PEN-YR-ENGLYN

Interpretive Ground Investigation Report

Project no. 4021526

Prepared for:

Natural Resources Wales

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Cyfoeth Naturiol Cymru
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1. Introduction

1.1 Project background

The Pen-yr-Englyn tip, situated between Treorchy and Treherbert, was part of Forestry Commission Wales' "Tips and Slips" initiative from 1999 to 2009. The financial downturn in 2008 led to the postponement of the stabilisation efforts planned for this site, along with the broader programme. Prior to the cessation of the programme, Halcrow had conducted a thorough ground investigation, interpreted landslide activity, and developed a preliminary scheme for earthworks and drainage stabilisation at the Pen-yr-Englyn tip. They assessed the site as on the verge of stability, as indicated by historic soil movements related to a pre-existing periglacial landslide.

The Coal Authority has assigned the highest concern level, Category D, to the Pen-yr-Englyn tip. The land encompassing the tip spans multiple ownerships, including the NRW Welsh Government Woodland Estate and the Rhondda-Cynon-Taff County Borough Council (RCTCBC). There have been partial remediation efforts in the past, specifically at the lower section of the tip.

1.2 Scope of works

Binnies UK Limited (Binnies) was commissioned by Natural Resources Wales (NRW) to carry out an interpretive geotechnical investigation report (GIR) following the 2024 ground investigation of the Pen-yr-Englyn colliery spoil to enable the production of detailed designs and construction contract documents.

This report forms part of the wider scope of geotechnical works which included:

- A desk-based review of the available site information, including reports obtained from NRW and RCTCBC archives.
- Site visit following review of topographic survey information.
- Detailed Geomorphological mapping.
- A high-level slope failure impact assessment to aid informal cost-benefit analysis and to aid decision-making for physical interventions at the site.
- Design of a geotechnical investigation to inform the geotechnical and geoenvironmental design aspects of this project.

This GIR interprets ground conditions based on the findings of the 2024 ground investigation alongside existing information. The scope of this report is based on the following objectives:

- Summarise the ground investigation works undertaken;
- Interpret and summarise the ground conditions encountered, including geology, hydrology, and hydrogeology;
- Determine characteristics geotechnical parameters to support geotechnical designs;

- Undertake a geo-environmental assessment of the potential hazards and associated risks to human health, controlled waters, ecology, and the built environment including recommendations for mitigation;
- Undertake a preliminary waste assessment of the soils at site and discuss their potential waste streams and suitability for re-use;
- Summarise ground risks and recommend mitigation measures.

1.3 Sources of information

Historical data has been collected into a desk study, prepared in 2024 and updated in 2025. Accordingly, this GIR should be read alongside the 2024 desk study, with a summary of the key findings provided in Section 3.

2. Site details

2.1 Site location and description

The Pen-yr-Englyn tip is situated on the eastern flank of the Rhondda Fawr Valley in Pen-yr-Englyn, Treherbert, within the Rhondda region. The site's approximate central point is marked by the National Grid Reference SS948980. The location is positioned on the southwestern inclines of Mynydd Ynysfeio, as depicted in Figure 1, which also presents a detailed site layout, including the demarcated site boundary.

Figure 1 presents Ordnance Survey (OS) mapping with 10-meter contours, revealing the hillside's varied topography, including flat areas and a steeper gradient on the northeast side. The one-meter LiDAR survey in Figure 3 outlines the plateau's location and identifies a mound along the hillside, which correlates with a historic tramway route used for spoil transport. The LiDAR data, validated by site walkover observations, offers a precise depiction of the site's terrain at a 1m resolution. It shows two steep areas on the upper hillside and a smaller flat 'plateau' region at the base. North of the dismantled tramway and associated spoil deposits, a notable bulge can be seen, likely related to the 'debris flow' area mapped by Halcrow in 2007.

Ownership of the hillside falls under the Welsh Government Woodland Estate, with Natural Resources Wales (NRW) overseeing its management. The area is predominantly forested and features paths informally used by the public for walking. The plateau area at the foot of the slope is owned by Rhondda-Cynon-Taff County Borough Council (RCTCBC). The plateau serves as an informal space for recreational walking and provides access to the lower hillside regions.

The designated areas for tree harvesting are located on the southwestern slopes of Mynydd Ynysfeio, spanning elevations from approximately 200 meters to 375 meters above the ordnance datum. A key infrastructure element is the Ynysfeio Forest Road, which branches off from the A4061 at Treherbert, ascending the southwestern side of Mynydd Ynysfeio. This road, which is engineered into the slope and primarily rests on rock foundations with adjacent embankments of loose spoil, facilitates access across the ridge to the upper reaches of the adjacent Nant Ynysfeio valley. Additionally, the slope hosts various other pathways, established either by NRW or from historical mining operations, with the primary track's route detailed in Figure 1 and Figure 2.

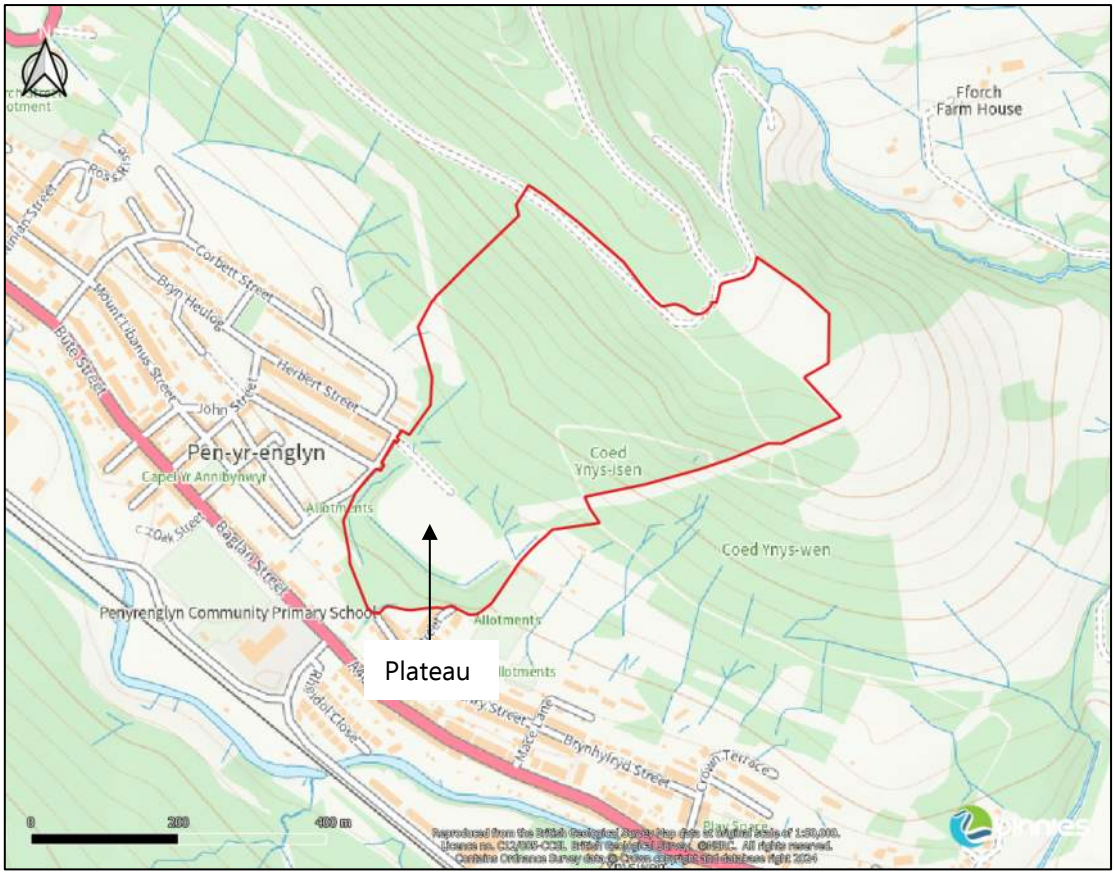

Figure 1: OS site mapping,1:5,000

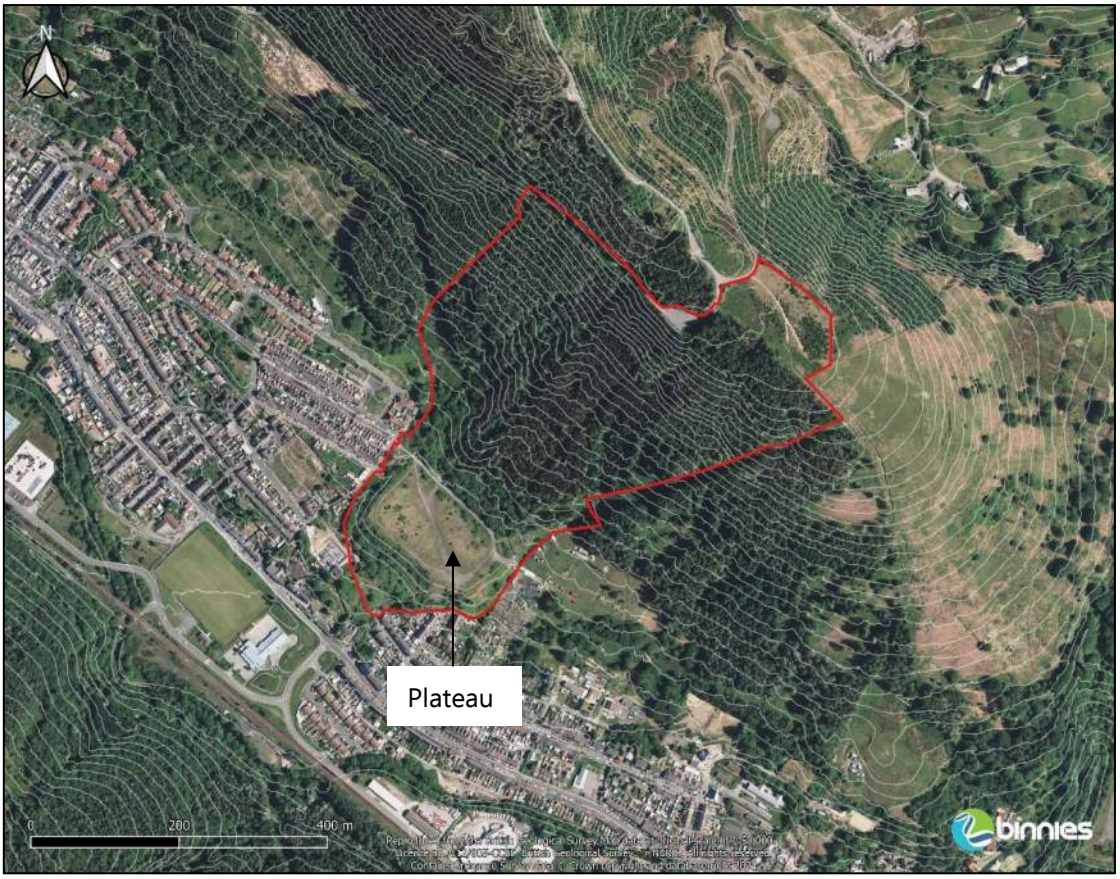

Figure 2: Pre-harvesting (2024) site aerial imagery with 5m contours, 1:5,000

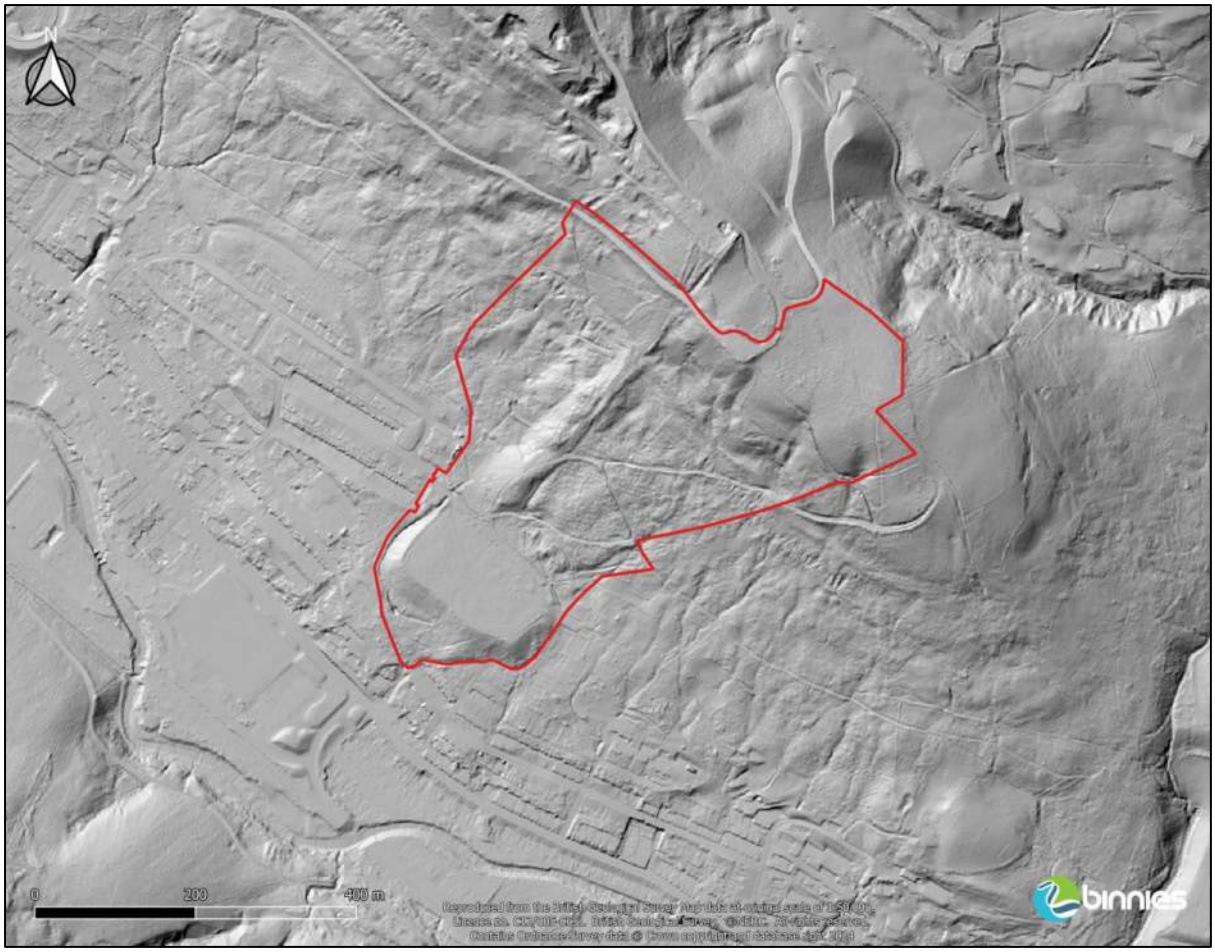

Figure 3: DTM Lidar (1m) 2020 hill shade mapping, 1:5,000

2.2 Proposed works

The proposed works for the site, at the time of preparing this report, are still being finalised. They are likely to comprise:

— Extensive surface drainage scheme including surface ditches to control rain run-off and horizontally bored drains installed into the slope;

— Resurfacing and extensions to the existing forestry tracks;

— Buried attenuation tank, and

— Revegetation of the upper slope.

3. Desk study summary

This section summarises the information obtained in the 2024 Binnies Desk Study which is pertinent to this report.

3.1 Published geology

The geology underlying the site is shown on the British Geological Survey (BGS), England & Wales 1:50,000 series, Pontypridd Solid and Drift Editions (BGS, 1963; BGS, 1975) and on the British Geological Survey interactive map GeoIndex Onshore (BGS, 2024). An extract of the most recent digital geological mapping available is presented in Figure 4.

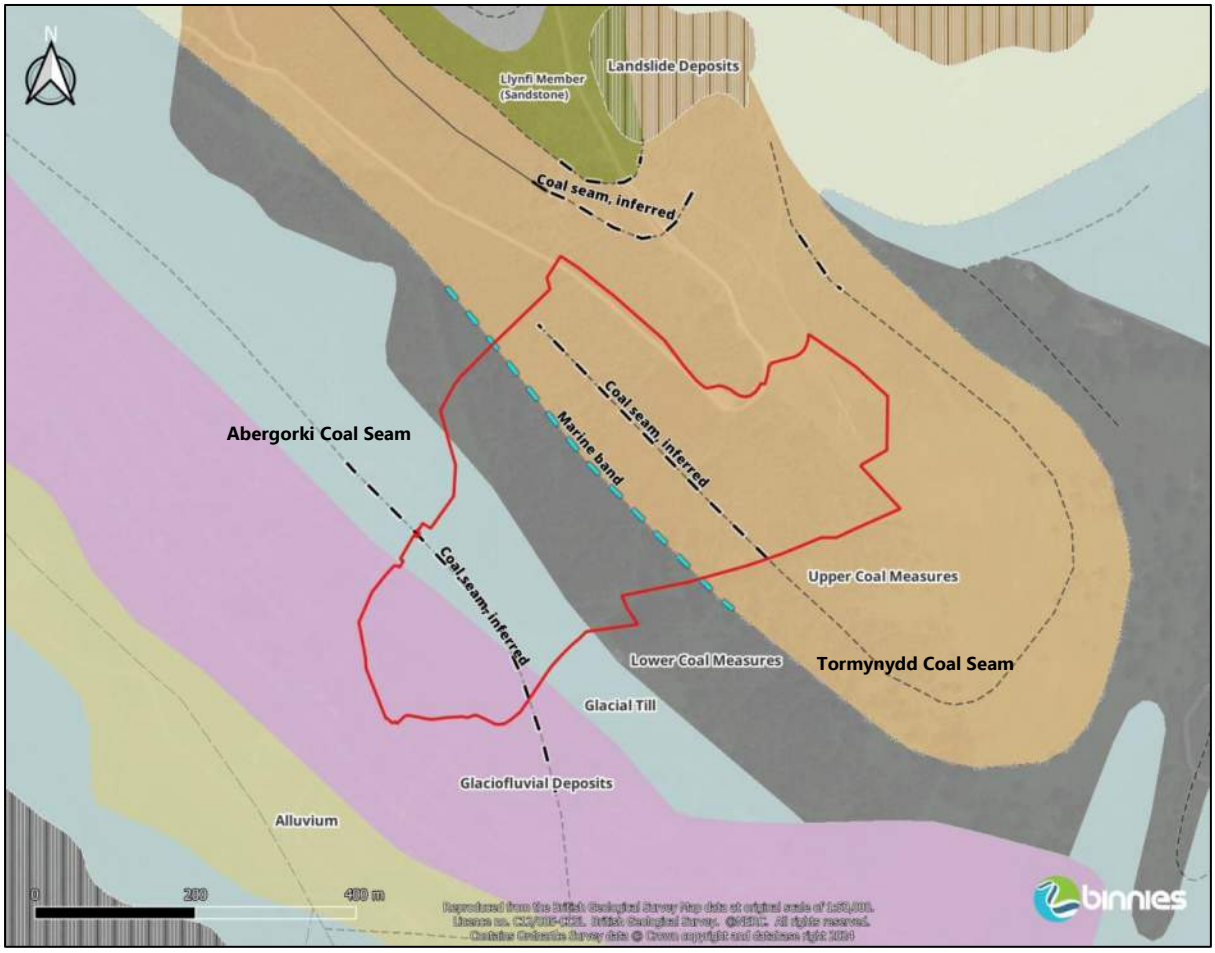

Figure 4: Superficial and Bedrock Geology after (Groundsure, 2023).

3.1.1 Memoir explanation of one-inch geological sheet 248 (Woodland & Evans, 1964)

The accompanying memoir to geological sheet 248 notes that the Tormynydd Coal Seam, often called the No. 3 Rhondda, was also mined as Hafod from Church Level [SS 9735 9562] in Ystrad Rhondda, where it was recorded to be approximately 0.97 meters thick. In other locations, its thickness rarely exceeds 0.61 meters, and at the Ynyswen Level [SS 951 979], it was mined at about 0.56 meters thick. Various exploratory excavations have been made on the east side of the valley, from Treorky to Pentre, south of Cwm-parc, west of Treherbert, and northeast of Blaen-y-cwm, where the seam's thickness ranged from 0.30 to 0.53 meters.

3.1.2 Artificial ground

The detailed geological mapping does not show any made ground at the site, though it depicts mounds at the former colliery location extending up the hillside. Similarly, the BGS digital mapping fails to show any made ground at the site. Given the site's history of mining and tipping, along with observations from site visits, it is known that much of the area is covered with colliery spoil. While evidence points to colliery spoil making up the made ground, it is possible that made ground from other activities could also be present. These activities include the plateau's construction, the remediation of old coal workings, and the erection, and subsequent removal of the historical tramway and construction of the forest track.

3.1.3 Superficial deposits

Beneath the plateau area, the geological mapping indicates the presence of Glaciofluvial sand and gravel deposits. Deposits of Glacial Till are noted within the northeastern edge of the plateau and extend up the hillside. While alluvial deposits are found along the valley floor and near the river's path, none are mapped within the site's boundaries. However, there may be small, localised deposits of finer-grained material adjacent to present-day watercourses across the site.

3.1.4 South Wales Coal Measures Formation

The South Wales Coal Measures Formation is made up of layers of mudstone, siltstone, and sandstone. This formation is divided into the Upper and Middle Coal Measures, distinguished by a marine band marking their boundary.

The slopes higher up are mainly composed of the Rhondda and Llynfi members within the Upper Coal Measures Pennant Sandstone Formation. These members are separated by the No.2 Rhondda coal seam, with the Rhondda Member positioned above this seam and the Llynfi Member below it. The Rhondda Beds are characterised by mostly medium to thick layers of strong, well-jointed sandstone with minimal mudstone bedding in between. On the other hand, the Llynfi Member consists of a mix of sandstones and mudstones, featuring at least three unnamed thin coal seams, including the Tormynydd Seam towards the base of the member.

The remainder of the site sits on the Middle Coal Measures, which include the Abergorki coal seam. The beds within the Middle Coal Measures are generally sub-horizontal dipping away from the face of the hillside at the site towards the northwest to north-north-west direction, with angles varying from a gentle 1° to a more noticeable 20°. Previous ground investigations have observed that the siltstone layers tend to dip between 5° and 10°.

3.1.5 Coal seams and Marine Band

Inferred coal seams are mapped along the northeast edge of the plateau (Abergorki Coal seam) and towards the top of the hillside below the forestry track (Tormynydd Coal seam). As mentioned above, the base of the Upper Coal Measures is marked by a band of marine sediments (the Marine Band shown in Figure 4).

3.2 Previous Studies and Ground Investigations

A combined exploratory hole plan that includes all available ground investigation locations and alignments is presented in Appendix A. Further details on the historic ground investigations can be found in the 2024 desk study.

3.3 Hydrology and Hydrogeology

Surface water from the site flows into the River Rhondda (a controlled waterbody) that flows northwest to southeast along the base of the valley about 250m south of the plateau.

Based on historical mapping, several issues (springs) were present prior to the tipping of any spoil which indicates that there may be a naturally occurring spring line beneath the spoil. The spring line is likely associated with the upper extent of the underlying Glacial Till. Glacial Till typically has a low permeability, reducing the ability for groundwater to flow vertically into the more permeable middle coal measures.

Figure 5 represents OS watercourse mapping of the site including observed hydrological features identified during the site walkover.

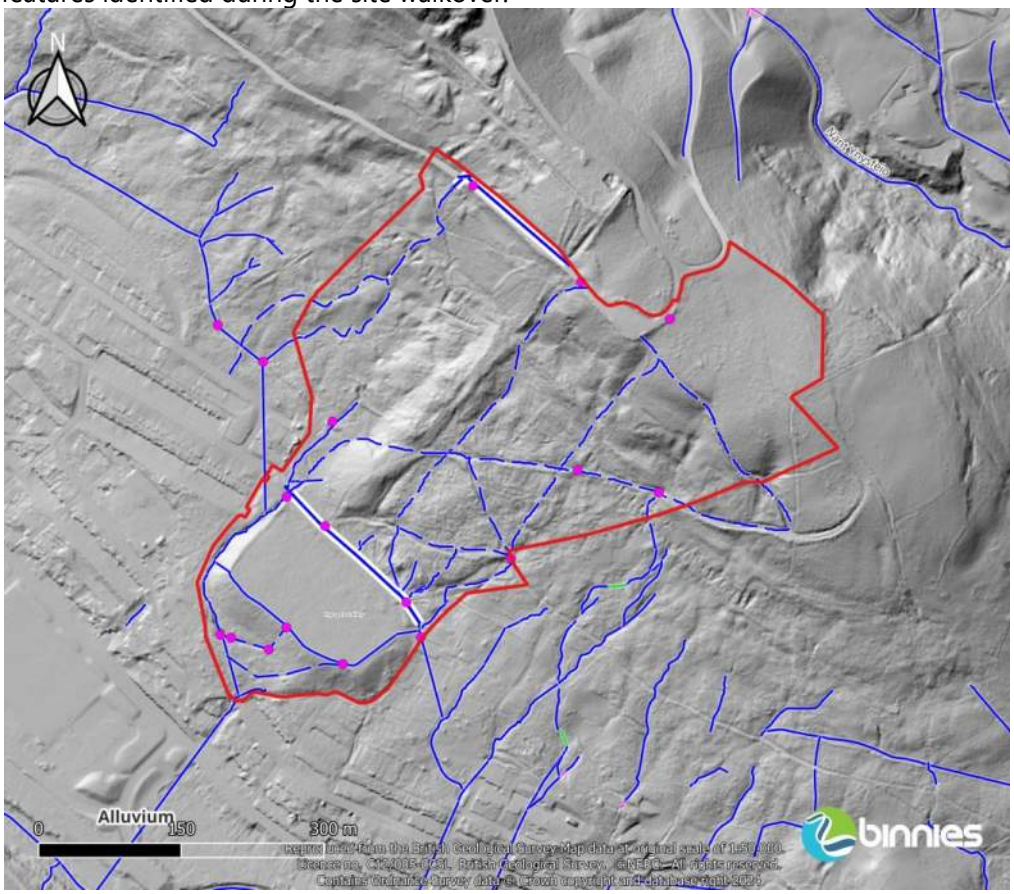

Figure 5: Hydrology mapping including Binnies observed surface water flow pathways (blue-dashed) and culvert locations (pink)

4. Field and laboratory studies

4.1 Ground investigation

Tetra tech Limited was commissioned by NRW, to undertake a ground investigation at the site. The aim of the ground investigation was to establish the ground conditions underlying the site including the extent and thickness of any made ground.

The results of the fieldwork and laboratory testing are contained in Tetra Tech (2024) Pen-yr-Englyn (784-B066842) ground investigation report, included in Appendix E.

4.1.1.1 Investigation Rationale

The techniques adopted for the investigation were chosen with consideration of the objectives and site constraints, which are described below.

Targeted hand dug pitting was chosen based on requirements for in-situ geotechnical data, the opportunity to collect both disturbed samples and ability to carry out this technique on the steep topography in areas inaccessible during previous investigations. This was supplemented by a multi-technique geophysics survey to obtain information on the thickness of the spoil tip and prove groundwater levels.

The ground investigation was carried out using intrusive ground investigation techniques in general accordance with the recommendations of BS5930:2015+A1:2020, which maintains compliance with BS EN 1997-1 and 1997-2 and their related standards.

The main constraints to the investigation included access restrictions due to vegetation, discarded needles and steep terrain. During the geophysical surveys several limitations were encountered on site including:

— ecological constraints, tall grass, gorse and shrubs could not be cut on the plateau area, thus preventing the ability to acquire data.

— the prevalence of drug paraphernalia, including needles/syringes within the undergrowth, as well as dog excrement, created a health and safety risk that could not be mitigated without devegetating the site.

— brash remaining on the hillside after felling of the conifer plantation obstructed access to the ground, preventing detailed data acquisition and accurate survey results.

— bedrock slopes exceed 40° towards the upper reaches of each profile, limiting the access to the upper end of each profile.

— surveying was not undertaken in areas where an excavator could not traverse due to the injury risk caused by the manual carrying.

4.1.1.2 Fieldwork

The following activities were completed during the ground investigation:

— 10 hand dug pits to a depth of 1.2m bgl;

— 4 surface water samples;

— Multi-technique geophysical survey across four transect lines and accessible region of the plateau;

— 10 nuclear density tests;

— 2 sand replacement tests.

A ground investigation plan is presented in Appendix A which shows the locations of the exploratory locations, including historic ground investigations.

4.2 Laboratory testing

4.2.1 Geotechnical testing

Geotechnical laboratory testing was undertaken at the UKAS accredited laboratory GSTL.

All the geotechnical soil testing work was carried out in accordance with procedures contained in the various sections of BS 1377:1990 'Methods of test for soils for civil engineering purposes' and to UKAS accreditations where applicable. Geotechnical tests undertaken on selected soil samples are listed below:

— 11 moisture Content (BS1377:1990 Part 2:3.2);

— 10 particle size distribution tests using wet sieve method (BS1377:1990 Part 2:9.2);

— 7 dry density using 2.5kg rammer method (BS1377:1990 Part 4 3.3);

— 4 dry density tests using 4.5kg rammer method (BS1377:1990 Part 4 3.3);

— 3 particle density tests (BS EN ISO 17892: Part 3);

— 4 falling head permeability test (BS EN ISO 17892-11); and

— 5 BRE SD1 suite B (BRE, 2005).

4.2.2 Geo-environmental testing

The geo-environmental chemical testing was carried out by i2 Analytical and comprised:

— 10 Soil suite E (ICE GI Specification) which includes Arsenic, boron, cadmium, chromium (total), copper, lead, mercury, nickel, zinc, pH, water-soluble sulphate (SO4), organic matter, total petroleum hydrocarbons (TPH), speciated polyaromatic hydrocarbons (PAH 16), phenol, cyanide (total) and asbestos screen with quantification required if identified,

— 2 hexavalent chromium tests;

— 10 total petroleum hydrocarbons tests with cleanup stage;

— 4 full waste landfill waste acceptance criteria (WAC) testing (ICE GI Specification); and

— 10 Water suite F (ICE GI Specification).

5. Ground model

Figure 6 below shows the cross-section alignments used to represent the different topographic zones across the site and varying geological profiles. These alignments are primarily based on the geophysics profiles which have been extended and interpolated to the site's extent. Figure 7, Figure 8 and Figure 9 are the geological cross-sections which have been interpreted based on borehole data, geophysical surveys, and topographical analysis. These sections have been used in Section 6 to assess stability of the tipped material .

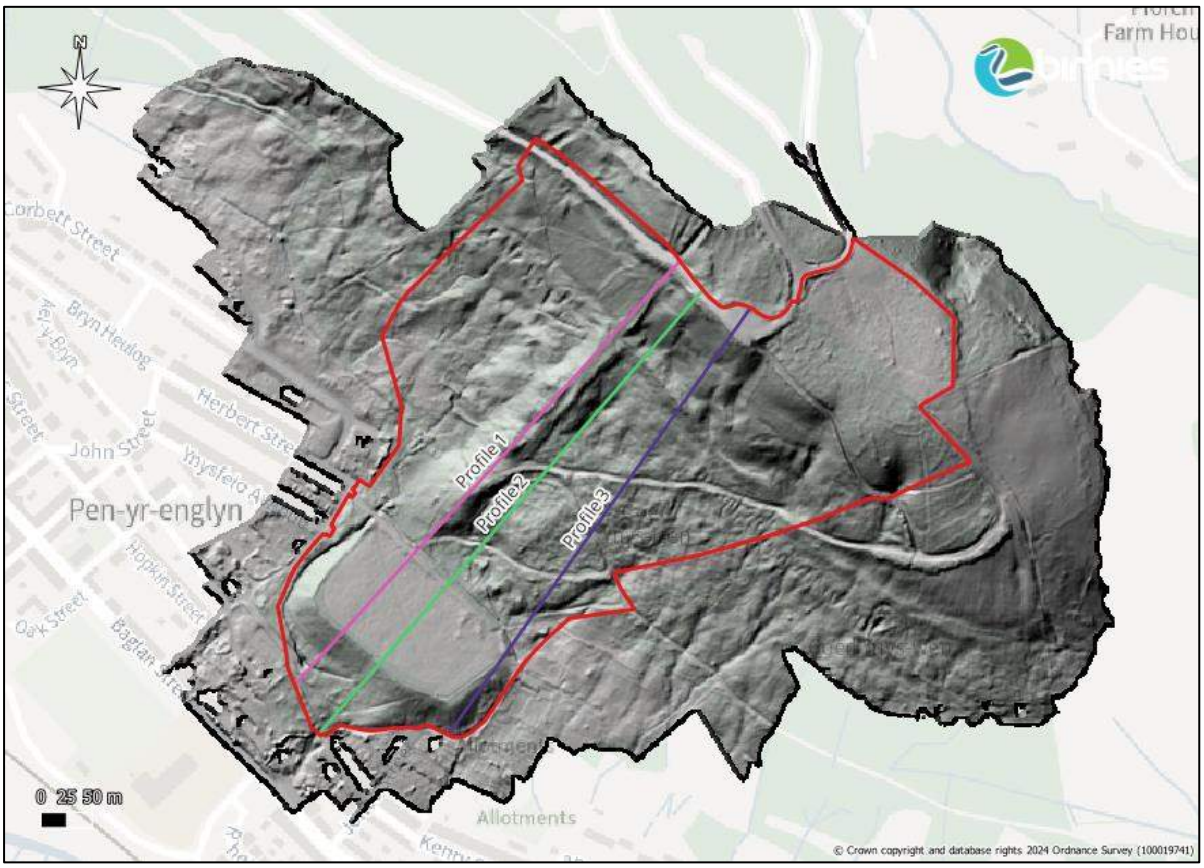

Figure 6: Figure showing the cross-section alignments used for the slope stability assessments.

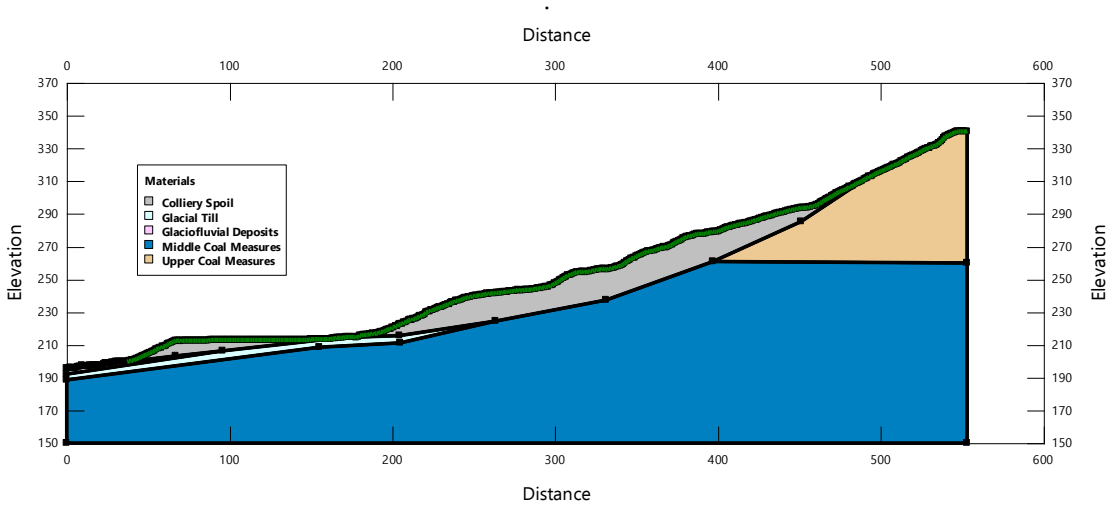

Figure 7: Profile 1 geological cross section

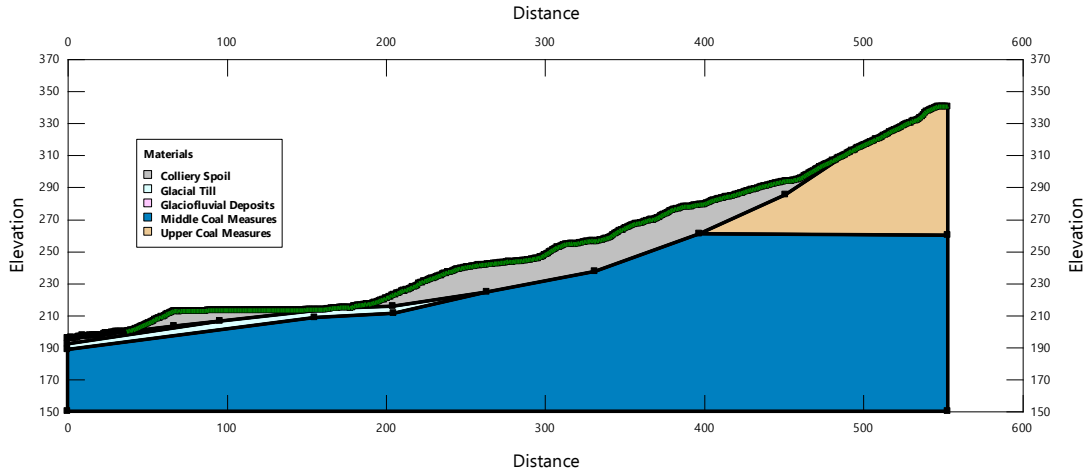

Figure 8: Profile 2 geological cross section

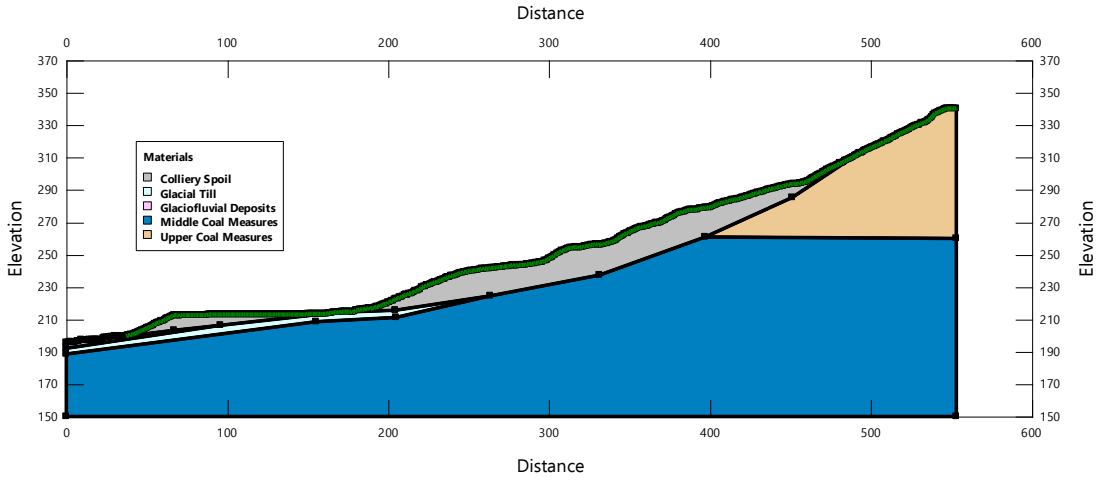

Figure 9: Profile 3 geological cross section

6. Geotechnical assessment

The historical and additional GI data available in and around the scheme, have been utilised in interpreting the soil strata, preparing ground models and arriving at design geotechnical parameters for each layer.

This section details the strata encountered at the site along with the geotechnical interpretation involving material test results and material parameters for each stratum.

6.1 Ground conditions

The ground conditions have been interpreted using information from the ground investigations and available existing information and are summarised in Table 1.

Table 1 Summary of ground conditions

Stratum	Top Depth (m bgl)	Base Depth (m bgl)	Thickness (m)	Description
Made Ground – Colliery spoil	0	0-19.7	Up to ~19.7 (estimated from geophysical surveys)	Made ground primarily composed of loose to medium dense, black or dark grey gravelly and sandy material with variable cobble and occasional boulder content. The material mainly consists of angular to subangular fragments of coal, mudstone, and sandstone, often mixed with silt, clay, and occasional rootlets, metal, or glass fragments. The composition includes frequent fine to coarse sand and gravel, with moderate cohesion in some sections due to dampness, but is generally non-cohesive. Notable inclusions include black ash, clinker, and coal, with areas of clayey matrix and mottling.
Glacial Till	0-17		0-17m	Consists mostly of firm to stiff, brown sandy clays containing varying quantities of sandstone and mudstone gravel and cobbles. Thickness under the toe of the main slope tip varies up to 6m.
Glaciofluvial Deposits	2.00-31.95	10.55-35.75	2.0-8.5	Firm to very stiff, light grey, rusty brown, dark brown mottled clays of low to high plasticity containing weathered sandstone gravels. (Only encountered in BH1 (1983), BH2 (1983) and BH3 (1986)).
Bedrock –South Wales Upper Coal Measures	0-16.2*	16.2-32.4*	16.2-32.4*	Encountered at the top half of the slope, the upper coal measures are expected to range up to 30m below the colliery spoil area before encountering the Middle coal measures.
Bedrock – South Wales Middle Coal Measures	10.7-19.7*	Base not proven		Weathered Mudstone at or close to the rock surface encountered as gravel or gravel with cobbles. The unweathered mudstone generally dips into the slope, towards the northwest through to the north-north-west, with indicated dips ranging from 1° to 20° The Abergorki coal seam is present within this sequence.
*below the colliery spoil				

6.2 Hydrogeology

Groundwater was not observed during the recent investigation works. The location of the proposed buried attenuation tank was not known at the time of the GI. Ground water conditions at its location should be confirmed because designing it against flotation may be required. Excavations for the drainage channels are not expected to encounter groundwater at

shallow depths. However, typical sump-pump methods may be required to drain any infiltrating surface waters that collect in open excavations.

6.3 Geotechnical parameters

The engineering properties of the soils are discussed in this section. The parameters have been selected based on soil descriptions and the results of both the in-situ and laboratory testing. In the absence of test results, the engineering properties of the soils were derived using recognised correlations and published data.

Unless stated otherwise, the geotechnical design parameters have been derived using recommendations in Eurocode 7 (EC7) and guidance given 'Handbook of Geotechnical investigation and Design Tables,' B, G, Look, 2007.

The borehole data and the available geotechnical desk study report have been used to arrive at the design geotechnical parameters. The geotechnical parameters for applicable soils at the site are summarised in Table 2. The 'typical' ranges of parameters presented ignore outliers or anomalous results but provide typical high and low values of the soil properties. The characteristic values presented are moderately conservative values and can be used to represent the soil units as a whole. However, depending on the geotechnical design being undertaken, it may be appropriate to consider the characteristic value, the higher or the lower value from the typical ranges presented. Any geotechnical parameter adopted should be reviewed against the local ground conditions on a case-by-case basis by an appropriately experienced Engineer.

6.3.1 Made Ground – Colliery Spoil

A unit weight of 18kN/m^3 is recommended for the made ground deposits based on the ten in-situ nuclear density tests carried out within the made ground. These results ranged between 16.6-20.0 kN/m^3.

Ten moisture content test results from ranged between 9.95% and 25.5%, with an average moisture content of 15.4%. Compaction testing indicates that the optimum moisture content for the widened/extended forest tracks is 9.7% (values ranged from 6.1% to 20%). The ground was wet of the optimum moisture content, generally reflecting the wet conditions prevailing during the investigation.

Ten insitu density tests were made, one in each of the test pits, using a nuclear density meter. The difficulty of access meant that these were carried out at shallow depths of typically 300 to 600mm below the tip surface. Four corresponding laboratory determinations of maximum dry density were made using the heavy Proctor method (with a 4.5kg rammer) and seven tests were made using the light Proctor method (2.5kg rammer). Ratios of insitu dry density to Proctor maximum dry density ranged from 70% to 116%, with an average of 83%. Two in situ sand replacement tests were also made for comparison and gave higher values than those from the nuclear density device. The range of results is probably due to variability in particle size and other mass characteristics of the tipped material.

Tips such as this one at Pen-yr-Englyn are known to consolidate with age. Data from examination of historic slips has shown that loosely-tipped material typically has an in situ dry density of 82% (Siddle et al, 1996). The tests were all made at shallow depth where little

consolidation could be expected. The tip is likely to be more consolidated at depth but the challenges of access mean that this cannot be demonstrated.

