> <b>(both EQS &amp; TV)</b>
TPH C <sub>21</sub> -C <sub>40</sub> (LORO) <sup>4</sup>	<2 - <b>23µg/l</b>	10µg/l (EA)	10µg/l (EA)	<b>1 of 8</b> <b>(both EQS &amp; TV)</b>
<b>Miscellaneous</b>				
Cyanide <sup>4</sup>	<40µg/l	1µg/l	50µg/l (PCV)	None of 8
Phenol <sup>4</sup>	<0.5 – 1.1µg/l	7.7µg/l	15.2µg/l (TV)	None of 8
Chloroform <sup>4</sup>	<1µg/l	-	2.5µg/l (TV)	None of 8
Bis(2-ethylhexyl)phthalate (DEHP) <sup>2</sup>	<1.0µg/l	1.3µg/l	8µg/l (WHO)	None of 8
Bis(2-ethylhexyl)ester <sup>4</sup>	<0.1µg/l	20µg/l	8µg/l (WHO)	None of 8
pH	7.4 – 7.7	-	6.5 – 9.5 (PCV)	None of 8

**Key to Table 8:**

EQS-AA – Environmental Quality Standard (surface waters) - Annual Average.

TV – Threshold Value (groundwater)

WHO – World Health Organisation Value (drinking water)

BbF – Benzo[b]fluoranthene

BghiP – benzo[ghi]pyrene

PCV – Prescribed Concentration Value (drinking water).

EA – Environment Agency defined value.

BkF – Benzo[k]fluoranthene

IDP – indeno [123-cd]pyrene

**Notes to Table 8:**

1. Priority Harmful substance.
2. Priority substance under consideration as Priority Harmful
3. Priority substance
4. Non-priority substance.
5. Assessment Criteria for Chromium VI.
6. EQS dependent on hardness of water in receptor.
7. Test results presented in Appendix D.

## 4.4 Risk to Controlled Waters – Level Two Assessment

### 4.4.1 Methodology

The potential impact of contamination originating at the site on controlled waters in the area of the site (i.e. groundwater and surface water) has been initially evaluated in line with the Environment Agency guidance (Carey et al, 2006).

Section 4.3.1 above, shows details of a ‘Level One’ (Carey et al, 2006) assessment where leachable contamination within the soil samples recovered at the site have been analysed.

Further assessment was warranted due to exceedances in the Level One assessment and levels of contaminants within the groundwater beneath the site have been analysed, which represents a ‘Level Two’ risk assessment (Carey et al, 2006).

The groundwater beneath the site has been analysed on three occasions and the results for the groundwater testing is shown in Table 9 below. In addition, surface water samples from up and down stream points to the site have been collected on two occasions and the results are also present in Table 9 for easy comparison.

**Table 9: Water Quality in Boreholes (three sampling visits)**

Determinand	Visit No.	Range Recorded from borehole (µg/l)					Level Upstream (µg/l)	Level Downstream (µg/l)	EQS – AA (µg/l)	TV – PCV (µg/l)	Comments
		BH201	BH202	BH203	BH204	BH205					
<b>Metals and Semi-metals</b>											
Arsenic <sup>4</sup>	V1	0.63	1.4	2.8	0.39	1.5	1.5	0.3	50	51.6 (TV)	All below EQS and TV.
	V2	2.1	1.6	3.4	1.4	0.61	-	-			
	V3	1.9	1.4	2.3	1.1	1.2	1.5	0.99			
Barium	V1	100	150	170	21	22	4.9	15	-	700 (WHO)	None above WHO.
	V2	150	190	190	61	38	-	-			
	V3	150	160	120	48	31	8.8	12			
Beryllium	V1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-	-	
	V2	<0.1	<0.1	<0.1	<0.1	<0.1	-	-			
	V3	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			
Boron	V1	<100	<100	<100	<100	<100	<100	<100	-	1000 (PCV)	All below PCV.
	V2	<100	<100	<100	<100	<100	-	-			
	V3	<100	<100	<100	<100	<100	<100	<100			
Cadmium <sup>1,6</sup>	V1	<0.03	<0.03	0.05	0.03	<b>0.28</b>	0.06	<0.03	<0.08	0.2 (TV)	<b>3 above EQS 1 above TV</b>
	V2	<0.03	<0.03	<b>0.1</b>	0.05	<b>0.11</b>	-	-			
	V3	<0.03	0.04	0.05	0.08	0.05	0.05	<0.03			
Chromium <sup>4,5</sup>	V1	2.9	0.55	0.52	1.5	0.93	<b>5.1</b>	<b>6.1</b>	4.7	5 (TV)	<b>1 above EQS and TV in groundwater.</b>
	V2	0.90	1.1	0.86	<b>6.0</b>	0.87	-	-			
	V3	0.32	0.32	0.89	0.74	0.56	<0.25	0.30			
Copper <sup>4,6</sup>	V1	<b>1.1</b>	0.7	0.5	<b>1.3</b>	<b>3.4</b>	<b>2.7</b>	<b>2.0</b>	1	10.1 (TV)	<b>7 above EQS in groundwater. Elevated concentrations upstream.</b>
	V2	0.9	0.6	<0.4	<b>3.5</b>	0.8	-	-			
	V3	<0.4	<b>1.0</b>	0.8	<b>2.1</b>	<b>1.9</b>	<b>1.7</b>	0.6			

**Table 9: Water Quality in Boreholes (three sampling visits) (Cont.)**

Determinand	Visit No.	Range Recorded from borehole (µg/l)					Level Upstream (µg/l)	Level Downstream (µg/l)	EQS – AA (µg/l)	TV – PCV (µg/l)	Comments
		BH201	BH202	BH203	BH204	BH205					
<b>Metals and Semi-metals</b>											
Iron <sup>4</sup>	V1	140	29	054	200	91	1900	150	1000	200 (PCV)	Single upstream above EQS, two above PCV in groundwater and elevated upstream (PCV).
	V2	28	45	100	170	370	-	-			
	V3	52	87	95	110	230	1000	140			
Lead <sup>2</sup>	V1	0.19	<0.09	<0.09	0.23	<0.09	1.9	0.43	7.2	7.3 (TV)	All below EQS and TV.
	V2	<0.9	<0.09	<0.09	0.57	<0.09	-	-			
	V3	<0.09	0.42	<0.09	0.28	0.14	0.50	0.24			
Mercury <sup>1</sup>	V1	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.05	1 (PCV)	All below EQS and PCV.
	V2	0.02	0.02	<0.01	0.01	<0.01	-	-			
	V3	0.02	<0.01	<0.01	0.01	<0.01	<0.01	<0.01			
Nickel <sup>3</sup>	V1	2.7	1.0	6.0	3.1	2.8	1.3	0.6	20	20.2 (TV)	All below EQS and TV.
	V2	2.9	0.8	4.7	3.6	4.2	-	-			
	V3	1.7	1.1	3.0	6.3	2.4	2.3	0.6			
Selenium	V1	1.0	0.86	0.68	0.58	0.58	0.59	0.51	-	10 (PVC)	All below PVC.
	V2	<0.31	<0.25	<0.25	5.9	2.5	-	-			
	V3	0.52	0.48	0.31	0.5	1.4	0.28	0.31			
Vanadium	V1	1.4	0.9	1.0	0.8	0.8	1.1	0.8	-	-	
	V2	4.3	4.8	6.2	3.9	3.2	-	-			
	V3	5.6	5.5	5.2	6.7	5.6	3.5	5.5			
Zinc <sup>4,6</sup>	V1	6.0	6.8	2.8	13	23	7.0	7.3	8	75.8 (TV)	Five groundwater above EQS. Above upstream once.
	V2	3.9	2.1	3.9	5.4	5.9	-	-			
	V3	<1.3	5.9	16	17	11	23	4.1			
<b>Polyaromatic hydrocarbon (PAH) compounds</b>											
Anthracene <sup>1</sup>	V1	<0.01	<0.01	0.23	<0.01	0.03	<0.01	<0.01	0.1	0.1 (TV)	Single sample above EQS and TV.
	V2	<0.01	<0.01	<0.01	<0.01	<0.01	-	-			
	V3	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01			
Benzo[a]pyrene <sup>1</sup>	V1	<0.01	<0.01	0.2	<0.01	<0.01	<0.01	<0.01	0.05	0.01 (PCV)	Single sample above EQS and PCV.
	V2	<0.01	<0.01	<0.01	<0.01	<0.01	-	-			
	V3	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01			
Sum BbF & BkF <sup>1</sup>	V1	<0.02	<0.02	0.26	<0.02	<0.02	<0.02	<0.02	0.03	-	Single sample above EQS
	V2	<0.02	<0.02	<0.02	<0.02	<0.02	-	-			
	V3	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02			
Sum BghiP & IDP <sup>1</sup>	V1	<0.02	<0.02	0.4	<0.02	<0.02	<0.02	<0.02	0.002	-	Single sample above EQS.
	V2	<0.02	<0.02	<0.02	<0.02	<0.02	-	-			
	V3	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02			
Sum BbF, BkF <sup>1</sup> , BghiP & IDP <sup>1</sup>	V1	<0.04	<0.04	0.66	<0.04	<0.04	<0.04	<0.04	-	0.1 (PCV)	Single sample above PCV.
	V2	<0.04	<0.04	<0.04	<0.04	<0.04	-	-			
	V3	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04			
Naphthalene <sup>2</sup>	V1	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	2.4	2.4 (TV)	All below EQS and TV.
	V2	<0.01	<0.01	0.02	<0.01	<0.01	-	-			
	V3	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01			
Fluoranthene <sup>3</sup>	V1	<0.01	<0.01	0.47	<0.01	0.27	<0.01	<0.01	0.1	0.1 (TV)	Two samples above EQS and TV.
	V2	<0.01	<0.01	<0.01	<0.01	<0.01	-	-			
	V3	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01			

**Table 9: Water Quality in Boreholes (three sampling visits) (Cont.)**

Determinand	Visit No.	Range Recorded from borehole (µg/l)					Level Upstream (µg/l)	Level Downstream (µg/l)	EQS – AA (µg/l)	TV – PCV (µg/l)	Comments
		BH201	BH202	BH203	BH204	BH205					
<b>Petroleum hydrocarbon compounds</b>											
Benzene <sup>3</sup>	V1	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	10	10.1 (TV)	All below EQS and TV.
	V2	<1.0	<1.0	<1.0	<1.0	<1.0	-	-			
	V3	2.6	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0			
Toluene <sup>4</sup>	V1	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	50	50.5 (TV)	All below EQS and TV.
	V2	<1.0	<1.0	<1.0	<1.0	<1.0	-	-			
	V3	2.9	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0			
Ethylbenzene <sup>4</sup>	V1	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	-	300 (WHO)	All below WHO.
	V2	<1.0	<1.0	<1.0	<1.0	<1.0	-	-			
	V3	2.5	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0			
Xylene <sup>4</sup>	V1	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	30	30.3 (TV)	All below EQS
	V2	<1.0	<1.0	<1.0	<1.0	<1.0	-	-			
	V3	7.1	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0			
Ali EC05-06 <sup>4</sup>	V1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	10 (EA)	10 (EA)	Single marginal exceedance.
	V2	<0.1	<0.1	<0.1	<0.1	<0.1	-	-			
	V3	11	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			
Ali EC06-08 <sup>4</sup>	V1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	10 (EA)	10 (EA)	All below EQS
	V2	<0.1	<0.1	<0.1	<0.1	<0.1	-	-			
	V3	8.8	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			
Ali EC08-10 <sup>4</sup>	V1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	10 (EA)	10 (EA)	Single marginal exceedance.
	V2	<0.1	<0.1	<0.1	<0.1	<0.1	-	-			
	V3	28	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			
Ali EC10-12 <sup>4</sup>	V1	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	10 (EA)	10 (EA)	All below EQS
	V2	<1.0	<1.0	<1.0	<1.0	<1.0	-	-			
	V3	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0			
Ali EC12-16 <sup>4</sup>	V1	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	10 (EA)	10 (EA)	All below EQS
	V2	<1.0	<1.0	<1.0	<1.0	<1.0	-	-			
	V3	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0			
Ali EC16-35 <sup>4</sup>	V1	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	24.9	10 (EA)	10 (EA)	Single exceedance downstream.
	V2	<2.0	<2.0	<2.0	<2.0	<2.0	-	-			
	V3	<2.0	<2.6	<2.0	<2.0	<2.0	<2.0	<2.0			
Aro EC05-07	V1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	10 (EA)	10 (EA)	All below EQS
	V2	<0.1	<0.1	<0.1	<0.1	<0.1	-	-			
	V3	2.6	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			
Aro EC07-08	V1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	10 (EA)	10 (EA)	All below EQS
	V2	<0.1	<0.1	<0.1	<0.1	<0.1	-	-			
	V3	2.9	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			
Aro EC08-10	V1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	10 (EA)	10 (EA)	All below EQS
	V2	<0.1	<0.1	<0.1	<0.1	<0.1	-	-			
	V3	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			
Aro EC10-12	V1	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	10 (EA)	10 (EA)	All below EQS
	V2	<1.0	<1.0	<1.0	<1.0	<1.0	-	-			
	V3	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0			
Aro EC12-16	V1	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	10 (EA)	10 (EA)	All below EQS
	V2	<1.0	<1.0	<1.0	<1.0	<1.0	-	-			
	V3	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0			
Aro EC16-21	V1	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	10 (EA)	10 (EA)	All below EQS
	V2	<1.0	<1.0	<1.0	<1.0	<1.0	-	-			
	V3	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0			

**Table 9: Water Quality in Boreholes (three sampling visits) (Cont.)**

Determinand	Visit No.	Range Recorded from borehole (µg/l)					Level Upstream (µg/l)	Level Downstream (µg/l)	EQS – AA (µg/l)	TV – PCV (µg/l)	Comments
		BH201	BH202	BH203	BH204	BH205					
<b>Petroleum hydrocarbon compounds</b>											
Aro EC21-35	V1	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	10 (EA)	10 (EA)	All below EQS
	V2	<1.0	<1.0	<1.0	<1.0	<1.0	-	-			
	V3	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	2			
<b>Volatile Organic Compounds (VOCs)</b>											
1,2-dichloroethane	V1	<1	<1	<1	6	<1	<1	<1	10	-	All below EQS.
	V2	<1	<1	<1	4	<1	-	-			
	V3	<1	<1	<1	5	<1	<1	<1			
1,1,1-trichloroethane	V1	<1	<1	<1	13	<1	<1	<1	100	-	All below EQS
	V2	<1	<1	<1	9	<1	-	-			
	V3	<1	<1	<1	15	<1	<1	<1			
1,1,1,2-tetrachloroethane	V1	<1	<1	<1	<1	<1	<1	<1	-	-	No measurable levels detected.
	V2	<1	<1	<1	<1	<1	-	-			
	V3	<1	<1	<1	<1	<1	<1	<1			
Chloroform	V1	<1	<1	<1	<1	<1	<1	<1		2.5 (TV)	No measurable levels detected.
	V2	<1	<1	<1	<1	<1	-	-			
	V3	<1	<1	<1	<1	<1	<1	<1			
Vinyl Chloride	V1	<1	<1	<1	<1	<1	<1	<1		0.5 (PCV)	No measurable levels detected.
	V2	<1	<1	<1	<1	<1	-	-			
	V3	<1	<1	<1	<1	<1	<1	<1			
<b>Miscellaneous determinands</b>											
Cyanide <sup>4</sup>	V1	<40	<40	<40	<40	<40	<40	<40	1	50 (PCV)	No measurable levels detected.
	V2	<40	<40	<40	<40	<40	-	-			
	V3	<40	<40	<40	<40	<40	<40	<40			
Phenol <sup>4</sup> – monohydric	V1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	7.7	15.2 (TV)	All below EQS, and TV.
	V2	<0.5	<0.5	<0.5	3.6	0.9	-	-			
	V3	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5			
pH	V1	7.1	7.4	7.3	6.9	6.7	6.5	7.1	-	6.5-9.5 (PCV)	Single variance upstream of site.
	V2	7.6	7.5	7.1	7.1	6.7	-	-			
	V3	7.4	7.5	6.8	6.9	6.7	5.8	7.0			

**Key to Table 9:**

EQS-AA – Environmental Quality Standard (surface waters) - Annual Average.

WHO – World Health Organisation Value (for drinking water)

EA – Environment Agency defined value.

BbF – Benzo[b]fluoranthene

BkF – Benzo[k]fluoranthene

BghiP – benzo[ghi]pyrene

IDP – indeno [123-cd]pyrene

**Notes to Table 9:**

1. Priority Harmful substance.
  2. Priority substance under consideration as Priority Harmful
  3. Priority substance
  4. Non-priority substance.
  5. Assessment Criteria for Chromium VI.
  6. EQS dependent on hardness of water in receptor.
  7. Test results presented in Appendix E.
  8. Dates of visits, V1 – 04/05/17, V2 – 01/06/17, V3 – 13/06/17.
- NB. No samples were taken upstream or downstream during Visit 2.

The results of groundwater testing indicates generally low levels of contaminants with many determinands below the detection limits of the test instruments. The groundwater testing has shown relatively persistent elevations of copper across the site and has been measured in four

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(BH201, BH202, BH204 and BH205) of the five boreholes on more than a single monitoring visit. Copper was also noted to be elevated in the upstream surface water sampling point, the downstream surface water data suggests a decrease in concentration across the site.

Elevated concentrations of zinc were noted in three (BH203, BH204 and BH205) of the five boreholes on up to two monitoring occasions. On a single occasion, zinc was elevated in the upstream sampling location, on the same monitoring visit, the concentration of zinc at the downstream monitoring point showed the concentration to decrease as it passed through the site to below guideline values.

Cadmium was elevated in the groundwater samples from BH203 and BH205 on three occasions in total.

An elevated level of chromium was noted in a single groundwater sample collected from BH204 during the second groundwater monitoring visits. The surface water sampling was not collected on this occasion, however, when chromium was elevated up and downstream, during the first visits, levels of chromium in the groundwater were below guideline limits. Where chromium was noted in the surface water, it was marginally higher downstream of the site.

Iron was noted to be above guideline limits in BH205 on two occasions.

Marginally elevated concentrations of anthracene, benzo(a)pyrene, benzo(b)fluoranthene, and benzo(K)fluoranthene, benzo(g,h,i)perylene, indeno(1,2,3-c,d)pyrene and fluoranthene were noted during visit 1 in BH203 and BH204. None of these compounds were noted in the surface water up or downstream of the site.

With the exception to marginally elevated petroleum hydrocarbons in BH201 on visit 3, no other concentrations were recorded above guideline limits, and were generally under detection limits. A single elevated concentration of petroleum hydrocarbons was measured downstream of the site on visit 1, however, no elevated hydrocarbons were noted in any of the groundwater samples taken during visit 1.

## 5.0 DISCUSSION

### 5.1 Introduction

The aims of the investigation, as outlined in Section 1.2, were to install five groundwater monitoring wells and undertake three falling head tests, test samples of surface water up and downstream of the site, test groundwater for a wide range of determinants and update the controlled waters risk assessment for the site.

### 5.2 Updated Controlled Waters Risk Assessment

As shown in Section 4.3.2 and 4.3.3, leachate testing has indicated that there is leachable concentrations of several metals, polyaromatic hydrocarbons, semi-volatile and volatile organic compounds, petroleum hydrocarbons and polychlorinated biphenols across the site.

Samples of leachate tested were generally taken from areas where either visually high levels of contamination were expected, or where previous contamination testing has indicated elevated levels of soil contamination, thus, the leachate samples are considered to have been taken from the worst case areas identified.

Groundwater testing in five boreholes spread across the site generally indicates that leachable levels of contamination identified in the leachate testing are generally not entering the groundwater. Additionally, surface water sampling of up and down stream points also indicate no general leachable contaminants continually entering the stream.

Whilst isolated and marginal exceedances of copper, iron, cadmium, chromium, zinc, some polyaromatic hydrocarbons and petroleum hydrocarbons were measured in the groundwater, none were significantly elevated or consistent and there appears to be no clear link between leachate and groundwater results. A possible reason for this difference may be the harsh leachate preparation process. Samples prepared for leachate analysis are crushed and manipulated to provide the maximum leachate possible for a given sample, and the crushing and preparation achieved in the laboratory is not likely to be realised on site with natural processes. Thus, it may be that leachate concentrations measured in soil samples may not be achievable on site.

As discussed in the previous reports, the site is situated in an area that has had a strong industrial past and groundwater below the site is likely to have been impacted during this industrial past. The slightly elevated levels of iron, copper, cadmium, chromium and zinc may be representative of natural fluxes in the groundwater chemistry and do not warrant further detailed consideration. Indeed, upstream surface water monitoring has shown elevated concentrations of iron, chromium, copper and zinc so are likely to be elevated in the general area.

Our experience suggests, that given that the main receptor, the River Taff is some 500m away, the concentrations encountered in the groundwater and surface water will likely disperse and dilute toward its journey to the receptor and the risks are likely to be low.

The site is to undergo a remediation scheme that will reduce risks to end users (residents) from contamination at the site. Whilst this scheme is still being developed, it will likely comprise removal of contamination sources and parts of the site will be developed with houses, hardstanding, thus

decreasing the area for infiltration. The site betterment and limit of infiltration areas will therefore reduce risks to receptors.

Given the above, the testing has shown that the site is not significantly impacting groundwater or the surface water.

## 5.2 Groundwater Conditions

Monitoring of groundwater (Section 3.2.1) at the site has shown possible artesian groundwater conditions in BH201, which is located in the higher, western portion of the site. As discussed in Section 4.2.2, the groundwater gradient is toward the east, i.e. groundwater is highest in the north and west of the site and shallower toward the south and east.

We understand that BH201 will be outside the proposed area of cutting to form the development platforms, the information however suggests that significant groundwater inflows could be encountered in excavation in the northern positions of the site; the proposed cut for the development platforms is understood to be at its deepest in the north of the site. Therefore significant groundwater inflow could be encountered in the cuts or excavations.

It would be prudent to continue monitoring of the boreholes to determine any seasonal fluctuations or trends. Rising head tests could be carried out in the boreholes to provide an indication on the rate of inflow likely to be expected if groundwater were to be encountered.

Alternatively, and probably the most sensible approach to adopt at this site, would be to conduct a series of trial excavations to the proposed depth of the cut or excavations (including additional foundation excavations), to allow an accurate assessment of inflow likely to be realised. The excavations should be left open and monitored for a suitable amount of time to ensure flows do not increase. This exercise could also provide information on the ease or requirements for plant to excavate into the bedrock and provide information for foundation design.