Forty-three SPT's conducted in this material recorded N values ranging typically from 6 and 38, ignoring two outliers (Figure 10), which probably resulted from the test encountering a boulder of other obstruction. This range corresponds a medium dense material with shear strengths ranging from 30° to 38°, with a typical value of 32°.

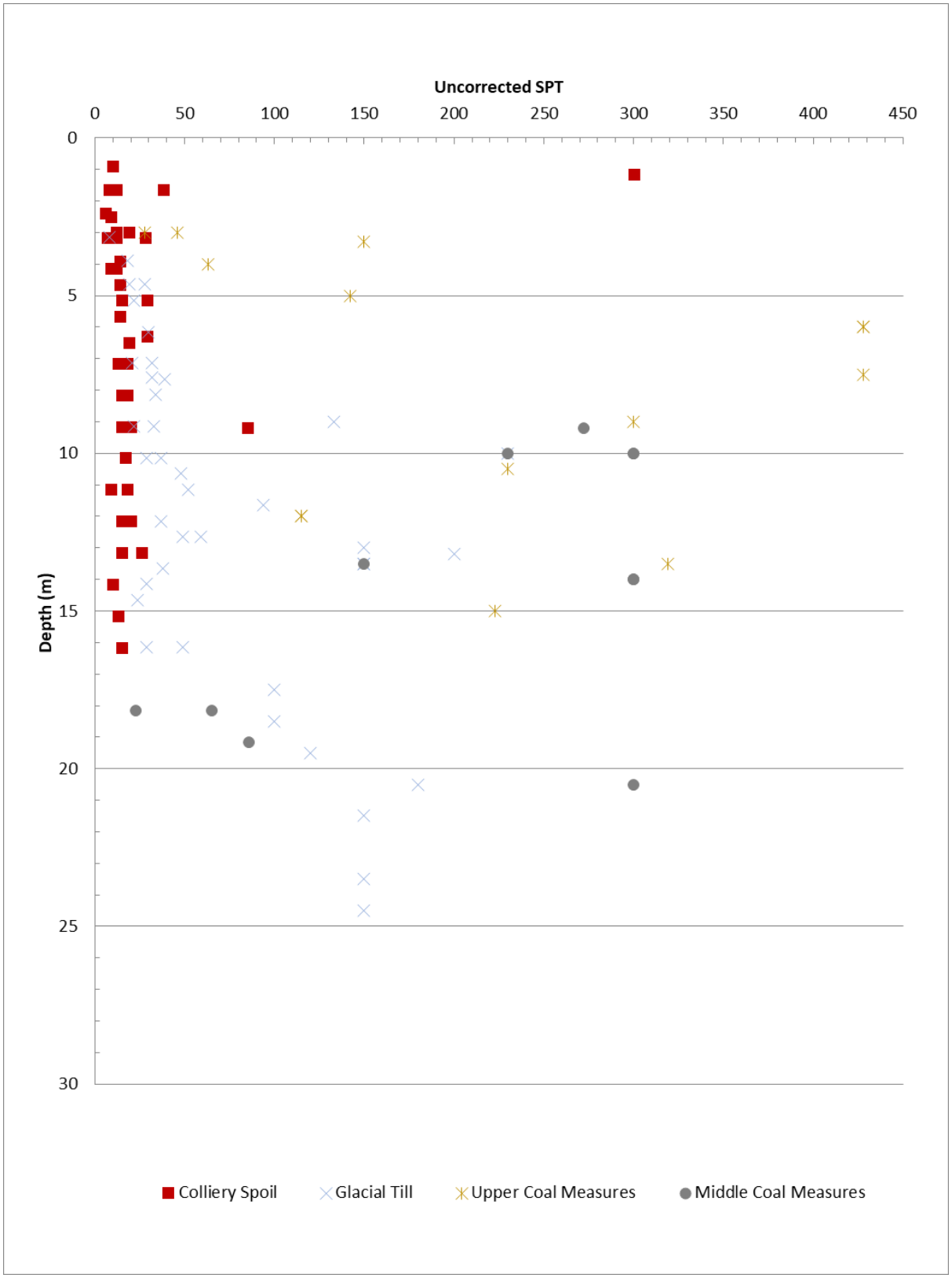

Figure 10: SPT N Value vs Depth

A total of thirteen grading analyses were carried out on samples of the Made Ground (Historic data in Figure 11 and 2024 data in Figure 12).

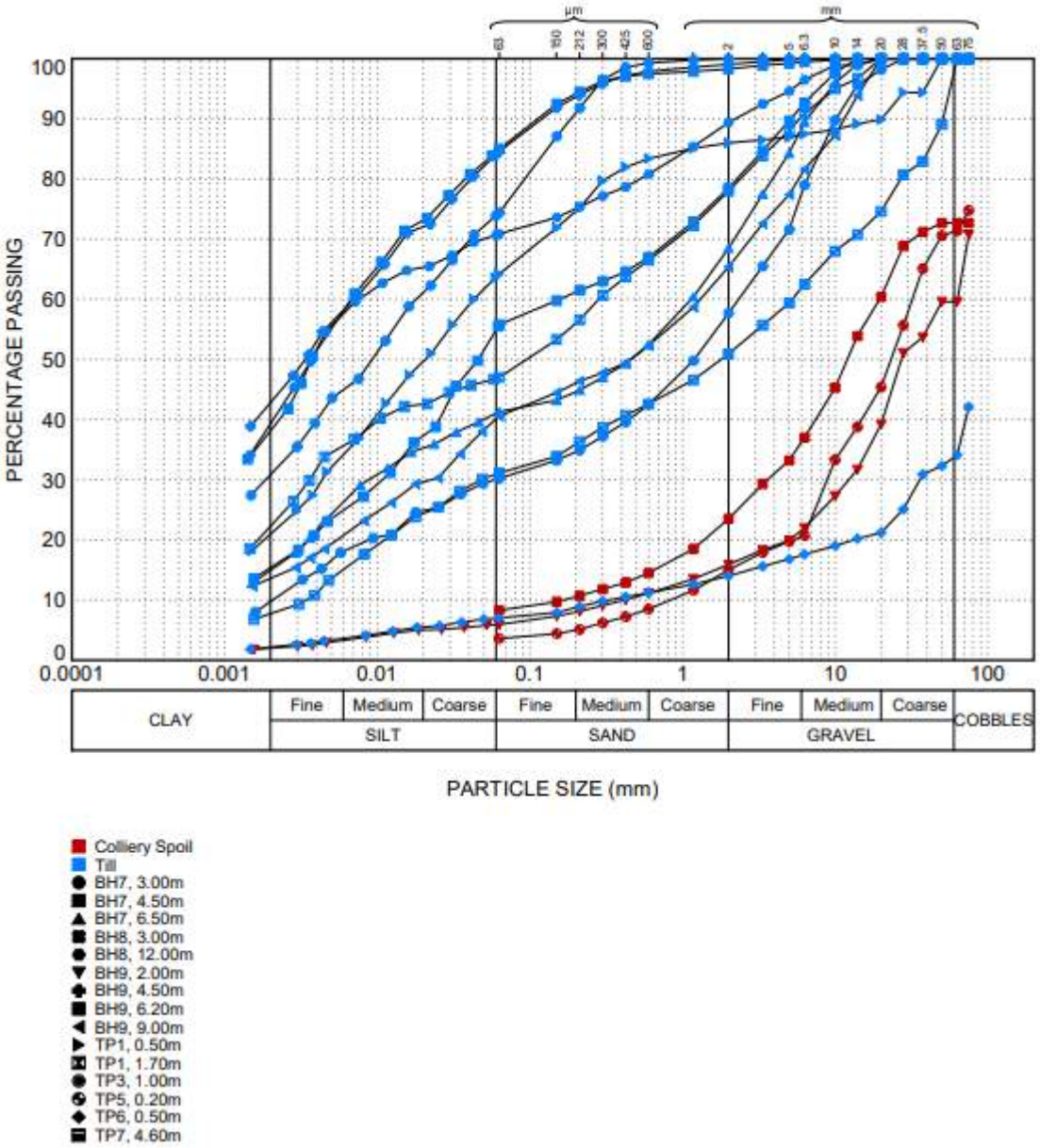

Figure 11: Historic particle size distribution curves (Extract from Arup, 2023 Desk Study)

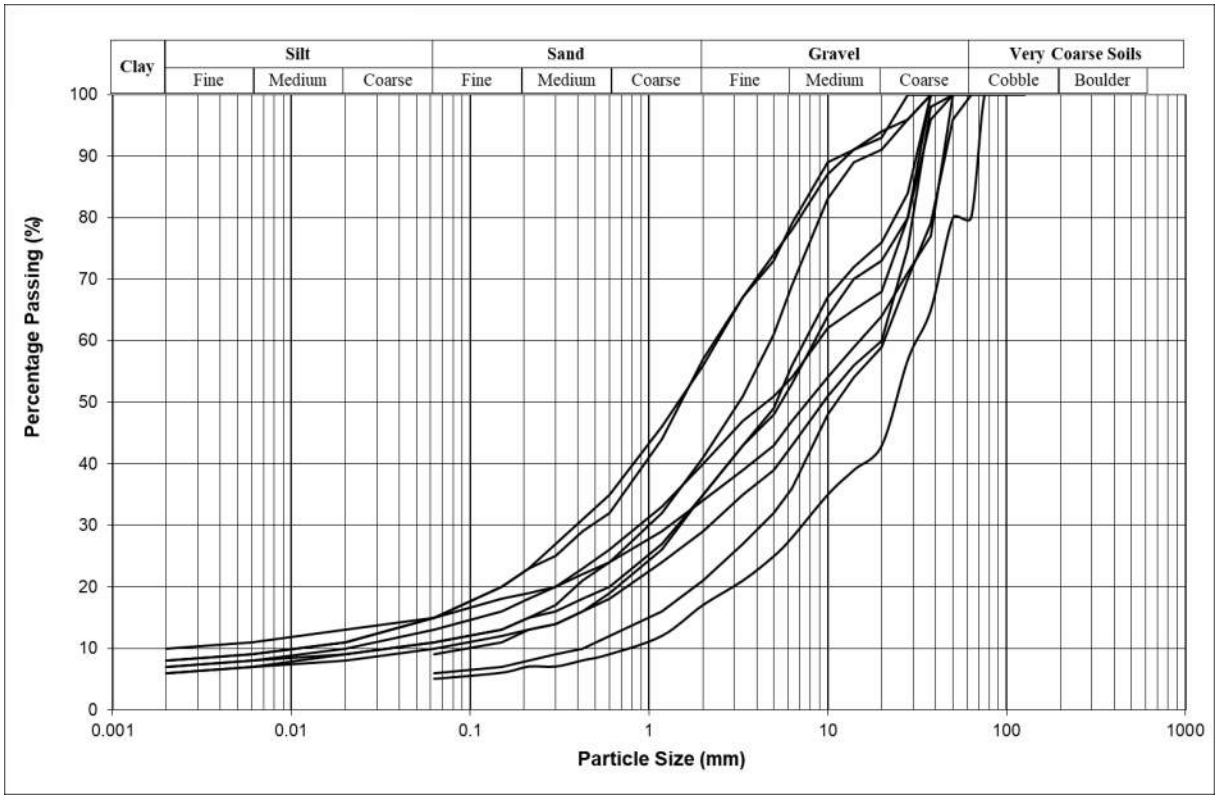

Figure 12: Particle size distribution curves of Colliery Spoil taken from the 2024 GI.

Four permeability tests were carried out on recompacted samples. The results ranged from 4.88x 10^{-5} to 3.29x 10^{-9} m/s. However, estimates of permeability based on the particle size distributions following Casagrande and Fadum,1940 (as reported in Carter and Bently, 2016) give values of k ranging from 8x10^{-3} to 1x10^{-6}m/s. The average D_{10} particle size diameter for the mine waste was 0.23mm, from which a permeability of 5.3 x 10-4m/s can be estimated using Hazen's formula. Both of these suggest that the recompacted samples were not typical of the very variable tip material. A characteristic permeability value of 1x10^{-6} m/s has been conservatively adopted for the colliery spoil.

Characteristic shear strength parameters for the tipped fill should be taken as c'=0kPa, ϕ'= 30°, based on shear box test results from 1997 (two samples reported peak residual angle of internal friction reported 32° and 34°, residual as 30° and 31°). Estimations provided by Das (2013) and the soil descriptions provided on the engineering logs were also used to inform this characteristic parameter. Small shear box test results were considered for the cohesion (c'); these ranged from 0 to 12kPa peak (all reported residual cohesion to be 0 kPa).

6.3.2 Glacial Till

A unit weight of 20kN/m^3 is recommended for the Glacial Till based on PSD results and soil descriptions.

Thirty-nine SPT's conducted in this material recorded N values ranging from 8 and 230 (Figure 10).

A total of twelve historic grading analyses were carried out within the Glacial materials (Figure 11).

Two historic in situ falling head permeability tests were carried out within the Glacial Till. The results ranged from 1.61x 10-7 to 6.27x 10-7. A characteristic permeability value of 1x10-7 m/s has been adopted for these soils.

A characteristic angle of internal friction of $\phi'=27°$ is suggested for the soils based on shear box test results from 1997 (peak angle of internal friction ranged from 27° to 32° (residual from 22° to 30°) in the five samples of Till tested). Estimations provided by Das (2013) and the soil descriptions provided on the engineering logs were also used to inform this characteristic parameter. Small shear box test results were considered for the cohesion (c'); these ranged from 0 to 14 kPa peak (all 0kPa as residual). The 0kPa value for cohesion reported has been omitted from the typical range as it is not considered realistic for Till.

Table 2 Geotechnical Parameters

Parameter		Symbol	Units	Typical range	Characteristic Value	Notes
Made Ground – Colliery Spoil						
Moisture content		-	%	9.9 -25.5	Variable	Derived from lab testing results
Optimal moisture content		-	%	6.1 to 20	9.7	Derived from lab testing results
SPT N (uncorrected)		N	Unitless	9-80	12	From historic in situ SPT results
Bulk unit weight		γ_b	kN/m^3	16.6-20.0	18	Based on in-situ nuclear density testing
Effective stress	Angle of internal friction	φ'	°	32-34	30	Das, 2013 and 1997 GI results
	Cohesion	c'	kN/m^2	0-12	10	Based on laboratory results from 1997 GI.
Permeability		k	m/sec	4.88x 10^{-5} - 3.29x 10^{-9}	1x10^{-6}	Values are derived from soil descriptions (Carter & Bentley, 2016, pp. 70-71, Figure 4.1 and Table 4.1) and laboratory falling head tests.
Glacial Till						
SPT N (uncorrected)		N	Unitless	8-230	20	From historic in situ SPT results
Bulk unit weight		γ_b	kN/m^3	19-21	20	Based on soil descriptions and PSDs
Effective stress	Angle of internal friction	φ'	°	27-32	27	Das, 2013 and 1997 GI results
	Cohesion	c'	kN/m^2	6-14	10	Based on soil descriptions and PSD correlations
Permeability		k	m/sec	1.61x 10^{-7} to 6.27x 10^{-7}	1x10^{-7}	Values are derived from soil descriptions (Carter & Bentley, 2016, pp. 70-71, Figure 4.1 and Table 4.1) and in situ falling head tests.
Bedrock: no design parameters required.						

6.4 Ground aggressivity

The aggressiveness of the colliery spoil to buried concrete was assessed through chemical tests and the results summarised are in Table 3 below.

Table 3 Soil aggressivity results

Test	Total number of samples tested	Strata Made Ground - Colliery Spoil	Characteristic values
pH	10	5.6-8.4	5.6
Water soluble Sulphate as SO_4 (2:1) (mg/l)	10	4.65-32.3	32.3

Following guidance in Building Research Establishment (BRE), 2005, Special Digest 1, 'Concrete in Aggressive Ground' the made ground has been assessed assuming mobile groundwater conditions.

It is recommended that the design sulphate class for proposed works in the made ground is DS-1 and Aggressive Chemical Environment for Concrete (ACEC) is class AC-1.

7. Slope stability assessment

7.1 Calculations undertaken

Appendix F shows the outputs from slope stability assessments made on the three slope profiles described in Section 5. For each profile three analyses were performed using the characteristic parameters derived in Table 2 and with the following water pressure conditions:

- Pore pressure ratio, R_u = 0 (no water pressure)
- Pore pressure ratio, R_u = 0.25 (ground water surface at approximately mid height in the tipped mass), and
- Pore pressure ratio, R_u = 0.545 (ground water surface at ground surface)

Calculations were made using the industry-standard Slope/W software set up to perform a cuckoo search to determine the lowest factors of safety. The 'cuckoo' algorithm was set up with 30 'nests', or starting areas, and 100 calculations were performed for each 'nest', resulting in 3000 stability calculations for each analysis. The results are plotted on colour contoured sections and shown in Appendix F.

7.2 Results of stability analyses

Calculations were performed with parameters factored according to the Eurocode 7 Design Approach 1, combination 2 limit state. The calculations were set to show the resulting 'Over Design Factors' (ODF), corresponding to the additional factors of safety remaining above the limit state condition. Thus, ODF = 1.0 corresponds to a utilisation factor of 100% and values above 1.0 to utilisations of less than 100%.

The nine sets of analyses performed gave the following lowest ODFs (Table 4).

Table 4 Summary of outputs from stability analyses

Profile/R_u	Min ODF	Notes
P1/0	1.45	Determined at 'nose' of main tip lobe
P1/0.25	1.10	Determined at 'nose' of main tip lobe
P1/0.545	0.70	Less than 1.00 throughout profile
P2/0	1.36	At edge of crest
P2/0.25	1.07	At edge of crest
P2/0.545	0.70	Less than 1.00 throughout profile
P3/0	1.17	Small patch of debris above tip. Tip = 1.42 or greater
P3/0.25	0.90	At edge of crest. Tip generally = 1.10 or greater
P3/0.545	0.60	Most of tip less than 1.0

7.3 Discussion

These analyses illustrate the importance of managing ground water in maintaining stability of the tips.

Provided the ground water phreatic surface can be maintained below about mid height within the tipped mass the tips will remain stable. Should the mass become saturated it is likely to fail.

8. Subsurface Drainage

8.1 General

Walkover observations and records from the historic boreholes indicate that ground water levels within the tipped material are low, generally not significantly above the base of the tipped material. Water is typically seen flowing from fissures at the toe of the main tips. This suggests that continuing seepage since deposition of the tips has eroded preferential seepage pathways along the surface of the underlying less permeable glacial and other superficial natural soils.

Stability calculations (Section 7) show that, when it is drained in this way, the tipped material at Pen-yr-Englyn remains stable. All studies of other failed tips have concluded that the failures were initiated by storm events that saturated the tips, effectively weakening the soil mass. Therefore, it is imperative to prevent or manage surface water infiltration into the tipped mass.

8.2 Managing water within the tip

It is proposed to manage water infiltration into the tipped mass in two ways:

- Firstly, to construct peripheral ditches to intercept surface water before it reaches the tipped material, and
- Secondly, to insert sub-horizontal drain pipes into the tipped material to reduce any ground water build up and to intercept the basal flows described in Section 8.1.

Detailed design of the peripheral ditch system is beyond the scope of this geotechnical report.

8.3 Sub-horizontal drain locations

It is proposed to install drains along the lower parts of the site adjacent to access tracks and other locations where the necessary machinery can operate. In particular, they will be inserted beneath the main tip lobe in the centre of the site, which the stability analyses identify as the feature with lowest factors of safety. 81 locations have been identified, as shown in Binnies' General Arrangement drawing number 4021526-BUK-ZZ-00-DR-C-00010.

Drains would be drilled at a shallow slope of around 1 vertical : 100 horizontal from the tip surface to intercept the base of the tip and provide a preferential route for any ground water build up in either the tip mass or the base flows to emerge from the tip.

The sketch section in Figure 14 illustrates the general arrangement of a drain. It can be seen that the length of each drain will be governed by the depth of the tip (Ht) at the outfall end and the bed slope of the tip at that location. These parameters have been estimated for each drain to calculate drain lengths ranging from 17m to almost 60m with an average length of just under 30m.

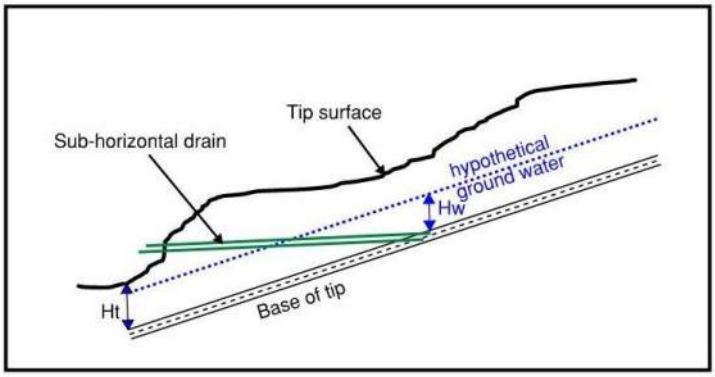

Figure 13 Sketch section showing drain arrangement

8.4 Analysis of internal sub-horizontal drains

The internal sub-horizontal drains are proposed as a mechanism to prevent saturation of the tipped materials.

Calculations have been made (Appendix G) of the flows likely to occur when with a series of drains lowering the ground water surface from a hypothetical mid height in the tip (Hw) to the near the base. Such calculations can be considered as only approximate because of the locally variable permeability characteristics of the tipped material (Section 6.3.1) and the variable depth of the fill.

For convenience of installation, it is likely that drain diameters will 75mm. The calculations show that the typical drain will produce around 3 millilitres/second and, therefore the aggregate flow from all 81 would be of the order of 0.25 litres/second. This represents a negligible increase in the water flows emanating from the site.

9. Geoenvironmental assessment

A geoenvironmental assessment has been undertaken of soils on site, in accordance with EA Land Contamination Risk Assessment (LCRM), to determine the potential risks to human health, controlled water and ecological receptors. In addition, the information gathered has also been used to determine the suitability of excavating soils for re-use if required including a preliminary waste assessment to inform disposal destinations for the soils if they cannot be re-used on site.

9.1 Sampling and testing strategy

As part of the ground investigation, a targeted sampling regime was adopted with total of ten geo-environmental soil samples taken from a mixture of made ground and underlying natural clays. Four surface water samples had been collected during the investigation works to provide a baseline for local watercourses and identify any significant contamination that may be leaching from the spoil.

The analytical suites for soil and water samples were selected based upon the findings of the desk study report and waste assessment requirements. Full details on the testing suites selected can be found in section 4.2.2 of this report and the full results are presented in the associated factual report (Tetra Tech Limited, 2024).

9.2 Visual/olfactory evidence of soil contamination

No visual or olfactory evidence of gross contamination had been encountered in any of the exploratory holes. This includes the absence of any asbestos containing material (ACM).

9.3 Generic quantitative risk assessment - Human health

Generic risk assessment is a two-stage process. In the first Risk Estimation stage, the measured contaminant concentrations are compared to generic assessment criteria (GAC) defined by the relevant Generic Acceptance Criteria (GACs), Category 4 Screening Levels (C4SLs) or Suitable 4 Use Levels (S4ULs) (CL:AIRE, 2010; CL:AIRE, 2014; LQM/CIEH, 2015) where these have been published. Where a suitable dataset is available, this is done after carrying out statistical analysis to determine the upper confidence limit on the true mean; otherwise, maximum or specific data points are compared directly. In cases where the C4SLs or GACs are exceeded, the second stage of Risk Evaluation is carried out. This comprises an authoritative review of the findings together with other pertinent information to assess if any exceedances may be acceptable in particular circumstances.

As the site is accessible to the general public the end-use for the site remains the same. It is therefore classed as public open space (park) for the purposes of this assessment.

Soil Organic Matter (SOM) testing was carried out on ten samples, with results ranging from 1.60 to 6.00%. However, given the soil type, a 1% sandy loam type was adopted for this assessment to determine the relevant assessment criteria.

As shown in Appendix B, no contaminants were recorded at concentrations exceeding their respective assessment criteria. Several contaminants of concern that were tested were also below their respective laboratory limits of detection.

9.3.1 Asbestos

During the ground investigation no suspected Asbestos Containing Materials (ACMs) had been identified. No asbestos fibres or ACM were detected in any of the ten samples screened (note that the laboratory quantification limit for these samples is 0.001%). As no fibres were detected, quantification testing was not required.

9.3.2 Acute Risks to Human Health: Construction Workers

There are currently no UK Generic Assessment Criteria for short term / acute soil exposures for construction site operatives when undertaking activities such as excavations / earthworks on a construction site. As such, a general discussion of the levels of chemical contamination recorded within the soil material sampled is presented below.

The primary potential exposure pathways to construction workers during earthworks are considered to be direct and indirect ingestion of soil (e.g. through soiling of hands and then accidental ingestion during eating or smoking), dermal contact and the inhalation of dust, gases and / or vapours.

In accordance with industry best practice, working methods should be implemented to minimise the risk of contamination to workers and equipment (e.g. damping down while excavating, keeping any stockpiled material moist and ensuring all equipment and clothing is thoroughly cleaned before leaving the area of concern). In addition to wearing PPE, and where necessary RPE, construction workers should maintain good site hygiene such as no drinking, eating or smoking on site (except in designated areas) and washing hands, face and lower arms when leaving the work area.

There will be a limited risk from dust to on-site workers during the construction works, as there is in any construction site. The contractor should carry out appropriate risk assessments, to allow appropriate controls for the mitigation of risk to the health of construction workers to be put in place. However, based on the available data, no additional requirements beyond standard good working practice will be required at this site.

9.3.3 Risks to Human Health: End-use Receptors

Laboratory analysis of soil samples collected during the site investigation did not identify any exceedances of relevant screening values for contaminants of concern, and no asbestos-containing materials were detected. As such, the strata encountered does not present a significant risk to human health. Subject to confirmation of geotechnical suitability, the tested material may be re-used on site if required.

9.4 Generic quantitative risk assessment - Controlled waters

No groundwater strikes were encountered during the ground investigation, though it is noted that the majority of the locations were terminated within the upper 1.20m of the site. Therefore, no groundwater samples have been taken at the time of writing this report.

9.4.1 Controlled water receptors

The nearest main surface water receptor is Rhondda Fawr (River Rhondda) and is located approximately 400m south from the toe of the tip.

As stated in the desk study, the Glacial Till is defined as Secondary undifferentiated aquifer. The bedrock across the site has been classified as a Secondary A Aquifer. Previous ground investigation encountered impermeable layer of glacial till clays, which would significantly reduce any migration pathways between surface waters and the underlying aquifers.

Targeted surface water samples were collected during the investigation and tested for a generic suite of contaminants. The results have been compared against freshwater EQS (for surface waters). and are presented in full in Appendix C. Copper and zinc exceed their respective thresholds. However, there is no obvious source of contamination from the material sampled on site to suggest that these concentrations are not a result of any gross contamination.

9.5 Conceptual site model

The pCSM has been updated to reflect the findings of the ground investigation below:

Table 5: Updated conceptual site model

Source	Potential Receptor	Possible Pathway	Probability	Consequence	Risk	Assessment of risk and possible mitigation
Colliery Spoil (heavy metals, sulphides and chlorides).	Construction Workers, Site users, Adjacent residential buildings	Oral Dermal Dust inhalation	1	3	3	Exposed spoil should be revegetated and measures put in place to prevent direct access to the tip.
	Rhondda River Aquifers (superficial and bedrock)	Infiltration of meteoric water through spoil tip and then into drain from springs into the River Rhondda or are in direct hydraulic continuity with aquifers	1	5	5	The proposed works aim to reduce water infiltration within the spoil which should result in an improvement to the draining surface waters on site flowing into the Rhondda River. Baseline testing of surface waters is recommended before works are carried out.

9.6 Summary and recommendations

Based on the above assessment, the majority of the material presents no unacceptable risks to human health end users or construction workers. As such, no additional risk assessment or remediation is required, and the material can be re-used on-site if required.

If any unexpected contamination is encountered work will need to be stopped, the risk assessment updated, and specialists contacted (or suitably qualified persons) for further advice. Suitable Respiratory Protective Equipment (RPE) and Personnel Protective Equipment (PPE) should be available to use.

10. Preliminary waste assessment

The following waste assessment should be considered as indicative as the volume of material requiring to be disposed of from this area is currently not known at this stage. Therefore, the assessment carried out is intended to aid design and estimate waste costs.

For waste soils produced during construction, further sampling and testing may be required, once the volume of waste material is known, in accordance with technical document WM3, Guidance on the classification and assessment of waste (Environment Agency, 2021).

The revised Waste Framework Directive (WFD) (2009/98/EC) defines waste as 'any substance or object which the holder discards or intends or is required to discard'. For soils which are not defined as a waste under WFD, such as those that are to be purposely re-used on-site, this assessment does not apply.

10.1 Waste classification

A preliminary waste classification report has been generated for soils sampled at the site using commercially available software (HazWasteOnline™, 2022), included Appendix D The process for generating the report follows the WM3 technical guidance for waste classification (Environment Agency, 2021).

The results from the ten soil samples classified indicate that material sampled is non-hazardous.

10.2 WAC assessment

Waste acceptance criteria (WAC) testing is used to determine whether the previously classified soils would be accepted at a particular type of landfill or suitably permitted facility. Materials classified as non-hazardous waste may be disposed of in a non-hazardous landfill without further testing. Such materials may also be disposed of at an inert waste landfill subject to meeting inert WAC and being free of any non-inert inclusions.

WAC testing has been completed on four samples obtained during the site investigation and the results indicate that the material is likely to be accepted at an inert waste facility. Further testing will be required once the final volumes of waste soils are confirmed.

11. Ground risk register

A Ground Risk Register is presented in Table 10, compiled in accordance with CD622 Managing geotechnical risk and LCRM guidance. The risk register summarises the identified geotechnical hazards and consequences associated with the proposed development and establish the approach which is to be taken to manage the risks. These risks should be transferred to the designer's risk register. The risk register will need to be updated to reflect additional information as it is gained through the construction process.

The degree of risk is determined by combining the likelihood of the hazard occurring with an assessment of the severity of the hazard, summarised in Table 6 and Table 7 respectively.

Risks that have been identified based on the information presented within this report have been assessed against the risk matrix shown in Table 8, with an explanation of the assessed risk and response presented in Table 9.

It should be noted that there could be other hazards at the site that have not yet been identified. Any additional information should be used to update the following risk assessment.

Table 6 Likelihood Ratings

Code	Meaning	CD622 Description	LCRM (CIRIA C552,CLR11) Description	
VL	Improbable	So unlikely that it can be assumed that it will not occur, or it cannot occur	There is a high probability that severe harm could arise to a designated receptor from an identified hazard at the site without appropriate remediation action.	
L	Remote	Unlikely but possible	Harm is likely to arise to a designated receptor from an identified hazard at the site without appropriate remediation action.	
M	Occasional	Likely to occur at some time	It is possible that without appropriate remediation action harm could arise to a designated receptor. It is relatively unlikely that any such harm would be severe, and if any harm were to occur it is more likely that such harm would be relatively mild.	
H	Probable	Likely to occur several times	Harm is likely to arise to a designated receptor from an identified hazard at the site without appropriate remediation action.	
VH	Frequent	Likely to occur many times	There is a high probability that severe harm could arise to a designated receptor from an identified hazard at the site without appropriate remediation action.	

Table 7 Severity Ratings

Code	Meaning	Geotechnical Description (based on CD622)	Geoenvironmental Description (based on C552,CLR11)
1	Negligible	Resulting in no injury and no loss of working time	
2	Marginal	Resulting in a minor 'first aid' injury or a minor loss of working time	Harm, not necessarily significant, but that could result in financial loss or expenditure to resolve. Non-permanent human health effects easily prevented by use of personal protective clothing. Easily repairable damage to buildings, structures and services.
3	Serious	Resulting in an injury or illness which causes a period of absence from work	Pollution of non-sensitive water resources. Significant damage to crops, buildings, structures and services ('significant harm' as defined in 'Draft Circular on Contaminated Land', DETR 2000). Damage to sensitive buildings, structures or the environment
4	Critical	Resulting in a severe injury with much lost time	Chronic damage to human health ('significant harm' as defined in 'Draft Circular on Contaminated Land', DETR 2000), Pollution of sensitive water resources, Significant change in an ecosystem or organism forming part of that ecosystem
5	Catastrophic	Resulting in a fatality or major disruption	Short term (acute) risk to human health likely to result in 'significant harm' as defined by the Environment Protection Act 1990, Part IIA. Short-term risk of pollution of sensitive water resources. Catastrophic damage to buildings or property. Short-term risk to an ecosystem or organism forming part of that ecosystem (note definition of ecosystem in 'Draft Circular on Contaminated Land', DETR 2000)

Table 8 Assessed Risk

SEVERITY / LIKELIHOOD	Negligible 1	Marginal 2	Serious 3	Critical 4	Catastrophic 5
Improbable VL	N	N	A	A	A
Remote L	N	A	A	AR	AR
Occasional M	A	A	AR	AR	UA
Probable H	A	AR	AR	UA	UA
Frequent VH	A	AR	UA	UA	UA

Table 9 Risk Response

Code	Meaning	Response needed
UA	Unacceptable	Action essential
AR	Action required	Action required if reasonably practicable
A	Acceptable	Risk to be managed
N	Negligible	—

Table 10 Ground Risk Register

Risk ID	Hazard	Consequence	Likelihood	Severity	Risk	Mitigation Measures
1	Slope stability	Slope failure (rotational failure, debris flows)	L	4	**AR**	Reduce pore water pressures during high rainfall events within the Colliery Spoil by constructing a surface water management scheme and installing targeted horizontal drains across the toe of highest risk slopes.
2	Made Ground - variable ground conditions	Poor foundations for surface structures, local instability	H	2	**AR**	Calculations to use conservative design values to account for heterogeneity within the Made Ground. Verification may be required during construction to confirm designs are suitable.
3	Localised instability due to loose colliery spoil/weathered bedrock.	Excavation collapse	H	3	**AR**	Temporary works measures may be required to provide adequate support to deep excavations.
4	Localised areas of competent bedrock where there is shallow spoil coverage in the upper slope region.	Difficult digging resulting in program delays/additional project costs associated with encountering obstructions.	H	2	**AR**	Use appropriate methods, such as breakers, to advance through cobbles within the competent Upper/Middle Coal Measures.
5	Shallow obstructions within the Made Ground	Program delays/additional project costs associated with encountering obstructions.	H	3	**AR**	Use appropriate methods, such as breakers, to advance through cobbles within the Made Ground.
6	Historic coal mining	Void collapse during loading/excavation.	M	5	**UA**	Undertake and coal mining risk assessment to identify high-risk areas and understand mitigation requirements.
7	Unanticipated ground conditions	Program delays/additional project costs associated with encountering obstructions.	L	3	**A**	Verification may be required during construction to confirm materials are within design requirements.

Risk ID	Hazard	Consequence	Likelihood	Severity	Risk	Mitigation Measures
8	Unanticipated contaminated ground	Exposure to site staff to potential toxicity.	VL	4	**A**	Site staff will remain vigilant during construction and report suspected contaminated material to the design team.
9	Groundwater ingress into excavations in areas containing high clay content (low permeability)	Flooding of excavations, instability issues, softening and deterioration of the existing soils.	M	3	**AR**	Suitable dewatering methods should be readily available during construction works.
10	Localised low-strength soils encountered during excavations.	Materials unsuitable for re-use in the works, i.e. soft or organic clays and peat. - Settlement of backfilled trenches due to poorly compacted materials	M	3	**AR**	On-site verification of materials is required. Any unsuitable footings should be excavated to an adequate depth and replaced with granular fill.
11	Slope destabilisation due to removal of tree roots	Local slope instability	M	3	**AR**	Tree stumps, saplings, and roots to be left in place where possible.

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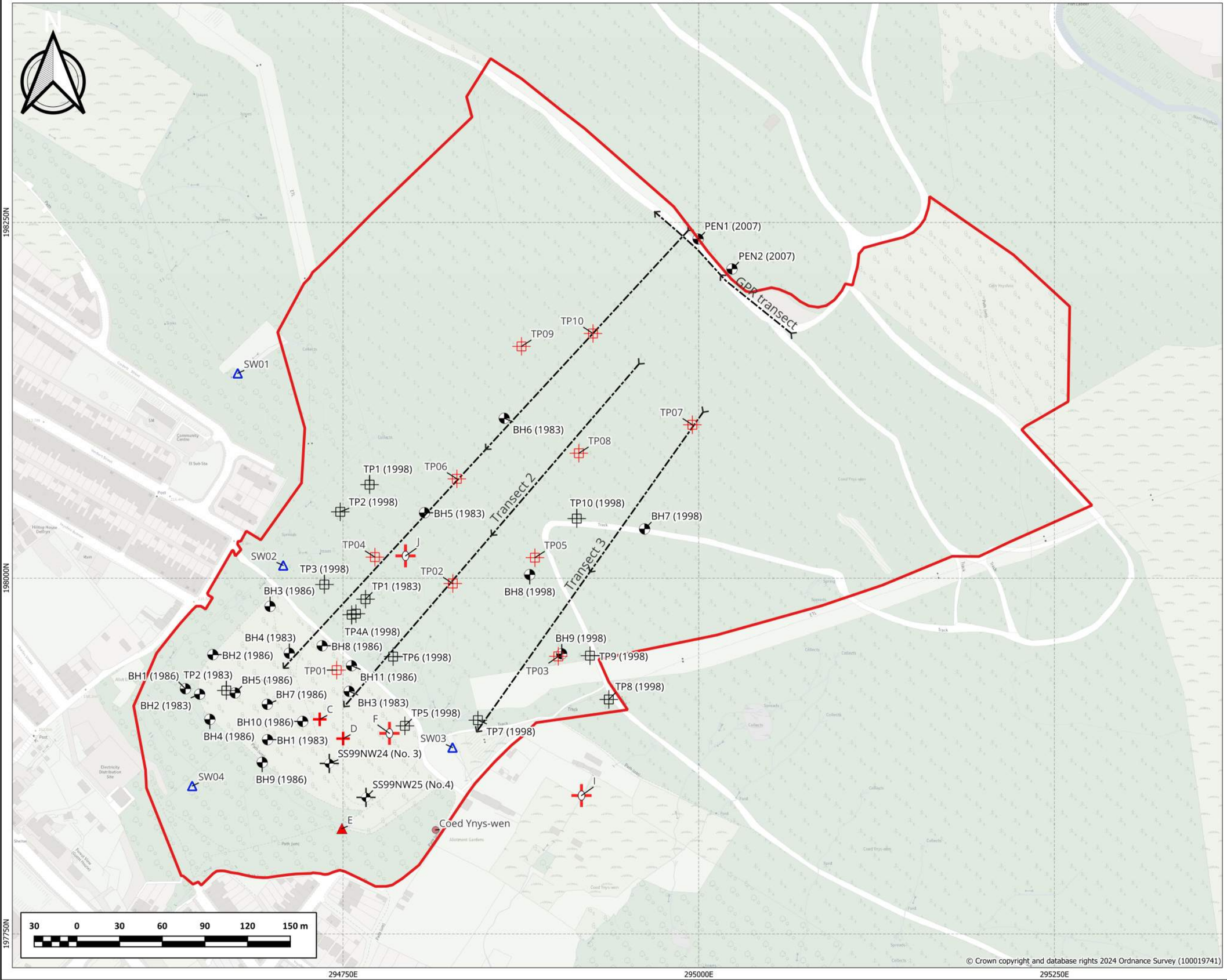
APPENDICES

Appendix A Combined ground investigation map

294750E 295000E 295250E

198250N 198000N 197750N



Note: The limits, including the height and depths of the Works, shown in this drawing are not to be taken as limiting the obligations of the contractor under Contract

Legend:

- Site Boundary

Exploratory holes
- Sampling Location - Surface water
- Trial Pit
- Transects

Historic Boreholes
- BGS Borehole
- Borehole
- Trial Pit

Historic Shafts
- Air Pit
- Level
- Shaft
- Brit Pit

Historic shaft designations

C: No 3 Pit
D: No 4 Pit
E: Old Coal Level
F: Unnamed Air Pit (shaft)
I : Unnamed Air Pit (shaft)
J: Unnamed Air Pit (shaft)

SKETCH ONLY
Purpose: This sketch is an informal tool for communicating and collaborating on projects. It shall not be considered as a project output, part of a project output or as satisfying a contractual requirement. All details are indicative and subject to further design and collaboration.