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## 6.0 RECOMMENDATIONS

The recommendations below are combined from previous phases of work at the site such that they can be seen in a single location. As such, many are based on previous assessments and reasoning behind each recommendation may be in a separate report, but is reference where needed below:

- An asbestos survey should be conducted to determine the location of asbestos materials within the existing buildings (ESP 2019, Section 7.2.2);
- It would be prudent to continue monitoring of the installed wells, and/or undertake further investigation to determine if an artesian groundwater regime is present on site, as indicated in BH201 (Section 3.2.1). This groundwater regime would need to be considered for the remediation scheme/methodology and may have important implications for the proposed cutting in that area to create the development platforms and foundation design (Section 5.2);
- A remedial strategy and options appraisal should be completed in accordance with CLR11 (an anticipated planning condition). A materials management plan will also be required for the earthworks (ESP 2016, Sections 7.7.1 and 7.8);
- A waste assessment would be required on materials leaving site and WAC testing undertaken on materials being disposed of at landfill (ESP 2016, Section 7.7.2);
- Topographic surveys of the quarry face beneath the site and the slopes to the west of the new access road (ESP 2016, Section 8.2.5 and Section 8.3.3);
- Further investigation above the quarry face in the south-east of the site to determine the Ground Model and further assessment of the stability and risk mitigation options in this area (ESP 2016, Section 8.2.5);
- Further investigation in track and slopes above the access road so that a suitable retaining structure can be designed, and to investigate the stability of the downslope to the football pitch (ESP 2016, Section 8.3.3);
- Preparation of an integrated Geotechnical Design Report, possibly requiring additional trial pitting (ESP 2016, Sections 8.2.7 and 8.5.4);
- Given the nature of the site, and the proposed development, it is considered essential that the remedial strategy and geotechnical design should be integrated (ESP 2016, Section 8.2.7); and
- The current environmental permit for the site should be surrendered to the satisfaction of Natural Resources Wales (ESP 2016, see Section 1.4).

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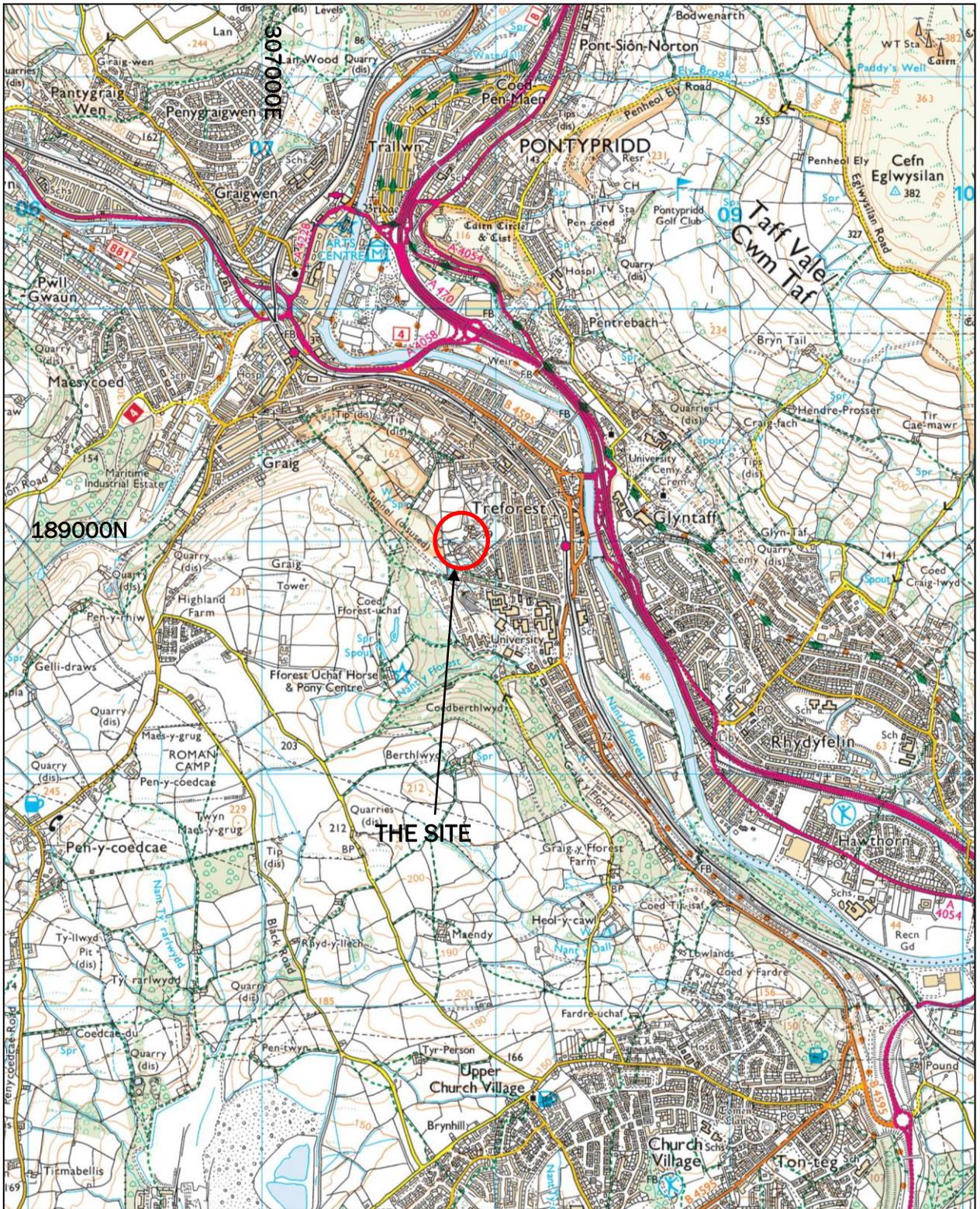
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## FIGURES



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**PROJECT: PROPOSED RESIDENTIAL DEVELOPMENT  
GENE METALS, TREForest**

**SCALE: 1: 25,000 (approx. at A4)**

**FIGURE 1: SITE LOCATION PLAN**



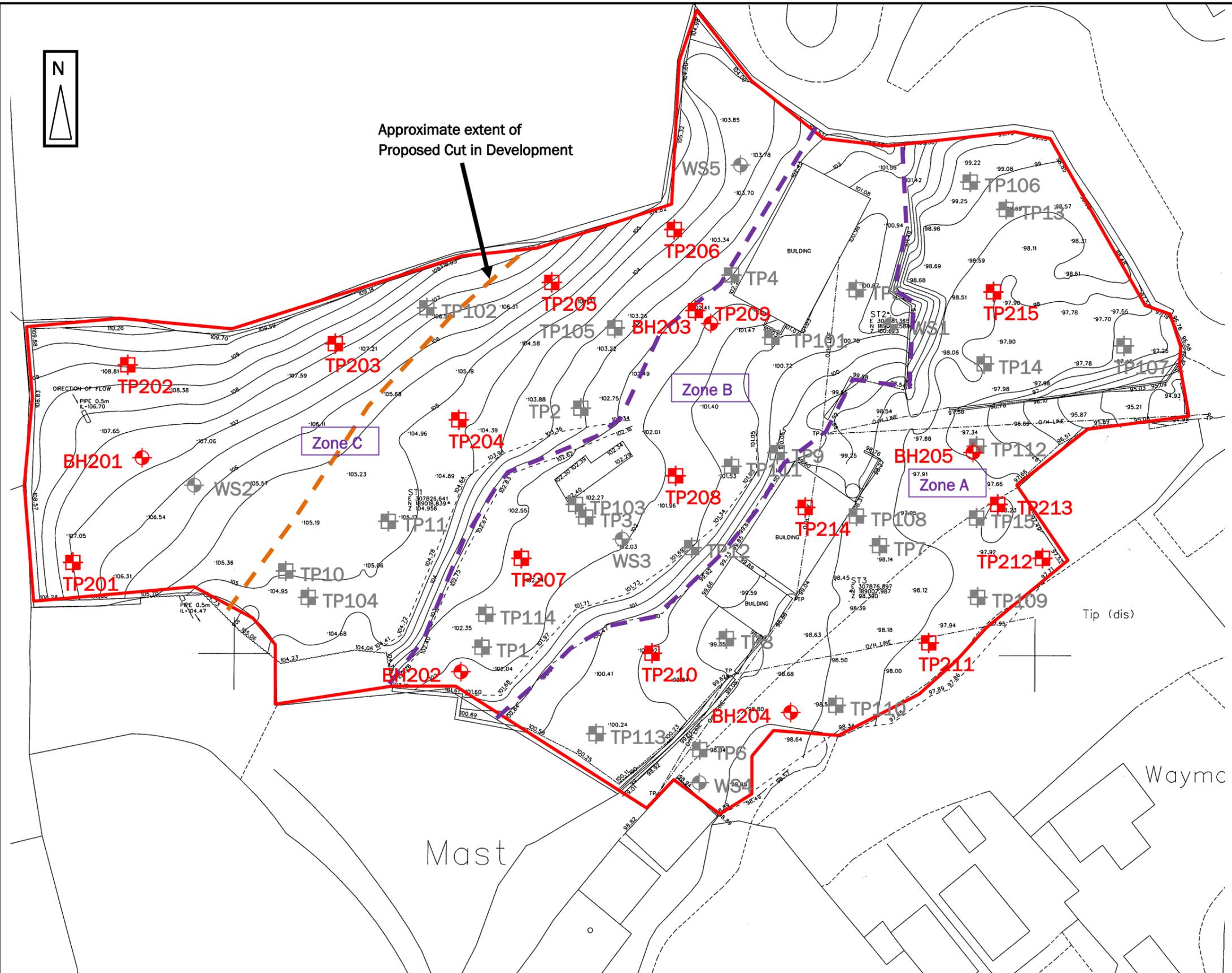
**EARTH SCIENCE PARTNERSHIP**

33 Cardiff Road, Taffs Well, Cardiff CF15 7RB

Tel: 029 2081 3385 enquiries@earthsciencepartnership.com



Approximate extent of Proposed Cut in Development



Notes:

- Phase One Trial Pit Location (2015)
- Phase Two Trial Pit Location (2016)
- Phase Two Windowless Sample Borehole Location (2016)
- Phase Three Trial Pit Location (2017)
- Phase Three Borehole Location (2017)
- Boundary of Zones (ESP, 2016)

PROJECT:  
PROPOSED RESIDENTIAL  
DEVELOPMENT  
GENE METALS, TREForest.

Scale: 1:500 (approx. at A3)

FIGURE 2:  
EXPLORATORY HOLE LOCATION  
PLAN

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Cardiff CF15 7RB Tel: 029 2081 3385  
enquiries@earthsciencepartnership.com



BH 203	
Visit	Level (mOD)
V1	100
V2	99.27
V3	101.1

BH 205	
Visit	Level (mOD)
V1	73
V2	83.65
V3	84.8

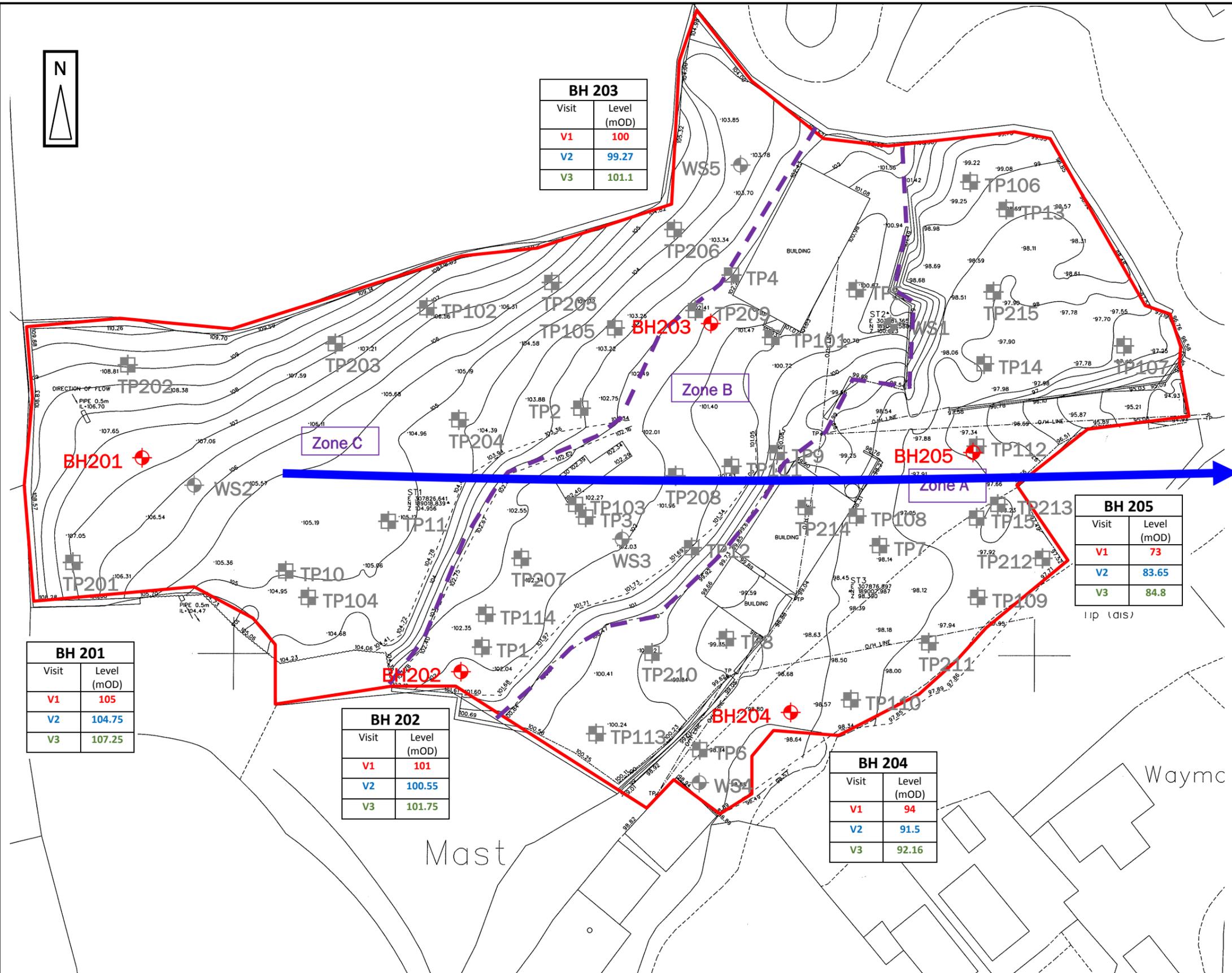
BH 201	
Visit	Level (mOD)
V1	105
V2	104.75
V3	107.25

BH 202	
Visit	Level (mOD)
V1	101
V2	100.55
V3	101.75

BH 204	
Visit	Level (mOD)
V1	94
V2	91.5
V3	92.16

**Notes:**

- Phase One Trial Pit Location (2015)
- Phase Two Trial Pit Location (2016)
- Phase Two Windowless Sample Borehole Location (2016)
- Phase Three Trial Pit Location (2017)
- Phase Three Borehole Location (2017)
- Boundary of Zones (ESP, 2016)
- Groundwater flow direction (based on 3no. visits, 2017)



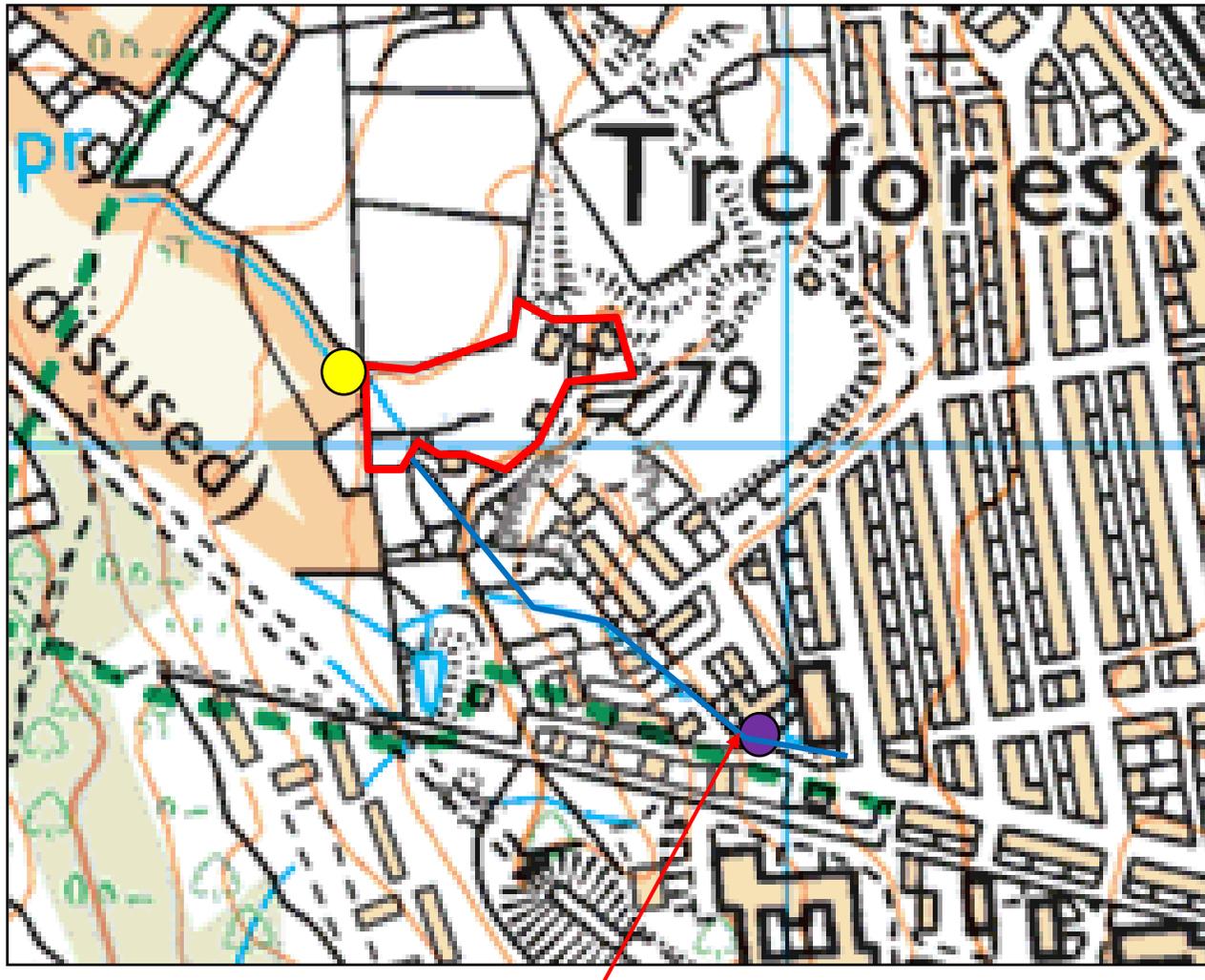
Mast

Waymc

**PROJECT:**  
PROPOSED RESIDENTIAL  
DEVELOPMENT  
GENE METALS, TREForest.

Scale: 1:500 (approx. at A3)

**FIGURE 3:**  
PLAN OF HYDRAULIC  
GRADIENT



Stream culverted until  
downstream sampling point



**Key:**

-  Site Boundary
-  Upstream Sampling point
-  Downstream Sampling point
-  Approx. culvert position, based upon Groundsure Data and site observations

**PROJECT:**  
PROPOSED RESIDENTIAL  
DEVELOPMENT  
GENE METALS, TREForest

**SCALE:** 1:1000 (approx. at A4)

**FIGURE 4:**  
PLAN OF SURFACE WATER  
SAMPLING LOCATIONS

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Cardiff CF15 7RB Tel: 029 2081 3385  
enquiries@earthsciencepartnership.com

**APPENDIX A**

**TRIAL PIT RECORDS**

# Earth Science Partnership

Consulting Engineers | Geologists | Environmental Scientists

Excavation method/plant:

JCB 3CX

Shoring/support:

None

# TP201

**Project Name:** Gene Metals

**Site Location:** Treforest

**Client:** Waterstone Homes

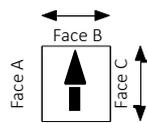
**Project No:** 5902b.4

**Excavation date:** 03-04-2017

**Backfill date:** 03-04-2017

**Logged by:** MTE

**Plan details:**



**Face Stability:**

Trial Pit Stable

**Groundwater observations:**

Slow inflow at 0.3m.

**Survey details:**

Ground Level: 107.0 mOD

Easting: 307874 mOD

Northing: 189029 mOD

Bearing:

Depth		Sample		Test Details		Strata Details			
m	mOD	Type	Class	Type	Result	Description	Depth (thickness)	mOD	Legend
0.20	106.80	ES				Scrub vegetation over dark brown gravelly cobbly clayey SAND with roots and occasional fragments of brick, glass and plastic. (MADE GROUND)	(0.30)	106.70	
0.50	106.50	ES				Soft orange-brown very sandy slightly gravelly CLAY. Gravel is fine to coarse, angular to subangular sandstone. (GLACIAL DIAMICTON)	(0.40)	106.30	
						Strong grey brown slightly weathered medium to coarse grained SANDSTONE. (BRITHDIR SANDSTONE)	(0.10)	106.20	
						End of Trialpit at 0.800m	0.80		
							1.0		
							2.0		
							3.0		
							4.0		

**Weather and environmental conditions:**

1. Overcast and dry

**Other comments:**

- Grid reference at centre of site. Elevation approximate only and interpolated from topographic survey.
- Sample notation ES: Environmental sample (1 plastic tub, 1 amber jar).
- Pit terminated in sandstone bedrock.
- Pit backfilled with arisings upon completion.

# Earth Science Partnership

Consulting Engineers | Geologists | Environmental Scientists

Excavation method/plant:

JCB 3CX

Shoring/support:

None

# TP202

**Project Name:** Gene Metals

**Site Location:** Treforest

**Client:** Waterstone Homes

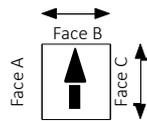
**Project No:** 5902b.4

**Excavation date:** 03-04-2017

**Backfill date:** 03-04-2017

**Logged by:** MTE

**Plan details:**



**Face Stability:**

Trial Pit Stable

**Groundwater observations:**

Slow inflow at 0.9m.

**Survey details:**

Ground Level: 109.0 mOD

Easting: 307874 mOD

Northing: 189029 mOD

Bearing:

Depth		Sample		Test Details		Strata Details			
m	mOD	Type	Class	Type	Result	Description	Depth (thickness)	mOD	Legend
0.05	108.95	ES				Scrub vegetation over very dark brown gravelly cobbly clayey organic SAND with roots and occasional fragments of brick and plastic. (MADE GROUND)	(0.10)	108.90	
0.30	108.70	ES				Soft orange-brown very sandy slightly gravelly CLAY. Gravel is fine to coarse, angular to subangular sandstone. (GLACIAL DIAMICTON)	(0.70)		
						Strong grey brown slightly weathered medium to coarse grained SANDSTONE. (BRITHDIR SANDSTONE)	0.80	108.20	
						End of Trialpit at 1.200m	1.20	107.80	
							2.0		
							3.0		
							4.0		

**Weather and environmental conditions:**

1. Overcast and dry

**Other comments:**

- Grid reference at centre of site. Elevation approximate only and interpolated from topographic survey.
- Sample notation ES: Environmental sample (1 plastic tub, 1 amber jar).
- Pit terminated in sandstone bedrock.
- Pit backfilled with arisings upon completion.