Rev	Drawn	Chkd	Rvwd	Apprvd	Date	Description
P02	JT	RH	AL	AH		
P01	JT	RH	AL	AH	10/2024	Suitable for Review and Comment

Designed by: Tasker, James Date: 11/2024

Client

Cyfoeth Naturiol Cymru Natural Resources Wales

Client drawing no. | Revision

binnies on RSK Group Company

Project:

Pen-yr-Englyn

Drawing Title:

Combined ground investigation plan

Drawing scale: 1:2500 Map units: meters
CRS: OSGB36 / British National Grid (EPSG:27700) Sheet Size: A3

Drawing no. 4021526-BUK-ZZ-00-SK-GE-00004 | Revision P01

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Print Version: Print Quality (300dpi @ A3)

Appendix B Geoenvironmental GQRA screening sheet (Soil)

Soil Analytical Results

GAC Exceeded: 100
LOD > GAC: <0.1
GAC: Public Open Space (Park) (1%)

Determinand	Unit	LOD	GAC	GAC Source	No. Samp	No. Exce	Min	Max	Sample Location	TP01	TP02	TP03	TP04	TP05	TP06	TP07	TP08	TP09	TP10
									Sample Type	ES	ES	ES	ES	ES	ES	ES	ES	ES	ES
									Depth Top (m)	0.3	0.6	1.2	0.3	0.6	1.2	0.6	1.2	0.6	0.3
									Strata	MGR	MGR	MGR	MGR	MGR	MGR	MGR	MGR	MGR	MGR
Moisture Content	%	0.01	-	-	10	-	7.2	16		11	7.5	7.2	8.5	16	11	7.5	7.2	8.5	16
Total mass of sample received	kg	0.1	-	-	10	-	0.8	0.9		0.9	0.9	0.8	0.9	0.8	0.9	0.9	0.8	0.9	0.8
Organic Matter (automated)	%	0.1	-	-	10	-	1.6	6		6	1.9	1.6	2.8	5.4	6	1.9	1.6	2.8	5.4
pH (L099)	pH Units	-	-	-	10	-	*<5.6*	*<7.6*		*6.4*	*6.6*	*6.9*	*5.6*	*7.6*	*6.4*	*6.6*	*6.9*	*5.6*	*7.6*
Stone Content	%	0.1	-	-	10	-	*<0.1*	*<0.1*		*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*
Water Soluble Sulphate as SO_4 16hr extraction (2:1)	mg/kg	2.5	-	-	10	-	9.3	24		9.3	24	14	12	15	9.3	24	14	12	15
Water Soluble SO_4 16hr extraction (2:1 Leachate Equivalent)	mg/l	1.25	-	-	10	-	4.65	12		4.65	12	7.09	5.84	7.39	4.65	12	7.09	5.84	7.39
Asbestos in Soil Detected/Not	Type	-	0.001	RSK	10	0	-	-		Not-	Not-	Not-	Not-	Not-	Not-	Not-	Not-	Not-	Not-
Asbestos Analyst ID	N/A	-	-	-	10	-	-	-		DSO	DSO	DSO	PDO	PDO	DSO	DSO	DSO	PDO	PDO
Arsenic (aqua regia extractable)	mg/kg	1	170	RSK	10	0	8.4	15		10	11	15	11	8.4	10	11	15	11	8.4
Boron (water soluble)	mg/kg	0.2	46000	RSK	10	0	*<0.2*	0.4		*0.2*	0.4	*0.2*	0.3	0.3	*0.2*	0.4	*0.2*	0.3	0.3
Cadmium (aqua regia extractable)	mg/kg	0.2	880	RSK	10	0	*<0.2*	*<0.2*		*0.2*	*0.2*	*0.2*	*0.2*	*0.2*	*0.2*	*0.2*	*0.2*	*0.2*	*0.2*
Chromium (aqua regia extractable)	mg/kg	1	33000	RSK	10	0	4.3	24		5.7	4.3	5.8	24	6.1	5.7	4.3	5.8	24	6.1
Chromium (hexavalent)	mg/kg	1.8	250	RSK	2	0	*<1.8*	*<1.8*		-	-	-	-	*1.8*	-	-	-	-	*1.8*
Copper (aqua regia extractable)	mg/kg	1	44000	RSK	10	0	43	49		43	49	44	48	49	43	49	44	48	49
Total Cyanide	mg/kg	1	170	RSK	10	0	*<1*	*<1*		*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*
Lead (aqua regia extractable)	mg/kg	1	1300	RSK	10	0	16	26		23	25	24	26	16	23	25	24	26	16
Mercury (aqua regia extractable)	mg/kg	0.3	240	RSK	10	0	*<0.3*	6.6		0.4	*0.3*	*0.3*	6.6	*0.3*	0.4	*0.3*	*0.3*	6.6	*0.3*
Nickel (aqua regia extractable)	mg/kg	1	800	RSK	10	0	19	41		24	36	41	30	19	24	36	41	30	19
Zinc (aqua regia extractable)	mg/kg	1	173200	RSK	10	0	40	99		55	77	99	90	40	55	77	99	90	40
Petroleum Range Organics (C6 -	mg/kg	1	-	-	10	-	*<1*	*<1*		*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*
TPH (C10 - C40) EH_CU_1D_TOTAL	mg/kg	10	-	-	10	-	*<10*	170		*10*	*10*	*10*	*10*	170	*10*	*10*	*10*	*10*	170
TPH Total >C6 - C40	mg/kg	10	-	-	10	-	*<10*	170		*10*	*10*	*10*	*10*	170	*10*	*10*	*10*	*10*	170
Acenaphthene	mg/kg	0.05	29000	RSK	10	0	*<0.1*	0.09		0.09	*0.05*	*0.05*	*0.05*	0.06	0.09	*0.05*	*0.05*	*0.05*	0.06
Acenaphthylene	mg/kg	0.05	29000	RSK	10	0	*<0.1*	*<0.05*		*0.05*	*0.05*	*0.05*	*0.05*	*0.05*	*0.05*	*0.05*	*0.05*	*0.05*	*0.05*
Anthracene	mg/kg	0.05	149000	RSK	10	0	*<0.1*	0.12		*0.05*	*0.05*	*0.05*	*0.05*	0.12	*0.05*	*0.05*	*0.05*	*0.05*	0.12
Benzo(ghi)perylene	mg/kg	0.05	1390	RSK	10	0	*<0.1*	0.1		0.1	*0.05*	*0.05*	*0.05*	*0.05*	0.1	*0.05*	*0.05*	*0.05*	*0.05*
Benzo(a)anthracene	mg/kg	0.05	49	RSK	10	0	*<0.1*	0.21		0.21	*0.05*	*0.05*	*0.05*	*0.05*	0.21	*0.05*	*0.05*	*0.05*	*0.05*
Benzo(a)pyrene	mg/kg	0.05	21	RSK	10	0	*<0.1*	0.13		0.13	*0.05*	*0.05*	*0.05*	*0.05*	0.13	*0.05*	*0.05*	*0.05*	*0.05*
Benzo(b)fluoranthene	mg/kg	0.05	13	RSK	10	0	*<0.1*	0.34		0.34	*0.05*	*0.05*	*0.05*	*0.05*	0.34	*0.05*	*0.05*	*0.05*	*0.05*
Benzo(k)fluoranthene	mg/kg	0.05	367	RSK	10	0	*<0.1*	0.12		0.12	*0.05*	*0.05*	*0.05*	*0.05*	0.12	*0.05*	*0.05*	*0.05*	*0.05*
Chrysene	mg/kg	0.05	93	RSK	10	0	*<0.1*	0.63		0.63	*0.05*	*0.05*	0.33	*0.05*	0.63	*0.05*	*0.05*	0.33	*0.05*
Dibenz(a,h)anthracene	mg/kg	0.05	1.1	RSK	10	0	*<0.1*	0.07		0.07	*0.05*	*0.05*	*0.05*	*0.05*	0.07	*0.05*	*0.05*	*0.05*	*0.05*
Fluoranthene	mg/kg	0.05	6300	RSK	10	0	*<0.1*	0.45		0.45	*0.05*	*0.05*	0.16	0.37	0.45	*0.05*	*0.05*	0.16	0.37
Fluorene	mg/kg	0.05	19600	RSK	10	0	0.06	0.23		0.22	0.08	0.06	0.13	0.23	0.22	0.08	0.06	0.13	0.23
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	150	S4UL	10	0	*<0.1*	0.1		0.1	*0.05*	*0.05*	*0.05*	*0.05*	0.1	*0.05*	*0.05*	*0.05*	*0.05*
Naphthalene	mg/kg	0.05	1200	RSK	10	0	0.24	0.84		0.84	0.3	0.24	0.7	0.72	0.84	0.3	0.24	0.7	0.72
Speciated Total EPA-16 PAHs	mg/kg	0.8	-	-	10	-	*<0.8*	5.14		5.14	0.85	*0.8*	2.26	3.32	5.14	0.85	*0.8*	2.26	3.32
Phenanthrene	mg/kg	0.05	6200	RSK	10	0	0.33	1.6		1.5	0.41	0.33	0.85	1.6	1.5	0.41	0.33	0.85	1.6
Pyrene	mg/kg	0.05	15000	RSK	10	0	*<0.1*	0.35		0.35	*0.05*	*0.05*	0.09	0.26	0.35	*0.05*	*0.05*	0.09	0.26
Total Phenols (monohydric)	mg/kg	1	760	S4UL	10	0	*<1*	*<1*		*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*

Appendix C Geoenvironmental GQRA screening sheet (Surface water)

Water Analytical Results

GAC Exceeded: 100 | LOD > GAC: <0.1
Water Body Impacted: Surface Water (Inland)
CaCO3 (mg/l): ≥200
Catchment: Taff | ABC= 2.8

Determina	Unit	LOD	Class	GAC	Source	No. Samp	No. Exce	Min	Max	SW1	SW2	SW3	SW4
Sample Location										SW1	SW2	SW3	SW4
Sample Depth										0	0	0	0
Sample Reference													
Sample Type										EW	EW	EW	EW
pH	pH Units	-	-	-	-	4	-	7.40	8.40	7.4	7.8	8.4	7.6
Arsenic	µg/l	0.15	Specific pollutant	50	FW-EQS	4	0	0.17	0.26	0.21	0.21	0.17	0.26
Cadmium	µg/l	0.02	Priority substance	0.25	FW-EQS	4	0	<0.02	0.04	0.02	0.02	0.02	0.04
Chromium	µg/l	0.2	Specific pollutant	8.1	FW-EQS	4	0	0.30	0.80	0.4	0.3	0.6	0.8
Copper	µg/l	0.5	Specific pollutant	1	FW-EQS	4	4	1.60	3.80	1.6	2.5	3.1	3.8
Cyanide	µg/l	1	Specific pollutant	1	FW-EQS	4	4	<1	<1	1	1	1	1
Lead	µg/l	0.2	Priority substance	1.2	FW-EQS	4	0	<0.2	<0.2	0.2	0.2	0.2	0.2
Mercury	µg/l	0.05	Priority hazardous substance	0.07	FW-EQS	4	0	<0.05	<0.05	0.05	0.05	0.05	0.05
Nickel	µg/l	0.5	Priority substance	4	FW-EQS	4	0	0.60	1.50	0.7	0.6	0.6	1.5
Zinc	µg/l	0.5	Specific pollutant	13.7	FW-EQS	4	1	1.60	33.00	2.8	2.2	1.6	33
Acenaphthene	µg/l	0.01	Priority hazardous substance	0.1	FW-EQS	4	0	<0.01	<0.01	0.01	0.01	0.01	0.01
Acenaphthylene	µg/l	0.01	-	5.8	FW-EQS	4	0	<0.01	<0.01	0.01	0.01	0.01	0.01
Anthracene	µg/l	0.01	Priority Substance	0.1	FW-EQS	4	0	<0.01	<0.01	0.01	0.01	0.01	0.01
Benzo (g,h,i) perylene	µg/l	0.01	Priority hazardous substance	See B(a)P	FW-EQS	4	0	<0.01	<0.01	0.01	0.01	0.01	0.01
Benzo(a)anthracene	µg/l	0.01	-	-	-	4	-	<0.01	<0.01	0.01	0.01	0.01	0.01
Benzo(a)pyrene	µg/l	0.01	Priority hazardous substance	0.00017	FW-EQS	4	4	<0.01	<0.01	0.01	0.01	0.01	0.01
Benzo(b)fluoranthene	µg/l	0.01	Priority hazardous substance	See B(a)P	FW-EQS	4	0	<0.01	<0.01	0.01	0.01	0.01	0.01
Benzo(k)fluoranthene	µg/l	10	Priority hazardous substance	See B(a)P	FW-EQS	4	0	12.00	51.00	12	13	27	51
Benzo(k)fluoranthene	µg/l	0.01	Priority hazardous substance	See B(a)P	FW-EQS	4	0	<0.01	<0.01	0.01	0.01	0.01	0.01
Chrysene	µg/l	0.01	-	-	-	4	-	<0.01	<0.01	0.01	0.01	0.01	0.01
Dibenz-a-h-anthracene	µg/l	0.01	-	-	-	4	-	<0.01	<0.01	0.01	0.01	0.01	0.01
Fluoranthene	µg/l	0.01	Priority Substance	0.0063	FW-EQS	4	4	<0.01	<0.01	0.01	0.01	0.01	0.01
Fluorene	µg/l	0.01	-	-	-	4	-	<0.01	<0.01	0.01	0.01	0.01	0.01
Indeno(1,2,3-cd)pyrene	µg/l	0.01	Priority hazardous substance	See B(a)P	FW-EQS	4	0	<0.01	<0.01	0.01	0.01	0.01	0.01
Naphthalene	µg/l	0.01	Priority Substance	2	FW-EQS	4	0	<0.01	<0.01	0.01	0.01	0.01	0.01
PAH 16 Total (USEPA)	µg/l	0.16	-	-	-	4	-	<0.16	<0.16	0.16	0.16	0.16	0.16
Phenanthrene	µg/l	0.01	-	-	-	4	-	<0.01	<0.01	0.01	0.01	0.01	0.01
Pyrene	µg/l	0.01	-	-	-	4	-	<0.01	<0.01	0.01	0.01	0.01	0.01
Phenol (Monohydric)	µg/l	1	-	-	-	4	-	<1	<1	1	1	1	1
Sulphate	µg/l	45	-	-	-	4	-	6470.00	34100.00	6470	8250	17200	34100
TPH (C10 - C40)	µg/l	10	#N/A	-	-	4	-	<10	<10	10	10	10	10

Appendix D Hazwaste report

Waste Classification Report

HazWasteOnline™ classifies waste as either **hazardous** or **non-hazardous** based on its chemical composition, related legislation and the rules and data defined in the current UK or EU technical guidance (Appendix C) (note that HP 9 Infectious is not assessed). It is the responsibility of the classifier named below to:

a) understand the origin of the waste
b) select the correct List of Waste code(s)
c) confirm that the list of determinands, results and sampling plan are fit for purpose
d) select and justify the chosen metal species (Appendix B)
e) correctly apply moisture correction and other available corrections
f) add the meta data for their user-defined substances (Appendix A)
g) check that the classification engine is suitable with respect to the national destination of the waste (Appendix C)

To aid the reviewer, the laboratory results, assumptions and justifications managed by the classifier are highlighted in pale yellow.

IVQJT-7VIDH-Z0YOM

Job name

Pen yr Englyn

Description/Comments

Project

Pen yr Englyn

Site

Pen yr Englyn

Classified by

Name:
James Tasker
Date:
10 Nov 2024 19:45 GMT
Telephone:
01244 409974

Company:
Binnies UK Limited
One City Place, Queens Road
Chester
CH1 3BQ

HazWasteOnline™ provides a two day, hazardous waste classification course that covers the use of the software and both basic and advanced waste classification techniques. Certification has to be renewed every 3 years.

HazWasteOnline™ Certification: **CERTIFIED**

Course	Date
Hazardous Waste Classification	09 Jun 2022

Next 3 year Refresher due by Jun 2025

Purpose of classification

2 - Material Characterisation

Address of the waste

N/A **Post Code** N/A

SIC for the process giving rise to the waste

80300 Investigation activities

Description of industry/producer giving rise to the waste

Ground Investigation lab samples

Description of the specific process, sub-process and/or activity that created the waste

Samples taken during a ground investigation for preliminary classification purposes to inform design

Description of the waste

Soil

Job summary

#	Sample name	Depth [m]	Classification Result	Hazard properties	Page
1	TP01;0.3		Non Hazardous		3
2	TP02;0.6		Non Hazardous		6
3	TP03;1.2		Non Hazardous		9
4	TP04;0.3		Non Hazardous		12
5	TP05;0.6		Non Hazardous		15
6	TP06;1.2		Non Hazardous		18
7	TP07;0.6		Non Hazardous		21
8	TP08;1.2		Non Hazardous		24
9	TP09;0.6		Non Hazardous		27
10	TP10;0.3		Non Hazardous		30

Related documents

#	Name	Description
1	Binnies - Standard waste stream template (Soils)	waste stream template used to create this Job

Report

Created by: James Tasker

Created date: 10 Nov 2024 19:45 GMT

Classification of sample: TP01;0.3

Non Hazardous Waste
Classified as **17 05 04**
in the List of Waste

Sample details

Sample name:
TP01;0.3
Moisture content:
11%
(dry weight correction)

LoW Code:
Chapter: 17: Construction and Demolition Wastes (including excavated soil from contaminated sites)
Entry: 17 05 04 (Soil and stones other than those mentioned in 17 05 03)

Hazard properties

None identified

Determinands

Moisture content: 11% Dry Weight Moisture Correction applied (MC)

#	Determinand	EU CLP index number	EC Number	CAS Number	CLP Note	User entered data		Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
1	pH			PH		6.4	pH		6.4	pH	6.4 pH		
2	asbestos	650-013-00-6	- - - - - - -	12001-28-4 132207-32-0 12172-73-5 77536-66-4 77536-68-6 77536-67-5 12001-29-5		<	mg/kg		<	mg/kg	<		**ND**
3	arsenic { arsenic trioxide }	033-003-00-0	215-481-4	1327-53-3		10	mg/kg	1.32	11.895	mg/kg	0.00119 %	✓	
4	boron { diboron trioxide }	005-008-00-8	215-125-8	1303-86-2		0.2	mg/kg	3.22	0.58	mg/kg	0.000058 %	✓	
5	cadmium { cadmium oxide }	048-002-00-0	215-146-2	1306-19-0		0.2	mg/kg	1.142	0.206	mg/kg	0.0000206 %	✓	
6	chromium { chromium(III) oxide (worst case) }		215-160-9	1308-38-9		5.7	mg/kg	1.462	7.505	mg/kg	0.000751 %	✓	
7	chromium in chromium(VI) compounds { chromium (VI) compounds, with the exception of barium chromate and of compounds specified elsewhere in this Annex }	024-017-00-8				<	mg/kg	2.27	<	mg/kg	<		**ND**
8	copper { dicopper oxide; copper (I) oxide }	029-002-00-X	215-270-7	1317-39-1		43	mg/kg	1.126	43.615	mg/kg	0.00436 %	✓	
9	lead { lead chromate }	082-004-00-2	231-846-0	7758-97-6	1	23	mg/kg	1.56	32.32	mg/kg	0.00207 %	✓	
10	mercury { mercury dichloride }	080-010-00-X	231-299-8	7487-94-7		0.4	mg/kg	1.353	0.488	mg/kg	0.0000488 %	✓	
11	nickel { nickel chromate }	028-035-00-7	238-766-5	14721-18-7		24	mg/kg	2.976	64.352	mg/kg	0.00644 %	✓	
12	zinc { zinc chromate }	024-007-00-3	236-878-9	13530-65-9		55	mg/kg	2.774	137.458	mg/kg	0.0137 %	✓	
13	cyanides { salts of hydrogen cyanide with the exception of complex cyanides such as ferrocyanides, ferricyanides and mercuric oxycyanide and those specified elsewhere in this Annex }	006-007-00-5				1	mg/kg	1.884	1.697	mg/kg	0.00017 %	✓	

#		Determinand			CLP Note	User entered data		Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
		EU CLP index number	EC Number	CAS Number									
14		TPH (C6 to C40) petroleum group		TPH		10	mg/kg		9.009	mg/kg	0.000901 %	✓	
15		naphthalene				0.84	mg/kg		0.757	mg/kg	0.0000757 %	✓	
		601-052-00-2	202-049-5	91-20-3									
16		acenaphthylene				0.05	mg/kg		0.045	mg/kg	0.0000045 %	✓	
			205-917-1	208-96-8									
17		acenaphthene				0.09	mg/kg		0.0811	mg/kg	0.00000811 %	✓	
			201-469-6	83-32-9									
18		fluorene				0.22	mg/kg		0.198	mg/kg	0.0000198 %	✓	
			201-695-5	86-73-7									
19		phenanthrene				1.5	mg/kg		1.351	mg/kg	0.000135 %	✓	
			201-581-5	85-01-8									
20		anthracene				0.05	mg/kg		0.045	mg/kg	0.0000045 %	✓	
			204-371-1	120-12-7									
21		fluoranthene				0.45	mg/kg		0.405	mg/kg	0.0000405 %	✓	
			205-912-4	206-44-0									
22		pyrene				0.35	mg/kg		0.315	mg/kg	0.0000315 %	✓	
			204-927-3	129-00-0									
23		benz[a]anthracene				0.21	mg/kg		0.189	mg/kg	0.0000189 %	✓	
		601-033-00-9	200-280-6	56-55-3									
24		chrysene				0.63	mg/kg		0.568	mg/kg	0.0000568 %	✓	
		601-048-00-0	205-923-4	218-01-9									
25		benzo[b]fluoranthene				0.34	mg/kg		0.306	mg/kg	0.0000306 %	✓	
		601-034-00-4	205-911-9	205-99-2									
26		benzo[k]fluoranthene				0.12	mg/kg		0.108	mg/kg	0.0000108 %	✓	
		601-036-00-5	205-916-6	207-08-9									
27		benzo[a]pyrene; benzo[def]chrysene				0.13	mg/kg		0.117	mg/kg	0.0000117 %	✓	
		601-032-00-3	200-028-5	50-32-8									
28		indeno[123-cd]pyrene				0.1	mg/kg		0.0901	mg/kg	0.00000901 %	✓	
			205-893-2	193-39-5									
29		dibenz[a,h]anthracene				0.07	mg/kg		0.0631	mg/kg	0.00000631 %	✓	
		601-041-00-2	200-181-8	53-70-3									
30		benzo[ghi]perylene				0.1	mg/kg		0.0901	mg/kg	0.00000901 %	✓	
			205-883-8	191-24-2									
31		phenol				1	mg/kg		0.901	mg/kg	0.0000901 %	✓	
		604-001-00-2	203-632-7	108-95-2									
										Total:	0.0303 %		

Key

	User supplied data
	Determinand values ignored for classification, see column 'Conc. Not Used' for reason
	Determinand defined or amended by HazWasteOnline (see Appendix A)
	Speciated Deteminand - Unless the Determinand is Note 1, the Conversion Factor is used to calculate the compound concentration
<LOD	Below limit of detection
ND	Not detected
CLP: Note 1	Only the metal concentration has been used for classification

Supplementary Hazardous Property Information

HP 3(i): Flammable "flammable liquid waste: liquid waste having a flash point below 60°C or waste gas oil, diesel and light heating oils having a flash point > 55°C and <= 75°C"

Force this Hazardous Property to non-hazardous for cumulative determinand results below the threshold of: 10000 mg/kg (1%) because: The hazard phase HP 3 refers to flammable substances however as the material is solid and no free product is visibly present this is not applicable and has been discounted from further consideration. Concentrations <10,000mg/kg are unlikely to be flammable if in soil mass.

Hazard Statements hit:

Flam. Liq. 3; H226 "Flammable liquid and vapour."

Because of determinand:

TPH (C6 to C40) petroleum group: (conc.: 0.0009%)

Classification of sample: TP02;0.6

Non Hazardous Waste
Classified as **17 05 04**
in the List of Waste

Sample details

Sample name:
TP02;0.6
Moisture content:
7.5%
(dry weight correction)

LoW Code:
Chapter: 17: Construction and Demolition Wastes (including excavated soil from contaminated sites)
Entry: 17 05 04 (Soil and stones other than those mentioned in 17 05 03)

Hazard properties

None identified

Determinands

Moisture content: 7.5% Dry Weight Moisture Correction applied (MC)

#	Determinand	EU CLP index number	EC Number	CAS Number	CLP Note	User entered data	Conv. Factor	Compound conc.	Classification value	MC Applied	Conc. Not Used
1	pH			PH		6.6 pH		6.6 pH	6.6 pH		
2	asbestos	650-013-00-6	- - - - - - -	12001-28-4 132207-32-0 12172-73-5 77536-66-4 77536-68-6 77536-67-5 12001-29-5		< mg/kg		< mg/kg	<		**ND**
3	arsenic { arsenic trioxide }	033-003-00-0	215-481-4	1327-53-3		11 mg/kg	1.32	13.51 mg/kg	0.00135 %	✓	
4	boron { diboron trioxide }	005-008-00-8	215-125-8	1303-86-2		0.4 mg/kg	3.22	1.198 mg/kg	0.00012 %	✓	
5	cadmium { cadmium oxide }	048-002-00-0	215-146-2	1306-19-0		0.2 mg/kg	1.142	0.213 mg/kg	0.0000213 %	✓	
6	chromium { chromium(III) oxide (worst case) }		215-160-9	1308-38-9		4.3 mg/kg	1.462	5.846 mg/kg	0.000585 %	✓	
7	chromium in chromium(VI) compounds { chromium (VI) compounds, with the exception of barium chromate and of compounds specified elsewhere in this Annex }	024-017-00-8				< mg/kg	2.27	< mg/kg	<		**ND**
8	copper { dicopper oxide; copper (I) oxide }	029-002-00-X	215-270-7	1317-39-1		49 mg/kg	1.126	51.32 mg/kg	0.00513 %	✓	
9	lead { lead chromate }	082-004-00-2	231-846-0	7758-97-6	1	25 mg/kg	1.56	36.275 mg/kg	0.00233 %	✓	
10	mercury { mercury dichloride }	080-010-00-X	231-299-8	7487-94-7		0.3 mg/kg	1.353	0.378 mg/kg	0.0000378 %	✓	
11	nickel { nickel chromate }	028-035-00-7	238-766-5	14721-18-7		36 mg/kg	2.976	99.67 mg/kg	0.00997 %	✓	
12	zinc { zinc chromate }	024-007-00-3	236-878-9	13530-65-9		77 mg/kg	2.774	198.706 mg/kg	0.0199 %	✓	
13	cyanides { salts of hydrogen cyanide with the exception of complex cyanides such as ferrocyanides, ferricyanides and mercuric oxycyanide and those specified elsewhere in this Annex }	006-007-00-5				1 mg/kg	1.884	1.753 mg/kg	0.000175 %	✓	

#		Determinand			CLP Note	User entered data		Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
		EU CLP index number	EC Number	CAS Number									
14		TPH (C6 to C40) petroleum group		TPH		10	mg/kg		9.302	mg/kg	0.00093 %	✓	
15		naphthalene				0.3	mg/kg		0.279	mg/kg	0.0000279 %	✓	
		601-052-00-2	202-049-5	91-20-3									
16		acenaphthylene				0.05	mg/kg		0.0465	mg/kg	0.00000465 %	✓	
			205-917-1	208-96-8									
17		acenaphthene				0.05	mg/kg		0.0465	mg/kg	0.00000465 %	✓	
			201-469-6	83-32-9									
18		fluorene				0.08	mg/kg		0.0744	mg/kg	0.00000744 %	✓	
			201-695-5	86-73-7									
19		phenanthrene				0.41	mg/kg		0.381	mg/kg	0.0000381 %	✓	
			201-581-5	85-01-8									
20		anthracene				0.05	mg/kg		0.0465	mg/kg	0.00000465 %	✓	
			204-371-1	120-12-7									
21		fluoranthene				0.05	mg/kg		0.0465	mg/kg	0.00000465 %	✓	
			205-912-4	206-44-0									
22		pyrene				0.05	mg/kg		0.0465	mg/kg	0.00000465 %	✓	
			204-927-3	129-00-0									
23		benz[a]anthracene				0.05	mg/kg		0.0465	mg/kg	0.00000465 %	✓	
		601-033-00-9	200-280-6	56-55-3									
24		chrysene				0.05	mg/kg		0.0465	mg/kg	0.00000465 %	✓	
		601-048-00-0	205-923-4	218-01-9									
25		benzo[b]fluoranthene				0.05	mg/kg		0.0465	mg/kg	0.00000465 %	✓	
		601-034-00-4	205-911-9	205-99-2									
26		benzo[k]fluoranthene				0.05	mg/kg		0.0465	mg/kg	0.00000465 %	✓	
		601-036-00-5	205-916-6	207-08-9									
27		benzo[a]pyrene; benzo[def]chrysene				0.05	mg/kg		0.0465	mg/kg	0.00000465 %	✓	
		601-032-00-3	200-028-5	50-32-8									
28		indeno[123-cd]pyrene				0.05	mg/kg		0.0465	mg/kg	0.00000465 %	✓	
			205-893-2	193-39-5									
29		dibenz[a,h]anthracene				0.05	mg/kg		0.0465	mg/kg	0.00000465 %	✓	
		601-041-00-2	200-181-8	53-70-3									
30		benzo[ghi]perylene				0.05	mg/kg		0.0465	mg/kg	0.00000465 %	✓	
			205-883-8	191-24-2									
31		phenol				1	mg/kg		0.93	mg/kg	0.000093 %	✓	
		604-001-00-2	203-632-7	108-95-2									
										Total:	0.0407 %		

Key

	User supplied data
	Determinand values ignored for classification, see column 'Conc. Not Used' for reason
	Determinand defined or amended by HazWasteOnline (see Appendix A)
	Speciated Deteminand - Unless the Determinand is Note 1, the Conversion Factor is used to calculate the compound concentration
<LOD	Below limit of detection
ND	Not detected
CLP: Note 1	Only the metal concentration has been used for classification

Supplementary Hazardous Property Information

HP 3(i): Flammable "flammable liquid waste: liquid waste having a flash point below 60°C or waste gas oil, diesel and light heating oils having a flash point > 55°C and <= 75°C"

Force this Hazardous Property to non-hazardous for cumulative determinand results below the threshold of: 10000 mg/kg (1%) because: The hazard phase HP 3 refers to flammable substances however as the material is solid and no free product is visibly present this is not applicable and has been discounted from further consideration. Concentrations <10,000mg/kg are unlikely to be flammable if in soil mass.

Hazard Statements hit:

Flam. Liq. 3; H226 "Flammable liquid and vapour."

Because of determinand:

TPH (C6 to C40) petroleum group: (conc.: 0.00093%)

Classification of sample: TP03;1.2

Non Hazardous Waste
Classified as **17 05 04**
in the List of Waste

Sample details

Sample name:
TP03;1.2
Moisture content:
7.2%
(dry weight correction)

LoW Code:
Chapter: 17: Construction and Demolition Wastes (including excavated soil from contaminated sites)
Entry: 17 05 04 (Soil and stones other than those mentioned in 17 05 03)

Hazard properties

None identified

Determinands

Moisture content: 7.2% Dry Weight Moisture Correction applied (MC)

#	Determinand	EU CLP index number	EC Number	CAS Number	CLP Note	User entered data	Conv. Factor	Compound conc.	Classification value	MC Applied	Conc. Not Used
1	pH			PH		6.9 pH		6.9 pH	6.9 pH		
2	asbestos	650-013-00-6	- - - - - - -	12001-28-4 132207-32-0 12172-73-5 77536-66-4 77536-68-6 77536-67-5 12001-29-5		< mg/kg		< mg/kg	<		**ND**
3	arsenic { arsenic trioxide }	033-003-00-0	215-481-4	1327-53-3		15 mg/kg	1.32	18.475 mg/kg	0.00185 %	✓	
4	boron { diboron trioxide }	005-008-00-8	215-125-8	1303-86-2		0.2 mg/kg	3.22	0.601 mg/kg	0.0000601 %	✓	
5	cadmium { cadmium oxide }	048-002-00-0	215-146-2	1306-19-0		0.2 mg/kg	1.142	0.213 mg/kg	0.0000213 %	✓	
6	chromium { chromium(III) oxide (worst case) }		215-160-9	1308-38-9		5.8 mg/kg	1.462	7.908 mg/kg	0.000791 %	✓	
7	chromium in chromium(VI) compounds { chromium (VI) compounds, with the exception of barium chromate and of compounds specified elsewhere in this Annex }	024-017-00-8				< mg/kg	2.27	< mg/kg	<		**ND**
8	copper { dicopper oxide; copper (I) oxide }	029-002-00-X	215-270-7	1317-39-1		44 mg/kg	1.126	46.212 mg/kg	0.00462 %	✓	
9	lead { lead chromate }	082-004-00-2	231-846-0	7758-97-6	1	24 mg/kg	1.56	34.921 mg/kg	0.00224 %	✓	
10	mercury { mercury dichloride }	080-010-00-X	231-299-8	7487-94-7		0.3 mg/kg	1.353	0.379 mg/kg	0.0000379 %	✓	
11	nickel { nickel chromate }	028-035-00-7	238-766-5	14721-18-7		41 mg/kg	2.976	113.831 mg/kg	0.0114 %	✓	
12	zinc { zinc chromate }	024-007-00-3	236-878-9	13530-65-9		99 mg/kg	2.774	256.195 mg/kg	0.0256 %	✓	
13	cyanides { salts of hydrogen cyanide with the exception of complex cyanides such as ferrocyanides, ferricyanides and mercuric oxycyanide and those specified elsewhere in this Annex }	006-007-00-5				1 mg/kg	1.884	1.757 mg/kg	0.000176 %	✓	

#		Determinand			CLP Note	User entered data		Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
		EU CLP index number	EC Number	CAS Number									
14		TPH (C6 to C40) petroleum group		TPH		10	mg/kg		9.328	mg/kg	0.000933 %	✓	
15		naphthalene				0.24	mg/kg		0.224	mg/kg	0.0000224 %	✓	
		601-052-00-2	202-049-5	91-20-3									
16		acenaphthylene				0.05	mg/kg		0.0466	mg/kg	0.00000466 %	✓	
			205-917-1	208-96-8									
17		acenaphthene				0.05	mg/kg		0.0466	mg/kg	0.00000466 %	✓	
			201-469-6	83-32-9									
18		fluorene				0.06	mg/kg		0.056	mg/kg	0.0000056 %	✓	
			201-695-5	86-73-7									
19		phenanthrene				0.33	mg/kg		0.308	mg/kg	0.0000308 %	✓	
			201-581-5	85-01-8									
20		anthracene				0.05	mg/kg		0.0466	mg/kg	0.00000466 %	✓	
			204-371-1	120-12-7									
21		fluoranthene				0.05	mg/kg		0.0466	mg/kg	0.00000466 %	✓	
			205-912-4	206-44-0									
22		pyrene				0.05	mg/kg		0.0466	mg/kg	0.00000466 %	✓	
			204-927-3	129-00-0									
23		benz[a]anthracene				0.05	mg/kg		0.0466	mg/kg	0.00000466 %	✓	
		601-033-00-9	200-280-6	56-55-3									
24		chrysene				0.05	mg/kg		0.0466	mg/kg	0.00000466 %	✓	
		601-048-00-0	205-923-4	218-01-9									
25		benzo[b]fluoranthene				0.05	mg/kg		0.0466	mg/kg	0.00000466 %	✓	
		601-034-00-4	205-911-9	205-99-2									
26		benzo[k]fluoranthene				0.05	mg/kg		0.0466	mg/kg	0.00000466 %	✓	
		601-036-00-5	205-916-6	207-08-9									
27		benzo[a]pyrene; benzo[def]chrysene				0.05	mg/kg		0.0466	mg/kg	0.00000466 %	✓	
		601-032-00-3	200-028-5	50-32-8									
28		indeno[123-cd]pyrene				0.05	mg/kg		0.0466	mg/kg	0.00000466 %	✓	
			205-893-2	193-39-5									
29		dibenz[a,h]anthracene				0.05	mg/kg		0.0466	mg/kg	0.00000466 %	✓	
		601-041-00-2	200-181-8	53-70-3									
30		benzo[ghi]perylene				0.05	mg/kg		0.0466	mg/kg	0.00000466 %	✓	
			205-883-8	191-24-2									
31		phenol				1	mg/kg		0.933	mg/kg	0.0000933 %	✓	
		604-001-00-2	203-632-7	108-95-2									
										Total:	0.0479 %		

Key

	User supplied data
	Determinand values ignored for classification, see column 'Conc. Not Used' for reason
	Determinand defined or amended by HazWasteOnline (see Appendix A)
	Speciated Deteminand - Unless the Determinand is Note 1, the Conversion Factor is used to calculate the compound concentration
<LOD	Below limit of detection
ND	Not detected
CLP: Note 1	Only the metal concentration has been used for classification

Supplementary Hazardous Property Information

HP 3(i): Flammable "flammable liquid waste: liquid waste having a flash point below 60°C or waste gas oil, diesel and light heating oils having a flash point > 55°C and <= 75°C"

Force this Hazardous Property to non-hazardous for cumulative determinand results below the threshold of: 10000 mg/kg (1%) because: The hazard phase HP 3 refers to flammable substances however as the material is solid and no free product is visibly present this is not applicable and has been discounted from further consideration. Concentrations <10,000mg/kg are unlikely to be flammable if in soil mass.

Hazard Statements hit:

Flam. Liq. 3; H226 "Flammable liquid and vapour."

Because of determinand:

TPH (C6 to C40) petroleum group: (conc.: 0.00093%)

Classification of sample: TP04;0.3

Non Hazardous Waste
Classified as **17 05 04**
in the List of Waste

Sample details

Sample name:
TP04;0.3
Moisture content:
8.5%
(dry weight correction)

LoW Code:
Chapter: 17: Construction and Demolition Wastes (including excavated soil from contaminated sites)
Entry: 17 05 04 (Soil and stones other than those mentioned in 17 05 03)

Hazard properties

None identified

Determinands

Moisture content: 8.5% Dry Weight Moisture Correction applied (MC)

#	Determinand	EU CLP index number	EC Number	CAS Number	CLP Note	User entered data	Conv. Factor	Compound conc.	Classification value	MC Applied	Conc. Not Used
1	pH			PH		5.6 pH		5.6 pH	5.6 pH		
2	asbestos	650-013-00-6	- - - - - - -	12001-28-4 132207-32-0 12172-73-5 77536-66-4 77536-68-6 77536-67-5 12001-29-5		< mg/kg		< mg/kg	<		**ND**
3	arsenic { arsenic trioxide }	033-003-00-0	215-481-4	1327-53-3		11 mg/kg	1.32	13.386 mg/kg	0.00134 %	✓	
4	boron { diboron trioxide }	005-008-00-8	215-125-8	1303-86-2		0.3 mg/kg	3.22	0.89 mg/kg	0.000089 %	✓	
5	cadmium { cadmium oxide }	048-002-00-0	215-146-2	1306-19-0		0.2 mg/kg	1.142	0.211 mg/kg	0.0000211 %	✓	
6	chromium { chromium(III) oxide (worst case) }		215-160-9	1308-38-9		24 mg/kg	1.462	32.329 mg/kg	0.00323 %	✓	
7	chromium in chromium(VI) compounds { chromium (VI) compounds, with the exception of barium chromate and of compounds specified elsewhere in this Annex }	024-017-00-8				< mg/kg	2.27	< mg/kg	<		**ND**
8	copper { dicopper oxide; copper (I) oxide }	029-002-00-X	215-270-7	1317-39-1		48 mg/kg	1.126	49.809 mg/kg	0.00498 %	✓	
9	lead { lead chromate }	082-004-00-2	231-846-0	7758-97-6	1	26 mg/kg	1.56	37.378 mg/kg	0.0024 %	✓	
10	mercury { mercury dichloride }	080-010-00-X	231-299-8	7487-94-7		6.6 mg/kg	1.353	8.233 mg/kg	0.000823 %	✓	
11	nickel { nickel chromate }	028-035-00-7	238-766-5	14721-18-7		30 mg/kg	2.976	82.293 mg/kg	0.00823 %	✓	
12	zinc { zinc chromate }	024-007-00-3	236-878-9	13530-65-9		90 mg/kg	2.774	230.114 mg/kg	0.023 %	✓	
13	cyanides { salts of hydrogen cyanide with the exception of complex cyanides such as ferrocyanides, ferricyanides and mercuric oxycyanide and those specified elsewhere in this Annex }	006-007-00-5				1 mg/kg	1.884	1.736 mg/kg	0.000174 %	✓	

#		Determinand			CLP Note	User entered data		Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
		EU CLP index number	EC Number	CAS Number									
14		TPH (C6 to C40) petroleum group		TPH		10	mg/kg		9.217	mg/kg	0.000922 %	✓	
15		naphthalene				0.7	mg/kg		0.645	mg/kg	0.0000645 %	✓	
		601-052-00-2	202-049-5	91-20-3									
16		acenaphthylene				0.05	mg/kg		0.0461	mg/kg	0.00000461 %	✓	
			205-917-1	208-96-8									
17		acenaphthene				0.05	mg/kg		0.0461	mg/kg	0.00000461 %	✓	
			201-469-6	83-32-9									
18		fluorene				0.13	mg/kg		0.12	mg/kg	0.000012 %	✓	
			201-695-5	86-73-7									
19		phenanthrene				0.85	mg/kg		0.783	mg/kg	0.0000783 %	✓	
			201-581-5	85-01-8									
20		anthracene				0.05	mg/kg		0.0461	mg/kg	0.00000461 %	✓	
			204-371-1	120-12-7									
21		fluoranthene				0.16	mg/kg		0.147	mg/kg	0.0000147 %	✓	
			205-912-4	206-44-0									
22		pyrene				0.09	mg/kg		0.0829	mg/kg	0.00000829 %	✓	
			204-927-3	129-00-0									
23		benz[a]anthracene				0.05	mg/kg		0.0461	mg/kg	0.00000461 %	✓	
		601-033-00-9	200-280-6	56-55-3									
24		chrysene				0.33	mg/kg		0.304	mg/kg	0.0000304 %	✓	
		601-048-00-0	205-923-4	218-01-9									
25		benzo[b]fluoranthene				0.05	mg/kg		0.0461	mg/kg	0.00000461 %	✓	
		601-034-00-4	205-911-9	205-99-2									
26		benzo[k]fluoranthene				0.05	mg/kg		0.0461	mg/kg	0.00000461 %	✓	
		601-036-00-5	205-916-6	207-08-9									
27		benzo[a]pyrene; benzo[def]chrysene				0.05	mg/kg		0.0461	mg/kg	0.00000461 %	✓	
		601-032-00-3	200-028-5	50-32-8									
28		indeno[123-cd]pyrene				0.05	mg/kg		0.0461	mg/kg	0.00000461 %	✓	
			205-893-2	193-39-5									
29		dibenz[a,h]anthracene				0.05	mg/kg		0.0461	mg/kg	0.00000461 %	✓	
		601-041-00-2	200-181-8	53-70-3									
30		benzo[ghi]perylene				0.05	mg/kg		0.0461	mg/kg	0.00000461 %	✓	
			205-883-8	191-24-2									
31		phenol				1	mg/kg		0.922	mg/kg	0.0000922 %	✓	
		604-001-00-2	203-632-7	108-95-2									
										Total:	0.0456 %		

Key

	User supplied data
	Determinand values ignored for classification, see column 'Conc. Not Used' for reason
	Determinand defined or amended by HazWasteOnline (see Appendix A)
	Speciated Deteminand - Unless the Determinand is Note 1, the Conversion Factor is used to calculate the compound concentration
<LOD	Below limit of detection
ND	Not detected
CLP: Note 1	Only the metal concentration has been used for classification

Supplementary Hazardous Property Information

HP 3(i): Flammable "flammable liquid waste: liquid waste having a flash point below 60°C or waste gas oil, diesel and light heating oils having a flash point > 55°C and <= 75°C"

Force this Hazardous Property to non-hazardous for cumulative determinand results below the threshold of: 10000 mg/kg (1%) because: The hazard phase HP 3 refers to flammable substances however as the material is solid and no free product is visibly present this is not applicable and has been discounted from further consideration. Concentrations <10,000mg/kg are unlikely to be flammable if in soil mass.

Hazard Statements hit:

Flam. Liq. 3; H226 "Flammable liquid and vapour."

Because of determinand:

TPH (C6 to C40) petroleum group: (conc.: 0.00092%)

Classification of sample: TP05;0.6

Non Hazardous Waste
Classified as **17 05 04**
in the List of Waste

Sample details

Sample name:
TP05;0.6
Moisture content:
16%
(dry weight correction)

LoW Code:
Chapter: 17: Construction and Demolition Wastes (including excavated soil from contaminated sites)
Entry: 17 05 04 (Soil and stones other than those mentioned in 17 05 03)

Hazard properties

None identified

Determinands

Moisture content: 16% Dry Weight Moisture Correction applied (MC)

#		Determinand	EU CLP index number	EC Number	CAS Number	CLP Note	User entered data		Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
1		pH			PH		7.6	pH		7.6	pH	7.6 pH		
2		asbestos	650-013-00-6	- - - - - - -	12001-28-4 132207-32-0 12172-73-5 77536-66-4 77536-68-6 77536-67-5 12001-29-5		<	mg/kg		<	mg/kg	<		**ND**
3		arsenic { arsenic trioxide }	033-003-00-0	215-481-4	1327-53-3		8.4	mg/kg	1.32	9.561	mg/kg	0.000956 %	✓	
4		boron { diboron trioxide }	005-008-00-8	215-125-8	1303-86-2		0.3	mg/kg	3.22	0.833	mg/kg	0.0000833 %	✓	
5		cadmium { cadmium oxide }	048-002-00-0	215-146-2	1306-19-0		0.2	mg/kg	1.142	0.197	mg/kg	0.0000197 %	✓	
6		chromium { chromium(III) oxide (worst case) }		215-160-9	1308-38-9		6.1	mg/kg	1.462	7.686	mg/kg	0.000769 %	✓	
7		chromium in chromium(VI) compounds { chromium (VI) compounds, with the exception of barium chromate and of compounds specified elsewhere in this Annex }	024-017-00-8				1.8	mg/kg	2.27	3.522	mg/kg	0.000352 %	✓	
8		copper { dicopper oxide; copper (I) oxide }	029-002-00-X	215-270-7	1317-39-1		49	mg/kg	1.126	47.559	mg/kg	0.00476 %	✓	
9		lead { lead chromate }	082-004-00-2	231-846-0	7758-97-6	1	16	mg/kg	1.56	21.515	mg/kg	0.00138 %	✓	
10		mercury { mercury dichloride }	080-010-00-X	231-299-8	7487-94-7		0.3	mg/kg	1.353	0.35	mg/kg	0.000035 %	✓	
11		nickel { nickel chromate }	028-035-00-7	238-766-5	14721-18-7		19	mg/kg	2.976	48.749	mg/kg	0.00487 %	✓	
12		zinc { zinc chromate }	024-007-00-3	236-878-9	13530-65-9		40	mg/kg	2.774	95.66	mg/kg	0.00957 %	✓	
13		cyanides { salts of hydrogen cyanide with the exception of complex cyanides such as ferrocyanides, ferricyanides and mercuric oxycyanide and those specified elsewhere in this Annex }	006-007-00-5				1	mg/kg	1.884	1.624	mg/kg	0.000162 %	✓	

#		Determinand			CLP Note	User entered data		Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
		EU CLP index number	EC Number	CAS Number									
14		TPH (C6 to C40) petroleum group		TPH		170	mg/kg		146.552	mg/kg	0.0147 %	✓	
15		naphthalene				0.72	mg/kg		0.621	mg/kg	0.0000621 %	✓	
		601-052-00-2	202-049-5	91-20-3									
16		acenaphthylene				0.05	mg/kg		0.0431	mg/kg	0.00000431 %	✓	
			205-917-1	208-96-8									
17		acenaphthene				0.06	mg/kg		0.0517	mg/kg	0.00000517 %	✓	
			201-469-6	83-32-9									
18		fluorene				0.23	mg/kg		0.198	mg/kg	0.0000198 %	✓	
			201-695-5	86-73-7									
19		phenanthrene				1.6	mg/kg		1.379	mg/kg	0.000138 %	✓	
			201-581-5	85-01-8									
20		anthracene				0.12	mg/kg		0.103	mg/kg	0.0000103 %	✓	
			204-371-1	120-12-7									
21		fluoranthene				0.37	mg/kg		0.319	mg/kg	0.0000319 %	✓	
			205-912-4	206-44-0									
22		pyrene				0.26	mg/kg		0.224	mg/kg	0.0000224 %	✓	
			204-927-3	129-00-0									
23		benz[a]anthracene				0.05	mg/kg		0.0431	mg/kg	0.00000431 %	✓	
		601-033-00-9	200-280-6	56-55-3									
24		chrysene				0.05	mg/kg		0.0431	mg/kg	0.00000431 %	✓	
		601-048-00-0	205-923-4	218-01-9									
25		benzo[b]fluoranthene				0.05	mg/kg		0.0431	mg/kg	0.00000431 %	✓	
		601-034-00-4	205-911-9	205-99-2									
26		benzo[k]fluoranthene				0.05	mg/kg		0.0431	mg/kg	0.00000431 %	✓	
		601-036-00-5	205-916-6	207-08-9									
27		benzo[a]pyrene; benzo[def]chrysene				0.05	mg/kg		0.0431	mg/kg	0.00000431 %	✓	
		601-032-00-3	200-028-5	50-32-8									
28		indeno[123-cd]pyrene				0.05	mg/kg		0.0431	mg/kg	0.00000431 %	✓	
			205-893-2	193-39-5									
29		dibenz[a,h]anthracene				0.05	mg/kg		0.0431	mg/kg	0.00000431 %	✓	
		601-041-00-2	200-181-8	53-70-3									
30		benzo[ghi]perylene				0.05	mg/kg		0.0431	mg/kg	0.00000431 %	✓	
			205-883-8	191-24-2									
31		phenol				1	mg/kg		0.862	mg/kg	0.0000862 %	✓	
		604-001-00-2	203-632-7	108-95-2									
										Total:	0.038 %		

Key

	User supplied data
	Determinand values ignored for classification, see column 'Conc. Not Used' for reason
	Determinand defined or amended by HazWasteOnline (see Appendix A)
	Speciated Deteminand - Unless the Determinand is Note 1, the Conversion Factor is used to calculate the compound concentration
<LOD	Below limit of detection
ND	Not detected
CLP: Note 1	Only the metal concentration has been used for classification

Supplementary Hazardous Property Information

HP 3(i): Flammable "flammable liquid waste: liquid waste having a flash point below 60°C or waste gas oil, diesel and light heating oils having a flash point > 55°C and <= 75°C"

Force this Hazardous Property to non-hazardous for cumulative determinand results below the threshold of: 10000 mg/kg (1%) because: The hazard phase HP 3 refers to flammable substances however as the material is solid and no free product is visibly present this is not applicable and has been discounted from further consideration. Concentrations <10,000mg/kg are unlikely to be flammable if in soil mass.