# Earth Science Partnership

Consulting Engineers | Geologists | Environmental Scientists

Excavation method/plant:

JCB 3CX

Shoring/support:

None

# TP203

**Project Name:** Gene Metals

**Site Location:** Treforest

**Client:** Waterstone Homes

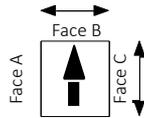
**Project No:** 5902b.4

**Excavation date:** 03-04-2017

**Backfill date:** 03-04-2017

**Logged by:** MTE

**Plan details:**



**Face Stability:**

Trial Pit Stable

**Groundwater observations:**

Groundwater not encountered

**Survey details:**

Ground Level: 107.8 mOD

Easting: 307874 mOD

Northing: 189029 mOD

Bearing:

Depth		Sample		Test Details		Strata Details			
m	mOD	Type	Class	Type	Result	Description	Depth (thickness)	mOD	Legend
0.10	107.65	ES				Scrub vegetation over dark brown gravelly cobbly clayey SAND with roots and occasional fragments of brick, glass and plastic. (MADE GROUND)	(0.20)	107.55	
						Strong grey brown slightly weathered medium to coarse grained SANDSTONE. (BRITHDIR SANDSTONE)	(0.05)	107.50	
						End of Trialpit at 0.250m	0.25		
							1.0		
							2.0		
							3.0		
							4.0		

**Weather and environmental conditions:**

1. Overcast and dry

**Other comments:**

- Grid reference at centre of site. Elevation approximate only and interpolated from topographic survey.
- Sample notation ES: Environmental sample (1 plastic tub, 1 amber jar).
- Pit terminated in sandstone bedrock.
- Pit backfilled with arisings upon completion.

# Earth Science Partnership

Consulting Engineers | Geologists | Environmental Scientists

Excavation method/plant:

JCB 3CX

Shoring/support:

None

# TP204

**Project Name:** Gene Metals

**Site Location:** Treforest

**Client:** Waterstone Homes

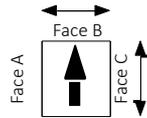
**Project No:** 5902b.4

**Excavation date:** 03-04-2017

**Backfill date:** 03-04-2017

**Logged by:** MTE

**Plan details:**



**Face Stability:**

Trial Pit Stable

**Groundwater observations:**

Seepage at 0.3m

**Survey details:**

Ground Level: 104.5 mOD

Easting: 307874 mOD

Northing: 189029 mOD

Bearing:

Depth		Sample		Test Details		Strata Details			
m	mOD	Type	Class	Type	Result	Description	Depth (thickness)	mOD	Legend
0.30	104.20	ES				Brown gravelly very sandy CLAY with roots and fragments of brick, concrete, slag, clinker and coal. (MADE GROUND)	(0.20)	104.30	
						Possibly cemented black, brown and white sandy GRAVEL of slag, sandstone, brick, clinker, coal and glass. (very slow progress with machine) (MADE GROUND)	(0.70)		
1.00	103.50	ES				Greenish brown and grey mottled orange-brown angular sandstone GRAVEL. (WEATHERED BRITHDIR SANDSTONE)	0.90 (0.30)	103.60	
						End of Trialpit at 1.200m	1.20	103.30	
							2.0		
							3.0		
							4.0		

**Weather and environmental conditions:**

1. Overcast and dry

**Other comments:**

- Grid reference at centre of site. Elevation approximate only and interpolated from topographic survey.
- Sample notation ES: Environmental sample (1 plastic tub, 1 amber jar).
- Pit terminated in sandstone bedrock.
- Pit backfilled with arisings upon completion.

# Earth Science Partnership

Consulting Engineers | Geologists | Environmental Scientists

Excavation method/plant:

JCB 3CX

Shoring/support:

None

# TP205

**Project Name:** Gene Metals

**Site Location:** Treforest

**Client:** Waterstone Homes

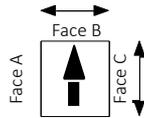
**Project No:** 5902b.4

**Excavation date:** 03-04-2017

**Backfill date:** 03-04-2017

**Logged by:** MTE

**Plan details:**



**Face Stability:**

Trial Pit Stable

**Groundwater observations:**

Groundwater not encountered

**Survey details:**

Ground Level: 106.0 mOD

Easting: 307874 mOD

Northing: 189029 mOD

Bearing:

Depth		Sample		Test Details		Strata Details			
m	mOD	Type	Class	Type	Result	Description	Depth (thickness)	mOD	Legend
0.20	105.8	ES				Brown organic clayey gravelly SAND with roots. (MADE GROUND)	(0.25)		
0.30	0	ES				Probably loose orange-brown very clayey gravelly SAND. Gravel is fine to coarse, angular to subangular sandstone. (GLACIAL DIAMICTON)	0.25	105.75	
	105.7						(0.55)		
	0					Strong grey brown slightly weathered medium to coarse grained SANDSTONE. (BRITHDIR SANDSTONE)	0.80	105.20	
						End of Trialpit at 0.850m	(0.05)	105.15	
							0.850		
							2.0		
							3.0		
							4.0		

**Weather and environmental conditions:**

1. Overcast and dry

**Other comments:**

- Grid reference at centre of site. Elevation approximate only and interpolated from topographic survey.
- Sample notation ES: Environmental sample (1 plastic tub, 1 amber jar).
- Pit terminated in sandstone bedrock.
- Pit backfilled with arisings upon completion.

# Earth Science Partnership

Consulting Engineers | Geologists | Environmental Scientists

Excavation method/plant:

JCB 3CX

Shoring/support:

None

# TP206

**Project Name:** Gene Metals

**Site Location:** Treforest

**Client:** Waterstone Homes

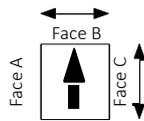
**Project No:** 5902b.4

**Excavation date:** 03-04-2017

**Backfill date:** 03-04-2017

**Logged by:** MTE

**Plan details:**



**Face Stability:**

Trial Pit Stable

**Groundwater observations:**

Groundwater not encountered

**Survey details:**

Ground Level: 104.2 mOD

Easting: 307874 mOD

Northing: 189029 mOD

Bearing:

Depth		Sample		Test Details		Strata Details			
m	mOD	Type	Class	Type	Result	Description	Depth (thickness)	mOD	Legend
0.10	104.15	ES				Blackish dark brown and grey clayey gravelly organic SAND with roots. (MADE GROUND)	(0.20)	104.05	
0.40	103.85	ES				Soft becoming firm orange-brown silty sandy occasionally gravelly CLAY. Gravel is fine and subangular to angular sandstone. (GLACIAL DIAMICTON)	(0.50)	103.55	
1.20	103.05	ES				Probably medium dense brown clayey gravelly SAND with fine to coarse subangular to angular sandstone gravel. (GLACIAL DIAMICTON)	(0.60)	102.95	
						Strong grey brown slightly weathered medium to coarse grained SANDSTONE. (BRITHDIR SANDSTONE)	(0.05)	102.90	
						End of Trialpit at 1.300m	1.35		
							2.0		
							3.0		
							4.0		

**Weather and environmental conditions:**

1. Overcast and dry

**Other comments:**

- Grid reference at centre of site. Elevation approximate only and interpolated from topographic survey.
- Sample notation ES: Environmental sample (1 plastic tub, 1 amber jar).
- Pit terminated in sandstone bedrock.
- Pit backfilled with arisings upon completion.

# Earth Science Partnership

Consulting Engineers | Geologists | Environmental Scientists

Excavation method/plant:

JCB 3CX

Shoring/support:

None

# TP207

**Project Name:** Gene Metals

**Site Location:** Treforest

**Client:** Waterstone Homes

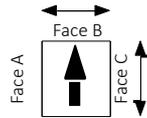
**Project No:** 5902b.4

**Excavation date:** 03-04-2017

**Backfill date:** 03-04-2017

**Logged by:** MTE

**Plan details:**



**Face Stability:**

Trial Pit Stable

**Groundwater observations:**

Seepage at 1.5m. Slight hydrocarbon odour in water.

**Survey details:**

Ground Level: 102.4 mOD

Easting: 307874 mOD

Northing: 189029 mOD

Bearing:

Depth		Sample		Test Details		Strata Details			
m	mOD	Type	Class	Type	Result	Description	Depth (thickness)	mOD	Legend
0.10	102.25	ES				Scrub vegetation over dark brown gravelly cobbly clayey organic SAND with roots and occasional fragments of brick, glass and plastic. (MADE GROUND)	(0.15)	102.20	
0.30	102.05	ES				Probably loose orange-brown, initially very clayey becoming clayey gravelly SAND. Gravel is fine to coarse, angular to subangular sandstone. (GLACIAL DIAMICTON)	(1.15)		
1.50	100.85	ES				Greenish brown and grey mottled orange-brown angular sandstone GRAVEL. (WEATHERED BRITHDIR SANDSTONE)	(0.30)	101.05	
						Strong grey brown slightly weathered medium to coarse grained SANDSTONE. (BRITHDIR SANDSTONE)	(0.05)	100.75	
						End of Trialpit at 1.650m	1.65	100.70	

**Weather and environmental conditions:**

1. Overcast and dry

**Other comments:**

- Grid reference at centre of site. Elevation approximate only and interpolated from topographic survey.
- Sample notation ES: Environmental sample (1 plastic tub, 1 amber jar).
- Pit terminated in sandstone bedrock.
- Pit backfilled with arisings upon completion.

# Earth Science Partnership

Consulting Engineers | Geologists | Environmental Scientists

Excavation method/plant:

JCB 3CX

Shoring/support:

None

# TP208

**Project Name:** Gene Metals

**Site Location:** Treforest

**Client:** Waterstone Homes

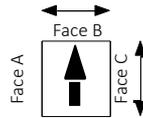
**Project No:** 5902b.4

**Excavation date:** 03-04-2017

**Backfill date:** 03-04-2017

**Logged by:** MTE

**Plan details:**



**Face Stability:**

Trial Pit Stable

**Groundwater observations:**

Groundwater not encountered.

**Survey details:**

Ground Level: 102.0 mOD

Easting: 307874 mOD

Northing: 189029 mOD

Bearing:

Depth		Sample		Test Details		Strata Details			
m	mOD	Type	Class	Type	Result	Description	Depth (thickness)	mOD	Legend
0.05	101.95	ES				Brown organic clayey sandy GRAVEL with roots. (MADE GROUND)	(0.10)	101.90	[Cross-hatch pattern]
0.30	101.70	ES				Loose black slightly silty sandy GRAVEL with fragments of metal chippings, brick, pipe, plastic sheeting, concrete and tarmacadam. (MADE GROUND).	(0.90)		[Cross-hatch pattern]
1.10	100.90	ES				Cemented black clayey sandy GRAVEL of ash, clinker, coal, slag, metal and glass. Very slow digging progress. (MADE GROUND)	(0.30)	101.00	[Cross-hatch pattern]
1.40	100.60	ES				Medium dense grey clayey gravelly SAND. Gravel is subrounded to subangular sandstone. (GLACIAL DIAMICTON)	(0.60)	100.70	[Dotted pattern]
						Strong grey brown slightly weathered medium to coarse grained SANDSTONE. (BRITHDIR SANDSTONE)	(0.20)	100.10	[Dotted pattern]
						End of Trialpit at 2.000m	2.00	100.00	[Dotted pattern]
							3.0		
							4.0		

**Weather and environmental conditions:**

1. Overcast and dry

**Other comments:**

- Grid reference at centre of site. Elevation approximate only and interpolated from topographic survey.
- Sample notation ES: Environmental sample (1 plastic tub, 1 amber jar).
- Pit terminated in sandstone bedrock.
- Pit backfilled with arisings upon completion.

# Earth Science Partnership

Consulting Engineers | Geologists | Environmental Scientists

Excavation method/plant:

JCB 3CX

Shoring/support:

None

# TP209

**Project Name:** Gene Metals

**Site Location:** Treforest

**Client:** Waterstone Homes

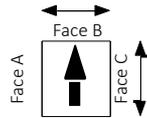
**Project No:** 5902b.4

**Excavation date:** 03-04-2017

**Backfill date:** 03-04-2017

**Logged by:** MTE

**Plan details:**



**Face Stability:**

Trial Pit Stable

**Groundwater observations:**

Groundwater not encountered.

**Survey details:**

Ground Level: 102.4 mOD

Easting: 307874 mOD

Northing: 189029 mOD

Bearing:

Depth		Sample		Test Details		Strata Details			
m	mOD	Type	Class	Type	Result	Description	Depth (thickness)	mOD	Legend
0.05	102.3	ES				Dark brown gravelly cobbly clayey organic SAND with roots and occasional fragments of brick, glass and plastic. (MADE GROUND) Probably medium dense orange-brown very sandy clayey GRAVEL. Gravel is fine to coarse, angular to subangular sandstone. (GLACIAL DIAMICTON) Strong grey brown slightly weathered medium to coarse grained SANDSTONE. (BRITHDIR SANDSTONE) <small>End of Trialpit at 0.350m</small>	(0.10)	102.30	
	5						0.10		
0.25	102.1	ES					(0.20)		
	5						0.30	102.10	
							(0.05)	102.05	
							0.35		
							1.0		
							2.0		
							3.0		
							4.0		

**Weather and environmental conditions:**

1. Overcast and dry

**Other comments:**

- Grid reference at centre of site. Elevation approximate only and interpolated from topographic survey.
- Sample notation ES: Environmental sample (1 plastic tub, 1 amber jar).
- Pit terminated in sandstone bedrock.
- Pit backfilled with arisings upon completion.

# Earth Science Partnership

Consulting Engineers | Geologists | Environmental Scientists

Excavation method/plant:

JCB 3CX

Shoring/support:

None

# TP210

**Project Name:** Gene Metals

**Site Location:** Treforest

**Client:** Waterstone Homes

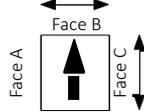
**Project No:** 5902b.4

**Excavation date:** 03-04-2017

**Backfill date:** 03-04-2017

**Logged by:** MTE

**Plan details:**



**Face Stability:**

Trial Pit Stable

**Groundwater observations:**

Seepage at 0.9m. Slight hydrocarbon odour in water.

**Survey details:**

Ground Level: 100.0 mOD

Easting: 307874 mOD

Northing: 189029 mOD

Bearing:

Depth		Sample		Test Details		Strata Details			
m	mOD	Type	Class	Type	Result	Description	Depth (thickness)	mOD	Legend
0.10	99.90	ES				Very dark brown to black organic gravelly clayey silty SAND with abundant roots, decayed vegetation, and fragments of metal, plastic, concrete and wood. (MADE GROUND) Probably loose to medium dense orange-brown very clayey fine medium SAND with occasional fine to medium angular to subangular sandstone gravel. (GLACIAL DIAMICTON)	(0.20)	99.80	
0.50	99.50	ES					(0.70)		
0.85	99.15	ES				Strong grey brown slightly weathered medium to coarse grained SANDSTONE. (BRITHDIR SANDSTONE)	0.90 (0.20)	99.10	
						End of Trialpit at 1.100m	1.10	98.90	
							2.0		
							3.0		
							4.0		

**Weather and environmental conditions:**

1. Overcast and dry

**Other comments:**

- Grid reference at centre of site. Elevation approximate only and interpolated from topographic survey.
- Sample notation ES: Environmental sample (1 plastic tub, 1 amber jar).
- Pit terminated in sandstone bedrock.
- Pit backfilled with arisings upon completion.

# Earth Science Partnership

Consulting Engineers | Geologists | Environmental Scientists

Excavation method/plant:

JCB 3CX

Shoring/support:

None

# TP211

**Project Name:** Gene Metals

**Site Location:** Treforest

**Client:** Waterstone Homes

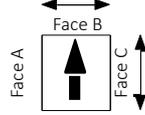
**Project No:** 5902b.4

**Excavation date:** 03-04-2017

**Backfill date:** 03-04-2017

**Logged by:** MTE

**Plan details:**



**Face Stability:**

Trial Pit collapsed

**Groundwater observations:**

Groundwater not encountered.

**Survey details:**

Ground Level: 97.9 mOD  
 Easting: 307874 mOD  
 Northing: 189029 mOD  
 Bearing:

Depth		Sample		Test Details		Strata Details			
m	mOD	Type	Class	Type	Result	Description	Depth (thickness)	mOD	Legend
0.40	97.50	ES				Probably very loose to loose black to very dark brown mottled grey and reddish brown clayey cobbly sandy GRAVEL with fragments of brick, metal, slag, concrete, wood, metal wire, metal strips, plastic, slate and rope. (MADE GROUND).			
1.50	96.40	ES					(2.80)		
2.50	95.40	ES							
						End of Trialpit at 2.800m	2.80	95.10	
							3.0		
							4.0		

**Weather and environmental conditions:**

1. Overcast and dry

**Other comments:**

- Grid reference at centre of site. Elevation approximate only and interpolated from topographic survey.
- Sample notation ES: Environmental sample (1 plastic tub, 1 amber jar).
- Pit backfilled with arisings upon completion.

# Earth Science Partnership

Consulting Engineers | Geologists | Environmental Scientists

Excavation method/plant:

JCB 3CX

Shoring/support:

None

# TP212

**Project Name:** Gene Metals

**Site Location:** Treforest

**Client:** Waterstone Homes

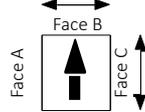
**Project No:** 5902b.4

**Excavation date:** 03-04-2017

**Backfill date:** 03-04-2017

**Logged by:** MTE

**Plan details:**



**Face Stability:**

Trial Pit Stable

**Groundwater observations:**

Groundwater not encountered.

**Survey details:**

Ground Level: 97.6 mOD

Easting: 307874 mOD

Northing: 189029 mOD

Bearing:

Depth		Sample		Test Details		Strata Details			
m	mOD	Type	Class	Type	Result	Description	Depth (thickness)	mOD	Legend
0.30	97.30	ES				Probably very loose to loose black to very dark brown mottled grey and reddish brown clayey cobbly sandy GRAVEL with fragments of brick, metal, slag, concrete, wood, metal wire, metal strips and plastic. (MADE GROUND).	(1.80)		
1.90	95.70	ES				Generally soft brown mottled grey very sandy very gravelly CLAY. Gravel is fine to coarse, subrounded to subangular sandstone. (PROBABLE GLACIAL DIAMICTON)	1.80	95.80	
4.00	93.60	D					3.0		
							(3.20)		
							4.0		

**Weather and environmental conditions:**

1. Overcast and dry

**Other comments:**

- Grid reference at centre of site. Elevation approximate only and interpolated from topographic survey.
- Sample notation ES: Environmental sample (1 plastic tub, 1 amber jar).
- Pit backfilled with arisings upon completion.

# Earth Science Partnership

Consulting Engineers | Geologists | Environmental Scientists

Excavation method/plant:

JCB 3CX

Shoring/support:

None

# TP212

**Project Name:** Gene Metals

**Site Location:** Treforest

**Client:** Waterstone Homes

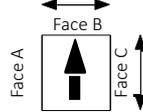
**Project No:** 5902b.4

**Excavation date:** 03-04-2017

**Backfill date:** 03-04-2017

**Logged by:** MTE

**Plan details:**



**Face Stability:**

Trial Pit Stable

**Groundwater observations:**

Groundwater not encountered.

**Survey details:**

Ground Level: 97.6 mOD

Easting: 307874 mOD

Northing: 189029 mOD

Bearing:

Depth		Sample		Test Details		Strata Details			
m	mOD	Type	Class	Type	Result	Description	Depth (thickness)	mOD	Legend
						Generally soft brown mottled grey very sandy very gravelly CLAY. Gravel is fine to coarse, subrounded to subangular sandstone. (PROBABLE GLACIAL DIAMICTON)	5.000	92.60	
						End of Trialpit at 5.000m			
							6.0		
							7.0		
							8.0		
							9.0		

**Weather and environmental conditions:**

1. Overcast and dry

**Other comments:**

- Grid reference at centre of site. Elevation approximate only and interpolated from topographic survey.
- Sample notation ES: Environmental sample (1 plastic tub, 1 amber jar).
- Pit backfilled with arisings upon completion.

# Earth Science Partnership

Consulting Engineers | Geologists | Environmental Scientists

Excavation method/plant:

JCB 3CX

Shoring/support:

None

# TP213

**Project Name:** Gene Metals

**Site Location:** Treforest

**Client:** Waterstone Homes

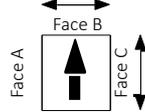
**Project No:** 5902b.4

**Excavation date:** 03-04-2017

**Backfill date:** 03-04-2017

**Logged by:** MTE

**Plan details:**



**Face Stability:**

Trial Pit Stable

**Groundwater observations:**

Groundwater not encountered.

**Survey details:**

Ground Level: 98.0 mOD

Easting: 307874 mOD

Northing: 189029 mOD

Bearing:

Depth		Sample		Test Details		Strata Details			
m	mOD	Type	Class	Type	Result	Description	Depth (thickness)	mOD	Legend
0.20	97.80	ES				Probably loose black to very dark brown and grey clayey cobbly gravelly SAND with fragments of brick, metal, slag, concrete, wood, metal and plastic. (MADE GROUND).	(1.20)		
1.10	96.90	ES					1.0		
						End of Trialpit at 1.200m	1.20	96.80	
							2.0		
							3.0		
							4.0		

**Weather and environmental conditions:**

1. Overcast and dry

**Other comments:**

- Grid reference at centre of site. Elevation approximate only and interpolated from topographic survey.
- Sample notation ES: Environmental sample (1 plastic tub, 1 amber jar).
- Pit terminated at the base of the inspection pit.
- Pit backfilled with arisings upon completion.

# Earth Science Partnership

Consulting Engineers | Geologists | Environmental Scientists

Excavation method/plant:

JCB 3CX

Shoring/support:

None

# TP214

**Project Name:** Gene Metals

**Site Location:** Treforest

**Client:** Waterstone Homes

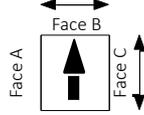
**Project No:** 5902b.4

**Excavation date:** 03-04-2017

**Backfill date:** 03-04-2017

**Logged by:** MTE

**Plan details:**



**Face Stability:**

Trial Pit Stable

**Groundwater observations:**

Water in base of inspection pit, at a depth of 1.1m

**Survey details:**

Ground Level: 99.5 mOD

Easting: 307874 mOD

Northing: 189029 mOD

Bearing:

Depth		Sample		Test Details		Strata Details			
m	mOD	Type	Class	Type	Result	Description	Depth (thickness)	mOD	Legend
						Inspection pit void contains breeze blocks, wooden posts, metal beams and bricks. Demolition rubble. (MADE GROUND)	(1.40)		
						End of Trialpit at 1.400m	1.40	98.10	
							2.0		
							3.0		
							4.0		

**Weather and environmental conditions:**

1. Overcast and dry

**Other comments:**

- Grid reference at centre of site. Elevation approximate only and interpolated from topographic survey.
- Sample notation ES: Environmental sample (1 plastic tub, 1 amber jar).
- Pit terminated at the base of the inspection pit.
- Pit backfilled with arisings upon completion.