Hazard Statements hit:

Flam. Liq. 3; H226 "Flammable liquid and vapour."

Because of determinand:

TPH (C6 to C40) petroleum group: (conc.: 0.0147%)

Classification of sample: TP06;1.2

Non Hazardous Waste
Classified as **17 05 04**
in the List of Waste

Sample details

Sample name:
TP06;1.2
Moisture content:
11%
(dry weight correction)

LoW Code:
Chapter: 17: Construction and Demolition Wastes (including excavated soil from contaminated sites)
Entry: 17 05 04 (Soil and stones other than those mentioned in 17 05 03)

Hazard properties

None identified

Determinands

Moisture content: 11% Dry Weight Moisture Correction applied (MC)

#	Determinand	EU CLP index number	EC Number	CAS Number	CLP Note	User entered data	Conv. Factor	Compound conc.	Classification value	MC Applied	Conc. Not Used
1	pH			PH		6.4 pH		6.4 pH	6.4 pH		
2	asbestos	650-013-00-6	- - - - - - -	12001-28-4 132207-32-0 12172-73-5 77536-66-4 77536-68-6 77536-67-5 12001-29-5		< mg/kg		< mg/kg	<		**ND**
3	arsenic { arsenic trioxide }	033-003-00-0	215-481-4	1327-53-3		10 mg/kg	1.32	11.895 mg/kg	0.00119 %	✓	
4	boron { diboron trioxide }	005-008-00-8	215-125-8	1303-86-2		0.2 mg/kg	3.22	0.58 mg/kg	0.000058 %	✓	
5	cadmium { cadmium oxide }	048-002-00-0	215-146-2	1306-19-0		0.2 mg/kg	1.142	0.206 mg/kg	0.0000206 %	✓	
6	chromium { chromium(III) oxide (worst case) }		215-160-9	1308-38-9		5.7 mg/kg	1.462	7.505 mg/kg	0.000751 %	✓	
7	chromium in chromium(VI) compounds { chromium (VI) compounds, with the exception of barium chromate and of compounds specified elsewhere in this Annex }	024-017-00-8				< mg/kg	2.27	< mg/kg	<		**ND**
8	copper { dicopper oxide; copper (I) oxide }	029-002-00-X	215-270-7	1317-39-1		43 mg/kg	1.126	43.615 mg/kg	0.00436 %	✓	
9	lead { lead chromate }	082-004-00-2	231-846-0	7758-97-6	1	23 mg/kg	1.56	32.32 mg/kg	0.00207 %	✓	
10	mercury { mercury dichloride }	080-010-00-X	231-299-8	7487-94-7		0.4 mg/kg	1.353	0.488 mg/kg	0.0000488 %	✓	
11	nickel { nickel chromate }	028-035-00-7	238-766-5	14721-18-7		24 mg/kg	2.976	64.352 mg/kg	0.00644 %	✓	
12	zinc { zinc chromate }	024-007-00-3	236-878-9	13530-65-9		55 mg/kg	2.774	137.458 mg/kg	0.0137 %	✓	
13	cyanides { salts of hydrogen cyanide with the exception of complex cyanides such as ferrocyanides, ferricyanides and mercuric oxycyanide and those specified elsewhere in this Annex }	006-007-00-5				1 mg/kg	1.884	1.697 mg/kg	0.00017 %	✓	

#		Determinand			CLP Note	User entered data		Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
		EU CLP index number	EC Number	CAS Number									
14		TPH (C6 to C40) petroleum group		TPH		10	mg/kg		9.009	mg/kg	0.000901 %	✓	
15		naphthalene				0.84	mg/kg		0.757	mg/kg	0.0000757 %	✓	
		601-052-00-2	202-049-5	91-20-3									
16		acenaphthylene				0.05	mg/kg		0.045	mg/kg	0.0000045 %	✓	
			205-917-1	208-96-8									
17		acenaphthene				0.09	mg/kg		0.0811	mg/kg	0.00000811 %	✓	
			201-469-6	83-32-9									
18		fluorene				0.22	mg/kg		0.198	mg/kg	0.0000198 %	✓	
			201-695-5	86-73-7									
19		phenanthrene				1.5	mg/kg		1.351	mg/kg	0.000135 %	✓	
			201-581-5	85-01-8									
20		anthracene				0.05	mg/kg		0.045	mg/kg	0.0000045 %	✓	
			204-371-1	120-12-7									
21		fluoranthene				0.45	mg/kg		0.405	mg/kg	0.0000405 %	✓	
			205-912-4	206-44-0									
22		pyrene				0.35	mg/kg		0.315	mg/kg	0.0000315 %	✓	
			204-927-3	129-00-0									
23		benz[a]anthracene				0.21	mg/kg		0.189	mg/kg	0.0000189 %	✓	
		601-033-00-9	200-280-6	56-55-3									
24		chrysene				0.63	mg/kg		0.568	mg/kg	0.0000568 %	✓	
		601-048-00-0	205-923-4	218-01-9									
25		benzo[b]fluoranthene				0.34	mg/kg		0.306	mg/kg	0.0000306 %	✓	
		601-034-00-4	205-911-9	205-99-2									
26		benzo[k]fluoranthene				0.12	mg/kg		0.108	mg/kg	0.0000108 %	✓	
		601-036-00-5	205-916-6	207-08-9									
27		benzo[a]pyrene; benzo[def]chrysene				0.13	mg/kg		0.117	mg/kg	0.0000117 %	✓	
		601-032-00-3	200-028-5	50-32-8									
28		indeno[123-cd]pyrene				0.1	mg/kg		0.0901	mg/kg	0.00000901 %	✓	
			205-893-2	193-39-5									
29		dibenz[a,h]anthracene				0.07	mg/kg		0.0631	mg/kg	0.00000631 %	✓	
		601-041-00-2	200-181-8	53-70-3									
30		benzo[ghi]perylene				0.1	mg/kg		0.0901	mg/kg	0.00000901 %	✓	
			205-883-8	191-24-2									
31		phenol				1	mg/kg		0.901	mg/kg	0.0000901 %	✓	
		604-001-00-2	203-632-7	108-95-2									
										Total:	0.0303 %		

Key

	User supplied data
	Determinand values ignored for classification, see column 'Conc. Not Used' for reason
	Determinand defined or amended by HazWasteOnline (see Appendix A)
	Speciated Deteminand - Unless the Determinand is Note 1, the Conversion Factor is used to calculate the compound concentration
<LOD	Below limit of detection
ND	Not detected
CLP: Note 1	Only the metal concentration has been used for classification

Supplementary Hazardous Property Information

HP 3(i): Flammable "flammable liquid waste: liquid waste having a flash point below 60°C or waste gas oil, diesel and light heating oils having a flash point > 55°C and <= 75°C"

Force this Hazardous Property to non-hazardous for cumulative determinand results below the threshold of: 10000 mg/kg (1%) because: The hazard phase HP 3 refers to flammable substances however as the material is solid and no free product is visibly present this is not applicable and has been discounted from further consideration. Concentrations <10,000mg/kg are unlikely to be flammable if in soil mass.

Hazard Statements hit:

Flam. Liq. 3; H226 "Flammable liquid and vapour."

Because of determinand:

TPH (C6 to C40) petroleum group: (conc.: 0.0009%)

Classification of sample: TP07;0.6

Non Hazardous Waste
Classified as **17 05 04**
in the List of Waste

Sample details

Sample name:
TP07;0.6
Moisture content:
7.5%
(dry weight correction)

LoW Code:
Chapter: 17: Construction and Demolition Wastes (including excavated soil from contaminated sites)
Entry: 17 05 04 (Soil and stones other than those mentioned in 17 05 03)

Hazard properties

None identified

Determinands

Moisture content: 7.5% Dry Weight Moisture Correction applied (MC)

#	Determinand	EU CLP index number	EC Number	CAS Number	CLP Note	User entered data		Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
1	pH			PH		6.6	pH		6.6	pH	6.6 pH		
2	asbestos	650-013-00-6	- - - - - - -	12001-28-4 132207-32-0 12172-73-5 77536-66-4 77536-68-6 77536-67-5 12001-29-5		<	mg/kg		<	mg/kg	<		**ND**
3	arsenic { arsenic trioxide }	033-003-00-0	215-481-4	1327-53-3		11	mg/kg	1.32	13.51	mg/kg	0.00135 %	✓	
4	boron { diboron trioxide }	005-008-00-8	215-125-8	1303-86-2		0.4	mg/kg	3.22	1.198	mg/kg	0.00012 %	✓	
5	cadmium { cadmium oxide }	048-002-00-0	215-146-2	1306-19-0		0.2	mg/kg	1.142	0.213	mg/kg	0.0000213 %	✓	
6	chromium { chromium(III) oxide (worst case) }		215-160-9	1308-38-9		4.3	mg/kg	1.462	5.846	mg/kg	0.000585 %	✓	
7	chromium in chromium(VI) compounds { chromium (VI) compounds, with the exception of barium chromate and of compounds specified elsewhere in this Annex }	024-017-00-8				<	mg/kg	2.27	<	mg/kg	<		**ND**
8	copper { dicopper oxide; copper (I) oxide }	029-002-00-X	215-270-7	1317-39-1		49	mg/kg	1.126	51.32	mg/kg	0.00513 %	✓	
9	lead { lead chromate }	082-004-00-2	231-846-0	7758-97-6	1	25	mg/kg	1.56	36.275	mg/kg	0.00233 %	✓	
10	mercury { mercury dichloride }	080-010-00-X	231-299-8	7487-94-7		0.3	mg/kg	1.353	0.378	mg/kg	0.0000378 %	✓	
11	nickel { nickel chromate }	028-035-00-7	238-766-5	14721-18-7		36	mg/kg	2.976	99.67	mg/kg	0.00997 %	✓	
12	zinc { zinc chromate }	024-007-00-3	236-878-9	13530-65-9		77	mg/kg	2.774	198.706	mg/kg	0.0199 %	✓	
13	cyanides { salts of hydrogen cyanide with the exception of complex cyanides such as ferrocyanides, ferricyanides and mercuric oxycyanide and those specified elsewhere in this Annex }	006-007-00-5				1	mg/kg	1.884	1.753	mg/kg	0.000175 %	✓	

#		Determinand			CLP Note	User entered data		Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
		EU CLP index number	EC Number	CAS Number									
14		TPH (C6 to C40) petroleum group		TPH		10	mg/kg		9.302	mg/kg	0.00093 %	✓	
15		naphthalene				0.3	mg/kg		0.279	mg/kg	0.0000279 %	✓	
		601-052-00-2	202-049-5	91-20-3									
16		acenaphthylene				0.05	mg/kg		0.0465	mg/kg	0.00000465 %	✓	
			205-917-1	208-96-8									
17		acenaphthene				0.05	mg/kg		0.0465	mg/kg	0.00000465 %	✓	
			201-469-6	83-32-9									
18		fluorene				0.08	mg/kg		0.0744	mg/kg	0.00000744 %	✓	
			201-695-5	86-73-7									
19		phenanthrene				0.41	mg/kg		0.381	mg/kg	0.0000381 %	✓	
			201-581-5	85-01-8									
20		anthracene				0.05	mg/kg		0.0465	mg/kg	0.00000465 %	✓	
			204-371-1	120-12-7									
21		fluoranthene				0.05	mg/kg		0.0465	mg/kg	0.00000465 %	✓	
			205-912-4	206-44-0									
22		pyrene				0.05	mg/kg		0.0465	mg/kg	0.00000465 %	✓	
			204-927-3	129-00-0									
23		benz[a]anthracene				0.05	mg/kg		0.0465	mg/kg	0.00000465 %	✓	
		601-033-00-9	200-280-6	56-55-3									
24		chrysene				0.05	mg/kg		0.0465	mg/kg	0.00000465 %	✓	
		601-048-00-0	205-923-4	218-01-9									
25		benzo[b]fluoranthene				0.05	mg/kg		0.0465	mg/kg	0.00000465 %	✓	
		601-034-00-4	205-911-9	205-99-2									
26		benzo[k]fluoranthene				0.05	mg/kg		0.0465	mg/kg	0.00000465 %	✓	
		601-036-00-5	205-916-6	207-08-9									
27		benzo[a]pyrene; benzo[def]chrysene				0.05	mg/kg		0.0465	mg/kg	0.00000465 %	✓	
		601-032-00-3	200-028-5	50-32-8									
28		indeno[123-cd]pyrene				0.05	mg/kg		0.0465	mg/kg	0.00000465 %	✓	
			205-893-2	193-39-5									
29		dibenz[a,h]anthracene				0.05	mg/kg		0.0465	mg/kg	0.00000465 %	✓	
		601-041-00-2	200-181-8	53-70-3									
30		benzo[ghi]perylene				0.05	mg/kg		0.0465	mg/kg	0.00000465 %	✓	
			205-883-8	191-24-2									
31		phenol				1	mg/kg		0.93	mg/kg	0.000093 %	✓	
		604-001-00-2	203-632-7	108-95-2									
										Total:	0.0407 %		

Key

	User supplied data
	Determinand values ignored for classification, see column 'Conc. Not Used' for reason
	Determinand defined or amended by HazWasteOnline (see Appendix A)
	Speciated Deteminand - Unless the Determinand is Note 1, the Conversion Factor is used to calculate the compound concentration
<LOD	Below limit of detection
ND	Not detected
CLP: Note 1	Only the metal concentration has been used for classification

Supplementary Hazardous Property Information

HP 3(i): Flammable "flammable liquid waste: liquid waste having a flash point below 60°C or waste gas oil, diesel and light heating oils having a flash point > 55°C and <= 75°C"

Force this Hazardous Property to non-hazardous for cumulative determinand results below the threshold of: 10000 mg/kg (1%) because: The hazard phase HP 3 refers to flammable substances however as the material is solid and no free product is visibly present this is not applicable and has been discounted from further consideration. Concentrations <10,000mg/kg are unlikely to be flammable if in soil mass.

Hazard Statements hit:

Flam. Liq. 3; H226 "Flammable liquid and vapour."

Because of determinand:

TPH (C6 to C40) petroleum group: (conc.: 0.00093%)

Classification of sample: TP08;1.2

Non Hazardous Waste
Classified as **17 05 04**
in the List of Waste

Sample details

Sample name:
TP08;1.2
Moisture content:
7.2%
(dry weight correction)

LoW Code:
Chapter: 17: Construction and Demolition Wastes (including excavated soil from contaminated sites)
Entry: 17 05 04 (Soil and stones other than those mentioned in 17 05 03)

Hazard properties

None identified

Determinands

Moisture content: 7.2% Dry Weight Moisture Correction applied (MC)

#	Determinand	EU CLP index number	EC Number	CAS Number	CLP Note	User entered data	Conv. Factor	Compound conc.	Classification value	MC Applied	Conc. Not Used
1	pH			PH		6.9 pH		6.9 pH	6.9 pH		
2	asbestos	650-013-00-6	- - - - - - -	12001-28-4 132207-32-0 12172-73-5 77536-66-4 77536-68-6 77536-67-5 12001-29-5		< mg/kg		< mg/kg	<		**ND**
3	arsenic { arsenic trioxide }	033-003-00-0	215-481-4	1327-53-3		15 mg/kg	1.32	18.475 mg/kg	0.00185 %	✓	
4	boron { diboron trioxide }	005-008-00-8	215-125-8	1303-86-2		0.2 mg/kg	3.22	0.601 mg/kg	0.0000601 %	✓	
5	cadmium { cadmium oxide }	048-002-00-0	215-146-2	1306-19-0		0.2 mg/kg	1.142	0.213 mg/kg	0.0000213 %	✓	
6	chromium { chromium(III) oxide (worst case) }		215-160-9	1308-38-9		5.8 mg/kg	1.462	7.908 mg/kg	0.000791 %	✓	
7	chromium in chromium(VI) compounds { chromium (VI) compounds, with the exception of barium chromate and of compounds specified elsewhere in this Annex }	024-017-00-8				< mg/kg	2.27	< mg/kg	<		**ND**
8	copper { dicopper oxide; copper (I) oxide }	029-002-00-X	215-270-7	1317-39-1		44 mg/kg	1.126	46.212 mg/kg	0.00462 %	✓	
9	lead { lead chromate }	082-004-00-2	231-846-0	7758-97-6	1	24 mg/kg	1.56	34.921 mg/kg	0.00224 %	✓	
10	mercury { mercury dichloride }	080-010-00-X	231-299-8	7487-94-7		0.3 mg/kg	1.353	0.379 mg/kg	0.0000379 %	✓	
11	nickel { nickel chromate }	028-035-00-7	238-766-5	14721-18-7		41 mg/kg	2.976	113.831 mg/kg	0.0114 %	✓	
12	zinc { zinc chromate }	024-007-00-3	236-878-9	13530-65-9		99 mg/kg	2.774	256.195 mg/kg	0.0256 %	✓	
13	cyanides { salts of hydrogen cyanide with the exception of complex cyanides such as ferrocyanides, ferricyanides and mercuric oxycyanide and those specified elsewhere in this Annex }	006-007-00-5				1 mg/kg	1.884	1.757 mg/kg	0.000176 %	✓	

#		Determinand			CLP Note	User entered data		Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
		EU CLP index number	EC Number	CAS Number									
14		TPH (C6 to C40) petroleum group		TPH		10	mg/kg		9.328	mg/kg	0.000933 %	✓	
15		naphthalene				0.24	mg/kg		0.224	mg/kg	0.0000224 %	✓	
		601-052-00-2	202-049-5	91-20-3									
16		acenaphthylene				0.05	mg/kg		0.0466	mg/kg	0.00000466 %	✓	
			205-917-1	208-96-8									
17		acenaphthene				0.05	mg/kg		0.0466	mg/kg	0.00000466 %	✓	
			201-469-6	83-32-9									
18		fluorene				0.06	mg/kg		0.056	mg/kg	0.0000056 %	✓	
			201-695-5	86-73-7									
19		phenanthrene				0.33	mg/kg		0.308	mg/kg	0.0000308 %	✓	
			201-581-5	85-01-8									
20		anthracene				0.05	mg/kg		0.0466	mg/kg	0.00000466 %	✓	
			204-371-1	120-12-7									
21		fluoranthene				0.05	mg/kg		0.0466	mg/kg	0.00000466 %	✓	
			205-912-4	206-44-0									
22		pyrene				0.05	mg/kg		0.0466	mg/kg	0.00000466 %	✓	
			204-927-3	129-00-0									
23		benz[a]anthracene				0.05	mg/kg		0.0466	mg/kg	0.00000466 %	✓	
		601-033-00-9	200-280-6	56-55-3									
24		chrysene				0.05	mg/kg		0.0466	mg/kg	0.00000466 %	✓	
		601-048-00-0	205-923-4	218-01-9									
25		benzo[b]fluoranthene				0.05	mg/kg		0.0466	mg/kg	0.00000466 %	✓	
		601-034-00-4	205-911-9	205-99-2									
26		benzo[k]fluoranthene				0.05	mg/kg		0.0466	mg/kg	0.00000466 %	✓	
		601-036-00-5	205-916-6	207-08-9									
27		benzo[a]pyrene; benzo[def]chrysene				0.05	mg/kg		0.0466	mg/kg	0.00000466 %	✓	
		601-032-00-3	200-028-5	50-32-8									
28		indeno[123-cd]pyrene				0.05	mg/kg		0.0466	mg/kg	0.00000466 %	✓	
			205-893-2	193-39-5									
29		dibenz[a,h]anthracene				0.05	mg/kg		0.0466	mg/kg	0.00000466 %	✓	
		601-041-00-2	200-181-8	53-70-3									
30		benzo[ghi]perylene				0.05	mg/kg		0.0466	mg/kg	0.00000466 %	✓	
			205-883-8	191-24-2									
31		phenol				1	mg/kg		0.933	mg/kg	0.0000933 %	✓	
		604-001-00-2	203-632-7	108-95-2									
										Total:	0.0479 %		

Key

	User supplied data
	Determinand values ignored for classification, see column 'Conc. Not Used' for reason
	Determinand defined or amended by HazWasteOnline (see Appendix A)
	Speciated Deteminand - Unless the Determinand is Note 1, the Conversion Factor is used to calculate the compound concentration
<LOD	Below limit of detection
ND	Not detected
CLP: Note 1	Only the metal concentration has been used for classification

Supplementary Hazardous Property Information

HP 3(i): Flammable "flammable liquid waste: liquid waste having a flash point below 60°C or waste gas oil, diesel and light heating oils having a flash point > 55°C and <= 75°C"

Force this Hazardous Property to non-hazardous for cumulative determinand results below the threshold of: 10000 mg/kg (1%) because: The hazard phase HP 3 refers to flammable substances however as the material is solid and no free product is visibly present this is not applicable and has been discounted from further consideration. Concentrations <10,000mg/kg are unlikely to be flammable if in soil mass.

Hazard Statements hit:

Flam. Liq. 3; H226 "Flammable liquid and vapour."

Because of determinand:

TPH (C6 to C40) petroleum group: (conc.: 0.00093%)

Classification of sample: TP09;0.6

Non Hazardous Waste
Classified as **17 05 04**
in the List of Waste

Sample details

Sample name:
TP09;0.6
Moisture content:
8.5%
(dry weight correction)

LoW Code:
Chapter: 17: Construction and Demolition Wastes (including excavated soil from contaminated sites)
Entry: 17 05 04 (Soil and stones other than those mentioned in 17 05 03)

Hazard properties

None identified

Determinands

Moisture content: 8.5% Dry Weight Moisture Correction applied (MC)

#	Determinand	EU CLP index number	EC Number	CAS Number	CLP Note	User entered data		Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
1	pH			PH		5.6	pH		5.6	pH	5.6 pH		
2	asbestos	650-013-00-6	- - - - - - -	12001-28-4 132207-32-0 12172-73-5 77536-66-4 77536-68-6 77536-67-5 12001-29-5		<	mg/kg		<	mg/kg	<		**ND**
3	arsenic { arsenic trioxide }	033-003-00-0	215-481-4	1327-53-3		11	mg/kg	1.32	13.386	mg/kg	0.00134 %	✓	
4	boron { diboron trioxide }	005-008-00-8	215-125-8	1303-86-2		0.3	mg/kg	3.22	0.89	mg/kg	0.000089 %	✓	
5	cadmium { cadmium oxide }	048-002-00-0	215-146-2	1306-19-0		0.2	mg/kg	1.142	0.211	mg/kg	0.0000211 %	✓	
6	chromium { chromium(III) oxide (worst case) }		215-160-9	1308-38-9		24	mg/kg	1.462	32.329	mg/kg	0.00323 %	✓	
7	chromium in chromium(VI) compounds { chromium (VI) compounds, with the exception of barium chromate and of compounds specified elsewhere in this Annex }	024-017-00-8				<	mg/kg	2.27	<	mg/kg	<		**ND**
8	copper { dicopper oxide; copper (I) oxide }	029-002-00-X	215-270-7	1317-39-1		48	mg/kg	1.126	49.809	mg/kg	0.00498 %	✓	
9	lead { lead chromate }	082-004-00-2	231-846-0	7758-97-6	1	26	mg/kg	1.56	37.378	mg/kg	0.0024 %	✓	
10	mercury { mercury dichloride }	080-010-00-X	231-299-8	7487-94-7		6.6	mg/kg	1.353	8.233	mg/kg	0.000823 %	✓	
11	nickel { nickel chromate }	028-035-00-7	238-766-5	14721-18-7		30	mg/kg	2.976	82.293	mg/kg	0.00823 %	✓	
12	zinc { zinc chromate }	024-007-00-3	236-878-9	13530-65-9		90	mg/kg	2.774	230.114	mg/kg	0.023 %	✓	
13	cyanides { salts of hydrogen cyanide with the exception of complex cyanides such as ferrocyanides, ferricyanides and mercuric oxycyanide and those specified elsewhere in this Annex }	006-007-00-5				1	mg/kg	1.884	1.736	mg/kg	0.000174 %	✓	

#		Determinand	EU CLP index number	EC Number	CAS Number	CLP Note	User entered data		Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
14		TPH (C6 to C40) petroleum group			TPH		10	mg/kg		9.217	mg/kg	0.000922 %	✓	
15		naphthalene	601-052-00-2	202-049-5	91-20-3		0.7	mg/kg		0.645	mg/kg	0.0000645 %	✓	
16		acenaphthylene		205-917-1	208-96-8		0.05	mg/kg		0.0461	mg/kg	0.00000461 %	✓	
17		acenaphthene		201-469-6	83-32-9		0.05	mg/kg		0.0461	mg/kg	0.00000461 %	✓	
18		fluorene		201-695-5	86-73-7		0.13	mg/kg		0.12	mg/kg	0.000012 %	✓	
19		phenanthrene		201-581-5	85-01-8		0.85	mg/kg		0.783	mg/kg	0.0000783 %	✓	
20		anthracene		204-371-1	120-12-7		0.05	mg/kg		0.0461	mg/kg	0.00000461 %	✓	
21		fluoranthene		205-912-4	206-44-0		0.16	mg/kg		0.147	mg/kg	0.0000147 %	✓	
22		pyrene		204-927-3	129-00-0		0.09	mg/kg		0.0829	mg/kg	0.00000829 %	✓	
23		benz[a]anthracene	601-033-00-9	200-280-6	56-55-3		0.05	mg/kg		0.0461	mg/kg	0.00000461 %	✓	
24		chrysene	601-048-00-0	205-923-4	218-01-9		0.33	mg/kg		0.304	mg/kg	0.0000304 %	✓	
25		benzo[b]fluoranthene	601-034-00-4	205-911-9	205-99-2		0.05	mg/kg		0.0461	mg/kg	0.00000461 %	✓	
26		benzo[k]fluoranthene	601-036-00-5	205-916-6	207-08-9		0.05	mg/kg		0.0461	mg/kg	0.00000461 %	✓	
27		benzo[a]pyrene; benzo[def]chrysene	601-032-00-3	200-028-5	50-32-8		0.05	mg/kg		0.0461	mg/kg	0.00000461 %	✓	
28		indeno[123-cd]pyrene		205-893-2	193-39-5		0.05	mg/kg		0.0461	mg/kg	0.00000461 %	✓	
29		dibenz[a,h]anthracene	601-041-00-2	200-181-8	53-70-3		0.05	mg/kg		0.0461	mg/kg	0.00000461 %	✓	
30		benzo[ghi]perylene		205-883-8	191-24-2		0.05	mg/kg		0.0461	mg/kg	0.00000461 %	✓	
31		phenol	604-001-00-2	203-632-7	108-95-2		1	mg/kg		0.922	mg/kg	0.0000922 %	✓	
											Total:	0.0456 %		

Key

	User supplied data
	Determinand values ignored for classification, see column 'Conc. Not Used' for reason
	Determinand defined or amended by HazWasteOnline (see Appendix A)
	Speciated Deteminand - Unless the Determinand is Note 1, the Conversion Factor is used to calculate the compound concentration
<LOD	Below limit of detection
ND	Not detected
CLP: Note 1	Only the metal concentration has been used for classification

Supplementary Hazardous Property Information

HP 3(i): Flammable "flammable liquid waste: liquid waste having a flash point below 60°C or waste gas oil, diesel and light heating oils having a flash point > 55°C and <= 75°C"

Force this Hazardous Property to non-hazardous for cumulative determinand results below the threshold of: 10000 mg/kg (1%) because: The hazard phase HP 3 refers to flammable substances however as the material is solid and no free product is visibly present this is not applicable and has been discounted from further consideration. Concentrations <10,000mg/kg are unlikely to be flammable if in soil mass.

Hazard Statements hit:

Flam. Liq. 3; H226 "Flammable liquid and vapour."

Because of determinand:

TPH (C6 to C40) petroleum group: (conc.: 0.00092%)

Classification of sample: TP10;0.3

Non Hazardous Waste
Classified as **17 05 04**
in the List of Waste

Sample details

Sample name:
TP10;0.3
Moisture content:
16%
(dry weight correction)

LoW Code:
Chapter: 17: Construction and Demolition Wastes (including excavated soil from contaminated sites)
Entry: 17 05 04 (Soil and stones other than those mentioned in 17 05 03)

Hazard properties

None identified

Determinands

Moisture content: 16% Dry Weight Moisture Correction applied (MC)

#		Determinand	EU CLP index number	EC Number	CAS Number	CLP Note	User entered data		Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
1		pH			PH		7.6	pH		7.6	pH	7.6 pH		
2		asbestos	650-013-00-6	- - - - - - -	12001-28-4 132207-32-0 12172-73-5 77536-66-4 77536-68-6 77536-67-5 12001-29-5		<	mg/kg		<	mg/kg	<		**ND**
3		arsenic { arsenic trioxide }	033-003-00-0	215-481-4	1327-53-3		8.4	mg/kg	1.32	9.561	mg/kg	0.000956 %	✓	
4		boron { diboron trioxide }	005-008-00-8	215-125-8	1303-86-2		0.3	mg/kg	3.22	0.833	mg/kg	0.0000833 %	✓	
5		cadmium { cadmium oxide }	048-002-00-0	215-146-2	1306-19-0		0.2	mg/kg	1.142	0.197	mg/kg	0.0000197 %	✓	
6		chromium { chromium(III) oxide (worst case) }		215-160-9	1308-38-9		6.1	mg/kg	1.462	7.686	mg/kg	0.000769 %	✓	
7		chromium in chromium(VI) compounds { chromium (VI) compounds, with the exception of barium chromate and of compounds specified elsewhere in this Annex }	024-017-00-8				1.8	mg/kg	2.27	3.522	mg/kg	0.000352 %	✓	
8		copper { dicopper oxide; copper (I) oxide }	029-002-00-X	215-270-7	1317-39-1		49	mg/kg	1.126	47.559	mg/kg	0.00476 %	✓	
9		lead { lead chromate }	082-004-00-2	231-846-0	7758-97-6	1	16	mg/kg	1.56	21.515	mg/kg	0.00138 %	✓	
10		mercury { mercury dichloride }	080-010-00-X	231-299-8	7487-94-7		0.3	mg/kg	1.353	0.35	mg/kg	0.000035 %	✓	
11		nickel { nickel chromate }	028-035-00-7	238-766-5	14721-18-7		19	mg/kg	2.976	48.749	mg/kg	0.00487 %	✓	
12		zinc { zinc chromate }	024-007-00-3	236-878-9	13530-65-9		40	mg/kg	2.774	95.66	mg/kg	0.00957 %	✓	
13		cyanides { salts of hydrogen cyanide with the exception of complex cyanides such as ferrocyanides, ferricyanides and mercuric oxycyanide and those specified elsewhere in this Annex }	006-007-00-5				1	mg/kg	1.884	1.624	mg/kg	0.000162 %	✓	

#		Determinand			CLP Note	User entered data		Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
		EU CLP index number	EC Number	CAS Number									
14		TPH (C6 to C40) petroleum group		TPH		170	mg/kg		146.552	mg/kg	0.0147 %	✓	
15		naphthalene				0.72	mg/kg		0.621	mg/kg	0.0000621 %	✓	
		601-052-00-2	202-049-5	91-20-3									
16		acenaphthylene				0.05	mg/kg		0.0431	mg/kg	0.00000431 %	✓	
			205-917-1	208-96-8									
17		acenaphthene				0.06	mg/kg		0.0517	mg/kg	0.00000517 %	✓	
			201-469-6	83-32-9									
18		fluorene				0.23	mg/kg		0.198	mg/kg	0.0000198 %	✓	
			201-695-5	86-73-7									
19		phenanthrene				1.6	mg/kg		1.379	mg/kg	0.000138 %	✓	
			201-581-5	85-01-8									
20		anthracene				0.12	mg/kg		0.103	mg/kg	0.0000103 %	✓	
			204-371-1	120-12-7									
21		fluoranthene				0.37	mg/kg		0.319	mg/kg	0.0000319 %	✓	
			205-912-4	206-44-0									
22		pyrene				0.26	mg/kg		0.224	mg/kg	0.0000224 %	✓	
			204-927-3	129-00-0									
23		benz[a]anthracene				0.05	mg/kg		0.0431	mg/kg	0.00000431 %	✓	
		601-033-00-9	200-280-6	56-55-3									
24		chrysene				0.05	mg/kg		0.0431	mg/kg	0.00000431 %	✓	
		601-048-00-0	205-923-4	218-01-9									
25		benzo[b]fluoranthene				0.05	mg/kg		0.0431	mg/kg	0.00000431 %	✓	
		601-034-00-4	205-911-9	205-99-2									
26		benzo[k]fluoranthene				0.05	mg/kg		0.0431	mg/kg	0.00000431 %	✓	
		601-036-00-5	205-916-6	207-08-9									
27		benzo[a]pyrene; benzo[def]chrysene				0.05	mg/kg		0.0431	mg/kg	0.00000431 %	✓	
		601-032-00-3	200-028-5	50-32-8									
28		indeno[123-cd]pyrene				0.05	mg/kg		0.0431	mg/kg	0.00000431 %	✓	
			205-893-2	193-39-5									
29		dibenz[a,h]anthracene				0.05	mg/kg		0.0431	mg/kg	0.00000431 %	✓	
		601-041-00-2	200-181-8	53-70-3									
30		benzo[ghi]perylene				0.05	mg/kg		0.0431	mg/kg	0.00000431 %	✓	
			205-883-8	191-24-2									
31		phenol				1	mg/kg		0.862	mg/kg	0.0000862 %	✓	
		604-001-00-2	203-632-7	108-95-2									
										Total:	0.038 %		

Key

	User supplied data
	Determinand values ignored for classification, see column 'Conc. Not Used' for reason
	Determinand defined or amended by HazWasteOnline (see Appendix A)
	Speciated Deteminand - Unless the Determinand is Note 1, the Conversion Factor is used to calculate the compound concentration
<LOD	Below limit of detection
ND	Not detected
CLP: Note 1	Only the metal concentration has been used for classification

Supplementary Hazardous Property Information

HP 3(i): Flammable "flammable liquid waste: liquid waste having a flash point below 60°C or waste gas oil, diesel and light heating oils having a flash point > 55°C and <= 75°C"

Force this Hazardous Property to non-hazardous for cumulative determinand results below the threshold of: 10000 mg/kg (1%) because: The hazard phase HP 3 refers to flammable substances however as the material is solid and no free product is visibly present this is not applicable and has been discounted from further consideration. Concentrations <10,000mg/kg are unlikely to be flammable if in soil mass.

Hazard Statements hit:

Flam. Liq. 3; H226 "Flammable liquid and vapour."

Because of determinand:

TPH (C6 to C40) petroleum group: (conc.: 0.0147%)

Appendix A: Classifier defined and non GB MCL determinands

pH (CAS Number: PH)

Description/Comments: Appendix C4
Data source: WM3 1st Edition 2015
Data source date: 25 May 2015
Hazard Statements: None.

chromium(III) oxide (worst case) (EC Number: 215-160-9, CAS Number: 1308-38-9)

Description/Comments: Data from C&L Inventory Database
Data source: https://echa.europa.eu/information-on-chemicals/cl-inventory-database/-/discli/details/33806
Data source date: 17 Jul 2015
Hazard Statements: Acute Tox. 4; H332 , Acute Tox. 4; H302 , Eye Irrit. 2; H319 , STOT SE 3; H335 , Skin Irrit. 2; H315 , Resp. Sens. 1; H334 , Skin Sens. 1; H317 , Repr. 1B; H360FD , Aquatic Acute 1; H400 , Aquatic Chronic 1; H410

salts of hydrogen cyanide with the exception of complex cyanides such as ferrocyanides, ferricyanides and mercuric oxycyanide and those specified elsewhere in this Annex

GB MCL index number: 006-007-00-5
Description/Comments: Conversion factor based on a worst case compound: sodium cyanide
Additional Hazard Statement(s): EUH032 >= 0.2 %
Reason for additional Hazards Statement(s):
20 Nov 2021 - EUH032 >= 0.2 % hazard statement sourced from: WM3, Table C12.2

TPH (C6 to C40) petroleum group (CAS Number: TPH)

Description/Comments: Hazard statements taken from WM3 1st Edition 2015; Risk phrases: WM2 3rd Edition 2013
Data source: WM3 1st Edition 2015
Data source date: 25 May 2015
Hazard Statements: Flam. Liq. 3; H226 , Asp. Tox. 1; H304 , STOT RE 2; H373 , Muta. 1B; H340 , Carc. 1B; H350 , Repr. 2; H361d , Aquatic Chronic 2; H411

acenaphthylene (EC Number: 205-917-1, CAS Number: 208-96-8)

Description/Comments: Data from C&L Inventory Database
Data source: http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database
Data source date: 17 Jul 2015
Hazard Statements: Acute Tox. 4; H302 , Acute Tox. 1; H330 , Acute Tox. 1; H310 , Eye Irrit. 2; H319 , STOT SE 3; H335 , Skin Irrit. 2; H315

acenaphthene (EC Number: 201-469-6, CAS Number: 83-32-9)

Description/Comments: Data from C&L Inventory Database
Data source: http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database
Data source date: 17 Jul 2015
Hazard Statements: Eye Irrit. 2; H319 , STOT SE 3; H335 , Skin Irrit. 2; H315 , Aquatic Acute 1; H400 , Aquatic Chronic 1; H410 , Aquatic Chronic 2; H411

fluorene (EC Number: 201-695-5, CAS Number: 86-73-7)

Description/Comments: Data from C&L Inventory Database
Data source: http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database
Data source date: 06 Aug 2015
Hazard Statements: Aquatic Acute 1; H400 , Aquatic Chronic 1; H410

phenanthrene (EC Number: 201-581-5, CAS Number: 85-01-8)

Description/Comments: Data from C&L Inventory Database
Data source: http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database
Data source date: 06 Aug 2015
Hazard Statements: Acute Tox. 4; H302 , Eye Irrit. 2; H319 , STOT SE 3; H335 , Carc. 2; H351 , Skin Sens. 1; H317 , Aquatic Acute 1; H400 , Aquatic Chronic 1; H410 , Skin Irrit. 2; H315

anthracene (EC Number: 204-371-1, CAS Number: 120-12-7)

Description/Comments: Data from C&L Inventory Database
Data source: http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database
Data source date: 17 Jul 2015
Hazard Statements: Eye Irrit. 2; H319 , STOT SE 3; H335 , Skin Irrit. 2; H315 , Skin Sens. 1; H317 , Aquatic Acute 1; H400 , Aquatic Chronic 1; H410

fluoranthene (EC Number: 205-912-4, CAS Number: 206-44-0)

Description/Comments: Data from C&L Inventory Database
Data source: http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database
Data source date: 21 Aug 2015
Hazard Statements: Acute Tox. 4; H302 , Aquatic Acute 1; H400 , Aquatic Chronic 1; H410

- **pyrene** (EC Number: 204-927-3, CAS Number: 129-00-0)

Description/Comments: Data from C&L Inventory Database; SDS Sigma Aldrich 2014
Data source: http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database
Data source date: 21 Aug 2015
Hazard Statements: Skin Irrit. 2; H315 , Eye Irrit. 2; H319 , STOT SE 3; H335 , Aquatic Acute 1; H400 , Aquatic Chronic 1; H410

- **indeno[123-cd]pyrene** (EC Number: 205-893-2, CAS Number: 193-39-5)

Description/Comments: Data from C&L Inventory Database
Data source: http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database
Data source date: 06 Aug 2015
Hazard Statements: Carc. 2; H351

- **benzo[ghi]perylene** (EC Number: 205-883-8, CAS Number: 191-24-2)

Description/Comments: Data from C&L Inventory Database; SDS Sigma Aldrich 28/02/2015
Data source: http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database
Data source date: 23 Jul 2015
Hazard Statements: Aquatic Acute 1; H400 , Aquatic Chronic 1; H410

Appendix B: Rationale for selection of metal species

arsenic {arsenic trioxide}

Reasonable case CLP species based on hazard statements/molecular weight and most common (stable) oxide of arsenic. Industrial sources include: smelting; main precursor to other arsenic compounds.

boron {diboron trioxide}

Reasonable case CLP species based on hazard statements/ molecular weight, physical form and low solubility. Industrial sources include: fluxing agent for glass/enamels; additive for fibre optics, borosilicate glass.

cadmium {cadmium oxide}

Reasonable case CLP species based on hazard statements/molecular weight, very low solubility in water. Industrial sources include: electroplating baths, electrodes for storage batteries, catalysts, ceramic glazes, phosphors, pigments and nematocides. Worst case compounds in CLP: cadmium sulphate, chloride, fluoride & iodide not expected as either very soluble and/or compound's industrial usage not related to site history.

chromium {chromium(III) oxide (worst case)}

Reasonable case species based on hazard statements/molecular weight. CrVI testing was carried out on two samples at site, which resulted in <LOD

chromium in chromium(VI) compounds {chromium (VI) compounds, with the exception of barium chromate and of compounds specified elsewhere in this Annex}

Worst case species based on hazard statements/molecular weight.

copper {dicopper oxide; copper (I) oxide}

Reasonable case CLP species based on hazard statements/molecular weight and insolubility in water. Industrial sources include: oxidised copper metal, brake pads, pigments, antifouling paints, fungicide. Worse case copper sulphate is very soluble and likely to have been leached away if ever present and/or not enough soluble sulphate detected.

lead {lead chromate}

Worst case CLP species based on hazard statements/molecular weight.

mercury {mercury dichloride}

Worst case CLP species based on hazard statements/molecular weight.

nickel {nickel chromate}

Worst case CLP species based on hazard statements/molecular weight.

zinc {zinc chromate}

Worst case CLP species based on hazard statements/molecular weight.

cyanides {salts of hydrogen cyanide with the exception of complex cyanides such as ferrocyanides, ferricyanides and mercuric oxycyanide and those specified elsewhere in this Annex}

Harmonised group entry used as most reasonable case as complex cyanides and those specified elsewhere in the annex are not likely to be present in this soil: [Note conversion factor based on a worst case compound: sodium cyanide].