# Earth Science Partnership

Consulting Engineers | Geologists | Environmental Scientists

Excavation method/plant:

JCB 3CX

Shoring/support:

None

# TP215

**Project Name:** Gene Metals

**Site Location:** Treforest

**Client:** Waterstone Homes

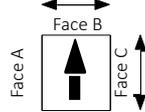
**Project No:** 5902b.4

**Excavation date:** 03-04-2017

**Backfill date:** 03-04-2017

**Logged by:** MTE

**Plan details:**



**Face Stability:**

Trial Pit Stable

**Groundwater observations:**

Initially fast, becoming moderate inflow at 1.1m

**Survey details:**

Ground Level: 98.0 mOD

Easting: 307874 mOD

Northing: 189029 mOD

Bearing:

Depth		Sample		Test Details		Strata Details			
m	mOD	Type	Class	Type	Result	Description	Depth (thickness)	mOD	Legend
0.30	97.70	ES				Grass surface over probably loose black gravelly SAND. Gravels are fine to coarse and angular to subangular with clinker, coal and slag. (MADE GROUND)	(1.10)		
1.20	96.80	ES				Probably medium dense silty gravelly SAND with medium cobble content. Gravels are fine to coarse. Gravels and cobbles are angular to subrounded. (GLACIAL DIAMICTON)	1.10 (0.40)	96.90	
						Probably medium dense light brown sandy fine to coarse angular sandstone GRAVEL with high angular to subrounded cobble content. (GLACIAL DIAMICTON)	1.50 (0.40)	96.50	
						Strong grey brown slightly weathered medium to coarse grained SANDSTONE. (BRITHDIR SANDSTONE)	1.90 (0.25)	96.10 96.05	
						End of Trialpit at 1.950m	1.95		

**Weather and environmental conditions:**

1. Overcast and dry

**Other comments:**

- Grid reference at centre of site. Elevation approximate only and interpolated from topographic survey.
- Sample notation ES: Environmental sample (1 plastic tub, 1 amber jar).
- Pit terminated in sandstone bedrock.
- Pit backfilled with arisings upon completion.

**APPENDIX B**

**ROTARY DRILLHOLE RECORDS**

# Earth Science Partnership

Consulting Engineers | Geologists | Environmental Scientists

Project Name:

Gene Metals

Site Location:

Treforest

Client:

Waterstone Homes

Project No:

5902b.4

Drilling method

Rotary open hole

Equipment

T-44

Ground Level: 107.25 mOD

Easting: 307874 m

Northing: 189029 m

# BH201

Start date: 03-04-2017

Driller: APEX

End date: 03-04-2017

Logged by: APEX

Backfill date: 03-04-2017

Date logged: 03-04-2017

Core Details and SPT Data

Strata Details

Water

Depth

Backfill/  
Installations

Depth (Length)	TCR (%)	SCR (%)	RQD (%)	SPT-N (penetration)	Depth	Description	Legend	Strikes/ Standing	Depth (Thickness) mOD	Backfill/ Installations
						FILL. Drillers description. (MADE GROUND)			(0.40)	
					0.5	CLAY. Drillers description. (PROBABLE GLACIAL DIAMICTON)			0.40	106.85
					1.0	SANDSTONE. Drillers description. (BRITHDIR SANDSTONE)			(0.50)	
									0.90	106.35
					1.5					
					2.0					
					2.5					
					3.0					
					3.5					
					4.0					
					4.5					
					5.0					
					5.5					
					6.0					
					6.5					
					7.0					
					7.5					
					8.0					
					8.5					
					9.0					
					9.5					

Progress & Standing Water Levels					Water Strikes					Hole Diameter		Casing Diameter			
Date	Time	Hole Depth	Casing Depth	Water Depth	Date	Time	Strike Depth	Casing Depth	Elapsed Minutes	Depth to Water	Depth Sealed	Hole Depth	Hole Diameter	Casing Diameter	Casing Depth
							23.90		0.00	0.00					

**General Remarks**

- Grid reference for centre of the site and ground level interpreted from site topographic survey.
- Service pit excavated to a depth of 1.2m.
- Groundwater encountered at a depth of 23.90m.
- 50mm diameter groundwater monitoring well installed with a response zone between 20m and 27m.

# Earth Science Partnership

Consulting Engineers | Geologists | Environmental Scientists

Project Name:

Gene Metals

Site Location:

Treforest

Client:

Waterstone Homes

Project No:

5902b.4

Drilling method

Rotary open hole

Equipment

T-44

Ground Level: 107.25 mOD

Easting: 307874 m

Northing: 189029 m

# BH201

Start date: 03-04-2017

Driller: APEX

End date: 03-04-2017

Logged by: APEX

Backfill date: 03-04-2017

Date logged: 03-04-2017

Core Details and SPT Data					Strata Details			Water	Depth		Backfill/ Installations
Depth (Length)	TCR (%)	SCR (%)	RQD (%)	SPT-N (penetration)	Depth	Description	Legend	Strikes/ Standing	Depth (Thickness)	mOD	
					10.5	SANDSTONE. Drillers description. (BRITHDIR SANDSTONE)	[Dotted Pattern]				
					11.0						
					11.5						
					12.0						
					12.5						
					13.0						
					13.5						
					14.0						
					14.5						
					15.0						
					15.5						
					16.0						
					16.5						
					17.0						
					17.5						
					18.0						
					18.5						
					19.0						
					19.5						
									(26.10)		

Progress & Standing Water Levels					Water Strikes					Hole Diameter		Casing Diameter			
Date	Time	Hole Depth	Casing Depth	Water Depth	Date	Time	Strike Depth	Casing Depth	Elapsed Minutes	Depth to Water	Depth Sealed	Hole Depth	Hole Diameter	Casing Diameter	Casing Depth
							23.90		0.00	0.00					

**General Remarks**

- Grid reference for centre of the site and ground level interpreted from site topographic survey.
- Service pit excavated to a depth of 1.2m.
- Groundwater encountered at a depth of 23.90m.
- 50mm diameter groundwater monitoring well installed with a response zone between 20m and 27m.

# Earth Science Partnership

Consulting Engineers | Geologists | Environmental Scientists

Project Name:

Gene Metals

Site Location:

Treforest

Client:

Waterstone Homes

Project No:

5902b.4

Drilling method

Rotary open hole

Equipment

T-44

Ground Level: 107.25 mOD

Easting: 307874 m

Northing: 189029 m

# BH201

Start date: 03-04-2017

Driller: APEX

End date: 03-04-2017

Logged by: APEX

Backfill date: 03-04-2017

Date logged: 03-04-2017

Core Details and SPT Data					Strata Details			Water	Depth		Backfill/
Depth (Length)	TCR (%)	SCR (%)	RQD (%)	SPT-N (penetration)	Depth	Description	Legend	Strikes/ Standing	Depth (Thickness)	mOD	Installations
					20.5	SANDSTONE. Drillers description. (BRITHDIR SANDSTONE)	[Dotted Pattern]				[Dotted Pattern]
					21.0						
					21.5						
					22.0						
					22.5						
					23.0						
					23.5						
					24.0						
					24.5						
					25.0						
					25.5						
					26.0						
					26.5						
					27.0						
					27.5						
					27.0	End of Borehole at 27.000m			27.00	80.25	
					28.0						
					28.5						
					29.0						
					29.5						



Progress & Standing Water Levels					Water Strikes					Hole Diameter		Casing Diameter			
Date	Time	Hole Depth	Casing Depth	Water Depth	Date	Time	Strike Depth	Casing Depth	Elapsed Minutes	Depth to Water	Depth Sealed	Hole Depth	Hole Diameter	Casing Diameter	Casing Depth
							23.90		0.00	0.00					

**General Remarks**

- Grid reference for centre of the site and ground level interpreted from site topographic survey.
- Service pit excavated to a depth of 1.2m.
- Groundwater encountered at a depth of 23.90m.
- 50mm diameter groundwater monitoring well installed with a response zone between 20m and 27m.

# Earth Science Partnership

Consulting Engineers | Geologists | Environmental Scientists

Project Name:

Gene Metals

Site Location:

Treforest

Client:

Waterstone Homes

Project No:

5902b.4

Drilling method

Rotary open hole

Equipment

T-44

Ground Level: 101.85 mOD

Easting: 307874 m

Northing: 189029 m

# BH202

Start date: 03-04-2017

Driller: APEX

End date: 04-04-2017

Logged by: APEX

Backfill date: 04-04-2017

Date logged: 03-04-2017

Core Details and SPT Data					Strata Details			Water	Depth		Backfill/Installations
Depth (Length)	TCR (%)	SCR (%)	RQD (%)	SPT-N (penetration)	Depth	Description	Legend	Strikes/Standing	Depth (Thickness)	mOD	
						FILL. Drillers description. (MADE GROUND)			(0.40)		
					0.5	CLAY. Drillers description. (PROBABLE GLACIAL DIAMICTON)			0.40 (0.10) 0.50	101.45 101.35	
					1.0	SANDSTONE with mudstone. Drillers description. (BRITHDIR SANDSTONE)					
					1.5						
					2.0						
					2.5						
					3.0						
					3.5						
					4.0						
					4.5						
					5.0						
					5.5						
					6.0						
					6.5						
					7.0						
					7.5						
					8.0						
					8.5						
					9.0						
					9.5						

Progress & Standing Water Levels					Water Strikes					Hole Diameter		Casing Diameter			
Date	Time	Hole Depth	Casing Depth	Water Depth	Date	Time	Strike Depth	Casing Depth	Elapsed Minutes	Depth to Water	Depth Sealed	Hole Depth	Hole Diameter	Casing Diameter	Casing Depth
							27.50		0.00	0.00					

**General Remarks**

- Grid reference for centre of the site and ground level interpreted from site topographic survey.
- Service pit excavated to a depth of 1.2m.
- Groundwater encountered at a depth of 27.50m.
- 50mm diameter groundwater monitoring well installed with a response zone between 24m and 33m.

# Earth Science Partnership

Consulting Engineers | Geologists | Environmental Scientists

Project Name:

Gene Metals

Site Location:

Treforest

Client:

Waterstone Homes

Project No:

5902b.4

Drilling method

Rotary open hole

Equipment

T-44

Ground Level: 101.85 mOD

Easting: 307874 m

Northing: 189029 m

# BH202

Start date: 03-04-2017

Driller: APEX

End date: 04-04-2017

Logged by: APEX

Backfill date: 04-04-2017

Date logged: 03-04-2017

Core Details and SPT Data

Strata Details

Water

Depth

Backfill/  
Installations

Depth (Length)	TCR (%)	SCR (%)	RQD (%)	SPT-N (penetration)	Depth	Description	Legend	Strikes/ Standing	Depth (Thickness)	mOD
						SANDSTONE with mudstone. Drillers description. (BRITHDIR SANDSTONE)				
					10.5					
					11.0					
					11.5					
					12.0					
					12.5					
					13.0					
					13.5					
					14.0					
					14.5					
					15.0					
					15.5				(29.90)	
					16.0					
					16.5					
					17.0					
					17.5					
					18.0					
					18.5					
					19.0					
					19.5					

Progress & Standing Water Levels					Water Strikes						Hole Diameter		Casing Diameter		
Date	Time	Hole Depth	Casing Depth	Water Depth	Date	Time	Strike Depth	Casing Depth	Elapsed Minutes	Depth to Water	Depth Sealed	Hole Depth	Hole Diameter	Casing Diameter	Casing Depth
							27.50		0.00	0.00					

**General Remarks**

- Grid reference for centre of the site and ground level interpreted from site topographic survey.
- Service pit excavated to a depth of 1.2m.
- Groundwater encountered at a depth of 27.50m.
- 50mm diameter groundwater monitoring well installed with a response zone between 24m and 33m.

# Earth Science Partnership

Consulting Engineers | Geologists | Environmental Scientists

Project Name:

Gene Metals

Site Location:

Treforest

Client:

Waterstone Homes

Project No:

5902b.4

Drilling method

Rotary open hole

Equipment

T-44

Ground Level: 101.85 mOD

Easting: 307874 m

Northing: 189029 m

# BH202

Start date: 03-04-2017

Driller: APEX

End date: 04-04-2017

Logged by: APEX

Backfill date: 04-04-2017

Date logged: 03-04-2017

Core Details and SPT Data

Strata Details

Water

Depth

Backfill/Installations

Depth (Length)	TCR (%)	SCR (%)	RQD (%)	SPT-N (penetration)	Depth	Description	Legend	Strikes/Standing	Depth (Thickness)	mOD	Backfill/Installations
					20.5	SANDSTONE with mudstone. Drillers description. (BRITHDIR SANDSTONE)	[Dotted pattern]				[Black bar]
					21.0						
					21.5						
					22.0						
					22.5						
					23.0						
					23.5						
					24.0						
					24.5						
					25.0						
					25.5						
					26.0						
					26.5						
					27.0						
					27.5						
					28.0						
					28.5						
					29.0						
					29.5						



Progress & Standing Water Levels					Water Strikes					Hole Diameter		Casing Diameter			
Date	Time	Hole Depth	Casing Depth	Water Depth	Date	Time	Strike Depth	Casing Depth	Elapsed Minutes	Depth to Water	Depth Sealed	Hole Depth	Hole Diameter	Casing Diameter	Casing Depth
							27.50		0.00	0.00					

**General Remarks**

- Grid reference for centre of the site and ground level interpreted from site topographic survey.
- Service pit excavated to a depth of 1.2m.
- Groundwater encountered at a depth of 27.50m.
- 50mm diameter groundwater monitoring well installed with a response zone between 24m and 33m.

# Earth Science Partnership

Consulting Engineers | Geologists | Environmental Scientists

Project Name:

Gene Metals

Site Location:

Treforest

Client:

Waterstone Homes

Project No:

5902b.4

Drilling method

Rotary open hole

Equipment

T-44

Ground Level: 101.85 mOD

Easting: 307874 m

Northing: 189029 m

# BH202

Start date: 03-04-2017

Driller: APEX

End date: 04-04-2017

Logged by: APEX

Backfill date: 04-04-2017

Date logged: 03-04-2017

Core Details and SPT Data					Strata Details			Water	Depth		Backfill/Installations
Depth (Length)	TCR (%)	SCR (%)	RQD (%)	SPT-N (penetration)	Depth	Description	Legend	Strikes/ Standing	Depth (Thickness)	mOD	
						SANDSTONE with mudstone. Drillers description. (BRITHDIR SANDSTONE)			30.40	71.45	
					30.5	COAL. Drillers description. (POSSIBLE INTERBEDDED COAL WITHIN BRITHDIR SANDSTONE)			(0.30) 30.70	71.15	
					31.0	SANDSTONE with mudstone. Drillers description. (BRITHDIR SANDSTONE)					
					31.5						
					32.0				(2.30)		
					32.5						
					33.0	End of Borehole at 33.000m			33.00	68.85	
					33.5						
					34.0						
					34.5						
					35.0						
					35.5						
					36.0						
					36.5						
					37.0						
					37.5						
					38.0						
					38.5						
					39.0						
					39.5						

Progress & Standing Water Levels					Water Strikes					Hole Diameter		Casing Diameter			
Date	Time	Hole Depth	Casing Depth	Water Depth	Date	Time	Strike Depth	Casing Depth	Elapsed Minutes	Depth to Water	Depth Sealed	Hole Depth	Hole Diameter	Casing Diameter	Casing Depth
							27.50		0.00	0.00					

**General Remarks**

- Grid reference for centre of the site and ground level interpreted from site topographic survey.
- Service pit excavated to a depth of 1.2m.
- Groundwater encountered at a depth of 27.50m.
- 50mm diameter groundwater monitoring well installed with a response zone between 24m and 33m.

# Earth Science Partnership

Consulting Engineers | Geologists | Environmental Scientists

Project Name:

Gene Metals

Site Location:

Treforest

Client:

Waterstone Homes

Project No:

5902b.4

Drilling method

Rotary open hole

Equipment

T-44

Ground Level: 101.97 mOD

Easting: 307874 m

Northing: 189029 m

# BH203

Start date: 04-04-2017

Driller: APEX

End date: 05-04-2017

Logged by: APEX

Backfill date: 05-04-2017

Date logged: 04-04-2017

Core Details and SPT Data					Strata Details			Water	Depth		Backfill/Installations
Depth (Length)	TCR (%)	SCR (%)	RQD (%)	SPT-N (penetration)	Depth	Description	Legend	Strikes/ Standing	Depth (Thickness)	mOD	
						FILL. Drillers description. (MADE GROUND)			(0.20)		
					0.5	CLAY. Drillers description. (PROBABLE GLACIAL DIAMICTON)			0.20	101.77	
						SANDSTONE with mudstone. Drillers description. (BRITHDIR SANDSTONE)			(0.20)	101.57	
					1.0				0.40		
					1.5						
					2.0						
					2.5						
					3.0						
					3.5						
					4.0						
					4.5						
					5.0						
					5.5						
					6.0						
					6.5						
					7.0						
					7.5						
					8.0						
					8.5						
					9.0						
					9.5						

Progress & Standing Water Levels					Water Strikes					Hole Diameter		Casing Diameter			
Date	Time	Hole Depth	Casing Depth	Water Depth	Date	Time	Strike Depth	Casing Depth	Elapsed Minutes	Depth to Water	Depth Sealed	Hole Depth	Hole Diameter	Casing Diameter	Casing Depth
							28.00		0.00	0.00					

**General Remarks**

- Grid reference for centre of the site and ground level interpreted from site topographic survey.
- Service pit excavated to a depth of 1.2m.
- Groundwater encountered at a depth of 28.0m.
- 50mm diameter groundwater monitoring well installed with a response zone between 24m and 33m.

# Earth Science Partnership

Consulting Engineers | Geologists | Environmental Scientists

Project Name:

Gene Metals

Site Location:

Treforest

Client:

Waterstone Homes

Project No:

5902b.4

Drilling method

Rotary open hole

Equipment

T-44

Ground Level: 101.97 mOD

Easting: 307874 m

Northing: 189029 m

# BH203

Start date: 04-04-2017

Driller: APEX

End date: 05-04-2017

Logged by: APEX

Backfill date: 05-04-2017

Date logged: 04-04-2017

Core Details and SPT Data

Strata Details

Water

Depth

Backfill/  
Installations

Depth (Length)	TCR (%)	SCR (%)	RQD (%)	SPT-N (penetration)	Depth	Description	Legend	Strikes/ Standing	Depth (Thickness)	mOD	Backfill/ Installations
						SANDSTONE with mudstone. Drillers description. (BRITHDIR SANDSTONE)					
					10.5						
					11.0						
					11.5						
					12.0						
					12.5						
					13.0						
					13.5						
					14.0						
					14.5						
					15.0						
					15.5						
					16.0						
					16.5						
					17.0				(32.60)		
					17.5						
					18.0						
					18.5						
					19.0						
					19.5						

Progress & Standing Water Levels					Water Strikes						Hole Diameter		Casing Diameter		
Date	Time	Hole Depth	Casing Depth	Water Depth	Date	Time	Strike Depth	Casing Depth	Elapsed Minutes	Depth to Water	Depth Sealed	Hole Depth	Hole Diameter	Casing Diameter	Casing Depth
							28.00		0.00	0.00					

**General Remarks**

- Grid reference for centre of the site and ground level interpreted from site topographic survey.
- Service pit excavated to a depth of 1.2m.
- Groundwater encountered at a depth of 28.0m.
- 50mm diameter groundwater monitoring well installed with a response zone between 24m and 33m.

# Earth Science Partnership

Consulting Engineers | Geologists | Environmental Scientists

Project Name:

Gene Metals

Site Location:

Treforest

Client:

Waterstone Homes

Project No:

5902b.4

Drilling method

Rotary open hole

Equipment

T-44

Ground Level: 101.97 mOD

Easting: 307874 m

Northing: 189029 m

# BH203

Start date: 04-04-2017

Driller: APEX

End date: 05-04-2017

Logged by: APEX

Backfill date: 05-04-2017

Date logged: 04-04-2017

Core Details and SPT Data

Strata Details

Water

Depth

Backfill/Installations

Depth (Length)	TCR (%)	SCR (%)	RQD (%)	SPT-N (penetration)	Depth	Description	Legend	Strikes/Standing	Depth (Thickness)	mOD	Backfill/Installations
					20.5	SANDSTONE with mudstone. Drillers description. (BRITHDIR SANDSTONE)	[Dotted pattern]				[Black bar]
					21.0						
					21.5						
					22.0						
					22.5						
					23.0						
					23.5						
					24.0						
					24.5						
					25.0						
					25.5						
					26.0						
					26.5						
					27.0						
					27.5						
					28.0						
					28.5						
					29.0						
					29.5						



Progress & Standing Water Levels					Water Strikes					Hole Diameter		Casing Diameter			
Date	Time	Hole Depth	Casing Depth	Water Depth	Date	Time	Strike Depth	Casing Depth	Elapsed Minutes	Depth to Water	Depth Sealed	Hole Depth	Hole Diameter	Casing Diameter	Casing Depth
							28.00		0.00	0.00					

**General Remarks**

- Grid reference for centre of the site and ground level interpreted from site topographic survey.
- Service pit excavated to a depth of 1.2m.
- Groundwater encountered at a depth of 28.0m.
- 50mm diameter groundwater monitoring well installed with a response zone between 24m and 33m.

# Earth Science Partnership

Consulting Engineers | Geologists | Environmental Scientists

Project Name:

Gene Metals

Site Location:

Treforest

Client:

Waterstone Homes

Project No:

5902b.4

Drilling method

Rotary open hole

Equipment

T-44

Ground Level: 101.97 mOD

Easting: 307874 m

Northing: 189029 m

# BH203

Start date: 04-04-2017

Driller: APEX

End date: 05-04-2017

Logged by: APEX

Backfill date: 05-04-2017

Date logged: 04-04-2017

Core Details and SPT Data

Strata Details

Water

Depth

Backfill/  
Installations

Depth (Length)	TCR (%)	SCR (%)	RQD (%)	SPT-N (penetration)	Depth	Description	Legend	Strikes/ Standing	Depth (Thickness)	mOD	Backfill/ Installations						
					30.5	SANDSTONE with mudstone. Drillers description. (BRITHDIR SANDSTONE)	[Pattern]				[Pattern]						
					31.0												
					31.5												
					32.0												
					32.5												
					33.0												
					33.0							End of Borehole at 33.000m			33.00	68.97	
					33.5												
					34.0												
					34.5												
					35.0												
					35.5												
					36.0												
					36.5												
					37.0												
					37.5												
					38.0												
					38.5												
					39.0												
					39.5												

Progress & Standing Water Levels					Water Strikes						Hole Diameter		Casing Diameter		
Date	Time	Hole Depth	Casing Depth	Water Depth	Date	Time	Strike Depth	Casing Depth	Elapsed Minutes	Depth to Water	Depth Sealed	Hole Depth	Hole Diameter	Casing Diameter	Casing Depth
							28.00		0.00	0.00					

**General Remarks**

- Grid reference for centre of the site and ground level interpreted from site topographic survey.
- Service pit excavated to a depth of 1.2m.
- Groundwater encountered at a depth of 28.0m.
- 50mm diameter groundwater monitoring well installed with a response zone between 24m and 33m.

# Earth Science Partnership

Consulting Engineers | Geologists | Environmental Scientists

Project Name:

Gene Metals

Site Location:

Treforest

Client:

Waterstone Homes

Project No:

5902b.4

Drilling method

Rotary open hole

Equipment

T-44

Ground Level: 98.65 mOD

Easting: 307874 m

Northing: 189029 m

# BH204

Start date: 05-04-2017

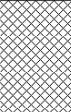
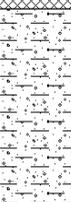
Driller: APEX

End date: 05-04-2017

Logged by: APEX

Backfill date: 05-04-2017

Date logged: 05-04-2017

Core Details and SPT Data					Strata Details			Water	Depth		Backfill/Installations
Depth (Length)	TCR (%)	SCR (%)	RQD (%)	SPT-N (penetration)	Depth	Description	Legend	Strikes/ Standing	Depth (Thickness)	mOD	
					0.5	FILL. Drillers description. (MADE GROUND)			(0.80)		
					1.0	CLAY. Drillers description. (PROBABLE GLACIAL DIAMICTON)			0.80	97.85	
					1.5				(1.30)		
					2.0	SANDSTONE with mudstone. Drillers description. (BRITHDIR SANDSTONE)			2.10	96.55	
					2.5						
					3.0						
					3.5						
					4.0						
					4.5						
					5.0						
					5.5						
					6.0						
					6.5						
					7.0						
					7.5						
					8.0						
					8.5						
					9.0						
					9.5						

Progress & Standing Water Levels					Water Strikes					Hole Diameter		Casing Diameter			
Date	Time	Hole Depth	Casing Depth	Water Depth	Date	Time	Strike Depth	Casing Depth	Elapsed Minutes	Depth to Water	Depth Sealed	Hole Depth	Hole Diameter	Casing Diameter	Casing Depth
							28.80		0.00	0.00					

**General Remarks**

- Grid reference for centre of the site and ground level interpreted from site topographic survey.
- Service pit excavated to a depth of 1.2m.
- Groundwater encountered at a depth of 28.8m.
- 50mm diameter groundwater monitoring well installed with a response zone between 24m and 33m.

# Earth Science Partnership

Consulting Engineers | Geologists | Environmental Scientists

Project Name:

Gene Metals

Site Location:

Treforest

Client:

Waterstone Homes

Project No:

5902b.4

Drilling method

Rotary open hole

Equipment

T-44

Ground Level: 98.65 mOD

Easting: 307874 m

Northing: 189029 m

# BH204

Start date: 05-04-2017

Driller: APEX

End date: 05-04-2017

Logged by: APEX

Backfill date: 05-04-2017

Date logged: 05-04-2017

Core Details and SPT Data

Strata Details

Water

Depth

Backfill/  
Installations

Depth (Length)	TCR (%)	SCR (%)	RQD (%)	SPT-N (penetration)	Depth	Description	Legend	Strikes/ Standing	Depth (Thickness)	mOD	Backfill/ Installations
						SANDSTONE with mudstone. Drillers description. (BRITHDIR SANDSTONE)					
					10.5						
					11.0						
					11.5						
					12.0						
					12.5						
					13.0						
					13.5						
					14.0						
					14.5						
					15.0						
					15.5						
					16.0						
					16.5						
					17.0						
					17.5				(30.90)		
					18.0						
					18.5						
					19.0						
					19.5						

Progress & Standing Water Levels					Water Strikes					Hole Diameter		Casing Diameter			
Date	Time	Hole Depth	Casing Depth	Water Depth	Date	Time	Strike Depth	Casing Depth	Elapsed Minutes	Depth to Water	Depth Sealed	Hole Depth	Hole Diameter	Casing Diameter	Casing Depth
							28.80		0.00	0.00					

**General Remarks**

- Grid reference for centre of the site and ground level interpreted from site topographic survey.
- Service pit excavated to a depth of 1.2m.
- Groundwater encountered at a depth of 28.8m.
- 50mm diameter groundwater monitoring well installed with a response zone between 24m and 33m.

# Earth Science Partnership

Consulting Engineers | Geologists | Environmental Scientists

Project Name:

Gene Metals

Site Location:

Treforest

Client:

Waterstone Homes

Project No:

5902b.4

Drilling method

Rotary open hole

Equipment

T-44

Ground Level: 98.65 mOD

Easting: 307874 m

Northing: 189029 m

# BH204

Start date: 05-04-2017

Driller: APEX

End date: 05-04-2017

Logged by: APEX

Backfill date: 05-04-2017

Date logged: 05-04-2017

Core Details and SPT Data					Strata Details			Water	Depth	Backfill/Installations
Depth (Length)	TCR (%)	SCR (%)	RQD (%)	SPT-N (penetration)	Depth	Description	Legend	Strikes/Standing	Depth (Thickness) mOD	
					20.5	SANDSTONE with mudstone. Drillers description. (BRITHDIR SANDSTONE)	[Dotted pattern]			[Black bar]
					21.0					
					21.5					
					22.0					
					22.5					
					23.0					
					23.5					
					24.0					
					24.5					
					25.0					
					25.5					
					26.0					
					26.5					
					27.0					
					27.5					
					28.0					
					28.5					
					29.0					
					29.5					



Progress & Standing Water Levels					Water Strikes					Hole Diameter		Casing Diameter			
Date	Time	Hole Depth	Casing Depth	Water Depth	Date	Time	Strike Depth	Casing Depth	Elapsed Minutes	Depth to Water	Depth Sealed	Hole Depth	Hole Diameter	Casing Diameter	Casing Depth
							28.80		0.00	0.00					

**General Remarks**

- Grid reference for centre of the site and ground level interpreted from site topographic survey.
- Service pit excavated to a depth of 1.2m.
- Groundwater encountered at a depth of 28.8m.
- 50mm diameter groundwater monitoring well installed with a response zone between 24m and 33m.

# Earth Science Partnership

Consulting Engineers | Geologists | Environmental Scientists

Project Name:

Gene Metals

Site Location:

Treforest

Client:

Waterstone Homes

Project No:

5902b.4

Drilling method

Rotary open hole

Equipment

T-44

Ground Level: 98.65 mOD

Easting: 307874 m

Northing: 189029 m

# BH204

Start date: 05-04-2017

Driller: APEX

End date: 05-04-2017

Logged by: APEX

Backfill date: 05-04-2017

Date logged: 05-04-2017

Core Details and SPT Data					Strata Details			Water	Depth		Backfill/
Depth (Length)	TCR (%)	SCR (%)	RQD (%)	SPT-N (penetration)	Depth	Description	Legend	Strikes/ Standing	Depth (Thickness)	mOD	Installations
					30.5	SANDSTONE with mudstone. Drillers description. (BRITHDIR SANDSTONE)	[Pattern]				[Pattern]
					31.0						
					31.5						
					32.0						
					32.5						
					33.0						
					33.5						
					34.0						
					34.5						
					35.0						
					35.5						
					36.0						
					36.5						
					37.0						
					37.5						
					38.0						
					38.5						
					39.0						
					39.5						
						End of Borehole at 33.000m			33.00	65.65	

Progress & Standing Water Levels					Water Strikes						Hole Diameter		Casing Diameter		
Date	Time	Hole Depth	Casing Depth	Water Depth	Date	Time	Strike Depth	Casing Depth	Elapsed Minutes	Depth to Water	Depth Sealed	Hole Depth	Hole Diameter	Casing Diameter	Casing Depth
							28.80		0.00	0.00					

**General Remarks**

- Grid reference for centre of the site and ground level interpreted from site topographic survey.
- Service pit excavated to a depth of 1.2m.
- Groundwater encountered at a depth of 28.8m.
- 50mm diameter groundwater monitoring well installed with a response zone between 24m and 33m.

# Earth Science Partnership

Consulting Engineers | Geologists | Environmental Scientists

Project Name:

Gene Metals

Site Location:

Treforest

Client:

Waterstone Homes

Project No:

5902b.4

Drilling method

Rotary open hole

Equipment

T-44

Ground Level: 96.65 mOD

Easting: 307874 m

Northing: 189029 m

# BH205

Start date: 05-04-2017

Driller: APEX

End date: 06-04-2017

Logged by: APEX

Backfill date: 06-04-2017

Date logged: 05-04-2017

Core Details and SPT Data

Strata Details

Water

Depth

Backfill/  
Installations

Depth (Length)	TCR (%)	SCR (%)	RQD (%)	SPT-N (penetration)	Depth	Description	Legend	Strikes/ Standing	Depth (Thickness)	mOD	Backfill/ Installations
					0.5	Fill. Drillers description. (MADE GROUND)			(2.00)		
					1.0						
					1.5	SANDSTONE with mudstone. Drillers description. (BRITHDIR SANDSTONE)			2.00	94.65	
					2.0						
					2.5						
					3.0						
					3.5						
					4.0						
					4.5						
					5.0						
					5.5						
					6.0						
					6.5						
					7.0						
					7.5						
					8.0						
					8.5						
					9.0						
					9.5						

Progress & Standing Water Levels

Water Strikes

Hole Diameter

Casing Diameter

Date	Time	Hole Depth	Casing Depth	Water Depth	Date	Time	Strike Depth	Casing Depth	Elapsed Minutes	Depth to Water	Depth Sealed	Hole Depth	Hole Diameter	Casing Diameter	Casing Depth
							28.40		0.00	0.00					

## General Remarks

1. Grid reference for centre of the site and ground level interpreted from site topographic survey.
2. Service pit excavated to a depth of 1.2m.
3. Groundwater encountered at a depth of 28.40m.
4. 50mm diameter groundwater monitoring well installed with a response zone between 24m and 33m.

# Earth Science Partnership

Consulting Engineers | Geologists | Environmental Scientists

Project Name:

Gene Metals

Site Location:

Treforest

Client:

Waterstone Homes

Project No:

5902b.4

Drilling method

Rotary open hole

Equipment

T-44

Ground Level: 96.65 mOD

Easting: 307874 m

Northing: 189029 m

# BH205

Start date: 05-04-2017

Driller: APEX

End date: 06-04-2017

Logged by: APEX

Backfill date: 06-04-2017

Date logged: 05-04-2017

Core Details and SPT Data

Strata Details

Water

Depth

Backfill/  
Installations

Depth (Length)	TCR (%)	SCR (%)	RQD (%)	SPT-N (penetration)	Depth	Description	Legend	Strikes/ Standing	Depth (Thickness)	mOD	Backfill/ Installations
						SANDSTONE with mudstone. Drillers description. (BRITHDIR SANDSTONE)					
					10.5						
					11.0						
					11.5						
					12.0						
					12.5						
					13.0						
					13.5						
					14.0						
					14.5						
					15.0						
					15.5						
					16.0						
					16.5						
					17.0						
					17.5				(31.00)		
					18.0						
					18.5						
					19.0						
					19.5						

Progress & Standing Water Levels					Water Strikes					Hole Diameter		Casing Diameter			
Date	Time	Hole Depth	Casing Depth	Water Depth	Date	Time	Strike Depth	Casing Depth	Elapsed Minutes	Depth to Water	Depth Sealed	Hole Depth	Hole Diameter	Casing Diameter	Casing Depth
							28.40		0.00	0.00					

**General Remarks**

- Grid reference for centre of the site and ground level interpreted from site topographic survey.
- Service pit excavated to a depth of 1.2m.
- Groundwater encountered at a depth of 28.40m.
- 50mm diameter groundwater monitoring well installed with a response zone between 24m and 33m.

# Earth Science Partnership

Consulting Engineers | Geologists | Environmental Scientists

Project Name:

Gene Metals

Site Location:

Treforest

Client:

Waterstone Homes

Project No:

5902b.4

Drilling method

Rotary open hole

Equipment

T-44

Ground Level: 96.65 mOD

Easting: 307874 m

Northing: 189029 m

# BH205

Start date: 05-04-2017

Driller: APEX

End date: 06-04-2017

Logged by: APEX

Backfill date: 06-04-2017

Date logged: 05-04-2017

Core Details and SPT Data

Strata Details

Water

Depth

Backfill/Installations

Depth (Length)	TCR (%)	SCR (%)	RQD (%)	SPT-N (penetration)	Depth	Description	Legend	Strikes/Standing	Depth (Thickness)	mOD	Backfill/Installations
					20.5	SANDSTONE with mudstone. Drillers description. (BRITHDIR SANDSTONE)	[Dotted pattern]				[Black bar]
					21.0						
					21.5						
					22.0						
					22.5						
					23.0						
					23.5						
					24.0						
					24.5						
					25.0						
					25.5						
					26.0						
					26.5						
					27.0						
					27.5						
					28.0						
					28.5						
					29.0						
					29.5						



Progress & Standing Water Levels					Water Strikes					Hole Diameter		Casing Diameter			
Date	Time	Hole Depth	Casing Depth	Water Depth	Date	Time	Strike Depth	Casing Depth	Elapsed Minutes	Depth to Water	Depth Sealed	Hole Depth	Hole Diameter	Casing Diameter	Casing Depth
							28.40		0.00	0.00					

**General Remarks**

- Grid reference for centre of the site and ground level interpreted from site topographic survey.
- Service pit excavated to a depth of 1.2m.
- Groundwater encountered at a depth of 28.40m.
- 50mm diameter groundwater monitoring well installed with a response zone between 24m and 33m.

# Earth Science Partnership

Consulting Engineers | Geologists | Environmental Scientists

Project Name:

Gene Metals

Site Location:

Treforest

Client:

Waterstone Homes

Project No:

5902b.4

Drilling method

Rotary open hole

Equipment

T-44

Ground Level: 96.65 mOD

Easting: 307874 m

Northing: 189029 m

# BH205

Start date: 05-04-2017

Driller: APEX

End date: 06-04-2017

Logged by: APEX

Backfill date: 06-04-2017

Date logged: 05-04-2017

Core Details and SPT Data					Strata Details			Water	Depth		Backfill/
Depth (Length)	TCR (%)	SCR (%)	RQD (%)	SPT-N (penetration)	Depth	Description	Legend	Strikes/ Standing	Depth (Thickness)	mOD	Installations
					30.5	SANDSTONE with mudstone. Drillers description. (BRITHDIR SANDSTONE)	[Pattern]				[Pattern]
					31.0						
					31.5						
					32.0						
					32.5						
					33.0						
					33.5						
					34.0						
					34.5						
					35.0						
					35.5						
					36.0						
					36.5						
					37.0						
					37.5						
					38.0						
					38.5						
					39.0						
					39.5						
						End of Borehole at 33.000m			33.00	63.65	

Progress & Standing Water Levels					Water Strikes						Hole Diameter		Casing Diameter		
Date	Time	Hole Depth	Casing Depth	Water Depth	Date	Time	Strike Depth	Casing Depth	Elapsed Minutes	Depth to Water	Depth Sealed	Hole Depth	Hole Diameter	Casing Diameter	Casing Depth
							28.40		0.00	0.00					

**General Remarks**

- Grid reference for centre of the site and ground level interpreted from site topographic survey.
- Service pit excavated to a depth of 1.2m.
- Groundwater encountered at a depth of 28.40m.
- 50mm diameter groundwater monitoring well installed with a response zone between 24m and 33m.

## **APPENDIX C**

### **FALLING HEAD TEST RESULTS**

# FALLING HEAD PERMEABILITY TEST RESULTS

Testing and assessment undertaken in accordance with BS EN ISO 22282-1/2

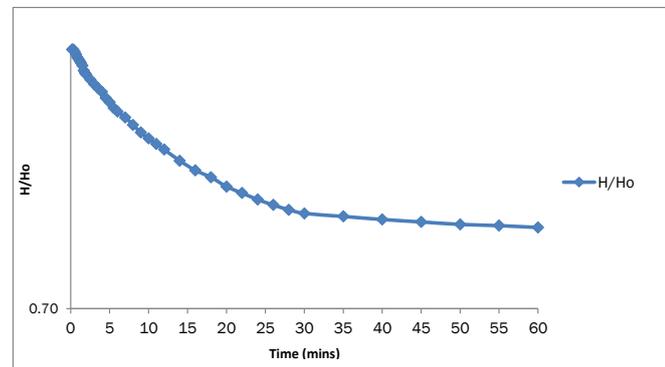
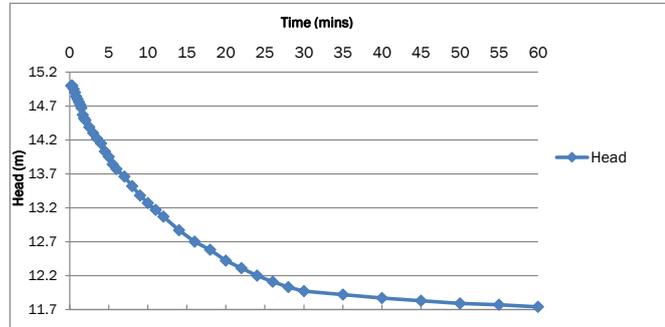


**Project Name:** Gene Metals, Treforest  
**Project No.:** 5902b.04

Borehole depth	15.00 m
Casing depth	2.70 m
Casing diameter	0.13 m
Intake factor, $F =$	14.623
ISO 22282-1:2012, Cylindrical $L/D > 10$	
Internal Cross Section, $S =$	$0.0123 \text{ m}^2$
Initial water level:	15 m (borehole dry)

**Test Borehole:** BH 204

Time (mins)	Water level (m bgl)	Head (m)	H/Ho
0.17	0.00	15.00	1.00
0.33	0.00	15.00	1.00
0.5	0.05	14.95	1.00
0.67	0.10	14.90	0.99
0.83	0.16	14.84	0.99
1	0.20	14.80	0.99
1.17	0.24	14.76	0.98
1.33	0.28	14.72	0.98
1.5	0.33	14.67	0.98
1.67	0.43	14.57	0.97
1.83	0.48	14.52	0.97
2	0.51	14.49	0.97
2.5	0.61	14.39	0.96
3	0.70	14.30	0.95
3.5	0.78	14.22	0.95
4	0.85	14.15	0.94
4.5	0.97	14.03	0.94
5	1.05	13.95	0.93
5.5	1.16	13.84	0.92
6	1.23	13.77	0.92
7	1.34	13.66	0.91
8	1.48	13.52	0.90
9	1.62	13.38	0.89
10	1.73	13.27	0.88
11	1.83	13.17	0.88
12	1.93	13.07	0.87
14	2.13	12.87	0.86
16	2.30	12.70	0.85
18	2.42	12.58	0.84
20	2.58	12.42	0.83
22	2.69	12.31	0.82
24	2.80	12.20	0.81
26	2.89	12.11	0.81
28	2.97	12.03	0.80
30	3.03	11.97	0.80
35	3.08	11.92	0.79
40	3.13	11.87	0.79
45	3.17	11.83	0.79
50	3.21	11.79	0.79
55	3.23	11.77	0.78
60	3.26	11.74	0.78



<b>Drainage rate:</b>			
<b>t1</b>	35 mins	<b>H1</b>	11.92 m
<b>t2</b>	60 mins	<b>H2</b>	11.74 m
<b>Permeability:</b>		<b>8.5E-09 m/s</b>	

**APPENDIX D**

**GEO-ENVIRONMENTAL LABORATORY TEST  
RESULTS - LEACHATE**



# DETS

## Certificate of Analysis

*Certificate Number* 17-04518

12-Jul-17

*Client* Earth Science Partnership  
33 Cardiff Road  
Taffs Well  
Cardiff  
CF15 7RB

*Our Reference* 17-04518

*Client Reference* 5902B.04

*Order No* (not supplied)

*Contract Title* GENE METALS

*Description* 8 Leachate samples.

*Date Received* 06-Jul-17

*Date Started* 06-Jul-17

*Date Completed* 12-Jul-17

*Test Procedures* Identified by prefix DETSn (details on request).

*Notes* Opinions and interpretations are outside the laboratory's scope of ISO 10725 accreditation. This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced except in full, without the prior written approval of the laboratory.

*Approved By*



Adam Fenwick  
Contracts Manager





## Summary of Chemical Analysis

### Leachate Samples

Our Ref 17-04518

Client Ref 5902B.04

Contract Title GENE METALS

Lab No	1200325	1200326	1200327	1200328	1200329	1200330
Sample ID	TP212	TP204	TP202	TP205	TP206	TP207
Depth	0.30	0.30	0.05	0.30	0.10	1.30
Other ID						
Sample Type	LEACHATE	LEACHATE	LEACHATE	LEACHATE	LEACHATE	LEACHATE
Sampling Date	03/07/17	03/07/17	03/07/17	03/07/17	03/07/17	03/07/17
Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units						
<b>Preparation</b>									
Leachate 10:1	DETS 036*			Y	Y	Y	Y	Y	Y
<b>Metals</b>									
Arsenic, Dissolved	DETSC 2306	0.16	ug/l	0.73	0.43	0.45	0.39	0.30	0.30
Barium, Dissolved	DETSC 2306	0.26	ug/l	12	28	7.6	4.1	5.2	1.6
Beryllium, Dissolved	DETSC 2306*	0.1	ug/l	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Boron	DETSC 2123	100	ug/l	< 100	< 100	470	< 100	< 100	< 100
Cadmium, Dissolved	DETSC 2306	0.03	ug/l	< 0.03	0.05	< 0.03	0.03	< 0.03	< 0.03
Chromium, Dissolved	DETSC 2306	0.25	ug/l	< 0.25	< 0.25	< 0.25	< 0.25	< 0.25	< 0.25
Copper, Dissolved	DETSC 2306	0.4	ug/l	4.2	3.7	1.4	2.2	2.4	0.7
Iron, Dissolved	DETSC 2306	5.5	ug/l	65	36	89	120	70	76
Lead, Dissolved	DETSC 2306	0.09	ug/l	0.97	0.53	0.53	0.42	0.68	0.21
Mercury, Dissolved	DETSC 2306	0.01	ug/l	< 0.01	< 0.01	0.02	< 0.01	< 0.01	< 0.01
Nickel, Dissolved	DETSC 2306	0.5	ug/l	0.7	3.5	< 0.5	< 0.5	< 0.5	< 0.5
Selenium, Dissolved	DETSC 2306	0.25	ug/l	< 0.25	< 0.25	1.7	1.1	0.70	0.70
Vanadium, Dissolved	DETSC 2306	0.6	ug/l	< 0.6	< 0.6	< 0.6	< 0.6	< 0.6	< 0.6
Zinc, Dissolved	DETSC 2306	1.3	ug/l	7.3	3.9	8.4	6.5	6.2	2.3
<b>Inorganics</b>									
pH	DETSC 2008			7.7	7.6	7.6	7.5	7.5	7.6
Cyanide, Total	DETSC 2130	40	ug/l	< 40	< 40	< 40	< 40	< 40	< 40
Phenol - Monohydric	DETSC 2131	0.5	ug/l	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
<b>Petroleum Hydrocarbons</b>									
Aliphatic C5-C6	DETSC 3322	0.1	ug/l	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Aliphatic C6-C8	DETSC 3322	0.1	ug/l	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Aliphatic C8-C10	DETSC 3322	0.1	ug/l	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Aliphatic C10-C12	DETSC 3072*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic C12-C16	DETSC 3072*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic C16-C21	DETSC 3072*	1	ug/l	5.2	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic C21-C35	DETSC 3072*	1	ug/l	10	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic C5-C35	DETSC 3072*	10	ug/l	17	< 10	< 10	< 10	< 10	< 10
Aromatic C5-C7	DETSC 3322	0.1	ug/l	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Aromatic C7-C8	DETSC 3322	0.1	ug/l	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Aromatic C8-C10	DETSC 3322	0.1	ug/l	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Aromatic C10-C12	DETSC 3072*	1	ug/l	3.5	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic C12-C16	DETSC 3072*	1	ug/l	6.9	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic C16-C21	DETSC 3072*	1	ug/l	13	1.9	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic C21-C35	DETSC 3072*	1	ug/l	13	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic C5-C35	DETSC 3072*	10	ug/l	36	< 10	< 10	< 10	< 10	< 10
TPH Ali/Aro Total	DETSC 3072*	10	ug/l	52	< 10	< 10	< 10	< 10	< 10
Benzene	DETSC 3322	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Toluene	DETSC 3322	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Ethylbenzene	DETSC 3322	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0