Appendix C: Version

HazWasteOnline Classification Engine: WM3 1st Edition v1.2.GB - Oct 2021
HazWasteOnline Classification Engine Version: 2024.304.6320.11573 (30 Oct 2024)
HazWasteOnline Database: 2024.304.6320.11573 (30 Oct 2024)

This classification utilises the following guidance and legislation:
WM3 v1.2.GB - Waste Classification - 1st Edition v1.2.GB - Oct 2021
CLP Regulation - Regulation 1272/2008/EC of 16 December 2008
1st ATP - Regulation 790/2009/EC of 10 August 2009
2nd ATP - Regulation 286/2011/EC of 10 March 2011
3rd ATP - Regulation 618/2012/EU of 10 July 2012
4th ATP - Regulation 487/2013/EU of 8 May 2013
Correction to 1st ATP - Regulation 758/2013/EU of 7 August 2013
5th ATP - Regulation 944/2013/EU of 2 October 2013
6th ATP - Regulation 605/2014/EU of 5 June 2014
WFD Annex III replacement - Regulation 1357/2014/EU of 18 December 2014
Revised List of Waste 2014 - Decision 2014/955/EU of 18 December 2014
7th ATP - Regulation 2015/1221/EU of 24 July 2015
8th ATP - Regulation (EU) 2016/918 of 19 May 2016
9th ATP - Regulation (EU) 2016/1179 of 19 July 2016
10th ATP - Regulation (EU) 2017/776 of 4 May 2017
HP14 amendment - Regulation (EU) 2017/997 of 8 June 2017
13th ATP - Regulation (EU) 2018/1480 of 4 October 2018
14th ATP - Regulation (EU) 2020/217 of 4 October 2019
15th ATP - Regulation (EU) 2020/1182 of 19 May 2020
The Chemicals (Health and Safety) and Genetically Modified Organisms (Contained Use)(Amendment etc.) (EU Exit) Regulations 2020 - UK: 2020 No. 1567 of 16th December 2020
The Waste and Environmental Permitting etc. (Legislative Functions and Amendment etc.) (EU Exit) Regulations 2020 - UK: 2020 No. 1540 of 16th December 2020
GB MCL List - version 1.1 of 09 June 2021
GB MCL List v2.0 - version 2.0 of 20th October 2023
GB MCL List v3.0 - version 3.0 of 11th January 2024
GB MCL List v4.0 - version 4.0 of 2nd March 2024
GB MCL List v5.0 - version 5.0 of 26th June 2024

Appendix E Tetra Tech 2024 Factual report

Pen-yr-englyn

784-B066842

Ground Investigation Report

Issue

Natural Resources Wales

August 2024

Document prepared by Tetra Tech Limited. Registered in England number: 01959704

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Status:	Final	**Approved By:**	Chris Pugh
Description of Revision:	Geophysical report included		

Revision:	V3	**Prepared by:**	Joel May
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Description of Revision:	Update to Geophysical Report		

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APPENDICES

ACRONYMS/ABBREVIATIONS

Acronyms/Abbreviations	Definition
AOD	above Ordnance Datum
bgl	below ground level
BGS	British Geological Survey
BTEX	Benzene, Toluene, Ethylbenzene and Xylenes
C4SL	Category 4 Screening Levels
CIEH	Chartered Institute of Environmental Health
CLEA	Contaminated Land Exposure Assessment
CoC	Constituent of Concern
CSM	Conceptual Site Model
DEFRA	Department of Environment, food and Rural Affairs
DQRA	Detailed Quantitative Risk Assessment
DTS	Desktop Study
DRO	Diesel Range Organics
DWS	Drinking Water Standard
EA	Environment Agency (England)
EPH	Extractable Petroleum Hydrocarbons
EQS	Environmental Quality Standards
FOC	Fraction Organic Carbon
GPR	Ground Penetrating Radar
LOD	Limit of detection
LQM	Land Quality Management
NRW	Natural Resources Wales
OS	Ordnance Survey
PAH	Polycyclic aromatic hydrocarbon
PCB	Polychlorinated biphenyl
PPE	Personal Protection Equipment
ppm	parts per million
PRO	Petroleum Range Organics
SGV	Soil Guideline Values
SOM	Soil Organic Matter
SVOC	Semi-volatile organic compounds
TPH	Total Petroleum Hydrocarbon
TSV	Tier 1 Screening Values
VOC	Volatile Organic Carbon
VPH	Volatile Petroleum Hydrocarbons

1.0 INTRODUCTION

1.1 INSTRUCTION

Tetra Tech Ltd (Tetra Tech) was commissioned by Natural Resources Wales (the client) to undertake a Ground Investigation for a site known as Pen-yr-englyn (known hereafter as “the site”).

The location of the site is shown on Figure 1.

1.2 BRIEF

The objective of the ground investigation is to collect additional information to confirm the depth of the deposited colliery spoil and determine its geotechnical and geo-environmental properties. The samples collected will also be tested to inform potential material reuse and waste disposal options.

The work was designed to comprise the following elements:

- 10no. hand pits to 1.20m bgl;
- 10no. nuclear density tests;
- 2no. sand replacement tests;
- P Wave Seismic Refraction Survey and MASW along three survey lines;
- Electrical Conductivity Survey of a section of the lower plateau;
- Electrical Resistivity Tomography along three survey lines;
- Surface Water Sampling
- On-site inspection and logging of recovered samples;
- Representative soil samples taken and submitted for geotechnical classification testing;
- Representative soil samples submitted and tested for a suite of potential contaminants;
- Representative surface water samples submitted and tested for a suite of potential contaminants;
- Preparation of a Ground Investigation Report.

1.3 PROPOSED DEVELOPMENT

It is understood that the proposed development will involve a new drainage plan on the hillside.

1.4 REPORT SCOPE

This report includes the following key elements:

- Full factual records of the site works carried out;
- Summary of the ground conditions encountered;
- In-Situ testing results;
- Environmental laboratory testing results;

- Geotechnical laboratory testing results;
- Interpretive report of the geophysical survey results;

1.5 LIMITATIONS

The recommendations and opinions expressed in this report are based on information obtained as part of the desk study or provided by others. Information provided from other sources is taken in good faith and Tetra Tech cannot guarantee its accuracy.

This report is subject to the report conditions presented in Appendix A.

The information contained in this report is intended for the use of the Natural Resources Wales and Tetra Tech can take no responsibility for the use of this information by any third party or for uses other than that described in this report or detailed within the terms of our engagement.

2.0 SITE INFORMATION

2.1 LOCATION

The site is located north of Jones Street, Treherbert. The site consists of a colliery spoil plateau at the foot of the slope with an area of brush and semi-mature trees at the base of the hillside. Northeast of the area of trees is the hillside overlain by colliery spoil which has been recently deforested at the time of writing. The site is approximately 52ha in area and is centered on National Grid Reference (NGR) 294888, 198078. The approximate postcode of the site is CF42 5HA.

The site address is:

Hillside north of Jones Street,

Ynyswen,

Treherbert,

Treorchy.

A site location plan is presented in Figure 1.

2.2 SITE DESCRIPTION

The Pen-yr-Englyn tip is situated on the eastern flank of the Rhondda Fawr Valley in Pen-yr-Englyn, Treherbert, within the Rhondda region

The site comprises a historic coal tip (colliery spoil) of varying depth on deforested land.

The site's topography varies significantly with an overall slope angle of 18° and a maximum slope angle of up to 45°.

Ownership of the hillside falls under the Welsh Government Woodland Estate, with Natural Resources Wales (NRW) overseeing its management. Adjacent areas are predominantly forested and feature informal walking paths. The plateau area at the foot of the slope is owned by the Rhondda-Cynon-Taff County Borough Council (RCTCBC). It serves as a space for recreational walking and provides access to the lower hillside regions..

2.3 GEOLOGY, HYDROGEOLOGY, HYDROLOGY AND RADON

2.3.1 Geology

Details of the geology underlying the site have been obtained from the following sources:

- British Geological Survey (BGS) Sheet No. 248 (Pontypridd) Solid Edition etc, 1:50 000;
- BGS website (British Geological Survey, 2021), accessed 06/06/2024.

Made Ground

BGS mapping does not show any Made Ground on site, but colliery spoil is anticipated across the majority of the site.

Superficial Strata

The superficial geology underlying the site is both Glaciofluvial deposits and Till deposits with Alluvium deposits located at the base of the valley southwest of the site. The majority of the colliery spoil plateau at the base of the site is underlain by the Glaciofluvial Deposits with the Till deposits shown on the northeastern edge of the plateau extending up the hillside.

Solid Geology

The bedrock geology underlying the site is both the South Wales Upper Coal Measures Formation (Mudstone, Siltstone and Sandstone) in the north-eastern half of the site and the South Wales Middle Coal Measure Formation (Mudstone, Siltstone and Sandstone in the south-western half of the site. Inferred coal seams are mapped along the northeast edge of the plateau (Abergorki Coal seam) and towards the top of the hillside below the forestry track (Tormynydd Coal seam). There is also a marine band running parallel to the upper inferred coal seam further down the hillside which dictates the boundary between the Upper and Middle Coal Measures.

2.3.2 Hydrogeology

The Bedrock geology is classified as a Secondary Undifferentiated Aquifer. This has been assigned in cases where it has not been possible to attribute either a Secondary A or B aquifer to the soil type due to the variable characteristics. In most cases, this means that the layer in question has previously been designated as both minor and non-aquifer in different locations due to the variable characteristics of the rock type.

2.3.3 Hydrology

Details of the hydrology of the area have been obtained from the following sources:

- BGS website (British Geological Survey, 2021), accessed 06/06/2024.

3.0 SITE INVESTIGATION

The site investigation was undertaken between the 28th May and 26th June 2024.

Details of the fieldwork methods are given in the notes section at the end of this report.

3.1 SCOPE

The scope of the site investigation included the following:

- 10no. hand pits to 1.20m bgl;
- 10no. nuclear density tests;
- 2no. sand replacement tests;
- P Wave Seismic Refraction Survey and MASW along three survey lines;
- Electrical Conductivity Survey of a section of the lower plateau;
- Electrical Resistivity Tomography along three survey lines;
- Surface Water Sampling
- On-site inspection and logging of recovered samples;
- Representative soil samples taken and submitted for geotechnical classification testing;
- Representative soil samples submitted and tested for a suite of potential contaminants;
- Representative surface water samples submitted and tested for a suite of potential contaminants;

The ground investigation was designed to provide an overall assessment of ground conditions and assess the vertical and lateral extent of the colliery spoil material.

Figure 2 shows the layout of the exploratory holes advanced during the site investigation. Exploratory hole logs including photographic plates are presented in Appendix B.

4.0 GROUND CONDITIONS ENCOUNTERED

4.1 STRATA ENCOUNTERED

The sequence of strata encountered beneath the site was;

- Topsoil
- Made Ground (Colliery Spoil)

A summary of each stratum depth is provided in the table below, with descriptions of each stratum detailed in the subsequent sections. Exploratory hole logs including photographic plates can also be seen in Appendix B.

Table 4-1 – Summary of Ground Conditions Encountered

Location	Depth to base of strata (m bgl)	
	Topsoil	Made Ground (Colliery Spoil)
TP01	GL – 0.10	0.10 – 1.20*
TP02	Ne	GL – 1.20*
TP03	Ne	GL – 1.20*
TP04	Ne	GL – 1.20*
TP05	Ne	GL – 1.20*
TP06	Ne	GL – 1.20*
TP07	Ne	GL – 1.20*
TP08	Ne	GL – 1.20*
TP09	Ne	GL – 1.20*
TP10	Ne	GL – 1.20*

*Base not proven

Ne denotes not encountered.

4.1.1 Topsoil

Topsoil was only encountered on the plateau at the foot of the site (TP01) to maximum depth of 0.10m bgl.

The Topsoil encountered in TP01 was described as *Black slightly gravelly SAND. Sand is fine to coarse. Gravel is fine to coarse angular to subangular of coal and mudstone.*

4.1.2 Made Ground

Made Ground was encountered in all locations across the site. The base of the Made Ground was not encountered in any exploratory hole location.

The Made Ground can generally be described as *Black sandy GRAVEL with a range of cobble content (Low to High). Sand is fine to coarse. Gravel is fine to coarse angular to subangular of coal, mudstone, and sandstone.*

Cobbles are angular to subangular of mudstone and sandstone. TP01 – TP06 also contained silt and the material encountered in TP04 was described as a *Black silty gravelly SAND.* Locations TP02 – TP10 had a range of rootlets, grass and moss at surface.

4.2 GROUNDWATER

Groundwater was not encountered in any of the exploratory hole locations.

4.3 IN SITU TESTING

4.3.1 Seismic Refraction Survey

Seismic refraction surveys were undertaken along 3 transects on the hillside of the site. The location of the survey transects are presented in Figure 2. Results are presented in Appendix E.

4.3.2 Electrical Resistivity Survey

Electrical resistivity surveys were undertaken along 3 transects on the hillside of the site. The location of the survey transects are presented in Figure 2. Results are presented in Appendix E.

4.3.3 Electromagnetic Survey

Electromagnetic survey was undertaken on the colliery spoil plateau at the base of the site. The location of the survey are presented in Figure 2. Results are presented in Appendix E.

4.3.4 Sand Replacement Testing

Sand replacement testing was undertaken in two exploratory locations (TP01 and TP05) in the colliery spoil material. Results are presented in Appendix C

4.3.5 Nuclear Density Testing

Nuclear density testing was undertaken in all exploratory locations (TP01 – TP10) up to 0.30m bgl across the site. Results are presented in Appendix C.

4.4 VISUAL OR OLFACTORY EVIDENCE OF CONTAMINATION

There were no significant visual or olfactory evidence of gross contamination other than the site wide presence of the colliery spoil.

4.5 OBSTRUCTIONS

No obstructions were encountered in any of the exploratory hole locations.

5.0 LABORATORY TESTING

5.1 GEOTECHNICAL TESTING

A programme of laboratory testing was carried out on samples taken from the various strata encountered during the site investigation. Geotechnical testing was scheduled by Tetra Tech and carried out by GSTL Ltd, an approved supplier in accordance with the requirements of Tetra Tech quality system and UKAS accredited for a range of geotechnical tests. The test procedures used were generally in accordance with the methods described in BS1377:1990. Details of the specific tests used in each case are given in Table 5-1. Laboratory geotechnical test results are given in Appendix C.

Table 5-1 - Summary of Geotechnical Testing

Test	No.	Test Method
Moisture Content	11	BS1377:1990 Part 2:3.2
PSD: Wet Sieve method	10	BS1377:1990 Part 2:9.2
PSD: Sedimentation by Pipette	0	BS1377:1990 Part 2:9.4
Dry Den/MC (2.5kg Rammer Method 1 Litre Mould)	7	BS1377:1990 Part 4 3.3
Dry Den/MC (4.5kg Rammer Method 1 Litre Mould)	4	BS1377:1990 Part 4 3.3
Particle Density	3	BS EN ISO 17892: Part 3
Falling Head Permeability	4	BS EN ISO 17892-11
BRE SD1 Suite B 2005	5	BRE

5.2 ENVIRONMENTAL TESTING

Environmental chemistry was investigated by specialist chemical analysis of selected soil samples carried out by ALS Environmental Laboratories, an approved supplier in accordance with the requirements of Tetra Tech quality system and UKAS and MCERTS accredited for a range of chemical analyses. The testing was scheduled by Tetra Tech and is summarised in Table 5-2 for soil samples. The test results are included in Appendix D.

Table 5-2 - Summary of Environmental Testing

Test suite	No.
Soil Samples: • Suite E1 o Heavy metals including Boron (water soluble), Arsenic, Beryllium, Cadmium, Chromium, Copper, Lead, Mercury, Nickel, Selenium, Vanadium and Zinc; o Cyanide o Inorganics – including pH, Water soluble Sulphate as SO4 (2:1 Extract), Cyanide (Easily liberatable- low level); o Soil Organic Matter o Total Petroleum Hydrocarbons (TPH CWG); o Speciated Polyaromatic Hydrocarbons (USEPA 16); o BTEX and MTBE; o Asbestos Screen; and, o Phenol	10
Hexavalent Chromium	2
Total TPH Clean-up Stage	10
WAC Full Suite	4
Asbestos Quantification	
Surface Water Samples: • Suite F o Heavy metals including Chromium (Hexavalent), Boron (water soluble), Arsenic, Cadmium, Chromium, Copper, Lead, Mercury, Nickel, and Zinc; o pH o Sulfate (as SO4); o Total Petroleum Hydrocarbons (TPH CWG); o Speciated Polyaromatic Hydrocarbons (USEPA 16); o Phenols o Cyanide	4

6.0 NOTES

1. Standards

All boring operations, sampling of soils, *in situ* testing and geotechnical laboratory testing have been carried out in accordance with the recommendations of the British Standards BS 5930(2015)[1], BS 1377 (1990)[2] and BS10175 (2001)[3].

Soil and rock descriptions follow the recommendations of BS 593. Where descriptions or classifications are based on other documents (e.g. BS 8004 (1986) or CIRIA Project Report 11 (1993)), this is stated in the report text.

2. Site methods

Unless specifically stated otherwise, the following methods are used for exploratory holes.

- Holes described as cable percussive are bored using a light cable percussive rig. Standard penetration tests are carried out where appropriate, as shown in the logs. Disturbed and undisturbed samples are taken from the exploratory holes at the depths on the records.
- Window sampling generally uses the windowless sampling method, using a tracked Geotool.
- Dynamic probes are usually heavy dynamic probes, using the same tracked Geotool used for window sampling.

3. Definitions and abbreviations

The following terms are used in the exploratory hole logs

Samples

U	Undisturbed 102mm dia. sample
TW	Thin Walled undisturbed 102mm dia. sample
B	Bulk sample
D	Small disturbed sample
W	Water sample
CBR	California Bearing Ratio test or CBR value obtained from Mexiprobe test

In situ tests

S	Standard penetration test (SPT)
N	SPT N value (blows/300mm)
HP	Hand penetrometer – shear strength
SV	Hand shear vane – shear strength
VOC	Volatile organic compounds (ppm)
PID	Photo-ionisation detector – used to detect the presence of VOCs.

Core recovery and rock quality

TCR	Total core recovery (%)
SCR	Solid core recovery (%)
RQD	Rock quality designation (%)
FI	Fracture index
NR	No recovery
NI	Not intact

Rotary drilling sizes

	Nominal diameter (mm)	
Index letter	**Borehole**	**Core**
N	75	54
H	99	76
P	120	92
S	146	113

Water strikes

▽	Level of water strike
▼	Water level rose to this level (see Remarks at foot of log for details)

Depth means depth below existing ground level unless otherwise specified. Values specified in soil descriptions given in the exploratory hole logs are depths unless otherwise specified.

7.0 REFERENCES

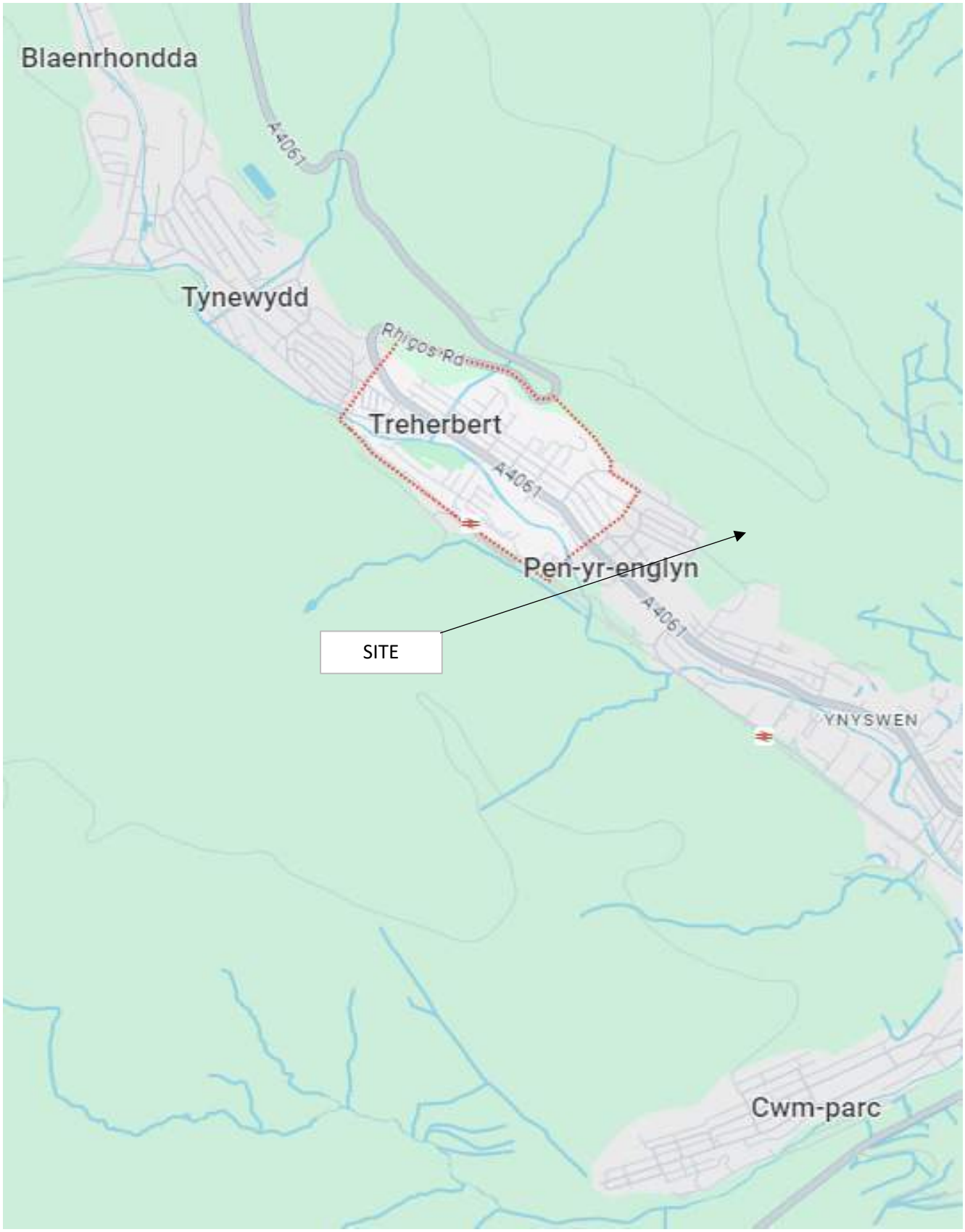
British Geological Survey. (2021). *GeoIndex*. Retrieved from http://www.bgs.ac.uk/GeoIndex/

DEFRA. (2021). *MAGIC*. Retrieved from Magic Map: http://magic.defra.gov.uk/MagicMap.aspx

Envionment Agency . (March 2017). *New Groundwater Vulnerability Mapping Methodology in England and Wales. Reference SC040016/R.* Environment Agency .

FIGURES

Figure 1 – Site Location Plan



Tetra Tech 5th Floor, Longcross Court, 47 Newport Road, Cardiff Tel: 02920 829200 Fax: 02920 455321 Environmental Consultancy Ground Engineering Services	Project Pen-Yr-Englyn	Drawing Title SITE LOCATION	
	Client NRW	Checked by	Drawing No. FIGURE 1

Figure 2 – Site Investigation Layout Plan

N

0 10 20 30 40 50 m

SCALE 1:1000

LEGEND:

- TRIAL PIT
- SOAKAWAY TEST
- TRANSECT LINES
- ELECTROMAGNETIC SURVEY AREA

PRELIMINARY ISSUE

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TETRA TECH

Client

NATURAL RESOURCES WALES

Project Name

PENYRENGLYN

Sheet Title

SITE INVESTIGATION LAYOUT PLAN

TTE Project Number	Drawn By	Date	Checked By	Date	Approved By	Date	Scale @ A1	Suitability
784-B066842	PP	12.06.24	JM	12.06.24	-			S0

Client Project Number	Originator	Volume/System	Level/Location	Type/Code	Role	Number	Revision
B066842 - TTE - 00 - XX - DR - U - 0002							P01

TTE_MT_v1

PLATES

Plate 1 TP01: Surface

Plate 2 TP01: Subsurface

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Plate 3 TP01: Handpit arisings

Plate 4 BLANK

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Plate 5 TP02: Surface

Plate 6 TP02: Subsurface

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Plate 7 TP02: Handpit arisings

Plate 8 BLANK

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Plate 9 TP03: Surface

Plate 10 TP03: Subsurface

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Plate 11 TP03: Handpit arisings

Plate 12 BLANK

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Plate 13 TP04: Surface

Plate 14 TP04: Subsurface

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Plate 15 TP04: Handpit arisings

Plate 16 BLANK

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Plate 17 TP05: Surface

Plate 18 TP05: Subsurface

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Plate 19 TP05: Handpit arisings

Plate 20 BLANK

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Plate 21 TP06: Surface

Plate 22 TP06: Subsurface

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Environmental Consultancy
Ground Technologies & Investigation

TETRA TECH

Project :-
Penyrenglyn

NRW

Project No.: B066842

29/05/2024

Plate 23 TP06: Handpit arisings

Plate 24 BLANK

Tetra Tech
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Project :-
Penyrenglyn

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29/05/2024

Plate 25 TP07: Surface

Plate 26 TP07: Subsurface

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Project :-
Penyrenglyn

NRW

Project No.: B066842

29/05/2024

Plate 27 TP07: Handpit arisings

Plate 28 BLANK

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Project :-
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NRW

Project No.: B066842

29/05/2024

Plate 29 TP08: Surface

Plate 30 TP08: Subsurface

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TETRA TECH

Project :-
Penyrenglyn

NRW

Project No.: B066842

29/05/2024

Plate 31 TP08: Handpit arisings

Plate 32 BLANK

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Project :-
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Project No.: B066842

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Plate 33 TP09: Surface

Plate 34 TP09: Subsurface

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Project :-
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Project No.: B066842

29/05/2024

Plate 35 TP09: Handpit arisings

Plate 36 BLANK

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Project :-
Penyrenglyn

NRW

Project No.: B066842

29/05/2024

Plate 37 TP10: Surface

Plate 38 TP10: Subsurface

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TETRA TECH

Project :-
Penyrenglyn

NRW

Project No.: B066842

29/05/2024

Plate 39 TP10: Handpit arisings

Plate 40 BLANK

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Environmental Consultancy
Ground Technologies & Investigation

Project :-
Penyrenglyn

NRW

Project No.: B066842

29/05/2024

APPENDIX A: REPORT CONDITIONS

APPENDIX A – REPORT CONDITIONS

GROUND INVESTIGATION

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

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

This report is based on a visual site inspection, reference to accessible referenced historical records, information supplied by those parties referenced in the text and preliminary discussions with local and Statutory Authorities. Some of the opinions are based on unconfirmed data and information and are presented as the best that can be obtained without further extensive research. Where ground contamination is suspected but no physical site test results are available to confirm this, the report must be regarded as initial advice only, and further assessment should be undertaken prior to activities related to the site. Where test results undertaken by others have been made available these can only be regarded as a limited sample. The possibility of the presence of contaminants, perhaps in higher concentrations, elsewhere on the site cannot be discounted.

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

The assessment of ground conditions within this report is based upon the findings of the study undertaken. We have interpreted the ground conditions in between locations on the assumption that conditions do not vary significantly. However, no investigation can inspect each and every part of the site and therefore changes or variances in the physical and chemical site conditions as described in this report cannot be discounted.

The report is limited to those aspects of land contamination specifically reported on and is necessarily restricted and no liability is accepted for any other aspect especially concerning gradual or sudden pollution incidents. The opinions expressed cannot be absolute due to the limitations of time and resources imposed by the agreed brief and the possibility of unrecorded previous use and abuse of the site and adjacent sites. The report concentrates on the site as defined in the report and provides an opinion on surrounding sites. If migrating pollution or contamination (past or present) exists further extensive research will be required before the effects can be better determined.

APPENDIX B: EXPLORATORY HOLE LOGS

TETRA TECH

Project: **Penyrenglyn**

Location: **Penyrenglyn**

Client: **Natural Resource Wales**

Location Details			
Easting:	294745.59	Northing:	197935.44
Level:	212.98mAOD	Depth:	1.20m
Logger:	JM	Type:	TP

Status: FINAL

Pit Number: **TP01**

Sheet 1 of 1

Hole Information		Groundwater			
Pit Dimensions	Orientation: °	Strike (m)	Rose To (m)	After (mins)	Remarks
0.30m x 0.30m	Shoring: None				
	Stability: Good				
	Plant: Hand digging tools.				

Scale: 1:25
Checked By: NEB
Approved By: SR
Start Date: 30/05/2024
Finish Date: 04/06/2024

Strata Description	Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Backfill	Samples and Testing: Depth (m)	Ref	Tests / Results
MADE GROUND: Black slightly gravelly SAND with frequent rootlets. Sand is fine to coarse. Gravel is fine to coarse angular to subaungular of coal and mudstone. TOP		0.10	212.88			0.10 - 1.20	B1	
@0.00m - 0.10m: Rootlets grass at surface.						0.30	ES1	
MADE GROUND: Black silty sandy GRAVEL with high cobble and low boulder content. Sand is fine to coarse. Gravel is fine to coarse angular to subangular of coal and mudstone. Cobbles are angular to subangular of coal and mudstone. Boulders are of mudstone. MGR						0.60	ES2	
EOH at 1.20m - Required depth.		1.20	211.78			1.20	ES3	

Observations / Remarks

1. Exploratory hole scanned using CAT & Genny prior to excavation.
2. No groundwater encountered.
3. Nuclear density test undertaken adjacent to exploratory hole.
4. Sand replacement test undertaken in exploratory hole.

Atlantic House, Greenwood Close,
Gate Business Park, Pontprennau,
Cardiff, CF23 8RD
029 2082 9200

Project Number: **784-B066842**

TETRA TECH

Project: **Penyrenglyn**

Location: **Penyrenglyn**

Client: **Natural Resource Wales**

Location Details			
Easting:	294827.21	Northing:	197996.27
Level:	234.57mAOD	Depth:	1.20m
Logger:	JM	Type:	TP

Status: FINAL

Pit Number: **TP02**

Sheet 1 of 1

Hole Information

Pit Dimensions: 0.30m x 0.30m

Orientation: °

Shoring: None

Stability: Good

Plant: Hand digging tools.

Groundwater

Strike (m)	Rose To (m)	After (mins)	Remarks

Scale: 1:25

Checked By: NEB

Approved By: SR

Start Date: 30/05/2024

Finish Date: 04/06/2024

Strata Description	Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Backfill	Samples and Testing: Depth (m)	Ref	Tests / Results
MADE GROUND: Black clayey very sandy GRAVEL with high cobble content. Sand is fine to coarse. Gravel is fine to coarse angular to subangular of coal, mudstone and sandstone. Cobbles are angular to subangular of coal, mudstone and sandstone. MGR *@0.00m - 0.10m: Rootlets and moss at surface.*						0.00 - 1.20	B1	
						0.30	ES1	
						0.60	ES2	
EOH at 1.20m - Required depth.		1.20	233.37			1.20	ES3	

Observations / Remarks

1. Exploratory hole scanned using CAT & Genny prior to excavation.
2. No groundwater encountered.
3. Nuclear density test undertaken adjacent to exploratory hole.

Atlantic House, Greenwood Close,
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029 2082 9200

Project Number: **784-B066842**

TETRA TECH

Project: **Penyrenglyn**

Location: **Penyrenglyn**

Client: **Natural Resource Wales**

Location Details			
Easting:	294901.38	Northing:	197945.08
Level:	233.44mAOD	Depth:	1.20m
Logger:	JM	Type:	TP

Status: FINAL

Pit Number: **TP03**

Sheet 1 of 1

Hole Information

Pit Dimensions: 0.30m x 0.30m

Orientation: °

Shoring: None

Stability: Good

Plant: Hand digging tools.

Groundwater

Strike (m)	Rose To (m)	After (mins)	Remarks

Scale: 1:25

Checked By: NEB

Approved By: SR

Start Date: 30/05/2024

Finish Date: 04/06/2024

Strata Description	Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Backfill	Samples and Testing: Depth (m)	Ref	Tests / Results
MADE GROUND: Dark grey silty sandy GRAVEL with high cobble content. Sand is fine to coarse. Gravel is fine to coarse angular to subangular of coal, mudstone and sandstone. Cobbles are angular to subaungular of coal, mudstone and sandstone. MGR *@0.00m - 0.10m: Rootlets and moss at surface.*						0.00 - 0.60 0.30	B1 ES1	
MADE GROUND: Black clayey sandy GRAVEL with medium cobble content. Sand is fine to coarse. Gravel is fine to coarse angular to subangular of coal, mudstone and sandstone. Cobbles are angular to subangular of mudstone and sandstone. MGR		0.60	232.84			0.60 0.60 - 1.20	ES2 B2	
EOH at 1.20m - Required depth.		1.20	232.24			1.20	ES3	

Observations / Remarks

1. Exploratory hole scanned using CAT & Genny prior to excavation.
2. No groundwater encountered.
3. Nuclear density test undertaken adjacent to exploratory hole.

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Project Number: **784-B066842**

TETRA TECH

Project:	**Penyrenglyn**	Location Details	Status
Location:	**Penyrenglyn**	Easting: 294772.44 Northing: 198014.83	FINAL
Client:	**Natural Resource Wales**	Level: 234.26mAOD Depth: 1.20m	Pit Number **TP04**
		Logger: JM Type: TP	Sheet 1 of 1

Hole Information

Pit Dimensions: 0.30m x 0.30m

Orientation: °
Shoring: None
Stability: Good
Plant: Hand digging tools.

Groundwater

Strike (m)	Rose To (m)	After (mins)	Remarks

Scale: 1:25
Checked By: NEB
Approved By: SR
Start Date: 30/05/2024
Finish Date: 04/06/2024

Strata Description	Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Backfill	Samples and Testing: Depth (m)	Ref	Tests / Results
MADE GROUND: Black clayey very sandy GRAVEL with low cobble content. Sand is fine to coarse. Gravel is fine to coarse angular to subangular of coal, mudstone and sandstone. Cobbles are angular to subangular of mudstone and sandstone. MGR *@0.00m - 0.10m: Rootlets at surface.*						0.00 - 1.20	B1	
						0.30	ES1	
						0.60	ES2	
EOH at 1.20m - Required depth.		1.20	233.06			1.20	ES3	

Observations / Remarks

1. Exploratory hole scanned using CAT & Genny prior to excavation.
2. No groundwater encountered.
3. Nuclear density test undertaken adjacent to exploratory hole.

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029 2082 9200

Project Number
784-B066842

TETRA TECH

Project: **Penyrenglyn**

Location: **Penyrenglyn**

Client: **Natural Resource Wales**

Location Details

Easting: 294884.93 Northing: 198014.45

Level: 247.96mAOD Depth: 1.20m

Logger: JM Type: TP

Status: FINAL

Pit Number: **TP05**

Sheet 1 of 1

Hole Information

Pit Dimensions: 0.30m x 0.30m

Orientation: °

Shoring: None

Stability: Good

Plant: Hand digging tools.

Groundwater

Strike (m)	Rose To (m)	After (mins)	Remarks

Scale: 1:25

Checked By: NEB

Approved By: SR

Start Date: 30/05/2024

Finish Date: 04/06/2024

Strata Description	Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Backfill	Samples and Testing: Depth (m)	Ref	Tests / Results
MADE GROUND: Black silty sandy GRAVEL with low cobble content. Sand is fine to coarse. Gravel is fine to coarse angular to subangular of coal, mudstone and sandstone. Cobbles are angular to subangular of mudstone and sandstone. MGR *@0.00m - 0.10m: Rootlets at surface.* *@0.90m - 1.20m: Cobble content increase (High cobble content).*						0.00 - 1.20	B1	
						0.30	ES1	
						0.60	ES2	
EOH at 1.20m - Required depth.		1.20	246.76			1.20	ES3	

Observations / Remarks

1. Exploratory hole scanned using CAT & Genny prior to excavation.
2. No groundwater encountered.
3. Nuclear density test undertaken adjacent to exploratory hole.
4. Sand replacement test undertaken in exploratory hole.

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029 2082 9200

Project Number

784-B066842

TETRA TECH

Project: **Penyrenglyn**

Location: **Penyrenglyn**

Client: **Natural Resource Wales**

Location Details

Easting: 294830.05 Northing: 198069.85

Level: 254.12mAOD Depth: 1.20m

Logger: JM Type: TP

Status: FINAL

Pit Number: **TP06**

Sheet 1 of 1

Hole Information

Pit Dimensions: 0.30m x 0.30m

Orientation: °

Shoring: None

Stability: Good

Plant: Hand digging tools.

Groundwater

Strike (m)	Rose To (m)	After (mins)	Remarks

Scale: 1:25

Checked By: NEB

Approved By: SR

Start Date: 29/05/2024

Finish Date: 04/06/2024

Strata Description	Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Backfill	Samples and Testing: Depth (m)	Ref	Tests / Results
MADE GROUND: Black clayey very sandy GRAVEL with high cobble content. Sand is fine to coarse. Gravel is fine to coarse angular to subangular of coal and mudstone. Cobbles are angular to subangular of mudstone. MGR *@0.00m - 0.10m: Rootlets and moss at surface.*						0.00 - 1.20	B1	
						0.30	ES1	
						0.60	ES2	
EOH at 1.20m - Required depth.		1.20	252.92			1.20	ES3	

Observations / Remarks

1. Exploratory hole scanned using CAT & Genny prior to excavation.
2. No groundwater encountered.
3. Nuclear density test undertaken adjacent to exploratory hole.

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Project Number

784-B066842

TETRA TECH

Project: **Penyrenglyn**

Location: **Penyrenglyn**

Client: **Natural Resource Wales**

Location Details

Easting: 294995.61 Northing: 198107.83

Level: 294.99mAOD Depth: 1.20m

Logger: JM Type: TP

Status: FINAL

Pit Number: **TP07**

Sheet 1 of 1

Hole Information

Pit Dimensions: 0.30m x 0.30m

Orientation: °

Shoring: None

Stability: Good

Plant: Hand digging tools.

Groundwater

Strike (m)	Rose To (m)	After (mins)	Remarks

Scale: 1:25

Checked By: NEB

Approved By: SR

Start Date: 29/05/2024

Finish Date: 04/06/2024

Strata Description	Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Backfill	Samples and Testing: Depth (m)	Ref	Tests / Results
MADE GROUND: Black clayey very sandy GRAVEL with high cobble content. Sand is fine to coarse. Gravel is fine to coarse angular to subangular of coal, mudstone and sandstone. Cobbles are angular to subangular of mudstone and sandstone. MGR *@0.00m - 0.10m: Rootlets and moss at surface.*						0.00 - 1.20	B1	
						0.30	ES1	
						0.60	ES2	
EOH at 1.20m - Required depth.		1.20	293.79			1.20	ES3	

Observations / Remarks

1. Exploratory hole scanned using CAT & Genny prior to excavation.
2. No groundwater encountered.
3. Nuclear density test undertaken adjacent to exploratory hole.

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Project Number: **784-B066842**

TETRA TECH

Project:	**Penyrenglyn**	Location Details	
Location:	**Penyrenglyn**	Easting: 294915.82	Northing: 198087.84
Client:	**Natural Resource Wales**	Level: 267.83mAOD	Depth: 1.20m
		Logger: JM	Type: TP

Status: FINAL

Pit Number: **TP08**

Sheet 1 of 1

Hole Information

Pit Dimensions: 0.30m x 0.30m

Orientation: °
Shoring: None
Stability: Good
Plant: Hand digging tools.

Groundwater

Strike (m)	Rose To (m)	After (mins)	Remarks

Scale: 1:25
Checked By: NEB
Approved By: SR
Start Date: 29/05/2024
Finish Date: 04/06/2024

Strata Description	Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Backfill	Samples and Testing: Depth (m)	Ref	Tests / Results
MADE GROUND: Black clayey very sandy GRAVEL with high cobble content. Sand is fine to coarse. Gravel is fine to coarse angular to subangular of coal and mudstone. Cobbles are angular to subangular of mudstone. MGR *@0.00m - 0.10m: Rootlets and moss at surface.*						0.00 - 1.20	B1	
						0.30	ES1	
						0.60	ES2	
EOH at 1.20m - Required depth.		1.20	266.63			1.20	ES3	

1
2
3
4
5

Observations / Remarks

1. Exploratory hole scanned using CAT & Genny prior to excavation.
2. No groundwater encountered.
3. Nuclear density test undertaken adjacent to exploratory hole.

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029 2082 9200

Project Number: **784-B066842**

TETRA TECH

Project: **Penyrenglyn**

Location: **Penyrenglyn**

Client: **Natural Resource Wales**

Location Details

Easting: 294875.50 Northing: 198162.93

Level: 277.18mAOD Depth: 1.20m

Logger: JM Type: TP

Status: FINAL

Pit Number: **TP09**

Sheet 1 of 1

Hole Information

Pit Dimensions: 0.30m x 0.30m

Orientation: °

Shoring: None

Stability: Good

Plant: Hand digging tools.

Groundwater

Strike (m)	Rose To (m)	After (mins)	Remarks

Scale: 1:25

Checked By: NEB

Approved By: SR

Start Date: 29/05/2024

Finish Date: 04/06/2024

Strata Description	Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Backfill	Samples and Testing: Depth (m)	Ref	Tests / Results
MADE GROUND: Black silty sandy GRAVEL with low cobble content. Sand is fine to coarse. Gravel is fine to coarse angular to subangular of coal and mudstone. Cobbles are angular to subangular of mudstone. MGR *@0.00m - 0.10m: Rootlets and moss ar surface.*						0.00 - 1.20	B1	
						0.30	ES1	
						0.60	ES2	
EOH at 1.20m - Required depth.		1.20	275.98			1.20	ES3	

Observations / Remarks

1. Exploratory hole scanned using CAT & Genny prior to excavation.
2. No groundwater encountered.
3. Nuclear density test undertaken adjacent to exploratory hole.

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029 2082 9200

Project Number

784-B066842

TETRA TECH

Project:	**Penyrenglyn**	Location Details	
Location:	**Penyrenglyn**	Easting: 294925.76	Northing: 198171.98
Client:	**Natural Resource Wales**	Level: 293.85mAOD	Depth: 1.20m
		Logger: JM	Type: TP

Status: FINAL

Pit Number: **TP10**

Sheet 1 of 1

Hole Information

Pit Dimensions: 0.30m x 0.30m

Orientation: °
Shoring: None
Stability: Good
Plant: Hand digging tools.

Groundwater

Strike (m)	Rose To (m)	After (mins)	Remarks

Scale:	1:25
Checked By:	NEB
Approved By:	SR
Start Date:	29/05/2024
Finish Date:	04/06/2024

Strata Description	Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Backfill	Samples and Testing: Depth (m)	Ref	Tests / Results
MADE GROUND: Black clayey very sandy GRAVEL with low cobble content. Sand is fine to coarse. Gravel is fine to coarse angular to subangular of coal and mudstone. Cobbles are angular to subangular of mudstone. MGR *@0.00m - 0.10m: Rootlets and moss at surface.*						0.00 0.00 - 1.20 0.30 0.60	B1 ES1 ES1 ES2	
EOH at 1.20m - Required depth.		1.20	292.65			1.20	ES3	

1
2
3
4
5

Observations / Remarks

1. Exploratory hole scanned using CAT & Genny prior to excavation.
2. No groundwater encountered.
3. Nuclear density test undertaken adjacent to exploratory hole.

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029 2082 9200

Project Number: **784-B066842**

APPENDIX C: GEOTECHNICAL TEST DATA

Laboratory Report

UKAS TESTING 2788

GSTL GEOTECHNICAL SITE & TESTING LABORATORIES A PHENNA GROUP COMPANY

Contract Number: 73163

Client Ref: **784-B068642**
Client PO: **7015670**

Date Received: **05-06-2024**
Date Completed: **28-06-2024**
Report Date: **28-06-2024**

Client: **Tetra Tech**

Contract Title: **Penyrenglyn**
For the attention of: **Nicholas Bool**

This report has been checked and approved by:

B. Evans

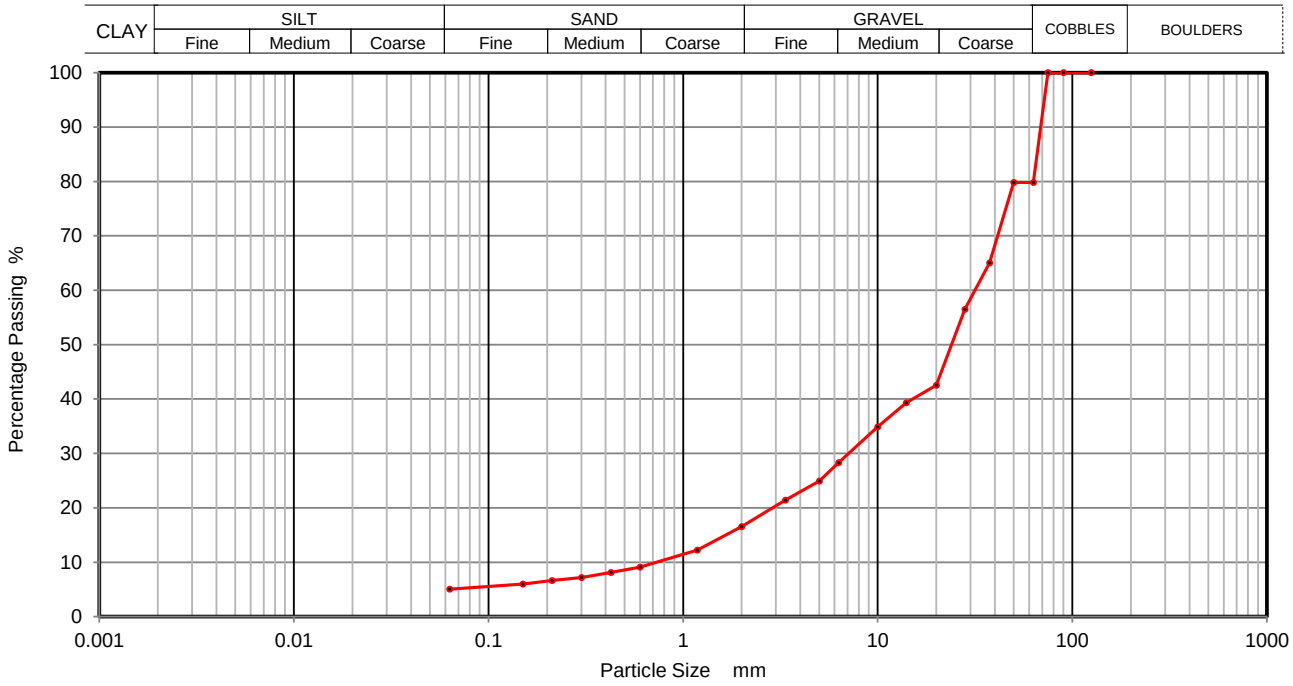
Brendan Evans
Office Administrator

Description	Qty
Moisture Content BS 1377:1990 - Part 2 : 3.2 - * UKAS	11
Particle Density (Gas Jar) BS 1377:1990 - Part 2 : 8.2 - * UKAS	3
PSD Wet Sieve method BS 1377:1990 - Part 2 : 9.2 - * UKAS	10
PSD: Sedimentation by pipette carried out with Wet Sieve (Wet Sieve must also be selected) BS 1377:1990 - Part 2 : 9.4 - * UKAS	7
Dry Den/MC (2.5kg Rammer Method 1 litre mould/CBR Mould) BS 1377:1990 - Part 4 : 3.4 - * UKAS	7
Dry Den/MC (4.5kg Rammer Method 1 litre mould/CBR Mould) BS 1377:1990 - Part 4 : 3.6 - * UKAS	4
BRE Suite B Greenfield Site (pyrite present) **includes pH, water & acid soluble sulphate and total sulphur** Sub-contracted Test	5
Determination of Permeabilty using Falling Head Permeameter - @ Non Accredited Test	4
Disposal of samples for job	1

Notes: Observations and Interpretations are outside the UKAS Accreditation
*** - denotes test included in laboratory scope of accreditation**
 # - denotes test carried out by approved contractor
@ - denotes non accredited tests

Approved Signatories:
Brendan Evans (Office Administrator) - Darren Bourne (Quality Senior Technician) - Paul Evans (Director)
Richard John (Quality/Technical Manager) - Shaun Jones (Laboratory manager) - Shaun Thomas (Site Manager)
Wayne Honey (HR & HSE Manager)

GSTL GEOTECHNICAL SITE & TESTING LABORATORIES	**PARTICLE SIZE DISTRIBUTION** **BS 1377 Part 2:1990** **Wet Sieve, Clause 9.2**	Contract Number	73163
		Borehole/Pit No.	TP01
Project Name	Penyrenglyn	Sample No.	1
Soil Description	Grey slightly silty/ clayey fine to coarse sandy fine to coarse GRAVEL with cobbles	Depth Top	0.10
		Depth Base	1.20
Date Tested	17/06/2024	Sample Type	B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	80		
50	80		
37.5	65		
28	57		
20	43		
14	39		
10	35		
6.3	28		
5	25		
3.35	21		
2	17		
1.18	12		
0.6	9		
0.425	8		
0.3	7		
0.212	7		
0.15	6		
0.063	5		

Sample Proportions	% dry mass
Cobbles	20
Gravel	63
Sand	12
Silt and Clay	5

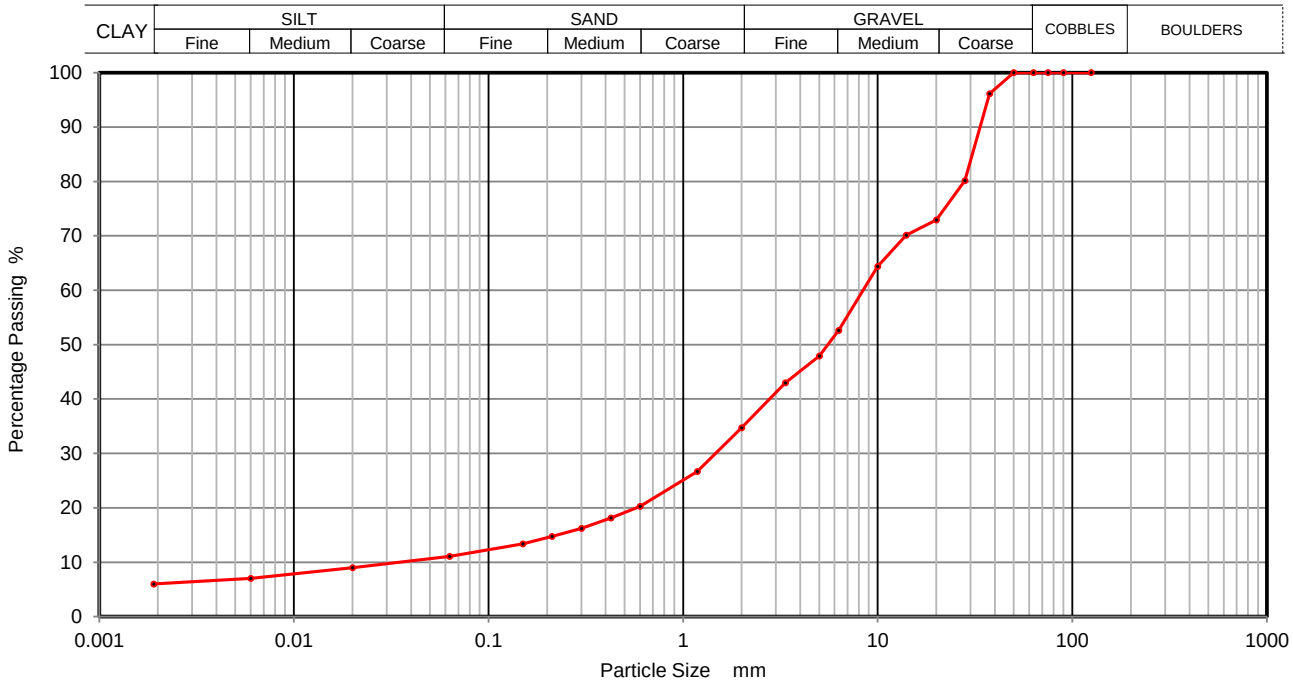
Remarks

Preparation and testing in accordance with BS1377 unless noted below

Operator
Cameron Thomas

UKAS TESTING 2788

GSTL GEOTECHNICAL SITE & TESTING LABORATORIES	**PARTICLE SIZE DISTRIBUTION BS 1377 Part 2:1990 Wet Sieve & Pipette Analysis, Clause 9.2 & 9.4**	Contract Number	73163
		Borehole/Pit No.	TP02
Project Name	Penyrenglyn	Sample No.	1
Soil Description	Grey shaley slightly silty slightly clayey fine to coarse sandy fine to coarse GRAVEL	Depth Top	0.00
		Depth Base	1.20
Date Tested	17/06/2024	Sample Type	B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0200	9
90	100	0.0060	7
75	100	0.0020	6
63	100		
50	100		
37.5	96		
28	80		
20	73		
14	70		
10	64		
6.3	53		
5	48		
3.35	43		
2	35		
1.18	27		
0.6	20		
0.425	18		
0.3	16		
0.212	15		
0.15	13		
0.063	11		

Sample Proportions	% dry mass
Cobbles	0
Gravel	65
Sand	24
Silt	5
Clay	6

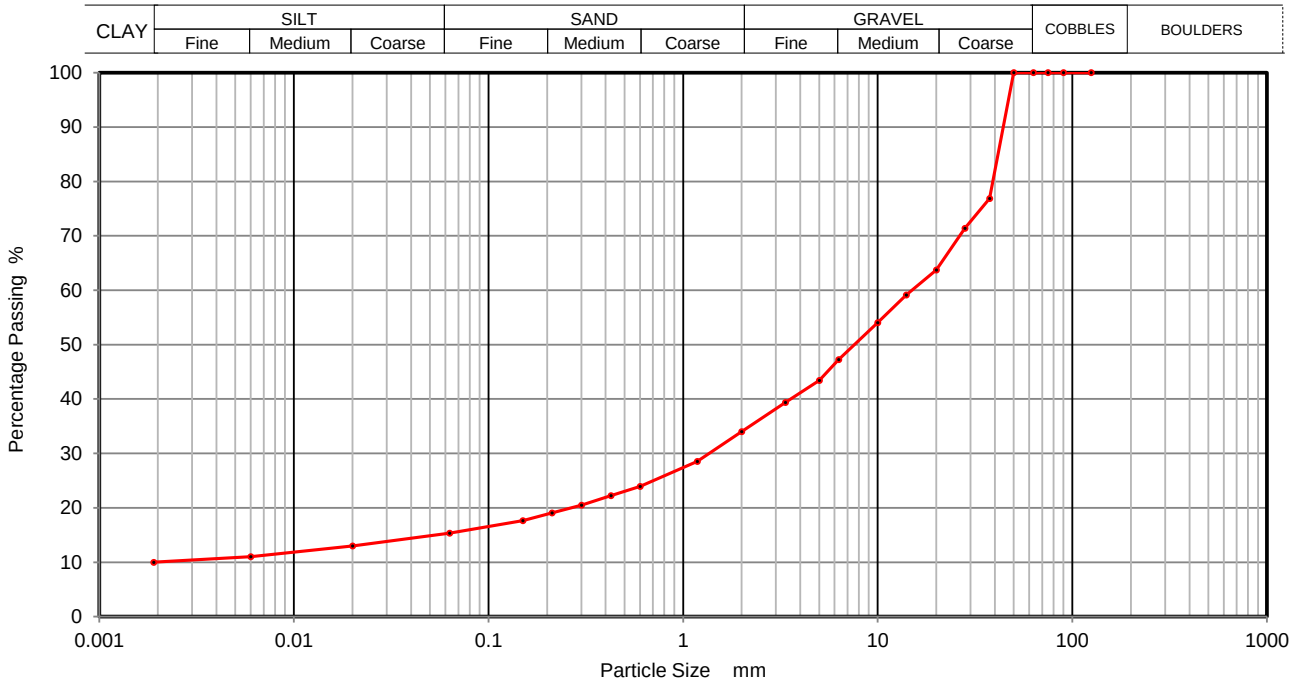
Remarks

Preparation and testing in accordance with BS1377 unless noted below

Operator
Cameron Thomas

UKAS TESTING 2788

GSTL GEOTECHNICAL SITE & TESTING LABORATORIES	**PARTICLE SIZE DISTRIBUTION BS 1377 Part 2:1990 Wet Sieve & Pipette Analysis, Clause 9.2 & 9.4**	Contract Number	73163
		Borehole/Pit No.	TP03
Project Name	Penyrenglyn	Sample No.	1
Soil Description	Grey/ brown slightly silty clayey fine to coarse sandy fine to coarse GRAVEL	Depth Top	0.00
		Depth Base	0.60
Date Tested	17/06/2024	Sample Type	B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0200	13
90	100	0.0060	11
75	100	0.0020	10
63	100		
50	100		
37.5	77		
28	71		
20	64		
14	59		
10	54		
6.3	47		
5	43		
3.35	39		
2	34		
1.18	29		
0.6	24		
0.425	22		
0.3	20		
0.212	19		
0.15	18		
0.063	15		

Sample Proportions	% dry mass
Cobbles	0
Gravel	66
Sand	19
Silt	5
Clay	10

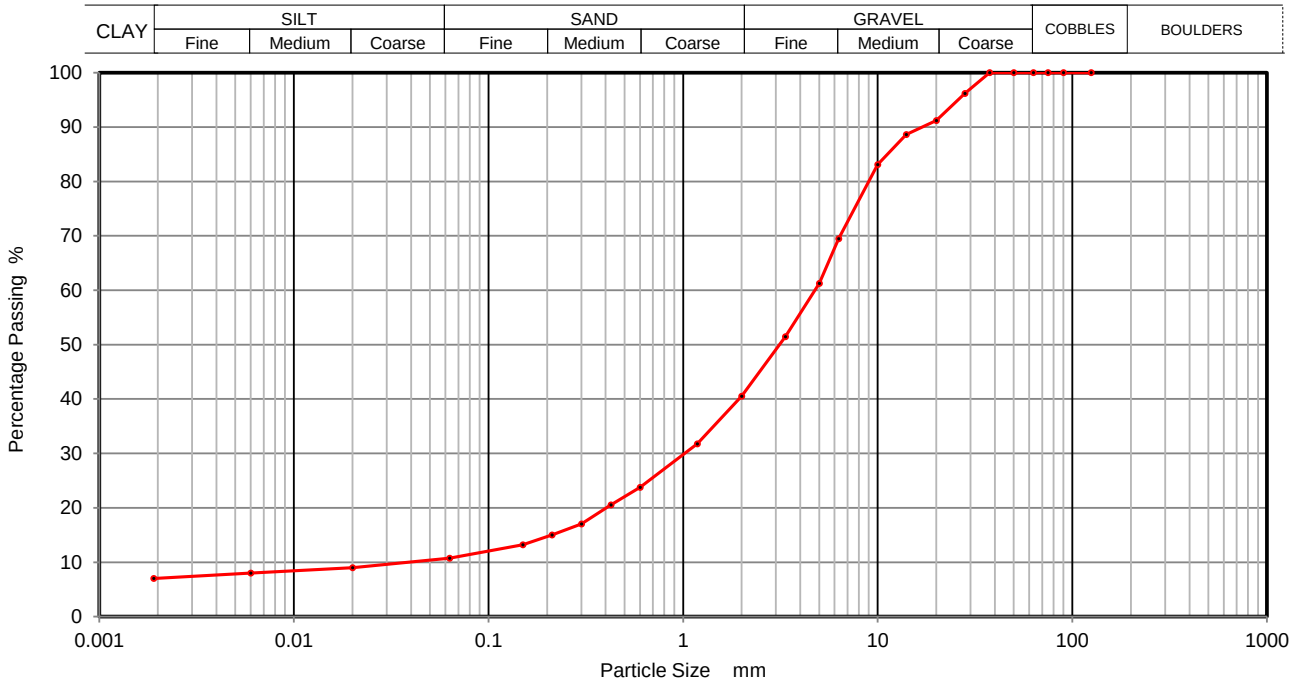
Remarks

Preparation and testing in accordance with BS1377 unless noted below

Operator
Cameron Thomas

UKAS TESTING 2788

GSTL GEOTECHNICAL SITE & TESTING LABORATORIES	**PARTICLE SIZE DISTRIBUTION BS 1377 Part 2:1990 Wet Sieve & Pipette Analysis, Clause 9.2 & 9.4**	Contract Number	73163
		Borehole/Pit No.	TP04
Project Name	Penyrenglyn	Sample No.	1
Soil Description	Grey slightly silty slightly clayey fine to coarse sandy fine to coarse GRAVEL (rootlets)	Depth Top	0.00
		Depth Base	1.20
Date Tested	17/06/2024	Sample Type	B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0200	9
90	100	0.0060	8
75	100	0.0020	7
63	100		
50	100		
37.5	100		
28	96		
20	91		
14	89		
10	83		
6.3	69		
5	61		
3.35	51		
2	41		
1.18	32		
0.6	24		
0.425	21		
0.3	17		
0.212	15		
0.15	13		
0.063	11		

Sample Proportions	% dry mass
Cobbles	0
Gravel	59
Sand	30
Silt	4
Clay	7

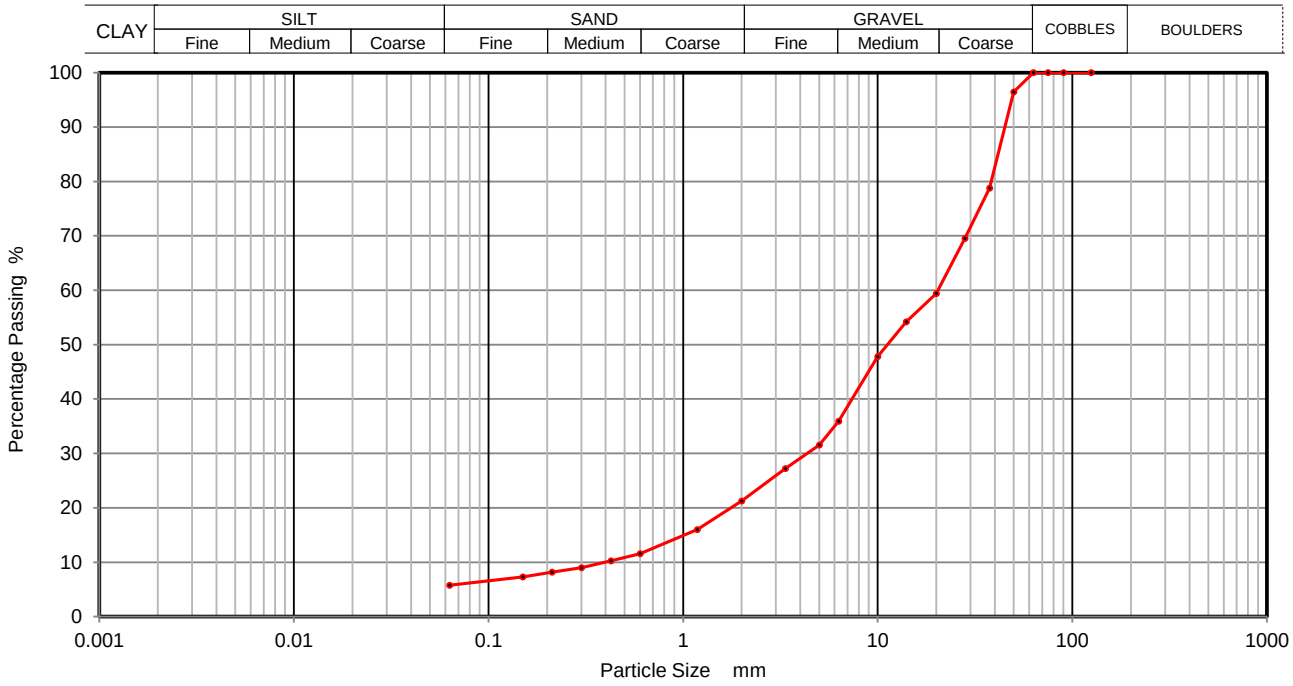
Remarks

Preparation and testing in accordance with BS1377 unless noted below

Operator
Cameron Thomas

UKAS TESTING 2788

GSTL GEOTECHNICAL SITE & TESTING LABORATORIES	**PARTICLE SIZE DISTRIBUTION** **BS 1377 Part 2:1990** **Wet Sieve, Clause 9.2**	Contract Number	73163
		Borehole/Pit No.	TP05
Project Name	Penyrenglyn	Sample No.	1
Soil Description	Grey slightly silty/ clayey fine to coarse sandy fine to coarse GRAVEL	Depth Top	0.00
		Depth Base	1.20
Date Tested	17/06/2024	Sample Type	B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	96		
37.5	79		
28	70		
20	59		
14	54		
10	48		
6.3	36		
5	32		
3.35	27		
2	21		
1.18	16		
0.6	12		
0.425	10		
0.3	9		
0.212	8		
0.15	7		
0.063	6		

Sample Proportions	% dry mass
Cobbles	0
Gravel	79
Sand	15
Silt and Clay	6

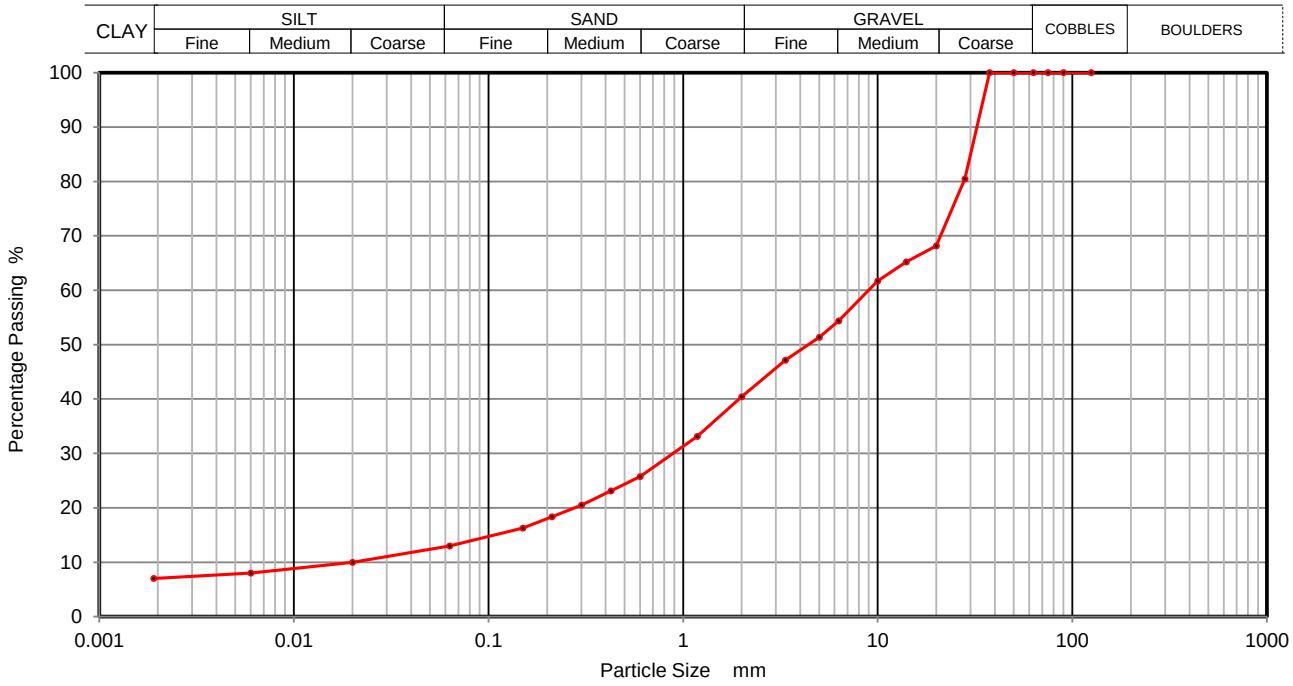
Remarks

Preparation and testing in accordance with BS1377 unless noted below

Operator
Cameron Thomas

UKAS TESTING 2788

GSTL GEOTECHNICAL SITE & TESTING LABORATORIES	**PARTICLE SIZE DISTRIBUTION BS 1377 Part 2:1990 Wet Sieve & Pipette Analysis, Clause 9.2 & 9.4**	Contract Number	73163
		Borehole/Pit No.	TP06
Project Name	Penyrenglyn	Sample No.	1
Soil Description	Grey shaley slightly silty slightly clayey fine to coarse sandy fine to coarse GRAVEL	Depth Top	0.00
		Depth Base	1.20
Date Tested	17/06/2024	Sample Type	B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0200	10
90	100	0.0060	8
75	100	0.0020	7
63	100		
50	100		
37.5	100		
28	80		
20	68		
14	65		
10	62		
6.3	54		
5	51		
3.35	47		
2	40		
1.18	33		
0.6	26		
0.425	23		
0.3	20		
0.212	18		
0.15	16		
0.063	13		

Sample Proportions	% dry mass
Cobbles	0
Gravel	60
Sand	27
Silt	6
Clay	7

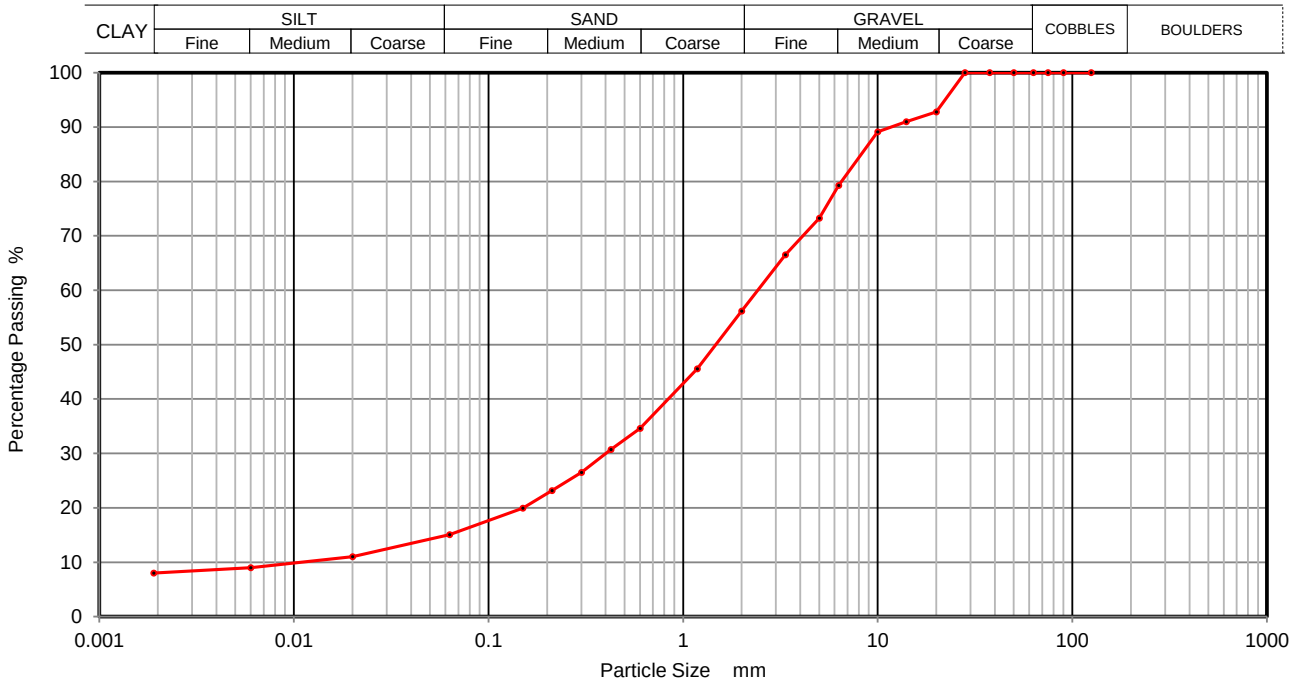
Remarks

Preparation and testing in accordance with BS1377 unless noted below

Operator
Cameron Thomas

UKAS TESTING 2788

GSTL GEOTECHNICAL SITE & TESTING LABORATORIES	**PARTICLE SIZE DISTRIBUTION BS 1377 Part 2:1990 Wet Sieve & Pipette Analysis, Clause 9.2 & 9.4**	Contract Number	73163
		Borehole/Pit No.	TP07
Project Name	Penyrenglyn	Sample No.	1
Soil Description	Grey slightly silty slightly clayey fine to coarse sandy fine to coarse GRAVEL (rootlets)	Depth Top	0.00
		Depth Base	1.20
Date Tested	17/06/2024	Sample Type	B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0200	11
90	100	0.0060	9
75	100	0.0020	8
63	100		
50	100		
37.5	100		
28	100		
20	93		
14	91		
10	89		
6.3	79		
5	73		
3.35	67		
2	56		
1.18	46		
0.6	35		
0.425	31		
0.3	27		
0.212	23		
0.15	20		
0.063	15		

Sample Proportions	% dry mass
Cobbles	0
Gravel	44
Sand	41
Silt	7
Clay	8

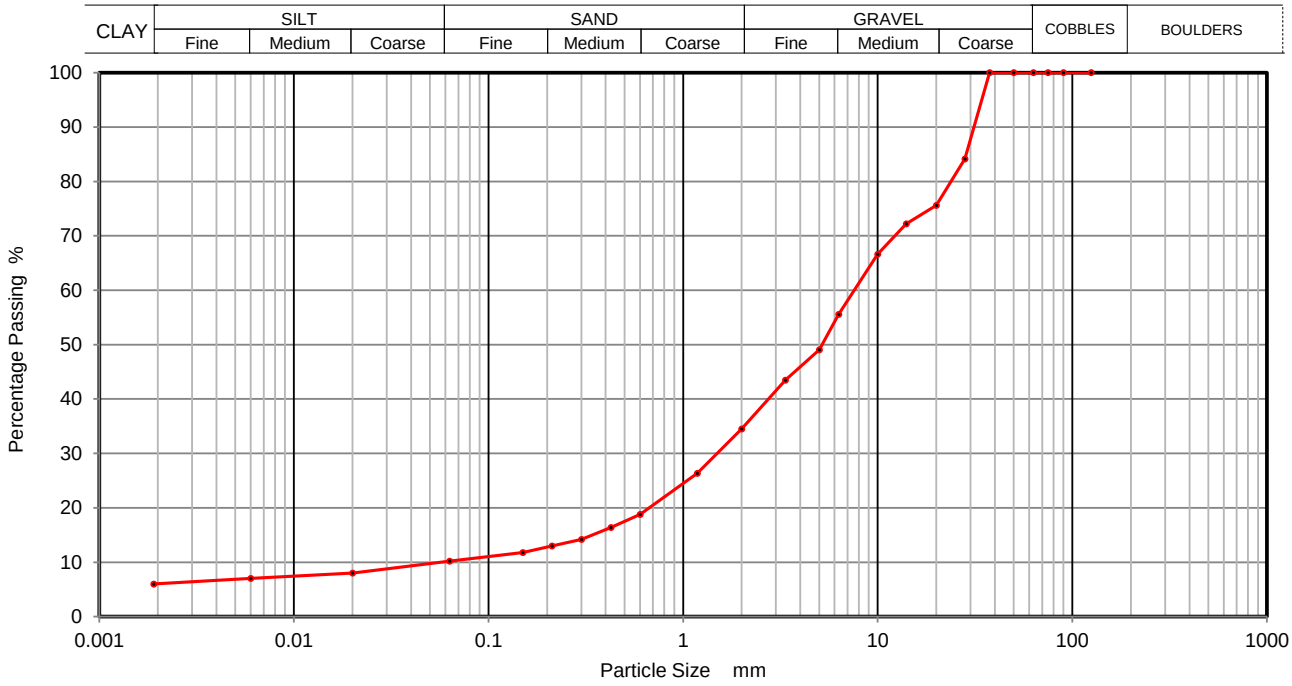
Remarks

Preparation and testing in accordance with BS1377 unless noted below

Operator
Cameron Thomas

UKAS TESTING 2788

GSTL GEOTECHNICAL SITE & TESTING LABORATORIES	**PARTICLE SIZE DISTRIBUTION BS 1377 Part 2:1990 Wet Sieve & Pipette Analysis, Clause 9.2 & 9.4**	Contract Number	73163
		Borehole/Pit No.	TP08
Project Name	Penyrenglyn	Sample No.	1
Soil Description	Grey slightly silty slightly clayey fine to coarse sandy fine to coarse GRAVEL	Depth Top	0.00
		Depth Base	1.20
Date Tested	17/06/2024	Sample Type	B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0200	8
90	100	0.0060	7
75	100	0.0020	6
63	100		
50	100		
37.5	100		
28	84		
20	76		
14	72		
10	67		
6.3	56		
5	49		
3.35	43		
2	35		
1.18	26		
0.6	19		
0.425	16		
0.3	14		
0.212	13		
0.15	12		
0.063	10		

Sample Proportions	% dry mass
Cobbles	0
Gravel	65
Sand	25
Silt	4
Clay	6

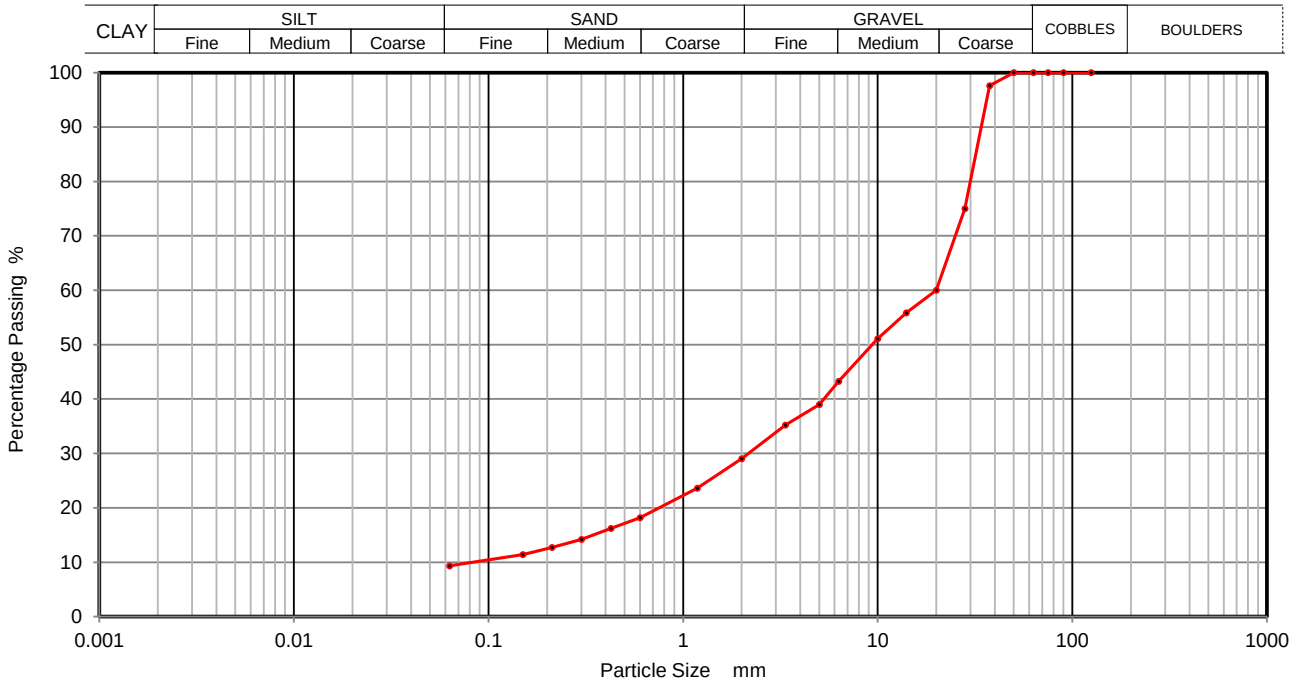
Remarks

Preparation and testing in accordance with BS1377 unless noted below

Operator
Cameron Thomas

UKAS TESTING 2788

GSTL GEOTECHNICAL SITE & TESTING LABORATORIES	**PARTICLE SIZE DISTRIBUTION** **BS 1377 Part 2:1990** **Wet Sieve, Clause 9.2**	Contract Number	73163
		Borehole/Pit No.	TP09
Project Name	Penyrenglyn	Sample No.	1
Soil Description	Grey slightly silty/ clayey fine to coarse sandy fine to coarse GRAVEL	Depth Top	0.00
		Depth Base	1.20
Date Tested	17/06/2024	Sample Type	B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	98		
28	75		
20	60		
14	56		
10	51		
6.3	43		
5	39		
3.35	35		
2	29		
1.18	24		
0.6	18		
0.425	16		
0.3	14		
0.212	13		
0.15	11		
0.063	9		

Sample Proportions	% dry mass
Cobbles	0
Gravel	71
Sand	20
Silt and Clay	9

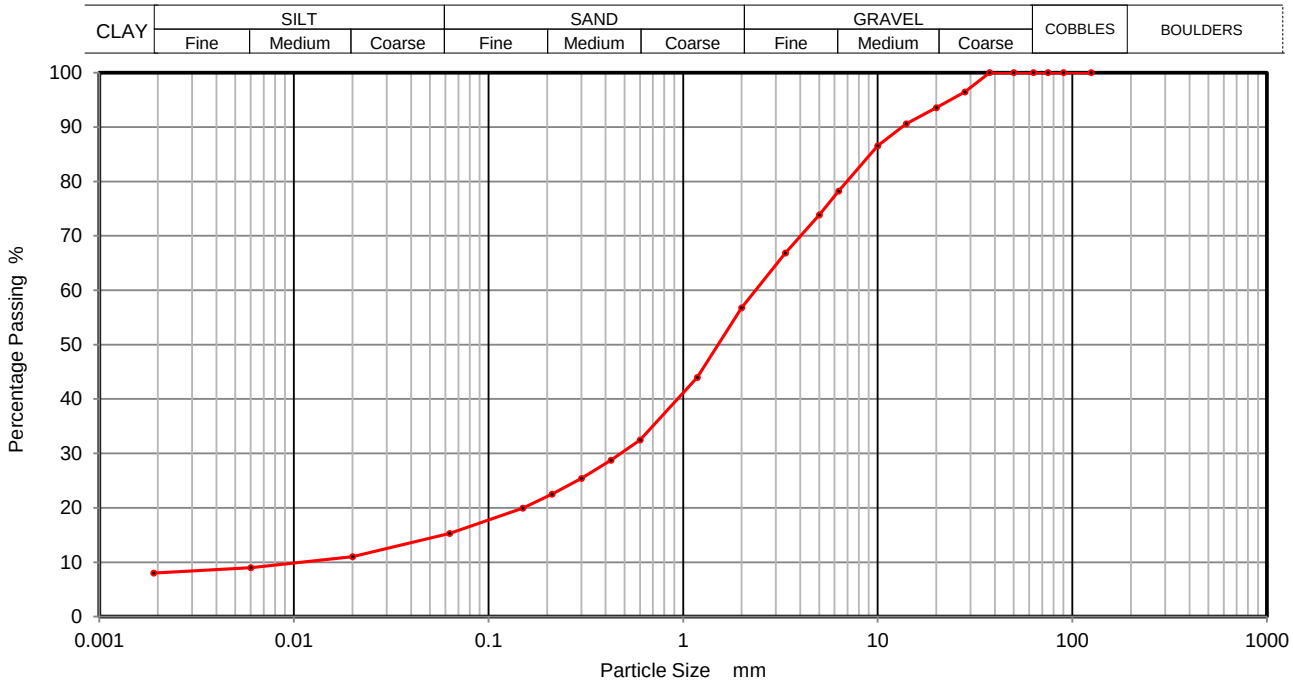
Remarks

Preparation and testing in accordance with BS1377 unless noted below

Operator
Cameron Thomas

UKAS TESTING 2788

GSTL GEOTECHNICAL SITE & TESTING LABORATORIES	**PARTICLE SIZE DISTRIBUTION BS 1377 Part 2:1990 Wet Sieve & Pipette Analysis, Clause 9.2 & 9.4**	Contract Number	73163
		Borehole/Pit No.	TP10
Project Name	Penyrenglyn	Sample No.	1
Soil Description	Grey slightly silty slightly clayey fine to coarse sandy fine to coarse GRAVEL	Depth Top	0.00
		Depth Base	1.20
Date Tested	17/06/2024	Sample Type	B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0200	11
90	100	0.0060	9
75	100	0.0020	8
63	100		
50	100		
37.5	100		
28	96		
20	94		
14	91		
10	87		
6.3	78		
5	74		
3.35	67		
2	57		
1.18	44		
0.6	32		
0.425	29		
0.3	25		
0.212	23		
0.15	20		
0.063	15		

Sample Proportions	% dry mass
Cobbles	0
Gravel	43
Sand	42
Silt	7
Clay	8

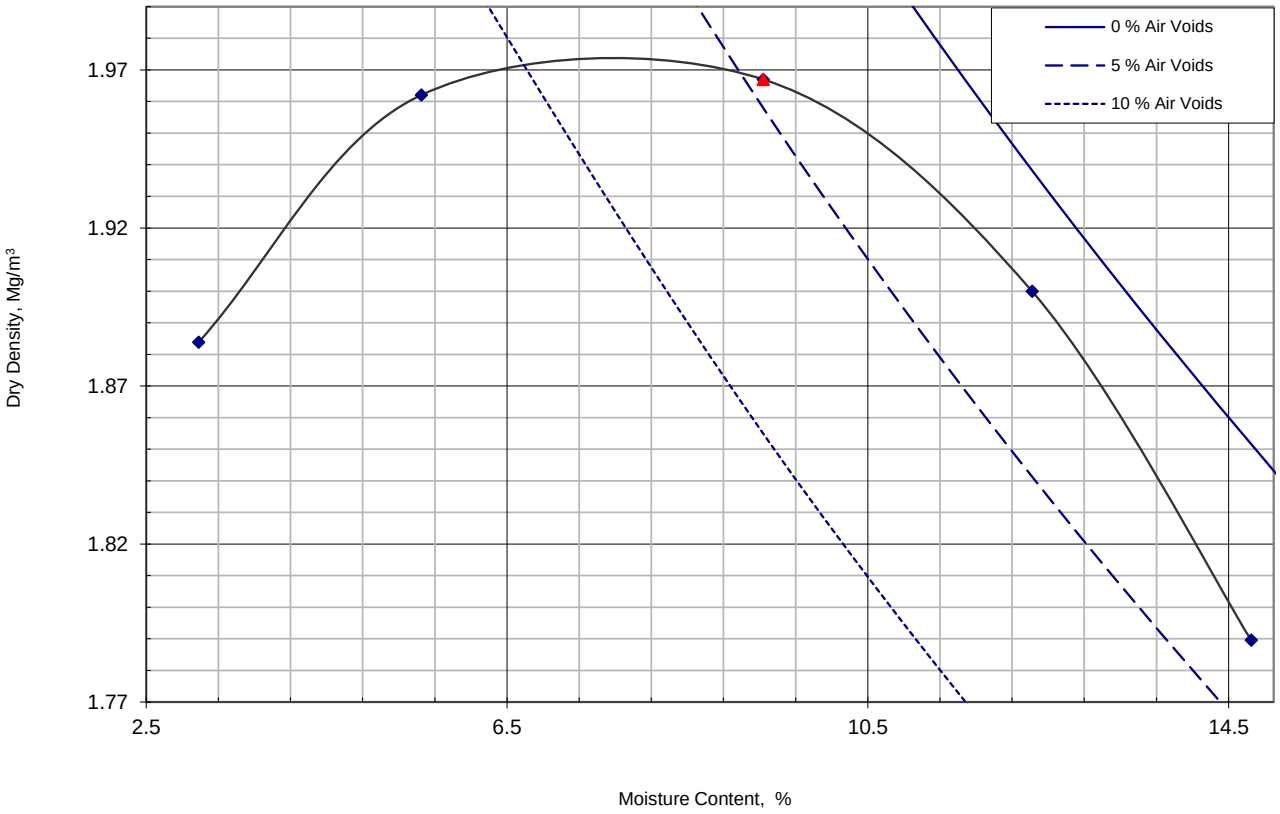
Remarks

Preparation and testing in accordance with BS1377 unless noted below

Operator
Cameron Thomas

UKAS TESTING 2788

GSTL GEOTECHNICAL SITE & TESTING LABORATORIES	**Dry Density / Moisture Content Relationship BS 1377:Part 4:1990**	Contract Number	73163
		Borehole / Pit No	TP02
Project Name	Penyrenglyn	Sample No	1
Date Tested	13/06/2024	Depth Top	0.00
Compaction Method	2.5 Kg Rammer	Depth Base	1.20
Compaction Clause	BS1377:Part 4:1990, Clause 3.3	Sample Type	B
Sample Description	Grey shaley slightly silty slightly clayey fine to coarse sandy fine to coarse GRAVEL	Single or Separate Sample Used	Single