## Summary of Chemical Analysis

### Leachate Samples

Our Ref 17-04518

Client Ref 5902B.04

Contract Title GENE METALS

Lab No	1200325	1200326	1200327	1200328	1200329	1200330
Sample ID	TP212	TP204	TP202	TP205	TP206	TP207
Depth	0.30	0.30	0.05	0.30	0.10	1.30
Other ID						
Sample Type	LEACHATE	LEACHATE	LEACHATE	LEACHATE	LEACHATE	LEACHATE
Sampling Date	03/07/17	03/07/17	03/07/17	03/07/17	03/07/17	03/07/17
Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units						
Xylene	DETSC 3322	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
<b>PAHs</b>									
Acenaphthene	DETSC 3304	0.01	ug/l	< 0.01	0.02	< 0.01	< 0.01	< 0.01	< 0.01
Acenaphthylene	DETSC 3304	0.01	ug/l	< 0.01	0.01	< 0.01	< 0.01	< 0.01	< 0.01
Anthracene	DETSC 3304	0.01	ug/l	< 0.01	0.03	< 0.01	< 0.01	< 0.01	< 0.01
Benzo(a)anthracene	DETSC 3304	0.01	ug/l	0.01	0.04	< 0.01	< 0.01	< 0.01	< 0.01
Benzo(a)pyrene	DETSC 3304	0.01	ug/l	0.01	0.07	< 0.01	< 0.01	< 0.01	< 0.01
Benzo(b)fluoranthene	DETSC 3304	0.01	ug/l	0.02	0.07	< 0.01	< 0.01	< 0.01	< 0.01
Benzo(g,h,i)perylene	DETSC 3304*	0.01	ug/l	0.03	0.09	< 0.01	< 0.01	< 0.01	< 0.01
Benzo(k)fluoranthene	DETSC 3304	0.01	ug/l	0.01	0.05	< 0.01	< 0.01	< 0.01	< 0.01
Chrysene	DETSC 3304	0.01	ug/l	0.02	0.05	< 0.01	< 0.01	< 0.01	< 0.01
Dibenzo(a,h)anthracene	DETSC 3304	0.01	ug/l	< 0.01	0.02	< 0.01	< 0.01	< 0.01	< 0.01
Fluoranthene	DETSC 3304	0.01	ug/l	0.02	0.06	< 0.01	< 0.01	< 0.01	< 0.01
Fluorene	DETSC 3304	0.01	ug/l	< 0.01	0.02	< 0.01	< 0.01	< 0.01	< 0.01
Indeno(1,2,3-c,d)pyrene	DETSC 3304*	0.01	ug/l	0.03	0.12	< 0.01	< 0.01	< 0.01	< 0.01
Naphthalene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Phenanthrene	DETSC 3304	0.01	ug/l	< 0.01	0.04	0.01	< 0.01	< 0.01	< 0.01
Pyrene	DETSC 3304	0.01	ug/l	0.02	0.04	< 0.01	< 0.01	< 0.01	< 0.01
PAH Total	DETSC 3304	0.04	ug/l	0.19	0.72	0.05	0.06	0.05	< 0.04
<b>PCBs</b>									
PCB 28 + PCB 31	DETSC 3402	0.3	ug/l	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
PCB 52	DETSC 3402	0.2	ug/l	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
PCB 101	DETSC 3402	0.3	ug/l	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
PCB 118 + PCB 123	DETSC 3402	0.6	ug/l	< 0.6	< 0.6	< 0.6	< 0.6	< 0.6	< 0.6
PCB 138	DETSC 3402	0.2	ug/l	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
PCB 153	DETSC 3402	0.2	ug/l	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
PCB 180	DETSC 3402	0.2	ug/l	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
PCB 7 Total	DETSC 3402	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0



# Summary of Chemical Analysis

## Leachate Samples

Our Ref 17-04518  
 Client Ref 5902B.04  
 Contract Title GENE METALS

Lab No	1200325	1200326	1200327	1200328	1200329	1200330
Sample ID	TP212	TP204	TP202	TP205	TP206	TP207
Depth	0.30	0.30	0.05	0.30	0.10	1.30
Other ID						
Sample Type	LEACHATE	LEACHATE	LEACHATE	LEACHATE	LEACHATE	LEACHATE
Sampling Date	03/07/17	03/07/17	03/07/17	03/07/17	03/07/17	03/07/17
Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units	1200325	1200326	1200327	1200328	1200329	1200330
<b>VOCs</b>									
Dichlorodifluoromethane	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1	< 1
Chloromethane	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1	< 1
Vinyl Chloride	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1	< 1
Bromomethane	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1	< 1
Chloroethane	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1	< 1
Trichlorofluoromethane	DETSC 3432*	1	ug/l	< 1	< 1	< 1	< 1	< 1	< 1
1,1-dichloroethylene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1	< 1
Trans-1,2-dichloroethylene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1	< 1
1,1-dichloroethane	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1	< 1
Cis-1,2-dichloroethylene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1	< 1
2,2-dichloropropane	DETSC 3432	2	ug/l	< 2	< 2	< 2	< 2	< 2	< 2
Bromochloromethane	DETSC 3432	4	ug/l	< 4	< 4	< 4	< 4	< 4	< 4
Chloroform	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1	< 1
1,1,1-trichloroethane	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1	< 1
1,1-dichloropropene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1	< 1
Carbon tetrachloride	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1	< 1
Benzene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1	< 1
1,2-dichloroethane	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1	< 1
Trichloroethylene	DETSC 3432*	1	ug/l	< 1	< 1	< 1	< 1	< 1	< 1
1,2-dichloropropane	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1	< 1
Dibromomethane	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1	< 1
Bromodichloromethane	DETSC 3432	4	ug/l	< 4	< 4	< 4	< 4	< 4	< 4
cis-1,3-dichloropropene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1	< 1
Toluene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1	< 1
trans-1,3-dichloropropene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1	< 1
1,1,2-trichloroethane	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1	< 1
Tetrachloroethylene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1	< 1
1,3-dichloropropane	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1	< 1
Dibromochloromethane	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1	< 1
1,2-dibromoethane	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1	< 1
Chlorobenzene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1	< 1
1,1,1,2-tetrachloroethane	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1	< 1
Ethylbenzene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1	< 1
m+p-Xylene	DETSC 3432	2	ug/l	< 2	< 2	< 2	< 2	< 2	< 2
o-Xylene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1	< 1
Styrene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1	< 1
Bromoform	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1	< 1
Isopropylbenzene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1	< 1
1,1,2,2-tetrachloroethane	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1	< 1
Bromobenzene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1	< 1
1,2,3-trichloropropane	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1	< 1



## Summary of Chemical Analysis

### Leachate Samples

Our Ref 17-04518

Client Ref 5902B.04

Contract Title GENE METALS

Lab No	1200325	1200326	1200327	1200328	1200329	1200330
Sample ID	TP212	TP204	TP202	TP205	TP206	TP207
Depth	0.30	0.30	0.05	0.30	0.10	1.30
Other ID						
Sample Type	LEACHATE	LEACHATE	LEACHATE	LEACHATE	LEACHATE	LEACHATE
Sampling Date	03/07/17	03/07/17	03/07/17	03/07/17	03/07/17	03/07/17
Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units						
n-propylbenzene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1	< 1
2-chlorotoluene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1	< 1
1,3,5-trimethylbenzene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1	< 1
4-chlorotoluene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1	< 1
Tert-butylbenzene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1	< 1
1,2,4-trimethylbenzene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1	< 1
sec-butylbenzene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1	< 1
p-isopropyltoluene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1	< 1
1,3-dichlorobenzene	DETSC 3432	2	ug/l	< 2	< 2	< 2	< 2	< 2	< 2
1,4-dichlorobenzene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1	< 1
n-butylbenzene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1	< 1
1,2-dichlorobenzene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1	< 1
1,2-dibromo-3-chloropropane	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1	< 1
1,2,4-trichlorobenzene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1	< 1
Hexachlorobutadiene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1	< 1
1,2,3-trichlorobenzene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1	< 1
MTBE	DETSC 3432*	1	ug/l	< 1	< 1	< 1	< 1	< 1	< 1

SVOCs									
Phenol	DETS 071*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aniline	DETS 071*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
2-Chlorophenol	DETS 071*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Benzyl Alcohol	DETS 071*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
2-Methylphenol	DETS 071*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Bis(2-chloroisopropyl)ether	DETS 071*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
3&4-Methylphenol	DETS 071*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Bis(2-chloroethoxy)methane	DETS 071*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
2,4-Dimethylphenol	DETS 071*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
2,4-Dichlorophenol	DETS 071*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,2,4-Trichlorobenzene	DETS 071*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
4-Chloro-3-methylphenol	DETS 071*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
2-Methylnaphthalene	DETS 071*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Hexachlorocyclopentadiene	DETS 071*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
2,4,6-Trichlorophenol	DETS 071*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
2,4,5-Trichlorophenol	DETS 071*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
2-Chloronaphthalene	DETS 071*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
2-Nitroaniline	DETS 071*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
2,4-Dinitrotoluene	DETS 071*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
3-Nitroaniline	DETS 071*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
4-Nitrophenol	DETS 071*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Dibenzofuran	DETS 071*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
2,6-Dinitrotoluene	DETS 071*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
2,3,4,6-Tetrachlorophenol	DETS 071*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0

## Summary of Chemical Analysis

### Leachate Samples

Our Ref 17-04518

Client Ref 5902B.04

Contract Title GENE METALS

Lab No	1200325	1200326	1200327	1200328	1200329	1200330
Sample ID	TP212	TP204	TP202	TP205	TP206	TP207
Depth	0.30	0.30	0.05	0.30	0.10	1.30
Other ID						
Sample Type	LEACHATE	LEACHATE	LEACHATE	LEACHATE	LEACHATE	LEACHATE
Sampling Date	03/07/17	03/07/17	03/07/17	03/07/17	03/07/17	03/07/17
Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units						
Diethylphthalate	DETS 071*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
4-Chlorophenylphenylether	DETS 071*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
4-Nitroaniline	DETS 071*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Diphenylamine	DETS 071*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
4-Bromophenylphenylether	DETS 071*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Hexachlorobenzene	DETS 071*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Bis(2-ethylhexyl)ester	DETS 071*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Pentachlorophenol	DETS 071*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Di-n-butylphthalate	DETS 071*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Butylbenzylphthalate	DETS 071*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Bis(2-ethylhexyl)phthalate	DETS 071*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Di-n-octylphthalate	DETS 071*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,4-Dinitrobenzene	DETS 071*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Dimethylphthalate	DETS 071*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1,3-Dinitrobenzene	DETS 071*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
2,3,5,6-Tetrachlorophenol	DETS 071*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Azobenzene	DETS 071*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Carbazole	DETS 071*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
1-Methylnaphthalene	DETS 071*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0

## Summary of Chemical Analysis

### Leachate Samples

Our Ref 17-04518

Client Ref 5902B.04

Contract Title GENE METALS

Lab No	1200331	1200332
Sample ID	TP208	TP210
Depth	0.40	0.85
Other ID		
Sample Type	LEACHATE	LEACHATE
Sampling Date	03/07/17	03/07/17
Sampling Time	n/s	n/s

Test	Method	LOD	Units		
<b>Preparation</b>					
Leachate 10:1	DETS 036*			Y	Y
<b>Metals</b>					
Arsenic, Dissolved	DETSC 2306	0.16	ug/l	0.51	0.24
Barium, Dissolved	DETSC 2306	0.26	ug/l	18	9.7
Beryllium, Dissolved	DETSC 2306*	0.1	ug/l	< 0.1	< 0.1
Boron	DETSC 2123	100	ug/l	< 100	< 100
Cadmium, Dissolved	DETSC 2306	0.03	ug/l	0.04	0.05
Chromium, Dissolved	DETSC 2306	0.25	ug/l	< 0.25	< 0.25
Copper, Dissolved	DETSC 2306	0.4	ug/l	1.2	1.0
Iron, Dissolved	DETSC 2306	5.5	ug/l	40	96
Lead, Dissolved	DETSC 2306	0.09	ug/l	0.28	0.48
Mercury, Dissolved	DETSC 2306	0.01	ug/l	< 0.01	< 0.01
Nickel, Dissolved	DETSC 2306	0.5	ug/l	< 0.5	0.8
Selenium, Dissolved	DETSC 2306	0.25	ug/l	0.74	0.39
Vanadium, Dissolved	DETSC 2306	0.6	ug/l	< 0.6	< 0.6
Zinc, Dissolved	DETSC 2306	1.3	ug/l	3.4	4.6
<b>Inorganics</b>					
pH	DETSC 2008			7.4	7.5
Cyanide, Total	DETSC 2130	40	ug/l	< 40	< 40
Phenol - Monohydric	DETSC 2131	0.5	ug/l	< 0.5	1.1
<b>Petroleum Hydrocarbons</b>					
Aliphatic C5-C6	DETSC 3322	0.1	ug/l	< 0.1	< 0.1
Aliphatic C6-C8	DETSC 3322	0.1	ug/l	< 0.1	< 0.1
Aliphatic C8-C10	DETSC 3322	0.1	ug/l	< 0.1	0.9
Aliphatic C10-C12	DETSC 3072*	1	ug/l	< 1.0	< 1.0
Aliphatic C12-C16	DETSC 3072*	1	ug/l	< 1.0	< 1.0
Aliphatic C16-C21	DETSC 3072*	1	ug/l	< 1.0	< 1.0
Aliphatic C21-C35	DETSC 3072*	1	ug/l	< 1.0	< 1.0
Aliphatic C5-C35	DETSC 3072*	10	ug/l	< 10	< 10
Aromatic C5-C7	DETSC 3322	0.1	ug/l	< 0.1	< 0.1
Aromatic C7-C8	DETSC 3322	0.1	ug/l	< 0.1	< 0.1
Aromatic C8-C10	DETSC 3322	0.1	ug/l	< 0.1	< 0.1
Aromatic C10-C12	DETSC 3072*	1	ug/l	< 1.0	< 1.0
Aromatic C12-C16	DETSC 3072*	1	ug/l	< 1.0	< 1.0
Aromatic C16-C21	DETSC 3072*	1	ug/l	< 1.0	< 1.0
Aromatic C21-C35	DETSC 3072*	1	ug/l	< 1.0	< 1.0
Aromatic C5-C35	DETSC 3072*	10	ug/l	< 10	< 10
TPH Ali/Aro Total	DETSC 3072*	10	ug/l	< 10	< 10
Benzene	DETSC 3322	1	ug/l	< 1.0	< 1.0
Toluene	DETSC 3322	1	ug/l	< 1.0	< 1.0
Ethylbenzene	DETSC 3322	1	ug/l	< 1.0	< 1.0

## Summary of Chemical Analysis

### Leachate Samples

Our Ref 17-04518

Client Ref 5902B.04

Contract Title GENE METALS

Lab No	1200331	1200332
Sample ID	TP208	TP210
Depth	0.40	0.85
Other ID		
Sample Type	LEACHATE	LEACHATE
Sampling Date	03/07/17	03/07/17
Sampling Time	n/s	n/s

Test	Method	LOD	Units		
Xylene	DETSC 3322	1	ug/l	< 1.0	< 1.0
<b>PAHs</b>					
Acenaphthene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01
Acenaphthylene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01
Anthracene	DETSC 3304	0.01	ug/l	0.01	< 0.01
Benzo(a)anthracene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01
Benzo(a)pyrene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01
Benzo(b)fluoranthene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01
Benzo(g,h,i)perylene	DETSC 3304*	0.01	ug/l	0.01	< 0.01
Benzo(k)fluoranthene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01
Chrysene	DETSC 3304	0.01	ug/l	0.01	< 0.01
Dibenzo(a,h)anthracene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01
Fluoranthene	DETSC 3304	0.01	ug/l	0.02	< 0.01
Fluorene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01
Indeno(1,2,3-c,d)pyrene	DETSC 3304*	0.01	ug/l	0.02	< 0.01
Naphthalene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01
Phenanthrene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01
Pyrene	DETSC 3304	0.01	ug/l	0.01	< 0.01
PAH Total	DETSC 3304	0.04	ug/l	0.10	0.04
<b>PCBs</b>					
PCB 28 + PCB 31	DETSC 3402	0.3	ug/l	< 0.3	< 0.3
PCB 52	DETSC 3402	0.2	ug/l	< 0.2	< 0.2
PCB 101	DETSC 3402	0.3	ug/l	< 0.3	< 0.3
PCB 118 + PCB 123	DETSC 3402	0.6	ug/l	< 0.6	< 0.6
PCB 138	DETSC 3402	0.2	ug/l	< 0.2	< 0.2
PCB 153	DETSC 3402	0.2	ug/l	< 0.2	< 0.2
PCB 180	DETSC 3402	0.2	ug/l	< 0.2	< 0.2
PCB 7 Total	DETSC 3402	1	ug/l	< 1.0	< 1.0

# Summary of Chemical Analysis

## Leachate Samples

Our Ref 17-04518  
 Client Ref 5902B.04  
 Contract Title GENE METALS

Lab No	1200331	1200332
Sample ID	TP208	TP210
Depth	0.40	0.85
Other ID		
Sample Type	LEACHATE	LEACHATE
Sampling Date	03/07/17	03/07/17
Sampling Time	n/s	n/s

Test	Method	LOD	Units		
<b>VOCs</b>					
Dichlorodifluoromethane	DETSC 3432	1	ug/l	< 1	< 1
Chloromethane	DETSC 3432	1	ug/l	< 1	< 1
Vinyl Chloride	DETSC 3432	1	ug/l	< 1	< 1
Bromomethane	DETSC 3432	1	ug/l	< 1	< 1
Chloroethane	DETSC 3432	1	ug/l	< 1	< 1
Trichlorofluoromethane	DETSC 3432*	1	ug/l	< 1	< 1
1,1-dichloroethylene	DETSC 3432	1	ug/l	< 1	< 1
Trans-1,2-dichloroethylene	DETSC 3432	1	ug/l	< 1	< 1
1,1-dichloroethane	DETSC 3432	1	ug/l	< 1	< 1
Cis-1,2-dichloroethylene	DETSC 3432	1	ug/l	< 1	< 1
2,2-dichloropropane	DETSC 3432	2	ug/l	< 2	< 2
Bromochloromethane	DETSC 3432	4	ug/l	< 4	< 4
Chloroform	DETSC 3432	1	ug/l	< 1	< 1
1,1,1-trichloroethane	DETSC 3432	1	ug/l	< 1	< 1
1,1-dichloropropene	DETSC 3432	1	ug/l	< 1	< 1
Carbon tetrachloride	DETSC 3432	1	ug/l	< 1	< 1
Benzene	DETSC 3432	1	ug/l	< 1	< 1
1,2-dichloroethane	DETSC 3432	1	ug/l	< 1	< 1
Trichloroethylene	DETSC 3432*	1	ug/l	< 1	< 1
1,2-dichloropropane	DETSC 3432	1	ug/l	< 1	< 1
Dibromomethane	DETSC 3432	1	ug/l	< 1	< 1
Bromodichloromethane	DETSC 3432	4	ug/l	< 4	< 4
cis-1,3-dichloropropene	DETSC 3432	1	ug/l	< 1	< 1
Toluene	DETSC 3432	1	ug/l	< 1	< 1
trans-1,3-dichloropropene	DETSC 3432	1	ug/l	< 1	< 1
1,1,2-trichloroethane	DETSC 3432	1	ug/l	< 1	< 1
Tetrachloroethylene	DETSC 3432	1	ug/l	< 1	< 1
1,3-dichloropropane	DETSC 3432	1	ug/l	< 1	< 1
Dibromochloromethane	DETSC 3432	1	ug/l	< 1	< 1
1,2-dibromoethane	DETSC 3432	1	ug/l	< 1	< 1
Chlorobenzene	DETSC 3432	1	ug/l	< 1	< 1
1,1,1,2-tetrachloroethane	DETSC 3432	1	ug/l	< 1	< 1
Ethylbenzene	DETSC 3432	1	ug/l	< 1	< 1
m+p-Xylene	DETSC 3432	2	ug/l	< 2	< 2
o-Xylene	DETSC 3432	1	ug/l	< 1	< 1
Styrene	DETSC 3432	1	ug/l	< 1	< 1
Bromoform	DETSC 3432	1	ug/l	< 1	< 1
Isopropylbenzene	DETSC 3432	1	ug/l	< 1	< 1
1,1,2,2-tetrachloroethane	DETSC 3432	1	ug/l	< 1	< 1
Bromobenzene	DETSC 3432	1	ug/l	< 1	< 1
1,2,3-trichloropropane	DETSC 3432	1	ug/l	< 1	< 1

## Summary of Chemical Analysis

### Leachate Samples

Our Ref 17-04518

Client Ref 5902B.04

Contract Title GENE METALS

Lab No	1200331	1200332
Sample ID	TP208	TP210
Depth	0.40	0.85
Other ID		
Sample Type	LEACHATE	LEACHATE
Sampling Date	03/07/17	03/07/17
Sampling Time	n/s	n/s

Test	Method	LOD	Units		
n-propylbenzene	DETSC 3432	1	ug/l	< 1	< 1
2-chlorotoluene	DETSC 3432	1	ug/l	< 1	< 1
1,3,5-trimethylbenzene	DETSC 3432	1	ug/l	< 1	< 1
4-chlorotoluene	DETSC 3432	1	ug/l	< 1	< 1
Tert-butylbenzene	DETSC 3432	1	ug/l	< 1	< 1
1,2,4-trimethylbenzene	DETSC 3432	1	ug/l	< 1	< 1
sec-butylbenzene	DETSC 3432	1	ug/l	< 1	< 1
p-isopropyltoluene	DETSC 3432	1	ug/l	< 1	< 1
1,3-dichlorobenzene	DETSC 3432	2	ug/l	< 2	< 2
1,4-dichlorobenzene	DETSC 3432	1	ug/l	< 1	< 1
n-butylbenzene	DETSC 3432	1	ug/l	< 1	< 1
1,2-dichlorobenzene	DETSC 3432	1	ug/l	< 1	< 1
1,2-dibromo-3-chloropropane	DETSC 3432	1	ug/l	< 1	< 1
1,2,4-trichlorobenzene	DETSC 3432	1	ug/l	< 1	< 1
Hexachlorobutadiene	DETSC 3432	1	ug/l	< 1	< 1
1,2,3-trichlorobenzene	DETSC 3432	1	ug/l	< 1	< 1
MTBE	DETSC 3432*	1	ug/l	< 1	< 1
<b>SVOCs</b>					
Phenol	DETS 071*	1	ug/l	< 1.0	< 1.0
Aniline	DETS 071*	1	ug/l	< 1.0	< 1.0
2-Chlorophenol	DETS 071*	1	ug/l	< 1.0	< 1.0
Benzyl Alcohol	DETS 071*	1	ug/l	< 1.0	< 1.0
2-Methylphenol	DETS 071*	1	ug/l	< 1.0	< 1.0
Bis(2-chloroisopropyl)ether	DETS 071*	1	ug/l	< 1.0	< 1.0
3&4-Methylphenol	DETS 071*	1	ug/l	< 1.0	< 1.0
Bis(2-chloroethoxy)methane	DETS 071*	1	ug/l	< 1.0	< 1.0
2,4-Dimethylphenol	DETS 071*	1	ug/l	< 1.0	< 1.0
2,4-Dichlorophenol	DETS 071*	1	ug/l	< 1.0	< 1.0
1,2,4-Trichlorobenzene	DETS 071*	1	ug/l	< 1.0	< 1.0
4-Chloro-3-methylphenol	DETS 071*	1	ug/l	< 1.0	< 1.0
2-Methylnaphthalene	DETS 071*	1	ug/l	< 1.0	< 1.0
Hexachlorocyclopentadiene	DETS 071*	1	ug/l	< 1.0	< 1.0
2,4,6-Trichlorophenol	DETS 071*	1	ug/l	< 1.0	< 1.0
2,4,5-Trichlorophenol	DETS 071*	1	ug/l	< 1.0	< 1.0
2-Chloronaphthalene	DETS 071*	1	ug/l	< 1.0	< 1.0
2-Nitroaniline	DETS 071*	1	ug/l	< 1.0	< 1.0
2,4-Dinitrotoluene	DETS 071*	1	ug/l	< 1.0	< 1.0
3-Nitroaniline	DETS 071*	1	ug/l	< 1.0	< 1.0
4-Nitrophenol	DETS 071*	1	ug/l	< 1.0	< 1.0
Dibenzofuran	DETS 071*	1	ug/l	< 1.0	< 1.0
2,6-Dinitrotoluene	DETS 071*	1	ug/l	< 1.0	< 1.0
2,3,4,6-Tetrachlorophenol	DETS 071*	1	ug/l	< 1.0	< 1.0