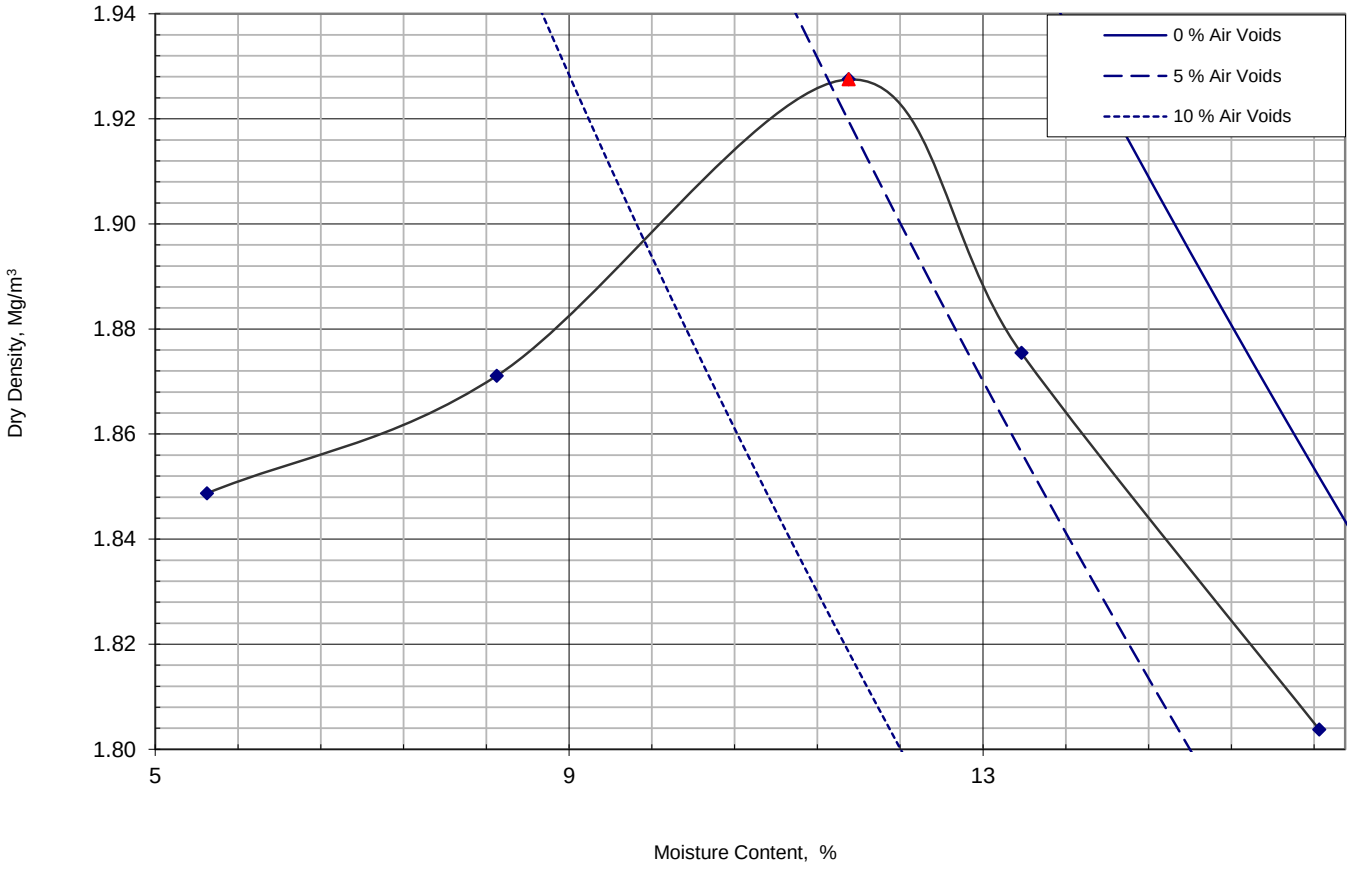
Compaction Point	1	2	3	4	5							
Moisture Content	3.1	5.6	9.3	12	15							
Bulk Density	1.94	2.07	2.15	2.13	2.05							
Dry Density	1.88	1.96	1.97	1.90	1.79							

Initial Moisture Content	12	%
Maximum Dry Density	1.97	Mg/m3
Optimum Moisture Content	9.3	%
Particle Density	2.55 Measured	Mg/m3
Material Retained 37.5mm	4	%
Material Retained 20mm	23	%

Operator
Conor

UKAS TESTING 2788

GSTL GEOTECHNICAL SITE & TESTING LABORATORIES	**Dry Density / Moisture Content Relationship BS 1377:Part 4:1990**	Contract Number	73163
		Borehole / Pit No	TP03
Project Name	Penyrenglyn	Sample No	1
Date Tested	13/06/2024	Depth Top	0.00
Compaction Method	2.5 Kg Rammer	Depth Base	0.60
Compaction Clause	BS1377:Part 4:1990, Clause 3.3	Sample Type	B
Sample Description	Grey/ brown slightly silty clayey fine to coarse sandy fine to coarse GRAVEL	Single or Separate Sample Used	Single



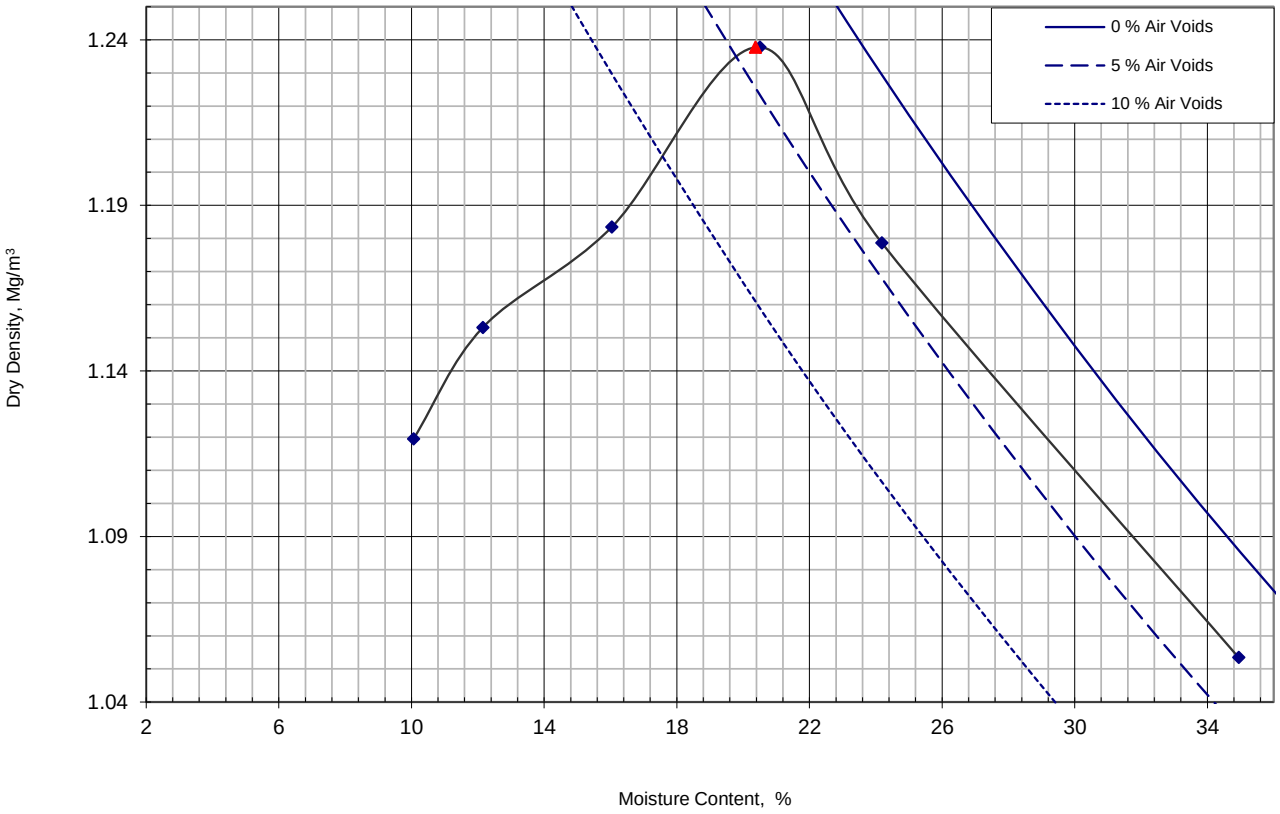
Compaction Point	1	2	3	4	5							
Moisture Content	5.5	8.3	12	13	16							
Bulk Density	1.95	2.03	2.15	2.13	2.10							
Dry Density	1.85	1.87	1.93	1.88	1.80							

Initial Moisture Content	12	%
Maximum Dry Density	1.93	Mg/m3
Optimum Moisture Content	12	%
Particle Density	2.65 Assumed	Mg/m3
Material Retained 37.5mm	23	%
Material Retained 20mm	13	%

Operator
Conor

UKAS TESTING 2788

GSTL GEOTECHNICAL SITE & TESTING LABORATORIES	Dry Density / Moisture Content Relationship BS 1377:Part 4:1990	Contract Number	73163
		Borehole / Pit No	TP04
Project Name	Penyrenglyn	Sample No	1
Date Tested	13/06/2024	Depth Top	0.00
Compaction Method	2.5 Kg Rammer	Depth Base	1.20
Compaction Clause	BS1377:Part 4:1990, Clause 3.3	Sample Type	B
Sample Description	Grey slightly silty slightly clayey fine to coarse sandy fine to coarse GRAVEL (rootlets)	Single or Separate Sample Used	Single



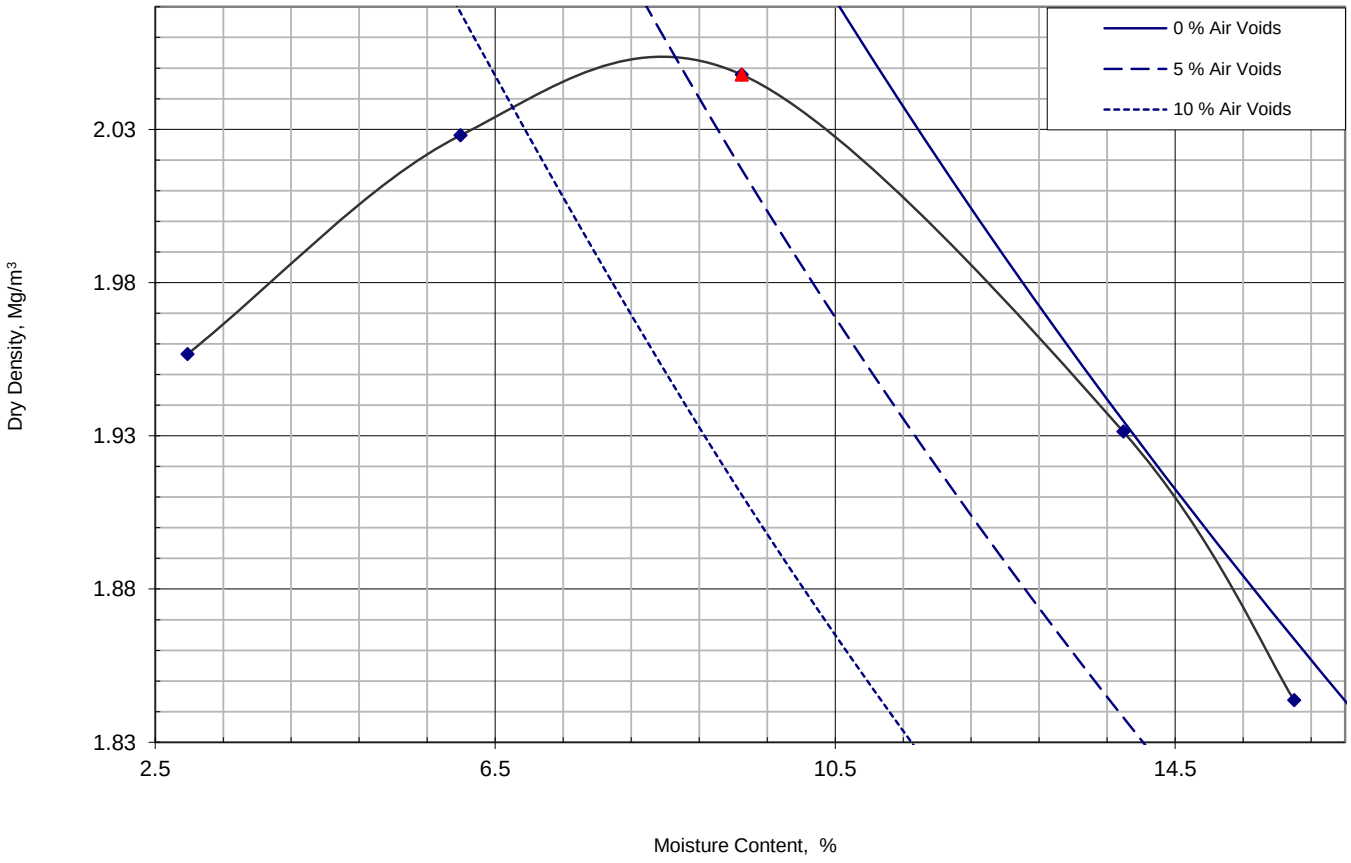
Compaction Point	1	2	3	4	5	6						
Moisture Content	10	12	16	21	24	35						
Bulk Density	1.23	1.29	1.37	1.49	1.46	1.42						
Dry Density	1.12	1.15	1.18	1.24	1.18	1.05						

Initial Moisture Content	35	%
Maximum Dry Density	1.24	Mg/m3
Optimum Moisture Content	20	%
Particle Density	1.75 Measured	Mg/m3
Material Retained 37.5mm	0	%
Material Retained 20mm	9	%

Operator
Conor

UKAS TESTING 2788

GSTL GEOTECHNICAL SITE & TESTING LABORATORIES	**Dry Density / Moisture Content Relationship BS 1377:Part 4:1990**	Contract Number	73163
		Borehole / Pit No	TP05
Project Name	Penyrenglyn	Sample No	1
Date Tested	13/06/2024	Depth Top	0.00
Compaction Method	2.5 Kg Rammer	Depth Base	1.20
Compaction Clause	BS1377:Part 4:1990, Clause 3.3	Sample Type	B
Sample Description	Grey slightly silty/ clayey fine to coarse sandy fine to coarse GRAVEL	Single or Separate Sample Used	Single



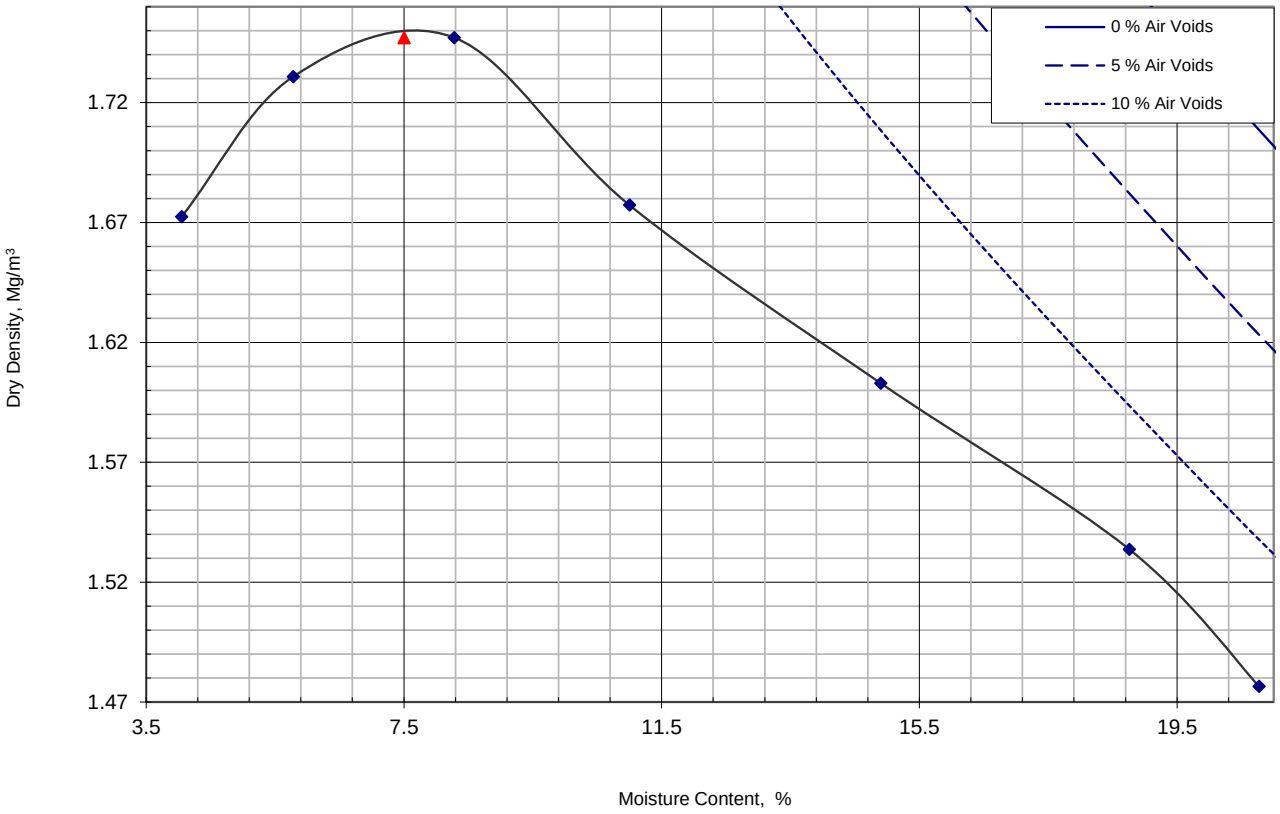
Compaction Point	1	2	3	4	5							
Moisture Content	2.9	6.1	9.4	14	16							
Bulk Density	2.01	2.15	2.24	2.20	2.14							
Dry Density	1.96	2.03	2.05	1.93	1.84							

Initial Moisture Content	9.4	%
Maximum Dry Density	2.05	Mg/m3
Optimum Moisture Content	9.4	%
Particle Density	2.65 Assumed	Mg/m3
Material Retained 37.5mm	21	%
Material Retained 20mm	20	%

Operator
Conor

UKAS TESTING 2788

GSTL GEOTECHNICAL SITE & TESTING LABORATORIES	Dry Density / Moisture Content Relationship BS 1377:Part 4:1990	Contract Number	73163
		Borehole / Pit No	TP06
Project Name	Penyrenglyn	Sample No	1
Date Tested	13/06/2024	Depth Top	0.00
Compaction Method	2.5 Kg Rammer	Depth Base	1.20
Compaction Clause	BS1377:Part 4:1990, Clause 3.3	Sample Type	B
Sample Description	Grey shaley slightly silty slightly clayey fine to coarse sandy fine to coarse GRAVEL	Single or Separate Sample Used	Single



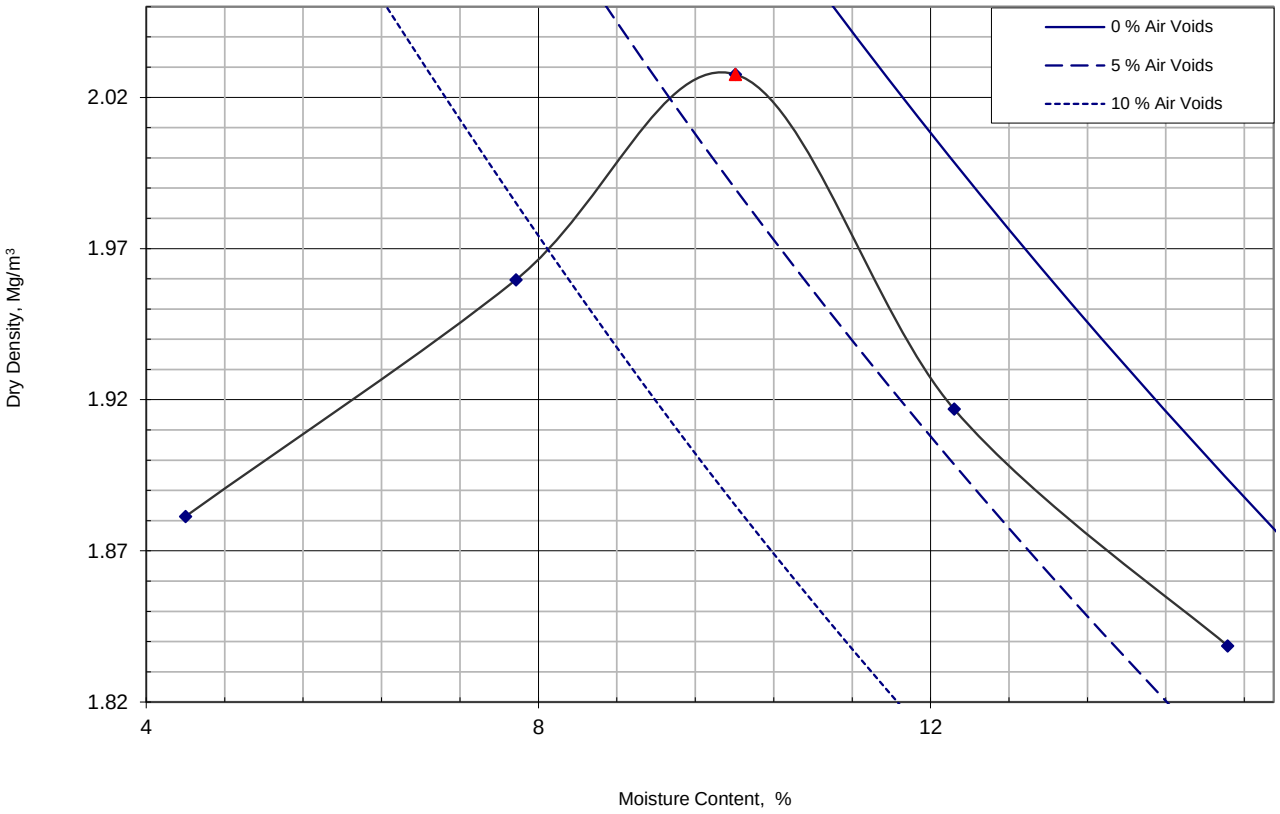
Compaction Point	1	2	3	4	5	6	7					
Moisture Content	4.1	5.8	8.3	11	15	19	21					
Bulk Density	1.74	1.83	1.89	1.86	1.84	1.82	1.78					
Dry Density	1.67	1.73	1.75	1.68	1.60	1.53	1.48					

Initial Moisture Content	19	%
Maximum Dry Density	1.75	Mg/m3
Optimum Moisture Content	7.5	%
Particle Density	2.65 Assumed	Mg/m3
Material Retained 37.5mm	0	%
Material Retained 20mm	32	%

Operator
Conor

UKAS TESTING 2788

GSTL GEOTECHNICAL SITE & TESTING LABORATORIES	Dry Density / Moisture Content Relationship BS 1377:Part 4:1990	Contract Number	73163
		Borehole / Pit No	TP08
Project Name	Penyrenglyn	Sample No	1
Date Tested	13/06/2024	Depth Top	0.00
Compaction Method	2.5 Kg Rammer	Depth Base	1.20
Compaction Clause	BS1377:Part 4:1990, Clause 3.3	Sample Type	B
Sample Description	Grey slightly silty slightly clayey fine to coarse sandy fine to coarse GRAVEL	Single or Separate Sample Used	Single



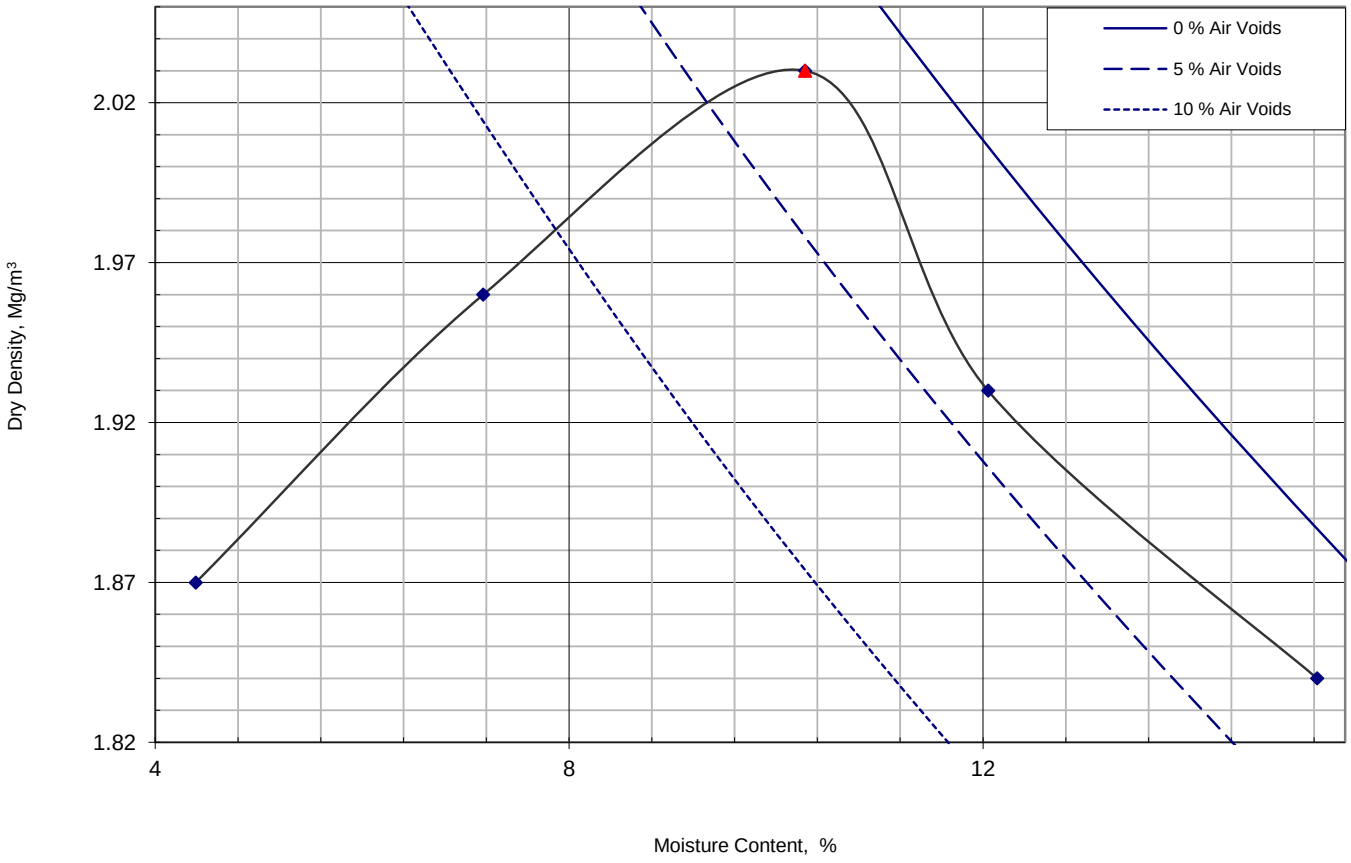
Compaction Point	1	2	3	4	5							
Moisture Content	4.4	7.8	10	12	15							
Bulk Density	1.96	2.11	2.23	2.15	2.11							
Dry Density	1.88	1.96	2.03	1.92	1.84							

Initial Moisture Content	10	%
Maximum Dry Density	2.03	Mg/m3
Optimum Moisture Content	10	%
Particle Density	2.65 Measured	Mg/m3
Material Retained 37.5mm	0	%
Material Retained 20mm	24	%

Operator
Conor

UKAS TESTING 2788

GSTL GEOTECHNICAL SITE & TESTING LABORATORIES	Dry Density / Moisture Content Relationship BS 1377:Part 4:1990	Contract Number	73163
		Borehole / Pit No	TP09
Project Name	Penyrenglyn	Sample No	1
Date Tested	13/06/2024	Depth Top	0.00
Compaction Method	2.5 Kg Rammer	Depth Base	1.20
Compaction Clause	BS1377:Part 4:1990, Clause 3.3	Sample Type	B
Sample Description	Grey slightly silty/ clayey fine to coarse sandy fine to coarse GRAVEL	Single or Separate Sample Used	Single



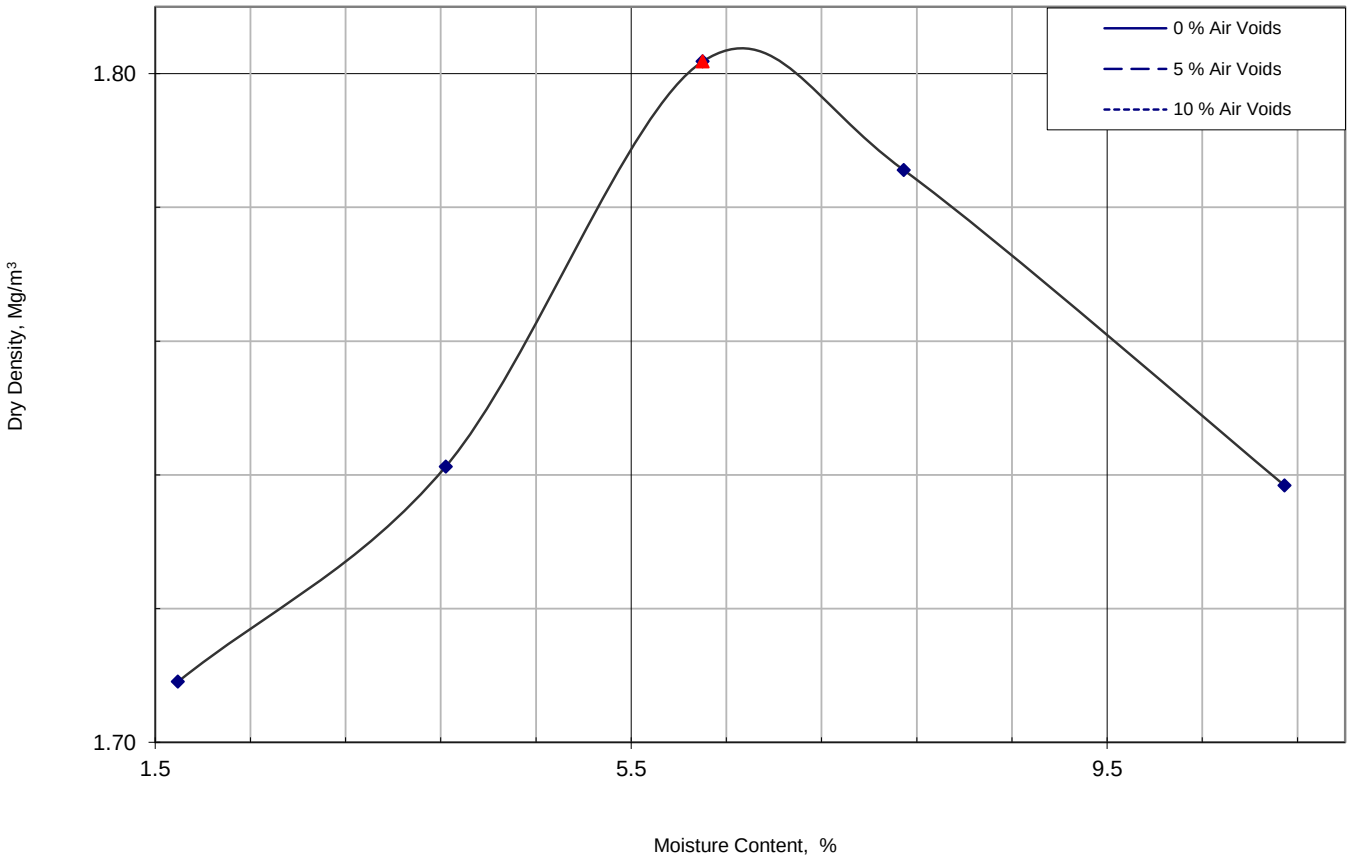
Compaction Point	1	2	3	4	5							
Moisture Content	4.4	7.2	10	12	15							
Bulk Density	1.95	2.10	2.24	2.16	2.12							
Dry Density	1.87	1.96	2.03	1.93	1.84							

Initial Moisture Content	10	%
Maximum Dry Density	2.03	Mg/m3
Optimum Moisture Content	10	%
Particle Density	2.65 Assumed	Mg/m3
Material Retained 37.5mm	2	%
Material Retained 20mm	38	%

Operator
Conor

UKAS TESTING 2788

GSTL GEOTECHNICAL SITE & TESTING LABORATORIES	**Dry Density / Moisture Content Relationship BS 1377:Part 4:1990**	Contract Number	73163
		Borehole / Pit No	TP01
Project Name	Penyrenglyn	Sample No	1
Date Tested	12/06/2024	Depth Top	0.10
Compaction Method	4.5 Kg Rammer	Depth Base	1.20
Compaction Clause	BS1377:Part 4:1990, Clause 3.5	Sample Type	B
Sample Description	Grey slightly silty/ clayey fine to coarse sandy fine to coarse GRAVEL with cobbles	Single or Separate Sample Used	Single



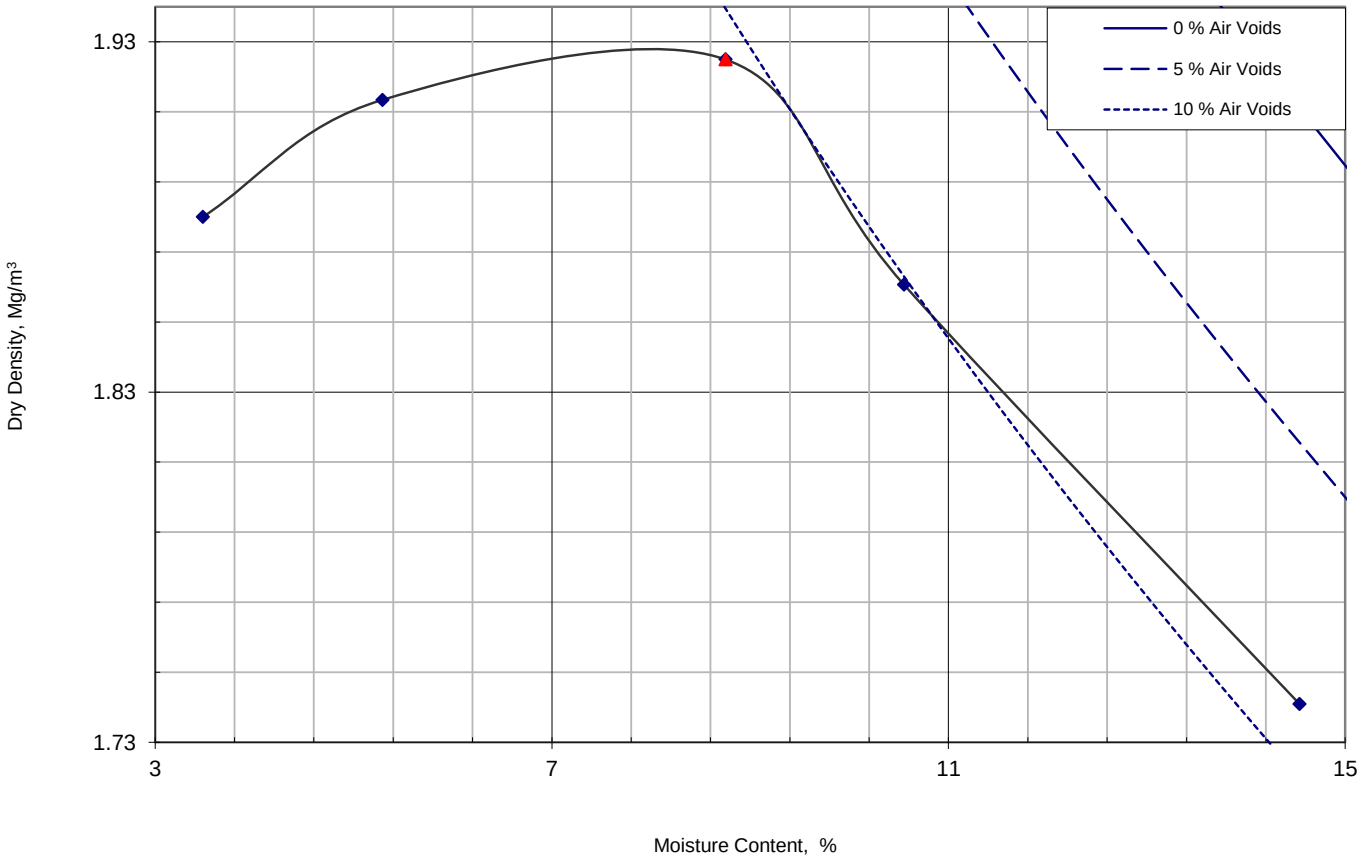
Compaction Point	1	2	3	4	5							
Moisture Content	1.7	3.9	6.1	7.8	11							
Bulk Density	1.74	1.81	1.91	1.92	1.93							
Dry Density	1.71	1.74	1.80	1.79	1.74							

Initial Moisture Content	11	%
Maximum Dry Density	1.80	Mg/m3
Optimum Moisture Content	6.1	%
Particle Density	2.65 Assumed	Mg/m3
Material Retained 37.5mm	35	%
Material Retained 20mm	22	%

Operator
Conal

UKAS TESTING 2788

GSTL GEOTECHNICAL SITE & TESTING LABORATORIES	Dry Density / Moisture Content Relationship BS 1377:Part 4:1990	Contract Number	73163
		Borehole / Pit No	TP03
Project Name	Penyrenglyn	Sample No	2
Date Tested	12/06/2024	Depth Top	0.60
Compaction Method	4.5 Kg Rammer	Depth Base	1.20
Compaction Clause	BS1377:Part 4:1990, Clause 3.5	Sample Type	B
Sample Description	Grey silty sandy clayey shaley GRAVEL	Single or Separate Sample Used	Single



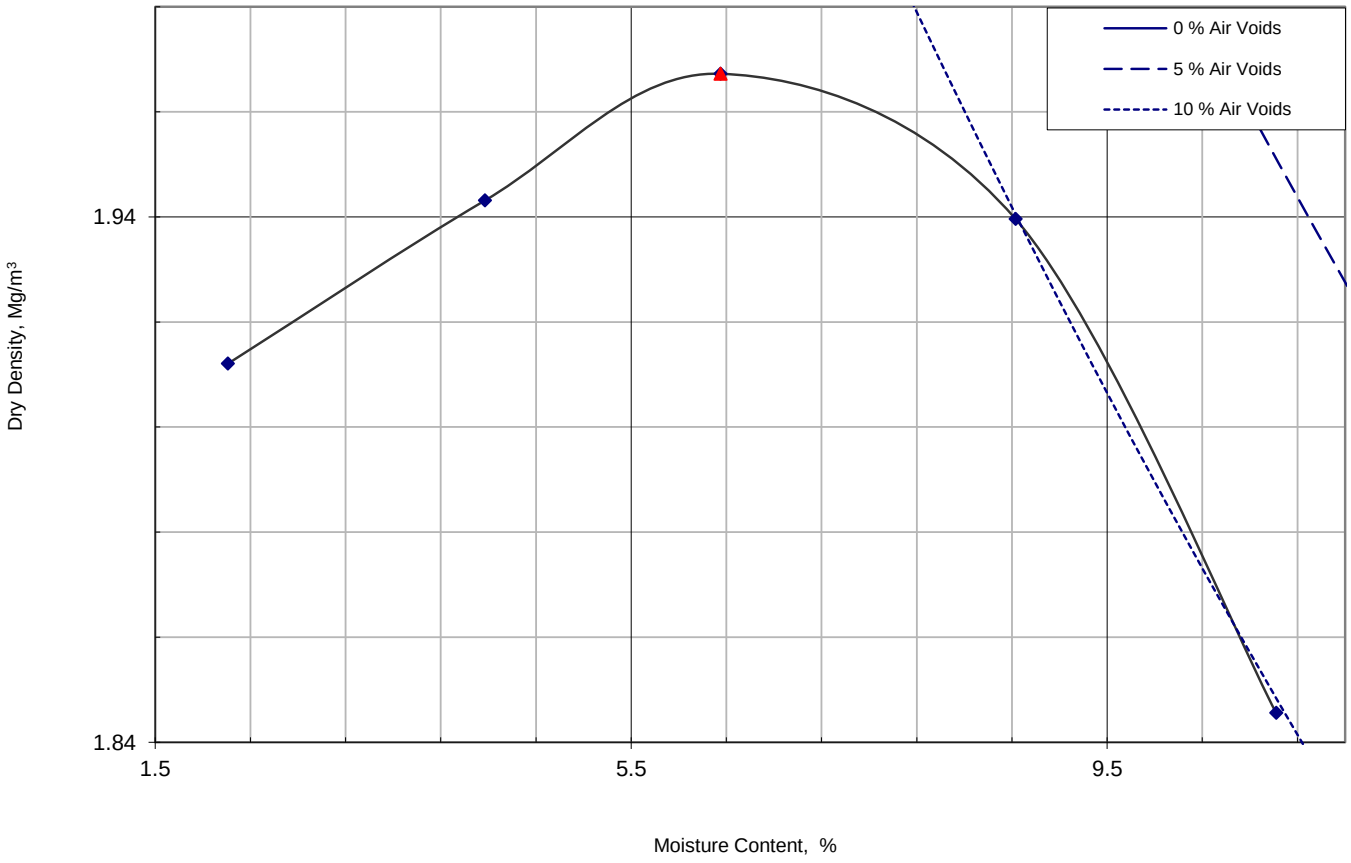
Compaction Point	1	2	3	4	5							
Moisture Content	3.5	5.3	8.8	11	15							
Bulk Density	1.95	2.01	2.09	2.06	1.99							
Dry Density	1.88	1.91	1.92	1.86	1.74							

Initial Moisture Content	11	%
Maximum Dry Density	1.92	Mg/m3
Optimum Moisture Content	8.8	%
Particle Density	2.65 Assumed	Mg/m3
Material Retained 37.5mm	0	%
Material Retained 20mm	0	%

Operator
Conal

UKAS TESTING 2788

GSTL GEOTECHNICAL SITE & TESTING LABORATORIES	**Dry Density / Moisture Content Relationship BS 1377:Part 4:1990**	Contract Number	73163
		Borehole / Pit No	TP07
Project Name	Penyrenglyn	Sample No	1
Date Tested	12/06/2024	Depth Top	0.00
Compaction Method	4.5 Kg Rammer	Depth Base	1.20
Compaction Clause	BS1377:Part 4:1990, Clause 3.5	Sample Type	B
Sample Description	Grey slightly silty slightly clayey fine to coarse sandy fine to coarse GRAVEL (rootlets)	Single or Separate Sample Used	Single



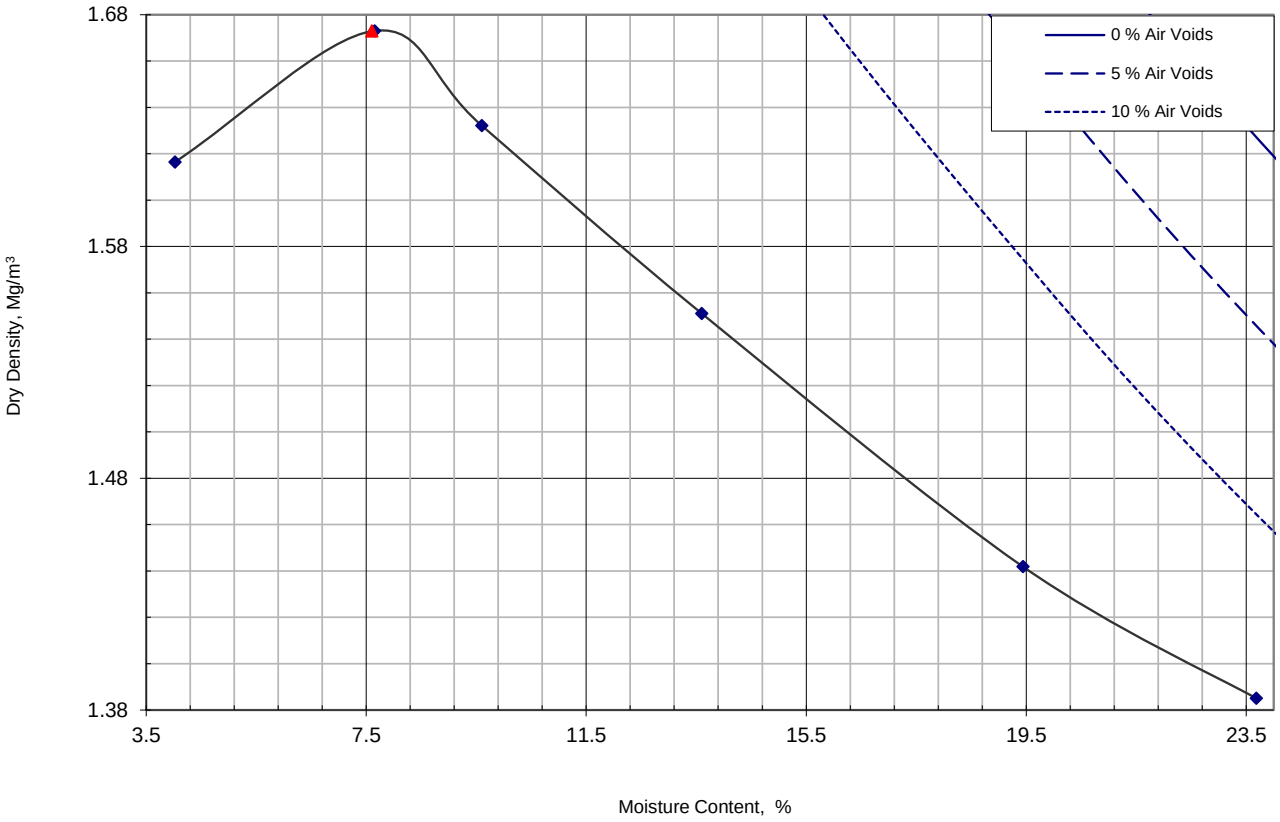
Compaction Point	1	2	3	4	5							
Moisture Content	2.1	4.3	6.3	8.7	11							
Bulk Density	1.95	2.03	2.09	2.11	2.05							
Dry Density	1.91	1.94	1.97	1.94	1.85							

Initial Moisture Content	8.7	%
Maximum Dry Density	1.97	Mg/m3
Optimum Moisture Content	6.3	%
Particle Density	2.65 Assumed	Mg/m3
Material Retained 37.5mm	0	%
Material Retained 20mm	7	%

Operator
Conal

UKAS TESTING 2788

GSTL GEOTECHNICAL SITE & TESTING LABORATORIES	Dry Density / Moisture Content Relationship BS 1377:Part 4:1990	Contract Number	73163
		Borehole / Pit No	TP10
Project Name	Penyrenglyn	Sample No	1
Date Tested	12/06/2024	Depth Top	0.00
Compaction Method	4.5 Kg Rammer	Depth Base	1.20
Compaction Clause	BS1377:Part 4:1990, Clause 3.5	Sample Type	B
Sample Description	Grey slightly silty slightly clayey fine to coarse sandy fine to coarse GRAVEL	Single or Separate Sample Used	Single



Compaction Point	1	2	3	4	5	6						
Moisture Content	4.0	7.7	9.6	14	19	24						
Bulk Density	1.68	1.80	1.79	1.76	1.72	1.71						
Dry Density	1.62	1.67	1.63	1.55	1.44	1.39						

Initial Moisture Content	19	%
Maximum Dry Density	1.67	Mg/m3
Optimum Moisture Content	7.6	%
Particle Density	2.65 Assumed	Mg/m3
Material Retained 37.5mm	0	%
Material Retained 20mm	6	%

Operator
Conal

UKAS TESTING 2788

Determination of a Permeability
Falling Head in Permeameter
K.H. Head Volume 2 : Section 10.7

Date:	28-Jun-24
Contract Number:	73163
Client Ref Number:	784-B068642
Borehole/Sample Number:	TP01
Depth:	0.10
Sample Type:	D
Sample Preparation:	Remoulded 4.5kg Rammer
Start Date:	12-Jun-24
Completion Date:	14-Jun-24
Test Duration (Days):	2
Operator:	Luke Williams

Soil Description

Grey silty sandy clayey GRAVEL

Test Results

Initial Conditions:

Diameter (mm):	104.87
Length (mm):	116.00
Bulk Density (Mg/m3)	2.10
Moisture Content (%)	12
Dry Density (Mg/m3):	1.87

Permeability:

Initial Test Time (mins)	865.00
Initial Height Above datum (mm)	1060
Final Test Time (mins)	952.00
Final Height above datum (mm)	325

Coefficient of Permeability m/s @ 20°c: **4.88x 10-5**

Remarks:
All remaining samples shall be retained for a period of one month from the above date, after which time all samples shall be disposed of.