## Summary of Chemical Analysis

### Leachate Samples

Our Ref 17-04518

Client Ref 5902B.04

Contract Title GENE METALS

Lab No	1200331	1200332
Sample ID	TP208	TP210
Depth	0.40	0.85
Other ID		
Sample Type	LEACHATE	LEACHATE
Sampling Date	03/07/17	03/07/17
Sampling Time	n/s	n/s

Test	Method	LOD	Units		
Diethylphthalate	DETS 071*	1	ug/l	< 1.0	< 1.0
4-Chlorophenylphenylether	DETS 071*	1	ug/l	< 1.0	< 1.0
4-Nitroaniline	DETS 071*	1	ug/l	< 1.0	< 1.0
Diphenylamine	DETS 071*	1	ug/l	< 1.0	< 1.0
4-Bromophenylphenylether	DETS 071*	1	ug/l	< 1.0	< 1.0
Hexachlorobenzene	DETS 071*	1	ug/l	< 1.0	< 1.0
Bis(2-ethylhexyl)ester	DETS 071*	1	ug/l	< 1.0	< 1.0
Pentachlorophenol	DETS 071*	1	ug/l	< 1.0	< 1.0
Di-n-butylphthalate	DETS 071*	1	ug/l	< 1.0	< 1.0
Butylbenzylphthalate	DETS 071*	1	ug/l	< 1.0	< 1.0
Bis(2-ethylhexyl)phthalate	DETS 071*	1	ug/l	< 1.0	< 1.0
Di-n-octylphthalate	DETS 071*	1	ug/l	< 1.0	< 1.0
1,4-Dinitrobenzene	DETS 071*	1	ug/l	< 1.0	< 1.0
Dimethylphthalate	DETS 071*	1	ug/l	< 1.0	< 1.0
1,3-Dinitrobenzene	DETS 071*	1	ug/l	< 1.0	< 1.0
2,3,5,6-Tetrachlorophenol	DETS 071*	1	ug/l	< 1.0	< 1.0
Azobenzene	DETS 071*	1	ug/l	< 1.0	< 1.0
Carbazole	DETS 071*	1	ug/l	< 1.0	< 1.0
1-Methylnaphthalene	DETS 071*	1	ug/l	< 1.0	< 1.0

## Information in Support of the Analytical Results

Our Ref 17-04518  
 Client Ref 5902B.04  
 Contract GENE METALS

### Containers Received & Deviating Samples

Lab No	Sample ID	Date Sampled	Containers Received	Holding time exceeded for tests	Inappropriate container for tests
1200325	TP212 0.30 LEACHATE	03/07/17	GJ 250ml, PT 1L		
1200326	TP204 0.30 LEACHATE	03/07/17	GJ 250ml, PT 1L		
1200327	TP202 0.05 LEACHATE	03/07/17	GJ 250ml, PT 1L		
1200328	TP205 0.30 LEACHATE	03/07/17	GJ 250ml, PT 1L		
1200329	TP206 0.10 LEACHATE	03/07/17	GJ 250ml, PT 1L		
1200330	TP207 1.30 LEACHATE	03/07/17	GJ 250ml, PT 1L		
1200331	TP208 0.40 LEACHATE	03/07/17	GJ 250ml, PT 1L		
1200332	TP210 0.85 LEACHATE	03/07/17	GJ 250ml, PT 1L		

Key: G-Glass P-Plastic J-Jar T-Tub

DETS cannot be held responsible for the integrity of samples received whereby the laboratory did not undertake the sampling. In this instance samples received may be deviating. Deviating Sample criteria are based on British and International standards and laboratory trials in conjunction with the UKAS note 'Guidance on Deviating Samples'. All samples received are listed above. However, those samples that have additional comments in relation to hold time, inappropriate containers etc are deviating due to the reasons stated. This means that the analysis is accredited where applicable, but results may be compromised due to sample deviations. If no sampled date (soils) or date+time (waters) has been supplied then samples are deviating. However, if you are able to supply a sampled date (and time for waters) this will prevent samples being reported as deviating where specific hold times are not exceeded and where the container supplied is suitable.

### Disposal

From the issue date of this test certificate, samples will be held for the following times prior to disposal :-

Soils - 1 month, Liquids - 2 weeks, Asbestos (test portion) - 6 months

**APPENDIX E**

**GEO-ENVIRONMENTAL LABORATORY TEST  
RESULTS - GROUNDWATER & SURFACE WATER**



# DETS

## Certificate of Analysis

*Certificate Number* 17-99130

15-May-17

*Client* Earth Science Partnership  
33 Cardiff Road  
Taffs Well  
Cardiff  
CF15 7RB

*Our Reference* 17-99130

*Client Reference* 5902b.4

*Order No* (not supplied)

*Contract Title* Gene Metals

*Description* 7 Water samples.

*Date Received* 09-May-17

*Date Started* 09-May-17

*Date Completed* 15-May-17

*Test Procedures* Identified by prefix DETSn (details on request).

*Notes* Opinions and interpretations are outside the scope of UKAS accreditation. This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. Observations and interpretations are outside the scope of ISO 17025. This certificate shall not be reproduced except in full, without the prior written approval of the laboratory.

*Approved By*



Adam Fenwick  
Contracts Manager



## Summary of Chemical Analysis

### Water Samples

Our Ref 17-99130

Client Ref 5902b.4

Contract Title Gene Metals

Lab No	1169896	1169897	1169898	1169899	1169900	1169901	1169902
Sample ID	BH201	BH202	BH203	BH204	BH205	Upstream	Downstream
Depth							
Other ID							
Sample Type	WATER						
Sampling Date	04/05/17	04/05/17	04/05/17	04/05/17	04/05/17	04/05/17	04/05/17
Sampling Time	n/s						

Test	Method	LOD	Units	1169896	1169897	1169898	1169899	1169900	1169901	1169902
<b>Metals</b>										
Arsenic, Dissolved	DETS 2306	0.16	ug/l	0.63	1.4	2.8	0.39	0.31	1.5	0.30
Barium, Dissolved	DETS 2306	0.26	ug/l	100	150	170	21	22	4.9	15
Beryllium, Dissolved	DETS 2306*	0.1	ug/l	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Boron	DETS 2123	100	ug/l	< 100	< 100	< 100	< 100	< 100	< 100	< 100
Cadmium, Dissolved	DETS 2306	0.03	ug/l	< 0.03	< 0.03	0.05	0.03	0.28	0.06	< 0.03
Chromium, Dissolved	DETS 2306	0.25	ug/l	2.9	0.55	0.52	1.5	0.93	5.1	6.1
Copper, Dissolved	DETS 2306	0.4	ug/l	1.1	0.7	0.5	1.3	3.4	2.7	2.0
Iron, Dissolved	DETS 2306	5.5	ug/l	140	29	54	200	91	1900	150
Lead, Dissolved	DETS 2306	0.09	ug/l	0.19	< 0.09	< 0.09	0.23	< 0.09	1.9	0.43
Mercury, Dissolved	DETS 2306	0.01	ug/l	< 0.01	< 0.01	< 0.01	< 0.01	0.01	< 0.01	< 0.01
Nickel, Dissolved	DETS 2306	0.5	ug/l	2.7	1.0	6.0	3.1	2.8	1.3	0.6
Selenium, Dissolved	DETS 2306	0.25	ug/l	1.0	0.86	0.68	0.58	0.58	0.59	0.51
Vanadium, Dissolved	DETS 2306	0.6	ug/l	1.4	0.9	1.0	0.8	0.8	1.1	0.8
Zinc, Dissolved	DETS 2306	1.3	ug/l	6.0	6.8	2.8	13	23	7.0	7.3
<b>Inorganics</b>										
pH	DETS 2008			7.1	7.4	7.3	6.9	6.7	6.5	7.1
Cyanide, Total	DETS 2130	40	ug/l	< 40	< 40	< 40	< 40	< 40	< 40	< 40
Phenol - Monohydric	DETS 2131	0.5	ug/l	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Hardness	DETS 2303	0.1	mg/l						7.98	
<b>Petroleum Hydrocarbons</b>										
Aliphatic C5-C6	DETS 3322	0.1	ug/l	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Aliphatic C6-C8	DETS 3322	0.1	ug/l	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Aliphatic C8-C10	DETS 3322	0.1	ug/l	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Aliphatic C10-C12	DETS 3072*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic C12-C16	DETS 3072*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic C16-C21	DETS 3072*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	9.9
Aliphatic C21-C35	DETS 3072*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	15
Aliphatic C5-C35	DETS 3072*	10	ug/l	< 10	< 10	< 10	< 10	< 10	< 10	26
Aromatic C5-C7	DETS 3322	0.1	ug/l	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Aromatic C7-C8	DETS 3322	0.1	ug/l	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Aromatic C8-C10	DETS 3322	0.1	ug/l	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Aromatic C10-C12	DETS 3072*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic C12-C16	DETS 3072*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic C16-C21	DETS 3072*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic C21-C35	DETS 3072*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic C5-C35	DETS 3072*	10	ug/l	< 10	< 10	< 10	< 10	< 10	< 10	< 10
TPH Ali/Aro Total	DETS 3072*	10	ug/l	< 10	< 10	< 10	< 10	< 10	< 10	26
Benzene	DETS 3322	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Toluene	DETS 3322	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Ethylbenzene	DETS 3322	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0



# Summary of Chemical Analysis

## Water Samples

Our Ref 17-99130

Client Ref 5902b.4

Contract Title Gene Metals

Lab No	1169896	1169897	1169898	1169899	1169900	1169901	1169902
Sample ID	BH201	BH202	BH203	BH204	BH205	Upstream	Downstream
Depth							
Other ID							
Sample Type	WATER						
Sampling Date	04/05/17	04/05/17	04/05/17	04/05/17	04/05/17	04/05/17	04/05/17
Sampling Time	n/s						

Test	Method	LOD	Units							
Xylene	DETS 3322	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
<b>PAHs</b>										
Acenaphthene	DETS 3304	0.01	ug/l	< 0.01	< 0.01	0.34	< 0.01	< 0.01	< 0.01	< 0.01
Acenaphthylene	DETS 3304	0.01	ug/l	< 0.01	< 0.01	0.16	< 0.01	< 0.01	< 0.01	< 0.01
Anthracene	DETS 3304	0.01	ug/l	< 0.01	< 0.01	0.23	< 0.01	0.03	< 0.01	< 0.01
Benzo(a)anthracene	DETS 3304	0.01	ug/l	< 0.01	< 0.01	0.13	< 0.01	0.03	< 0.01	< 0.01
Benzo(a)pyrene	DETS 3304	0.01	ug/l	< 0.01	< 0.01	0.20	< 0.01	< 0.01	< 0.01	< 0.01
Benzo(b)fluoranthene	DETS 3304	0.01	ug/l	< 0.01	< 0.01	0.19	< 0.01	< 0.01	< 0.01	< 0.01
Benzo(g,h,i)perylene	DETS 3304*	0.01	ug/l	< 0.01	< 0.01	0.22	< 0.01	< 0.01	< 0.01	< 0.01
Benzo(k)fluoranthene	DETS 3304	0.01	ug/l	< 0.01	< 0.01	0.07	< 0.01	< 0.01	< 0.01	< 0.01
Chrysene	DETS 3304	0.01	ug/l	< 0.01	< 0.01	0.17	< 0.01	0.05	< 0.01	< 0.01
Dibenzo(a,h)anthracene	DETS 3304	0.01	ug/l	< 0.01	< 0.01	0.03	< 0.01	< 0.01	< 0.01	< 0.01
Fluoranthene	DETS 3304	0.01	ug/l	< 0.01	< 0.01	0.47	< 0.01	0.27	< 0.01	< 0.01
Fluorene	DETS 3304	0.01	ug/l	< 0.01	< 0.01	0.27	< 0.01	< 0.01	< 0.01	< 0.01
Indeno(1,2,3-c,d)pyrene	DETS 3304*	0.01	ug/l	< 0.01	< 0.01	0.18	< 0.01	< 0.01	< 0.01	< 0.01
Naphthalene	DETS 3304	0.01	ug/l	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Phenanthrene	DETS 3304	0.01	ug/l	< 0.01	< 0.01	0.90	< 0.01	0.18	< 0.01	< 0.01
Pyrene	DETS 3304	0.01	ug/l	< 0.01	< 0.01	0.33	< 0.01	0.50	< 0.01	< 0.01
PAH Total	DETS 3304	0.04	ug/l	< 0.04	< 0.04	3.9	< 0.04	1.1	< 0.04	< 0.04
<b>VOCs</b>										
Dichlorodifluoromethane	DETS 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Chloromethane	DETS 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Vinyl Chloride	DETS 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Bromomethane	DETS 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Chloroethane	DETS 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Trichlorofluoromethane	DETS 3432*	1	ug/l	< 1	< 1	< 1	< 1	< 1	< 1	< 1
1,1-dichloroethylene	DETS 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Trans-1,2-dichloroethylene	DETS 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1	< 1	< 1
1,1-dichloroethane	DETS 3432	1	ug/l	< 1	< 1	< 1	6	< 1	< 1	< 1
Cis-1,2-dichloroethylene	DETS 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1	< 1	< 1
2,2-dichloropropane	DETS 3432	2	ug/l	< 2	< 2	< 2	< 2	< 2	< 2	< 2
Bromochloromethane	DETS 3432	4	ug/l	< 4	< 4	< 4	< 4	< 4	< 4	< 4
Chloroform	DETS 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1	< 1	< 1
1,1,1-trichloroethane	DETS 3432	1	ug/l	< 1	< 1	< 1	13	< 1	< 1	< 1
1,1-dichloropropene	DETS 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Carbon tetrachloride	DETS 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Benzene	DETS 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1	< 1	< 1
1,2-dichloroethane	DETS 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Trichloroethylene	DETS 3432*	1	ug/l	< 1	< 1	< 1	2	< 1	< 1	< 1
1,2-dichloropropane	DETS 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Dibromomethane	DETS 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1	< 1	< 1

## Summary of Chemical Analysis

### Water Samples

Our Ref 17-99130

Client Ref 5902b.4

Contract Title Gene Metals

Lab No	1169896	1169897	1169898	1169899	1169900	1169901	1169902
Sample ID	BH201	BH202	BH203	BH204	BH205	Upstream	Downstream
Depth							
Other ID							
Sample Type	WATER						
Sampling Date	04/05/17	04/05/17	04/05/17	04/05/17	04/05/17	04/05/17	04/05/17
Sampling Time	n/s						

Test	Method	LOD	Units							
Bromodichloromethane	DETSC 3432	4	ug/l	< 4	< 4	< 4	< 4	< 4	< 4	< 4
cis-1,3-dichloropropene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Toluene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1	< 1	< 1
trans-1,3-dichloropropene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1	< 1	< 1
1,1,2-trichloroethane	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Tetrachloroethylene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1	< 1	< 1
1,3-dichloropropane	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Dibromochloromethane	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1	< 1	< 1
1,2-dibromoethane	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Chlorobenzene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1	< 1	< 1
1,1,1,2-tetrachloroethane	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Ethylbenzene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1	< 1	< 1
m+p-Xylene	DETSC 3432	2	ug/l	< 2	< 2	< 2	< 2	< 2	< 2	< 2
o-Xylene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Styrene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Bromoform	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Isopropylbenzene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1	< 1	< 1
1,1,2,2-tetrachloroethane	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Bromobenzene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1	< 1	< 1
1,2,3-trichloropropane	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1	< 1	< 1
n-propylbenzene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1	< 1	< 1
2-chlorotoluene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1	< 1	< 1
1,3,5-trimethylbenzene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1	< 1	< 1
4-chlorotoluene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Tert-butylbenzene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1	< 1	< 1
1,2,4-trimethylbenzene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1	< 1	< 1
sec-butylbenzene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1	< 1	< 1
p-isopropyltoluene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1	< 1	< 1
1,3-dichlorobenzene	DETSC 3432	2	ug/l	< 2	< 2	< 2	< 2	< 2	< 2	< 2
1,4-dichlorobenzene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1	< 1	< 1
n-butylbenzene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1	< 1	< 1
1,2-dichlorobenzene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1	< 1	< 1
1,2-dibromo-3-chloropropane	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1	< 1	< 1
1,2,4-trichlorobenzene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Hexachlorobutadiene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1	< 1	< 1
1,2,3-trichlorobenzene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1	< 1	< 1
MTBE	DETSC 3432*	1	ug/l	< 1	< 1	< 1	< 1	< 1	< 1	< 1

## Information in Support of the Analytical Results

Our Ref 17-99130

Client Ref 5902b.4

Contract Gene Metals

### Containers Received & Deviating Samples

Lab No	Sample ID	Date Sampled	Containers Received	Holding time exceeded for tests	Inappropriate container for tests
1169896	BH201 WATER	04/05/17	GB 1L x2, GV		
1169897	BH202 WATER	04/05/17	GB 1L x2, GV		
1169898	BH203 WATER	04/05/17	GB 1L x2, GV		
1169899	BH204 WATER	04/05/17	GB 1L x2, GV		
1169900	BH205 WATER	04/05/17	GB 1L x2, GV		
1169901	Upstream WATER	04/05/17	GB 1L x2		VOC
1169902	Downstream WATER	04/05/17	GB 1L x2		VOC

Key: G-Glass B-Bottle V-Vial

DETS cannot be held responsible for the integrity of samples received whereby the laboratory did not undertake the sampling. In this instance samples received may be deviating. Deviating Sample criteria are based on British and International standards and laboratory trials in conjunction with the UKAS note 'Guidance on Deviating Samples'. All samples received are listed above. However, those samples that have additional comments in relation to hold time, inappropriate containers etc are deviating due to the reasons stated. This means that the analysis is accredited where applicable, but results may be compromised due to sample deviations. If no sampled date (soils) or date+time (waters) has been supplied then samples are deviating. However, if you are able to supply a sampled date (and time for waters) this will prevent samples being reported as deviating where specific hold times are not exceeded and where the container supplied is suitable.

### Disposal

From the issue date of this test certificate, samples will be held for the following times prior to disposal :-

Soils - 1 month, Liquids - 2 weeks, Asbestos (test portion) - 6 months



# DETS

## Certificate of Analysis

*Certificate Number* 17-01624

09-Jun-17

*Client* Earth Science Partnership  
33 Cardiff Road  
Taffs Well  
Cardiff  
CF15 7RB

*Our Reference* 17-01624

*Client Reference* 5902b.4

*Order No* (not supplied)

*Contract Title* Gene Metals

*Description* 5 Water samples.

*Date Received* 05-Jun-17

*Date Started* 05-Jun-17

*Date Completed* 09-Jun-17

*Test Procedures* Identified by prefix DETSn (details on request).

*Notes* Opinions and interpretations are outside the laboratory's scope of ISO 10725 accreditation. This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced except in full, without the prior written approval of the laboratory.

*Approved By*



Adam Fenwick  
Contracts Manager



## Summary of Chemical Analysis

### Water Samples

Our Ref 17-01624

Client Ref 5902b.4

Contract Title Gene Metals

Lab No	1183343	1183344	1183345	1183346	1183347
Sample ID	BH201	BH202	BH203	BH204	BH205
Depth					
Other ID					
Sample Type	WATER	WATER	WATER	WATER	WATER
Sampling Date	04/05/17	04/05/17	04/05/17	04/05/17	04/05/17
Sampling Time	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units					
<b>Metals</b>								
Arsenic, Dissolved	DETSC 2306	0.16	ug/l	2.1	1.6	3.4	1.4	0.61
Barium, Dissolved	DETSC 2306	0.26	ug/l	150	190	190	61	38
Beryllium, Dissolved	DETSC 2306*	0.1	ug/l	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Boron	DETSC 2123	100	ug/l	< 100	< 100	< 100	< 100	< 100
Cadmium, Dissolved	DETSC 2306	0.03	ug/l	< 0.03	< 0.03	0.10	0.05	0.11
Chromium, Dissolved	DETSC 2306	0.25	ug/l	0.90	1.1	0.86	6.0	0.87
Copper, Dissolved	DETSC 2306	0.4	ug/l	0.9	0.6	< 0.4	3.5	0.8
Iron, Dissolved	DETSC 2306	5.5	ug/l	28	45	100	170	370
Lead, Dissolved	DETSC 2306	0.09	ug/l	< 0.09	< 0.09	< 0.09	0.57	< 0.09
Mercury, Dissolved	DETSC 2306	0.01	ug/l	0.02	0.02	< 0.01	0.01	< 0.01
Nickel, Dissolved	DETSC 2306	0.5	ug/l	2.9	0.8	4.7	3.6	4.2
Selenium, Dissolved	DETSC 2306	0.25	ug/l	0.31	< 0.25	< 0.25	5.9	2.5
Vanadium, Dissolved	DETSC 2306	0.6	ug/l	4.3	4.8	6.2	3.9	3.2
Zinc, Dissolved	DETSC 2306	1.3	ug/l	3.9	2.1	3.9	5.4	5.9
<b>Inorganics</b>								
pH	DETSC 2008			7.6	7.5	7.1	7.1	6.7
Cyanide, Total	DETSC 2130	40	ug/l	< 40	< 40	< 40	< 40	< 40
Phenol - Monohydric	DETSC 2131	0.5	ug/l	< 0.5	< 0.5	< 0.5	3.6	0.9
<b>Petroleum Hydrocarbons</b>								
Aliphatic C5-C6	DETSC 3322	0.1	ug/l	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Aliphatic C6-C8	DETSC 3322	0.1	ug/l	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Aliphatic C8-C10	DETSC 3322	0.1	ug/l	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Aliphatic C10-C12	DETSC 3072*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic C12-C16	DETSC 3072*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic C16-C21	DETSC 3072*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic C21-C35	DETSC 3072*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic C5-C35	DETSC 3072*	10	ug/l	< 10	< 10	< 10	< 10	< 10
Aromatic C5-C7	DETSC 3322	0.1	ug/l	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Aromatic C7-C8	DETSC 3322	0.1	ug/l	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Aromatic C8-C10	DETSC 3322	0.1	ug/l	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Aromatic C10-C12	DETSC 3072*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic C12-C16	DETSC 3072*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic C16-C21	DETSC 3072*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic C21-C35	DETSC 3072*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic C5-C35	DETSC 3072*	10	ug/l	< 10	< 10	< 10	< 10	< 10
TPH Ali/Aro Total	DETSC 3072*	10	ug/l	< 10	< 10	< 10	< 10	< 10
Benzene	DETSC 3322	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Toluene	DETSC 3322	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Ethylbenzene	DETSC 3322	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Xylene	DETSC 3322	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0



## Summary of Chemical Analysis

### Water Samples

Our Ref 17-01624

Client Ref 5902b.4

Contract Title Gene Metals

Lab No	1183343	1183344	1183345	1183346	1183347
Sample ID	BH201	BH202	BH203	BH204	BH205
Depth					
Other ID					
Sample Type	WATER	WATER	WATER	WATER	WATER
Sampling Date	04/05/17	04/05/17	04/05/17	04/05/17	04/05/17
Sampling Time	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units					
<b>PAHs</b>								
Acenaphthene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Acenaphthylene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Anthracene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Benzo(a)anthracene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Benzo(a)pyrene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Benzo(b)fluoranthene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Benzo(g,h,i)perylene	DETSC 3304*	0.01	ug/l	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Benzo(k)fluoranthene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Chrysene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Dibenzo(a,h)anthracene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Fluoranthene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Fluorene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01	0.02	< 0.01	< 0.01
Indeno(1,2,3-c,d)pyrene	DETSC 3304*	0.01	ug/l	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Naphthalene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01	0.02	0.01	0.01
Phenanthrene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01	0.04	0.01	< 0.01
Pyrene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
PAH Total	DETSC 3304	0.04	ug/l	< 0.04	< 0.04	0.08	< 0.04	< 0.04
<b>VOCs</b>								
Dichlorodifluoromethane	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1
Chloromethane	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1
Vinyl Chloride	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1
Bromomethane	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1
Chloroethane	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1
Trichlorofluoromethane	DETSC 3432*	1	ug/l	< 1	< 1	< 1	< 1	< 1
1,1-dichloroethylene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1
Trans-1,2-dichloroethylene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1
1,1-dichloroethane	DETSC 3432	1	ug/l	< 1	< 1	< 1	4	< 1
Cis-1,2-dichloroethylene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1
2,2-dichloropropane	DETSC 3432	2	ug/l	< 2	< 2	< 2	< 2	< 2
Bromochloromethane	DETSC 3432	4	ug/l	< 4	< 4	< 4	< 4	< 4
Chloroform	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1
1,1,1-trichloroethane	DETSC 3432	1	ug/l	< 1	< 1	< 1	9	< 1
1,1-dichloropropene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1
Carbon tetrachloride	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1
Benzene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1
1,2-dichloroethane	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1
Trichloroethylene	DETSC 3432*	1	ug/l	< 1	< 1	< 1	1	< 1
1,2-dichloropropane	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1
Dibromomethane	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1
Bromodichloromethane	DETSC 3432	4	ug/l	< 4	< 4	< 4	< 4	< 4
cis-1,3-dichloropropene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1



## Summary of Chemical Analysis

### Water Samples

Our Ref 17-01624

Client Ref 5902b.4

Contract Title Gene Metals

Lab No	1183343	1183344	1183345	1183346	1183347
Sample ID	BH201	BH202	BH203	BH204	BH205
Depth					
Other ID					
Sample Type	WATER	WATER	WATER	WATER	WATER
Sampling Date	04/05/17	04/05/17	04/05/17	04/05/17	04/05/17
Sampling Time	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units					
Toluene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1
trans-1,3-dichloropropene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1
1,1,2-trichloroethane	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1
Tetrachloroethylene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1
1,3-dichloropropane	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1
Dibromochloromethane	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1
1,2-dibromoethane	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1
Chlorobenzene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1
1,1,1,2-tetrachloroethane	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1
Ethylbenzene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1
m+p-Xylene	DETSC 3432	2	ug/l	< 2	< 2	< 2	< 2	< 2
o-Xylene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1
Styrene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1
Bromoform	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1
Isopropylbenzene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1
1,1,2,2-tetrachloroethane	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1
Bromobenzene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1
1,2,3-trichloropropane	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1
n-propylbenzene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1
2-chlorotoluene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1
1,3,5-trimethylbenzene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1
4-chlorotoluene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1
Tert-butylbenzene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1
1,2,4-trimethylbenzene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1
sec-butylbenzene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1
p-isopropyltoluene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1
1,3-dichlorobenzene	DETSC 3432	2	ug/l	< 2	< 2	< 2	< 2	< 2
1,4-dichlorobenzene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1
n-butylbenzene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1
1,2-dichlorobenzene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1
1,2-dibromo-3-chloropropane	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1
1,2,4-trichlorobenzene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1
Hexachlorobutadiene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1
1,2,3-trichlorobenzene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1
MTBE	DETSC 3432*	1	ug/l	< 1	< 1	< 1	< 1	< 1

## Information in Support of the Analytical Results

Our Ref 17-01624  
 Client Ref 5902b.4  
 Contract Gene Metals

### Containers Received & Deviating Samples

Lab No	Sample ID	Date Sampled	Containers Received	Holding time exceeded for tests	Inappropriate container for tests
1183343	BH201 WATER	04/05/17	GB 1L, GV	Aliphatics/Aromatics (14 days), Boron (30 days), BTEX/PRO (14 days), pH/Cond/TDS (7 days), Metals (Soluble) ICPMS (30 days), Naphthalene (14 days), PAH MS (14 days), Phenol - Monohydric (30 days), Cyanide/Mono pHoh (7 days), VOC (14 days)	
1183344	BH202 WATER	04/05/17	GB 1L, GV	Aliphatics/Aromatics (14 days), Boron (30 days), BTEX/PRO (14 days), pH/Cond/TDS (7 days), Metals (Soluble) ICPMS (30 days), Naphthalene (14 days), PAH MS (14 days), Phenol - Monohydric (30 days), Cyanide/Mono pHoh (7 days), VOC (14 days)	
1183345	BH203 WATER	04/05/17	GB 1L, GV	Aliphatics/Aromatics (14 days), Boron (30 days), BTEX/PRO (14 days), pH/Cond/TDS (7 days), Metals (Soluble) ICPMS (30 days), Naphthalene (14 days), PAH MS (14 days), Phenol - Monohydric (30 days), Cyanide/Mono pHoh (7 days), VOC (14 days)	
1183346	BH204 WATER	04/05/17	GB 1L, GV	Aliphatics/Aromatics (14 days), Boron (30 days), BTEX/PRO (14 days), pH/Cond/TDS (7 days), Metals (Soluble) ICPMS (30 days), Naphthalene (14 days), PAH MS (14 days), Phenol - Monohydric (30 days), Cyanide/Mono pHoh (7 days), VOC (14 days)	
1183347	BH205 WATER	04/05/17	GB 1L, GV	Aliphatics/Aromatics (14 days), Boron (30 days), BTEX/PRO (14 days), pH/Cond/TDS (7 days), Metals (Soluble) ICPMS (30 days), Naphthalene (14 days), PAH MS (14 days), Phenol - Monohydric (30 days), Cyanide/Mono pHoh (7 days), VOC (14 days)	

Key: G-Glass B-Bottle V-Vial

DETS cannot be held responsible for the integrity of samples received whereby the laboratory did not undertake the sampling. In this instance samples received may be deviating. Deviating Sample criteria are based on British and International standards and laboratory trials in conjunction with the UKAS note 'Guidance on Deviating Samples'. All samples received are listed above. However, those samples that have additional comments in relation to hold time, inappropriate containers etc are deviating due to the reasons stated. This means that the analysis is accredited where applicable, but results may be compromised due to sample deviations. If no sampled date (soils) or date+time (waters) has been supplied then samples are deviating. However, if you are able to supply a sampled date (and time for waters) this will prevent samples being reported as deviating where specific hold times are not exceeded and where the container supplied is suitable.

### Disposal

From the issue date of this test certificate, samples will be held for the following times prior to disposal :-

Soils - 1 month, Liquids - 2 weeks, Asbestos (test portion) - 6 months



# DETS

## Certificate of Analysis

*Certificate Number* 17-02670

22-Jun-17

*Client* Earth Science Partnership  
33 Cardiff Road  
Taffs Well  
Cardiff  
CF15 7RB

*Our Reference* 17-02670

*Client Reference* 5902B.4

*Order No* 6187

*Contract Title* GENE METALS

*Description* 7 Water samples.

*Date Received* Thursday, June 15, 2017

*Date Started* Thursday, June 15, 2017

*Date Completed* Thursday, June 22, 2017

*Test Procedures* Identified by prefix DETSn (details on request).

*Notes* Opinions and interpretations are outside the laboratory's scope of ISO 10725 accreditation. This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced except in full, without the prior written approval of the laboratory.

*Approved By*



Adam Fenwick  
Contracts Manager





## Summary of Chemical Analysis

### Water Samples

Our Ref 17-02670

Client Ref 5902B.4

Contract Title GENE METALS

Lab No	1189928	1189929	1189930	1189931	1189932	1189933	1189934
Sample ID	BH201	BH202	BH203	BH204	BH205	UPSTREA	DOWNST
Depth						M	REAM
Other ID							
Sample Type	WATER						
Sampling Date	13-Jun-17						
Sampling Time	n/s						

Test	Method	LOD	Units							
<b>Metals</b>										
Arsenic, Dissolved	DETSC 2306	0.16	ug/l	1.9	1.4	2.3	1.1	1.2	1.5	0.99
Barium, Dissolved	DETSC 2306	0.26	ug/l	150	160	120	48	31	8.8	12
Beryllium, Dissolved	DETSC 2306*	0.1	ug/l	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Boron	DETSC 2123	100	ug/l	< 100	< 100	< 100	< 100	< 100	< 100	< 100
Cadmium, Dissolved	DETSC 2306	0.03	ug/l	< 0.03	0.04	0.05	0.08	0.05	0.05	< 0.03
Chromium, Dissolved	DETSC 2306	0.25	ug/l	0.32	0.32	0.89	0.74	0.56	< 0.25	0.30
Copper, Dissolved	DETSC 2306	0.4	ug/l	< 0.4	1.0	0.8	2.1	1.9	1.7	0.6
Iron, Dissolved	DETSC 2306	5.5	ug/l	52	87	95	110	230	1000	140
Lead, Dissolved	DETSC 2306	0.09	ug/l	< 0.09	0.42	< 0.09	0.28	0.14	0.50	0.24
Mercury, Dissolved	DETSC 2306	0.01	ug/l	0.02	< 0.01	< 0.01	0.01	< 0.01	< 0.01	< 0.01
Nickel, Dissolved	DETSC 2306	0.5	ug/l	1.7	1.1	3.0	6.3	2.4	2.3	0.6
Selenium, Dissolved	DETSC 2306	0.25	ug/l	0.52	0.48	0.31	0.50	1.4	0.28	0.31
Vanadium, Dissolved	DETSC 2306	0.6	ug/l	5.6	5.5	5.2	6.7	5.6	3.5	5.5
Zinc, Dissolved	DETSC 2306	1.3	ug/l	< 1.3	5.9	16	17	11	23	4.1
<b>Inorganics</b>										
pH	DETSC 2008			7.4	7.5	6.8	6.9	6.7	5.8	7.0
Cyanide, Total	DETSC 2130	40	ug/l	< 40	< 40	< 40	< 40	< 40	< 40	< 40
Phenol - Monohydric	DETSC 2131	0.5	ug/l	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
<b>Petroleum Hydrocarbons</b>										
Aliphatic C5-C6	DETSC 3322	0.1	ug/l	11	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Aliphatic C6-C8	DETSC 3322	0.1	ug/l	8.8	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Aliphatic C8-C10	DETSC 3322	0.1	ug/l	28	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Aliphatic C10-C12	DETSC 3072*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic C12-C16	DETSC 3072*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic C16-C21	DETSC 3072*	1	ug/l	< 1.0	1.6	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic C21-C35	DETSC 3072*	1	ug/l	2.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic C5-C35	DETSC 3072*	10	ug/l	49	< 10	< 10	< 10	< 10	< 10	< 10
Aromatic C5-C7	DETSC 3322	0.1	ug/l	2.6	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Aromatic C7-C8	DETSC 3322	0.1	ug/l	2.9	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Aromatic C8-C10	DETSC 3322	0.1	ug/l	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Aromatic C10-C12	DETSC 3072*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic C12-C16	DETSC 3072*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic C16-C21	DETSC 3072*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic C21-C35	DETSC 3072*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	2.0
Aromatic C5-C35	DETSC 3072*	10	ug/l	< 10	< 10	< 10	< 10	< 10	< 10	< 10
TPH Ali/Aro Total	DETSC 3072*	10	ug/l	55	< 10	< 10	< 10	< 10	< 10	< 10
Benzene	DETSC 3322	1	ug/l	2.6	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Toluene	DETSC 3322	1	ug/l	2.9	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Ethylbenzene	DETSC 3322	1	ug/l	2.5	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Xylene	DETSC 3322	1	ug/l	7.1	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0

# Summary of Chemical Analysis

## Water Samples

Our Ref 17-02670

Client Ref 5902B.4

Contract Title GENE METALS

Lab No	1189928	1189929	1189930	1189931	1189932	1189933	1189934
Sample ID	BH201	BH202	BH203	BH204	BH205	UPSTREA M	DOWNST REAM
Depth							
Other ID							
Sample Type	WATER	WATER	WATER	WATER	WATER	WATER	WATER
Sampling Date	13-Jun-17	13-Jun-17	13-Jun-17	13-Jun-17	13-Jun-17	13-Jun-17	13-Jun-17
Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units	1189928	1189929	1189930	1189931	1189932	1189933	1189934
<b>PAHs</b>										
Acenaphthene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Acenaphthylene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Anthracene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Benzo(a)anthracene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Benzo(a)pyrene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Benzo(b)fluoranthene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Benzo(g,h,i)perylene	DETSC 3304*	0.01	ug/l	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Benzo(k)fluoranthene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Chrysene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Dibenzo(a,h)anthracene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Fluoranthene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Fluorene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Indeno(1,2,3-c,d)pyrene	DETSC 3304*	0.01	ug/l	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Naphthalene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Phenanthrene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Pyrene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01	< 0.01	0.02	< 0.01	< 0.01	< 0.01
PAH Total	DETSC 3304	0.04	ug/l	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04	< 0.04
<b>VOCs</b>										
Dichlorodifluoromethane	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Chloromethane	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Vinyl Chloride	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Bromomethane	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Chloroethane	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Trichlorofluoromethane	DETSC 3432*	1	ug/l	< 1	< 1	< 1	< 1	< 1	< 1	< 1
1,1-dichloroethylene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Trans-1,2-dichloroethylene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1	< 1	< 1
1,1-dichloroethane	DETSC 3432	1	ug/l	< 1	< 1	< 1	5	< 1	< 1	< 1
Cis-1,2-dichloroethylene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1	< 1	< 1
2,2-dichloropropane	DETSC 3432	2	ug/l	< 2	< 2	< 2	< 2	< 2	< 2	< 2
Bromochloromethane	DETSC 3432	4	ug/l	< 4	< 4	< 4	< 4	< 4	< 4	< 4
Chloroform	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1	< 1	< 1
1,1,1-trichloroethane	DETSC 3432	1	ug/l	< 1	< 1	< 1	15	< 1	< 1	< 1
1,1-dichloropropene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Carbon tetrachloride	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Benzene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1	< 1	< 1
1,2-dichloroethane	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Trichloroethylene	DETSC 3432*	1	ug/l	< 1	< 1	< 1	< 1	< 1	< 1	< 1
1,2-dichloropropane	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Dibromomethane	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Bromodichloromethane	DETSC 3432	4	ug/l	< 4	< 4	< 4	< 4	< 4	< 4	< 4



# Summary of Chemical Analysis

## Water Samples

Our Ref 17-02670

Client Ref 5902B.4

Contract Title GENE METALS

Lab No	1189928	1189929	1189930	1189931	1189932	1189933	1189934
Sample ID	BH201	BH202	BH203	BH204	BH205	UPSTREA	DOWNST
Depth						M	REAM
Other ID							
Sample Type	WATER						
Sampling Date	13-Jun-17						
Sampling Time	n/s						

Test	Method	LOD	Units							
cis-1,3-dichloropropene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Toluene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1	< 1	< 1
trans-1,3-dichloropropene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1	< 1	< 1
1,1,2-trichloroethane	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Tetrachloroethylene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1	< 1	< 1
1,3-dichloropropane	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Dibromochloromethane	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1	< 1	< 1
1,2-dibromoethane	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Chlorobenzene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1	< 1	< 1
1,1,1,2-tetrachloroethane	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Ethylbenzene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1	< 1	< 1
m+p-Xylene	DETSC 3432	2	ug/l	< 2	< 2	< 2	< 2	< 2	< 2	< 2
o-Xylene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Styrene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Bromoform	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Isopropylbenzene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1	< 1	< 1
1,1,2,2-tetrachloroethane	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Bromobenzene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1	< 1	< 1
1,2,3-trichloropropane	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1	< 1	< 1
n-propylbenzene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1	< 1	< 1
2-chlorotoluene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1	< 1	< 1
1,3,5-trimethylbenzene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1	< 1	< 1
4-chlorotoluene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Tert-butylbenzene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1	< 1	< 1
1,2,4-trimethylbenzene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1	< 1	< 1
sec-butylbenzene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1	< 1	< 1
p-isopropyltoluene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1	< 1	< 1
1,3-dichlorobenzene	DETSC 3432	2	ug/l	< 2	< 2	< 2	< 2	< 2	< 2	< 2
1,4-dichlorobenzene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1	< 1	< 1
n-butylbenzene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1	< 1	< 1
1,2-dichlorobenzene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1	< 1	< 1
1,2-dibromo-3-chloropropane	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1	< 1	< 1
1,2,4-trichlorobenzene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Hexachlorobutadiene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1	< 1	< 1
1,2,3-trichlorobenzene	DETSC 3432	1	ug/l	< 1	< 1	< 1	< 1	< 1	< 1	< 1
MTBE	DETSC 3432*	1	ug/l	< 1	< 1	< 1	< 1	< 1	< 1	< 1

## Information in Support of the Analytical Results

Our Ref 17-02670  
 Client Ref 5902B.4  
 Contract GENE METALS

### Containers Received & Deviating Samples

Lab No	Sample ID	Date Sampled	Containers Received	Holding time exceeded for tests	Inappropriate container for tests
1189928	BH201 WATER	13-06-17	GB 1L, GV, PB 1L		
1189929	BH202 WATER	13-06-17	GB 1L, GV, PB 1L		
1189930	BH203 WATER	13-06-17	GB 1L, GV, PB 1L		
1189931	BH204 WATER	13-06-17	GB 1L, GV, PB 1L		
1189932	BH205 WATER	13-06-17	GB 1L, GV, PB 1L		
1189933	UPSTREAM WATER	13-06-17	GB 1L, GV, PB 1L		
1189934	DOWNSTREAM WATER	13-06-17	GB 1L, GV, PB 1L		

Key: G-Glass P-Plastic B-Bottle V-Vial

DETS cannot be held responsible for the integrity of samples received whereby the laboratory did not undertake the sampling. In this instance samples received may be deviating. Deviating Sample criteria are based on British and International standards and laboratory trials in conjunction with the UKAS note 'Guidance on Deviating Samples'. All samples received are listed above. However, those samples that have additional comments in relation to hold time, inappropriate containers etc are deviating due to the reasons stated. This means that the analysis is accredited where applicable, but results may be compromised due to sample deviations. If no sampled date (soils) or date+time (waters) has been supplied then samples are deviating. However, if you are able to supply a sampled date (and time for waters) this will prevent samples being reported as deviating where specific hold times are not exceeded and where the container supplied is suitable.

### Disposal

From the issue date of this test certificate, samples will be held for the following times prior to disposal :-

Soils - 1 month, Liquids - 2 weeks, Asbestos (test portion) - 6 months

## GENERAL NOTES

1. Earth Science Partnership (ESP) believes that providing information about limitations is essential to help clients identify and therefore manage their risks. These risks can be mitigated through further investigation or research, but they cannot be eliminated. This report may not be used for any purpose other than that for which it was commissioned.
2. This report includes available factual data for the site as obtained only from the sources described in the text. The data are related to the site on the basis of the site location and boundary information provided by the client. The findings and opinions conveyed in this assessment are based on the information obtained from a variety of sources as detailed in the report, which ESP believe are reliable. Nevertheless, ESP cannot and does not guarantee the authenticity or reliability of the information it has relied on. It is possible that the assessment failed to indicate the existence of further sources of information on the site. Assuming such sources do exist, their information could not have been considered in the formulation of the opinions and findings in this report. It should be recognised that different conditions on site may have existed between and subsequent to the various map surveys.
3. In preparing this report it has been assumed that all past and present occupants of the site have provided all relevant and other information, especially relating to known or potential hazards. This report is not required to identify insufficiencies or mistakes in the information provided by the user/owner or from any other source, but has sought to compensate for these where obvious in the light of other information.
4. Reports are normally prepared and written in the context of a stated purpose, and should not, therefore be used in a different context. Furthermore, new information, improved practices and legislation may necessitate an alteration to the report in whole or in part after its submission.
5. The opinions presented in this report are based on the findings derived from a site inspection, investigations and a review of historical and other records. The report details any indicators that may suggest that hazardous substances exist at the site at levels likely to warrant mitigation. Not finding such indicators does not mean that hazardous substances do not exist at the site. The most recent site inspection was undertaken as detailed within the report. Circumstances on sites are subject to change and certain indicators of the presence of hazardous substances that may have been latent at the time of this inspection may subsequently have become observable.
6. The work carried out for the assessment can only investigate a small portion of the subsurface conditions. Certain indicators or evidence of hazardous substances may have been outside the limited portion of the subsurface investigated, latent at the time of the work or only partially intercepted by the works, and thus their full significance could not be appreciated. In this regard, groundwater levels are particularly susceptible to variation and it should be noted that groundwater levels are subject to diurnal, seasonal, and climatic changes and are solely dependent on the time the ground investigation was carried out and the weather before and during the investigation.
7. Accordingly, it is possible that the assessment failed to indicate the presence or significance of hazardous substances. Assuming such substances exist, their presence could not have been considered in the formulation of the report's findings and opinions. The conclusions resulting from this study and contained in this report are not necessarily indicative of future conditions or operating practices at or adjacent to the site. Where differing ground conditions or suspect materials are encountered during future site works, additional specialist advice should be sought to assess whether the new information will materially affect the recommendations currently provided herein and whether further consideration is required. Any limiting factors should be assessed by an appropriately qualified specialist.
8. The assessment was prepared for the sole internal use and reliance of the Client. The report shall not be relied upon by or transferred to other parties without the express written authorisation of the Earth Science Partnership. If an unauthorised party comes into possession of the report, they rely on it at their peril and the authors owe them no duty of care and skill.
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