Determination of a Permeability
Falling Head in Permeameter
K.H. Head Volume 2 : Section 10.7

Date:	28-Jun-24
Contract Number:	73163
Client Ref Number:	784-B068642
Borehole/Sample Number:	TP03
Depth:	0.60
Sample Type:	D
Sample Preparation:	Remoulded 4.5kg Rammer
Start Date:	12-Jun-24
Completion Date:	14-Jun-24
Test Duration (Days):	2
Operator:	Luke Williams

Soil Description

Grey silty sandy clayey GRAVEL (Shale)

Test Results

Initial Conditions:

Diameter (mm):	104.87
Length (mm):	116.00
Bulk Density (Mg/m3)	2.06
Moisture Content (%)	11
Dry Density (Mg/m3):	1.86

Permeability:

Initial Test Time (mins)	623.00
Initial Height Above datum (mm)	1060
Final Test Time (mins)	618.00
Final Height above datum (mm)	326
Coefficient of Permeability m/s @ 20°c:	**3.31x 10-7**

Remarks:
All remaining samples shall be retained for a period of one month from the above date, after which time all samples shall be disposed of.

Determination of a Permeability
Falling Head in Permeameter
K.H. Head Volume 2 : Section 10.7

Date:	28-Jun-24
Contract Number:	73163
Client Ref Number:	784-B068642
Borehole/Sample Number:	TP07
Depth:	0.00
Sample Type:	D
Sample Preparation:	Remoulded 4.5kg Rammer
Start Date:	17-Jun-24
Completion Date:	19-Jun-24
Test Duration (Days):	2
Operator:	Luke Williams

Soil Description

Grey silty sandy clayey GRAVEL (Shale)

Test Results

Initial Conditions:

Diameter (mm):	104.87
Length (mm):	116.00
Bulk Density (Mg/m3)	2.10
Moisture Content (%)	9
Dry Density (Mg/m3):	1.93

Permeability:

Initial Test Time (mins)	768.00
Initial Height Above datum (mm)	1060
Final Test Time (mins)	718.00
Final Height above datum (mm)	412
Coefficient of Permeability m/s @ 20°c:	**5.24x 10-8**

Remarks:
All remaining samples shall be retained for a period of one month from the above date, after which time all samples shall be disposed of.

Determination of a Permeability
Falling Head in Permeameter
K.H. Head Volume 2 : Section 10.7

Date:	28-Jun-24
Contract Number:	73163
Client Ref Number:	784-B068642
Borehole/Sample Number:	TP10
Depth:	0.00
Sample Type:	D
Sample Preparation:	Remoulded 4.5kg Rammer
Start Date:	19-Jun-24
Completion Date:	21-Jun-24
Test Duration (Days):	2
Operator:	Luke Williams

Soil Description

Grey silty sandy gravelly CLAY

Test Results

Initial Conditions:

Diameter (mm):	104.87
Length (mm):	116.00
Bulk Density (Mg/m3)	1.72
Moisture Content (%)	19
Dry Density (Mg/m3):	1.44

Permeability:

Initial Test Time (mins)	869.00
Initial Height Above datum (mm)	1060
Final Test Time (mins)	945.00
Final Height above datum (mm)	785
Coefficient of Permeability m/s @ 20°c:	**3.29x 10-9**

Remarks:
All remaining samples shall be retained for a period of one month from the above date, after which time all samples shall be disposed of.

7 - 11 Harding Street
Leicester
LE1 4DH

GSTL
Unit 3-4 Heol Aur
Dafen Ind Estate
Dafen
SA14 8QN

Analytical Test Report:	**L24/05239/GSL - 24-46173**

Your Project Reference:	**Penyrenglyn 784-B068642**		
Your Order Number:	73163	Samples Received / Instructed:	11/06/2024 / 11/06/2024
Report Issue Number:	1	Sample Tested:	11/06 to 17/06/2024
Samples Analysed:	5 soil samples	Report issued:	17/06/2024

Signed

James Gane
Analytical Services Manager
CTS Group

Notes:

General

Please refer to Methodologies page for details pertaining to the analytical methods undertaken.

Samples will be retained for 14 days after issue of this report unless otherwise requested.

Moisture Content was determined in accordance with CTS method statement MS - CL - Sample Prep, oven dried at <30˚C.

Moisture Content is reported as a percentage of the dry mass of soil, this calculation is in accordance with BS1377, Part 2, 1990, Clause 3.2

Where specification limits are included these are for guidance only. Where a measured value has been highlighted this is not implying acceptance or failure and certainty of measurement values have not been taken into account.

Uncertainty of measurement values are available on request.

Samples were supplied by customer, results apply to the samples as received.

Deviating Samples

On receipt samples are compared against our sample holding and handling protocols, where any deviations have been noted these are reported on our deviating sample page (if present)

Accreditation Key

UKAS = UKAS Accreditation, MCERTS = MCERTS Accreditation, u = Unaccredited, subUKAS - Subcontracted to a laboratory UKAS accredited for this test, subMCERTS - Subcontracted to a laboratory MCERTS accredited for this test

MCERTS Accreditation only covers the SAND, CLAY and LOAM matrices

Date of Issue: 29.05.2024
Issued by: J. Gane
Issue No: 4
Rev No: 10

7 - 11 Harding Street
Leicester
LE1 4DH

L24/05239/GSL - 24-46173

Project Reference - Penyrenglyn 784-B068642

Analytical Test Results - Chemical Analysis

Lab Reference			371127	371128	371129	371130	371131
Client Sample ID			-	-	-	-	-
Client Sample Location			TP01	TP03	TP05	TP08	TP10
Client Sample Type			B	B	B	B	B
Client Sample Number			-	-	-	-	-
Depth - Top (m)			0.10	0.60	0.00	0.00	0.00
Depth - Bottom (m)			1.20	1.20	1.20	1.20	1.20
Date of Sampling			-	-	-	-	-
Time of Sampling			-	-	-	-	-
Sample Matrix			Sand	Sand	Sand	Sand	Sand
Determinant	**Units**	**Accreditation**					
Water soluble sulphate (as SO_4)	(mg/l)	u	65	< 10	< 10	< 10	< 10
Acid Soluble Sulphate	(%)	u	0.07	0.07	0.03	0.02	0.03
Total Sulphur	(%)	UKAS	0.20	0.13	0.10	0.06	0.09
pH Value	pH Units	MCERTS	6.5	6.8	5.3	6.3	5.3

7 - 11 Harding Street
Leicester
LE1 4DH

L24/05239/GSL - 24-46173

Project Reference - Penyrenglyn 784-B068642

Sample Descriptions

Lab Reference	Client Sample ID	Client Sample Location	Client Sample Type	Client Sample Number	Description	Moisture Content (%)	Stone Content (%)	Passing 2mm test sieve (%)
371127	-	TP01	B	-	Black very silty gravelly sand with frequent organic matter	-	-	50
371128	-	TP03	B	-	Black very silty gravelly sand with frequent organic matter	-	-	46
371129	-	TP05	B	-	Black very silty gravelly sand with frequent organic matter	-	-	66
371130	-	TP08	B	-	Dark grey very silty gravelly sand with frequent organic matter	-	-	78
371131	-	TP10	B	-	Black very silty gravelly sand with frequent organic matter	-	-	74

7 - 11 Harding Street
Leicester
LE1 4DH

L24/05239/GSL - 24-46173

Project Reference - Penyrenglyn 784-B068642

Sample Comments

Lab Reference	Client Sample ID	Client Sample Location	Client Sample Type	Client Sample Number	Comments
371127	-	TP01	B	-	
371128	-	TP03	B	-	
371129	-	TP05	B	-	
371130	-	TP08	B	-	
371131	-	TP10	B	-	

L24/05239/GSL - 24-46173

Project Reference - Penyrenglyn 784-B068642

Analysis Methodologies

Test Code	Test Name / Reference	Sample condition for analysis	Sample Preperation	Test Details
ANIONSS	MS - CL - Anions by Aquakem (2:1Extract)	Oven dried	Passing 2mm test sieve	Determination of Anions (inc Sulphate, chloride etc.) in soils by Aquakem. Analysis is based on a 2:1 water to soil extraction ratio
PHS	MS - CL - pH in Soils	As received	Passing 10mm test sieve	Determination of pH in soils using a pH probe (using a 1:3 soil to water extraction)
ASSO4S	MS - CL - Acid Soluble Sulphate	Oven Dried	Passing 2mm test sieve	Determination of total sulphate in soils by acid extraction followed by ICP analysis
SAMPLEPREP	MS - CL - Sample Preparation	-	-	Preparation of samples (including determination of moisture content) to allow for subsequent analysis
1377TS-ELT	BS1377 Total Sulphur Content by HTC	Oven dried	BS1377 : Part 1 : 2016	Total Sulphur Content testing of Soil in accordance with BS 1377 : Part 3 : 2018 + A1 : 2021 Clause 7.10 (using Eltra CS-800 Analyser)

L24/05239/GSL - 24-46173

Project Reference - Penyrenglyn 784-B068642

Sample Deviations

Deviations are listed below against each sample and associated test method, where deviation(s) are noted it means data may not be representative of the sample at the time of sampling and it is possible that results provided may be compromised.

Observations on receipt

A - No date of sampling provided
C - Received in inappropriate container
H - Contains headspace
T - Temperature on receipt exceeds storage temperature
R - Sample(s) received with less than 96 hours for testing to commence/complete, any result formally classed as deviating will be marked with an X against the applicable test (i.e. RX)

Observations whilst in laboratory

X - Exceeds sampling to extraction or analysis timescales

Lab Reference	Client Sample ID	Client Sample Location	Client Sample Type	Client Sample Number	Test	Deviations
371127	-	TP01	B	-		A
371128	-	TP03	B	-		A
371129	-	TP05	B	-		A
371130	-	TP08	B	-		A
371131	-	TP10	B	-		A

Laboratory Report

UKAS TESTING 2788

GSTL GEOTECHNICAL SITE & TESTING LABORATORIES A PHENNA GROUP COMPANY

Contract Number: 72912

Client Ref:
Client PO: **7015670**

Date Received: **21-05-2024**
Date Completed: **31-05-2024**
Report Date: **31-05-2024**

Client: **Tetra Tech**

This report has been checked and approved by:

Contract Title: **Penyrenglyn Jonest St, Treherbert**
For the attention of: **Nicholas Bool**

Shaun Thomas
Site Manager

Description	Qty
2 Man Hand pitting Crew Day Rate. Mob Included	2
Mobilisation of Field Technician and equipment to site and carry out SRD testing day rate.	1
Disposal of samples for job	1

Notes: **Observations and Interpretations are outside the UKAS Accreditation**
*** - denotes test included in laboratory scope of accreditation**
 # - denotes test carried out by approved contractor
@ - denotes non accredited tests

Approved Signatories:
Brendan Evans (Office Administrator) - Darren Bourne (Quality Senior Technician) - Paul Evans (Director)
Richard John (Quality/Technical Manager) - Shaun Jones (Laboratory manager) - Shaun Thomas (Site Manager)
Wayne Honey (HR & HSE Manager)

GEO Site & Testing Services Ltd
Unit 3-4 Heol Aur, Dafen Ind Est, Llanelli, Carmarthenshire SA14 8QN
Tel: 01554 784 040 Fax: 01554 784 040 info@gstl.co.uk https://gstl.co.uk

Test Report: **Determination of in-situ Density**
Sand replacement method suitable for fine-medium-and coarse grained soils
(large pouring cylinder method)
BS 1377: 2.1.2.2 Part 9: 1990

Client:	**Tetra Tech**
Client ref:	
Location:	**Penyrenglyn Jonest St, Treherbert**
Contract Number:	**72912**
Date of Test:	**30/05/2024**
Tested Carried out By:	**Ashley Davies**
Description:	**Grey silty fine to coarse GRAVEL**

TEST DETAILS.

Position/Location

	TP01	**TP05**
Depth of test (m)	**0.15**	**GL**
Depth (mm)	**150**	**150**
Bulk density (Mg/m^3):	**2.03**	**1.86**
Dry density (Mg/m^3):	**1.83**	**1.69**
Moisture Content (%):	**11**	**10**

Remarks:

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.

For and behalf of Geo Site & testing services Limited (GSTL)

GSTL
GEOTECHNICAL SITE & TESTING LABORATORIES

UKAS TESTING
2788

TEST REPORT

In-Situ Dry Density And Relative Compaction

BS 1377-9: 1990 Nuclear Density Method Compliance tests for compacted material (Direct transmission)

REPORT NUMBER:	C1087293 / 298401.1.1.10		
CLIENT REF:	1087293	CLIENT:	Tetra Tech
DATE COMPLETED:	04/06/2024	ADDRESS:	3 Sovereign Square, Sovereign Street, Leeds, LS1 4ER
TESTED BY:	Cameron Moore	SITE:	Penyrenglyn, Treherbert
SAMPLING PLAN:	Client Specification	ENVIRONMENTAL CONDITIONS:	Overcast
GAUGE MODEL No:	3440	SUPPLIER / SOURCE:	Site Won Site Won
GAUGE SERIAL No:	14307	MATERIAL:	Black Brown, silty rock with fines and large rocks
CORRECTION FACTORS:	Bulk y=0.988 Moisture b=0.993	LOCATION:	Penyrenglyn, Treherbert
MAX DRY DENSITY:	1.80 Mg/m^3	VARIATIONS FROM PROCEDURE:	N/A
DEPTH OF LAYER:	300	DEPTH OF TEST	300

TEST RESULTS **Activity Location: On-Site**

Test No.	Gauge Bulk Density (Mg/m^3)	Gauge Moisture Density (Mg/m^3)	Corrected Bulk Density (Mg/m^3)	Corrected Moisture Content (%)	Mean Dry Density (Mg/m^3)	Mean Relative Compaction (%)
TP01	1.925	0.295	1.90	18	1.62	90
	1.974	0.331	1.95	20		

MMD Figure for locating supplied by client

Remarks:
Test results reported relate only to the items tested.
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Opinions and interpretations expressed herein are outside the scope of UKAS Accreditation.The laboratory does not apply a conformity statement to test reports as standard, unless specifically requested by the customer.
Amended report. This test report supersedes test report version 1 - Client changed address title

Report Format: NDMSoils05a/TP13/Rep Issue 1 Rev 0 10/15

For and on behalf of CTS
Paul Smith - Operations supervisor

Approved Signatory
Report date 22-Jul-24

UKAS TESTING
4161

Unit 1280
Park Avenue Aztec West
Almondsbury
Bristol
BS32 4SQ

0343 227 8545
enquiries@constructiontesting.co.uk
www.constructiontesting.co.uk

END OF REPORT

Construction Testing Solutions Ltd.
Registered in England No. 05998333

TEST REPORT

In-Situ Dry Density And Relative Compaction

BS 1377-9: 1990 Nuclear Density Method Compliance tests for compacted material (Direct transmission)

REPORT NUMBER:	C1087293 / 298401.1.1.8		
CLIENT REF:	1087293	CLIENT:	Tetra Tech
DATE COMPLETED:	04/06/2024	ADDRESS:	3 Sovereign Square, Sovereign Street, Leeds, LS1 4ER
TESTED BY:	Cameron Moore	SITE:	Penyrenglyn, Treherbert
SAMPLING PLAN:	Client Specification	ENVIRONMENTAL CONDITIONS:	Overcast
GAUGE MODEL No:	3440	SUPPLIER / SOURCE:	Site Won Site Won
GAUGE SERIAL No:	14307	MATERIAL:	Black Brown, silty rock with fines and large rocks
CORRECTION FACTORS:	Bulk y=0.988 Moisture b=0.993	LOCATION:	Penyrenglyn, Treherbert
MAX DRY DENSITY:	1.97 Mg/m^3	VARIATIONS FROM PROCEDURE:	N/A
DEPTH OF LAYER:	300	DEPTH OF TEST	300

TEST RESULTS **Activity Location: On-Site**

Test No.	Gauge Bulk Density (Mg/m^3)	Gauge Moisture Density (Mg/m^3)	Corrected Bulk Density (Mg/m^3)	Corrected Moisture Content (%)	Mean Dry Density (Mg/m^3)	Mean Relative Compaction (%)
TP02	1.696	0.206	1.68	14	1.45	74
	1.660	0.212	1.64	15		

MMD Figure for locating supplied by client

Remarks:
Test results reported relate only to the items tested.
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Amended report. This test report supersedes test report version 1 - Client changed address title

Report Format: NDMSoils05a/TP13/Rep Issue 1 Rev 0 10/15

For and on behalf of CTS
Paul Smith - Operations supervisor

Approved Signatory
Report date 22-Jul-24

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Bristol
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enquiries@constructiontesting.co.uk
www.constructiontesting.co.uk

END OF REPORT

Construction Testing Solutions Ltd.
Registered in England No. 05998333

TEST REPORT

In-Situ Dry Density And Relative Compaction

BS 1377-9: 1990 Nuclear Density Method Compliance tests for compacted material (Direct transmission)

REPORT NUMBER:	C1087293 / 298401.1.1.9		
CLIENT REF:	1087293	CLIENT:	Tetra Tech
DATE COMPLETED:	04/06/2024	ADDRESS:	3 Sovereign Square, Sovereign Street, Leeds, LS1 4ER
TESTED BY:	Cameron Moore	SITE:	Penyrenglyn, Treherbert
SAMPLING PLAN:	Client Specification	ENVIRONMENTAL CONDITIONS:	Overcast
GAUGE MODEL No:	3440	SUPPLIER / SOURCE:	Site Won Site Won
GAUGE SERIAL No:	14307	MATERIAL:	Black Brown, silty rock with fines and large rocks
CORRECTION FACTORS:	Bulk y=0.988 Moisture b=0.993	LOCATION:	Penyrenglyn, Treherbert
MAX DRY DENSITY:	1.92 Mg/m^3	VARIATIONS FROM PROCEDURE:	N/A
DEPTH OF LAYER:	300	DEPTH OF TEST	300

TEST RESULTS **Activity Location: On-Site**

Test No.	Gauge Bulk Density (Mg/m^3)	Gauge Moisture Density (Mg/m^3)	Corrected Bulk Density (Mg/m^3)	Corrected Moisture Content (%)	Mean Dry Density (Mg/m^3)	Mean Relative Compaction (%)
TP03	2.032	0.212	2.01	12	1.78	93
	2.015	0.230	1.99	13		

MMD Figure for locating supplied by client

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Amended report. This test report supersedes test report version 1 - Client changed address title

Report Format: NDMSoils05a/TP13/Rep Issue 1 Rev 0 10/15

For and on behalf of CTS
Paul Smith - Operations supervisor

Approved Signatory
Report date 22-Jul-24

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Almondsbury
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BS32 4SQ

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enquiries@constructiontesting.co.uk
www.constructiontesting.co.uk

END OF REPORT

Construction Testing Solutions Ltd.
Registered in England No. 05998333

TEST REPORT

In-Situ Dry Density And Relative Compaction

BS 1377-9: 1990 Nuclear Density Method Compliance tests for compacted material (Direct transmission)

REPORT NUMBER:	C1087293 / 298401.1.1.6		
CLIENT REF:	1087293	CLIENT:	Tetra Tech
DATE COMPLETED:	04/06/2024	ADDRESS:	3 Sovereign Square, Sovereign Street, Leeds, LS1 4ER
TESTED BY:	Cameron Moore	SITE:	Penyrenglyn, Treherbert
SAMPLING PLAN:	Client Specification	ENVIRONMENTAL CONDITIONS:	Overcast
GAUGE MODEL No:	3440	SUPPLIER / SOURCE:	Site Won Site Won
GAUGE SERIAL No:	14307	MATERIAL:	Black Brown, silty rock with fines and large rocks
CORRECTION FACTORS:	Bulk y=0.988 Moisture b=0.993	LOCATION:	Penyrenglyn, Treherbert
MAX DRY DENSITY:	1.24 Mg/m^3	VARIATIONS FROM PROCEDURE:	N/A
DEPTH OF LAYER:	300	DEPTH OF TEST	300

TEST RESULTS **Activity Location: On-Site**

Test No.	Gauge Bulk Density (Mg/m^3)	Gauge Moisture Density (Mg/m^3)	Corrected Bulk Density (Mg/m^3)	Corrected Moisture Content (%)	Mean Dry Density (Mg/m^3)	Mean Relative Compaction (%)
TP04	1.681	0.230	1.66	16	1.44	116
	1.706	0.237	1.69	16		

MMD Figure for locating supplied by client

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TEST REPORT

In-Situ Dry Density And Relative Compaction

BS 1377-9: 1990 Nuclear Density Method Compliance tests for compacted material (Direct transmission)

REPORT NUMBER:	C1087293 / 298401.1.1.7		
CLIENT REF:	1087293	CLIENT:	Tetra Tech
DATE COMPLETED:	04/06/2024	ADDRESS:	3 Sovereign Square, Sovereign Street, Leeds, LS1 4ER
TESTED BY:	Cameron Moore	SITE:	Penyrenglyn, Treherbert
SAMPLING PLAN:	Client Specification	ENVIRONMENTAL CONDITIONS:	Overcast
GAUGE MODEL No:	3440	SUPPLIER / SOURCE:	Site Won Site Won
GAUGE SERIAL No:	14307	MATERIAL:	Black Brown, silty rock with fines and large rocks
CORRECTION FACTORS:	Bulk y=0.988 Moisture b=0.993	LOCATION:	Penyrenglyn, Treherbert
MAX DRY DENSITY:	2.05 Mg/m^3	VARIATIONS FROM PROCEDURE:	N/A
DEPTH OF LAYER:	300	DEPTH OF TEST	300

TEST RESULTS **Activity Location: On-Site**

Test No.	Gauge Bulk Density (Mg/m^3)	Gauge Moisture Density (Mg/m^3)	Corrected Bulk Density (Mg/m^3)	Corrected Moisture Content (%)	Mean Dry Density (Mg/m^3)	Mean Relative Compaction (%)
TP05	1.801	0.157	1.78	9.6	1.62	79
	1.793	0.166	1.77	10		

MMD Figure for locating supplied by client

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TEST REPORT

In-Situ Dry Density And Relative Compaction

BS 1377-9: 1990 Nuclear Density Method Compliance tests for compacted material (Direct transmission)

REPORT NUMBER:	C1087293 / 298401.1.1.5		
CLIENT REF:	1087293	CLIENT:	Tetra Tech
DATE COMPLETED:	04/06/2024	ADDRESS:	3 Sovereign Square, Sovereign Street, Leeds, LS1 4ER
TESTED BY:	Cameron Moore	SITE:	Penyrenglyn, Treherbert
SAMPLING PLAN:	Client Specification	ENVIRONMENTAL CONDITIONS:	Overcast
GAUGE MODEL No:	3440	SUPPLIER / SOURCE:	Site Won Site Won
GAUGE SERIAL No:	14307	MATERIAL:	Black Brown, silty rock with fines and large rocks
CORRECTION FACTORS:	Bulk y=0.988 Moisture b=0.993	LOCATION:	Penyrenglyn, Treherbert
MAX DRY DENSITY:	1.75 Mg/m^3	VARIATIONS FROM PROCEDURE:	N/A
DEPTH OF LAYER:	300	DEPTH OF TEST	300

TEST RESULTS **Activity Location: On-Site**

Test No.	Gauge Bulk Density (Mg/m^3)	Gauge Moisture Density (Mg/m^3)	Corrected Bulk Density (Mg/m^3)	Corrected Moisture Content (%)	Mean Dry Density (Mg/m^3)	Mean Relative Compaction (%)
TP06	1.702	0.243	1.68	17	1.44	82
	1.701	0.247	1.68	17		

MMD Figure for locating supplied by client

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TEST REPORT

In-Situ Dry Density And Relative Compaction

BS 1377-9: 1990 Nuclear Density Method Compliance tests for compacted material (Direct transmission)

REPORT NUMBER:	C1087293 / 298401.1.1.1		
CLIENT REF:	1087293	CLIENT:	Tetra Tech
DATE COMPLETED:	04/06/2024	ADDRESS:	3 Sovereign Square, Sovereign Street, Leeds, LS1 4ER
TESTED BY:	Cameron Moore	SITE:	Penyrenglyn, Treherbert
SAMPLING PLAN:	Client Specification	ENVIRONMENTAL CONDITIONS:	Overcast
GAUGE MODEL No:	3440	SUPPLIER / SOURCE:	Site Won Site Won
GAUGE SERIAL No:	14307	MATERIAL:	Black Brown, silty rock with fines and large rocks
CORRECTION FACTORS:	Bulk y=0.988 Moisture b=0.993	LOCATION:	Penyrenglyn, Treherbert
MAX DRY DENSITY:	1.97 Mg/m^3	VARIATIONS FROM PROCEDURE:	N/A
DEPTH OF LAYER:	300	DEPTH OF TEST	300

TEST RESULTS **Activity Location: On-Site**

Test No.	Gauge Bulk Density (Mg/m^3)	Gauge Moisture Density (Mg/m^3)	Corrected Bulk Density (Mg/m^3)	Corrected Moisture Content (%)	Mean Dry Density (Mg/m^3)	Mean Relative Compaction (%)
TP07	1.769	0.273	1.75	18	1.50	76
	1.779	0.231	1.76	15		

MMD Figure for locating supplied by client

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TEST REPORT

In-Situ Dry Density And Relative Compaction

BS 1377-9: 1990 Nuclear Density Method Compliance tests for compacted material (Direct transmission)

REPORT NUMBER:	C1087293 / 298401.1.1.4		
CLIENT REF:	1087293	CLIENT:	Tetra Tech
DATE COMPLETED:	04/06/2024	ADDRESS:	3 Sovereign Square, Sovereign Street, Leeds, LS1 4ER
TESTED BY:	Cameron Moore	SITE:	Penyrenglyn, Treherbert
SAMPLING PLAN:	Client Specification	ENVIRONMENTAL CONDITIONS:	Overcast
GAUGE MODEL No:	3440	SUPPLIER / SOURCE:	Site Won Site Won
GAUGE SERIAL No:	14307	MATERIAL:	Black Brown, silty rock with fines and large rocks
CORRECTION FACTORS:	Bulk y=0.988 Moisture b=0.993	LOCATION:	Penyrenglyn, Treherbert
MAX DRY DENSITY:	2.03 Mg/m^3	VARIATIONS FROM PROCEDURE:	N/A
DEPTH OF LAYER:	300	DEPTH OF TEST	300

TEST RESULTS **Activity Location: On-Site**

Test No.	Gauge Bulk Density (Mg/m^3)	Gauge Moisture Density (Mg/m^3)	Corrected Bulk Density (Mg/m^3)	Corrected Moisture Content (%)	Mean Dry Density (Mg/m^3)	Mean Relative Compaction (%)
TP08	1.767	0.173	1.75	11	1.56	77
	1.726	0.169	1.71	11		

MMD Figure for locating supplied by client

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TEST REPORT

In-Situ Dry Density And Relative Compaction

BS 1377-9: 1990 Nuclear Density Method Compliance tests for compacted material (Direct transmission)

REPORT NUMBER:	C1087293 / 298401.1.1.3		
CLIENT REF:	1087293	CLIENT:	Tetra Tech
DATE COMPLETED:	04/06/2024	ADDRESS:	3 Sovereign Square, Sovereign Street, Leeds, LS1 4ER
TESTED BY:	Cameron Moore	SITE:	Penyrenglyn, Treherbert
SAMPLING PLAN:	Client Specification	ENVIRONMENTAL CONDITIONS:	Overcast
GAUGE MODEL No:	3440	SUPPLIER / SOURCE:	Site Won Site Won
GAUGE SERIAL No:	14307	MATERIAL:	Black Brown, silty rock with fines and large rocks
CORRECTION FACTORS:	Bulk y=0.988 Moisture b=0.993	LOCATION:	Penyrenglyn, Treherbert
MAX DRY DENSITY:	2.03 Mg/m^3	VARIATIONS FROM PROCEDURE:	N/A
DEPTH OF LAYER:	300	DEPTH OF TEST	300

TEST RESULTS **Activity Location: On-Site**

Test No.	Gauge Bulk Density (Mg/m^3)	Gauge Moisture Density (Mg/m^3)	Corrected Bulk Density (Mg/m^3)	Corrected Moisture Content (%)	Mean Dry Density (Mg/m^3)	Mean Relative Compaction (%)
TP09	1.626	0.176	1.61	12	1.43	70
	1.623	0.181	1.60	13		

MMD Figure for locating supplied by client

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Paul Smith - Operations supervisor

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TEST REPORT

In-Situ Dry Density And Relative Compaction

BS 1377-9: 1990 Nuclear Density Method Compliance tests for compacted material (Direct transmission)

REPORT NUMBER:	C1087293 / 298401.1.1.2		
CLIENT REF:	1087293	CLIENT:	Tetra Tech
DATE COMPLETED:	04/06/2024	ADDRESS:	3 Sovereign Square, Sovereign Street, Leeds, LS1 4ER
TESTED BY:	Cameron Moore	SITE:	Penyrenglyn, Treherbert
SAMPLING PLAN:	Client Specification	ENVIRONMENTAL CONDITIONS:	Overcast
GAUGE MODEL No:	3440	SUPPLIER / SOURCE:	Site Won Site Won
GAUGE SERIAL No:	14307	MATERIAL:	Black Brown, silty rock with fines and large rocks
CORRECTION FACTORS:	Bulk y=0.988 Moisture b=0.993	LOCATION:	Penyrenglyn, Treherbert
MAX DRY DENSITY:	1.67 Mg/m^3	VARIATIONS FROM PROCEDURE:	N/A
DEPTH OF LAYER:	300	DEPTH OF TEST	300

TEST RESULTS **Activity Location: On-Site**

Test No.	Gauge Bulk Density (Mg/m^3)	Gauge Moisture Density (Mg/m^3)	Corrected Bulk Density (Mg/m^3)	Corrected Moisture Content (%)	Mean Dry Density (Mg/m^3)	Mean Relative Compaction (%)
TP10	1.616	0.337	1.60	26	1.28	77
	1.637	0.320	1.62	24		

MMD Figure for locating supplied by client

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For and on behalf of CTS
Paul Smith - Operations supervisor

Approved Signatory
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Construction Testing Solutions Ltd.
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APPENDIX D: CHEMICAL LABORATORY TEST RESULTS

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e: nicholas.bool@tetratech.com

i2 Analytical Ltd.
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Watford,
Herts,
WD18 8YS

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e: reception@i2analytical.com

Analytical Report Number : 24-022998

Project / Site name:	Penyrenglyn	**Samples received on:**	03/06/2024
Your job number:	B066842	**Samples instructed on/ Analysis started on:**	04/06/2024
Your order number:		**Analysis completed by:**	12/06/2024
Report Issue Number:	1	**Report issued on:**	13/06/2024
Samples Analysed:	10 soil samples		

Signed: _____

Anna Goc
PL Head of Reporting Team
For & on behalf of i2 Analytical Ltd.

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

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

Standard sample disposal times, unless otherwise agreed with the laboratory, are :

soils - 4 weeks from reporting
leachates - 2 weeks from reporting
waters - 2 weeks from reporting
asbestos - 6 months from reporting

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

Analytical Report Number: 24-022998
Project / Site name: Penyrenglyn

Lab Sample Number				216619	216620	216621	216622	216623
Sample Reference				TP01	TP02	TP03	TP04	TP05
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.30	0.60	1.20	0.30	0.60
Date Sampled				30/05/2024	30/05/2024	30/05/2024	30/05/2024	30/05/2024
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
Stone Content	%	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Moisture Content	%	0.01	NONE	6.2	9.6	7.6	17	6.7
Total mass of sample received	kg	0.1	NONE	0.8	0.8	0.9	0.9	0.8
Asbestos								
Asbestos in Soil Detected/Not Detected	Type	N/A	ISO 17025	Not-detected	Not-detected	Not-detected	Not-detected	Not-detected
Asbestos Analyst ID	N/A	N/A	N/A	WEM	WEM	WEM	WEM	DSO
General Inorganics								
pH (L099)	pH Units	N/A	MCERTS	7.4	5.9	8.3	8.4	8.1
Total Cyanide	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Water Soluble Sulphate as SO_4 16hr extraction (2:1)	mg/kg	2.5	MCERTS	16	24	65	25	21
Water Soluble SO_4 16hr extraction (2:1 Leachate Equivalent)	mg/l	1.25	MCERTS	8.22	11.8	32.3	12.7	10.5
Organic Matter (automated)	%	0.1	MCERTS	2.6	2.9	3.1	9.3	1.4
Total Phenols								
Total Phenols (monohydric)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Speciated PAHs								
Naphthalene	mg/kg	0.05	MCERTS	0.49	0.56	1	< 0.05	0.22
Acenaphthylene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Acenaphthene	mg/kg	0.05	MCERTS	0.06	0.06	0.16	< 0.05	< 0.05
Fluorene	mg/kg	0.05	MCERTS	0.13	0.08	0.17	< 0.05	< 0.05
Phenanthrene	mg/kg	0.05	MCERTS	1.1	0.65	1.3	0.25	0.33
Anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	0.12	< 0.05	< 0.05
Fluoranthene	mg/kg	0.05	MCERTS	0.34	0.19	0.47	< 0.05	0.07
Pyrene	mg/kg	0.05	MCERTS	0.21	0.13	0.33	< 0.05	< 0.05
Benzo(a)anthracene	mg/kg	0.05	MCERTS	0.13	< 0.05	0.15	0.06	< 0.05
Chrysene	mg/kg	0.05	MCERTS	0.41	0.26	0.5	0.11	< 0.05
Benzo(b)fluoranthene	mg/kg	0.05	ISO 17025	0.2	0.09	0.22	< 0.05	< 0.05
Benzo(k)fluoranthene	mg/kg	0.05	ISO 17025	0.06	< 0.05	0.06	< 0.05	< 0.05
Benzo(a)pyrene	mg/kg	0.05	MCERTS	0.08	< 0.05	< 0.05	< 0.05	< 0.05
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	0.09	< 0.05	< 0.05	< 0.05	< 0.05
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	0.11	< 0.05	< 0.05	< 0.05	< 0.05
Total PAH								
Speciated Total EPA-16 PAHs	mg/kg	0.8	ISO 17025	3.42	2.02	4.44	< 0.80	< 0.80

Analytical Report Number: 24-022998
Project / Site name: Penyrenglyn

Lab Sample Number				216619	216620	216621	216622	216623
Sample Reference				TP01	TP02	TP03	TP04	TP05
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.30	0.60	1.20	0.30	0.60
Date Sampled				30/05/2024	30/05/2024	30/05/2024	30/05/2024	30/05/2024
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
Heavy Metals / Metalloids								
Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	8.1	10	15	6.9	14
Boron (water soluble)	mg/kg	0.2	MCERTS	< 0.2	0.2	0.3	0.3	0.3
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	0.4	< 0.2	< 0.2	< 0.2	< 0.2
Chromium (hexavalent)	mg/kg	1.8	MCERTS	< 1.8	-	-	-	-
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	11	6	5.8	7	7.5
Copper (aqua regia extractable)	mg/kg	1	MCERTS	42	41	44	51	45
Lead (aqua regia extractable)	mg/kg	1	MCERTS	22	32	27	24	22
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	0.4	< 0.3	< 0.3	< 0.3	< 0.3
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	34	28	33	46	32
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	180	87	68	30	84
Petroleum Hydrocarbons								
TPH Total >C6 - C40 EH_CU+HS_1D_TOTAL	mg/kg	10	NONE	< 10	< 10	< 10	< 10	< 10
Petroleum Range Organics (C6 - C10) HS_1D_TOTAL	mg/kg	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
TPH (C10 - C40) EH_CU_1D_TOTAL	mg/kg	10	MCERTS	< 10	< 10	< 10	< 10	< 10

U/S = Unsuitable Sample I/S = Insufficient Sample ND = Not detected

Analytical Report Number: 24-022998
Project / Site name: Penyrenglyn

Lab Sample Number				216624	216625	216626	216627	216628
Sample Reference				TP06	TP07	TP08	TP09	TP10
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				1.20	0.60	1.20	0.60	0.30
Date Sampled				29/05/2024	29/05/2024	29/05/2024	29/05/2024	29/05/2024
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
Stone Content	%	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Moisture Content	%	0.01	NONE	11	7.5	7.2	8.5	16
Total mass of sample received	kg	0.1	NONE	0.9	0.9	0.8	0.9	0.8
Asbestos								
Asbestos in Soil Detected/Not Detected	Type	N/A	ISO 17025	Not-detected	Not-detected	Not-detected	Not-detected	Not-detected
Asbestos Analyst ID	N/A	N/A	N/A	DSO	DSO	DSO	PDO	PDO
General Inorganics								
pH (L099)	pH Units	N/A	MCERTS	6.4	6.6	6.9	5.6	7.6
Total Cyanide	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Water Soluble Sulphate as SO_4 16hr extraction (2:1)	mg/kg	2.5	MCERTS	9.3	24	14	12	15
Water Soluble SO_4 16hr extraction (2:1 Leachate Equivalent)	mg/l	1.25	MCERTS	4.65	12	7.09	5.84	7.39
Organic Matter (automated)	%	0.1	MCERTS	6	1.9	1.6	2.8	5.4
Total Phenols								
Total Phenols (monohydric)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Speciated PAHs								
Naphthalene	mg/kg	0.05	MCERTS	0.84	0.3	0.24	0.7	0.72
Acenaphthylene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Acenaphthene	mg/kg	0.05	MCERTS	0.09	< 0.05	< 0.05	< 0.05	0.06
Fluorene	mg/kg	0.05	MCERTS	0.22	0.08	0.06	0.13	0.23
Phenanthrene	mg/kg	0.05	MCERTS	1.5	0.41	0.33	0.85	1.6
Anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	0.12
Fluoranthene	mg/kg	0.05	MCERTS	0.45	0.05	< 0.05	0.16	0.37
Pyrene	mg/kg	0.05	MCERTS	0.35	< 0.05	< 0.05	0.09	0.26
Benzo(a)anthracene	mg/kg	0.05	MCERTS	0.21	< 0.05	< 0.05	< 0.05	< 0.05
Chrysene	mg/kg	0.05	MCERTS	0.63	< 0.05	< 0.05	0.33	< 0.05
Benzo(b)fluoranthene	mg/kg	0.05	ISO 17025	0.34	< 0.05	< 0.05	< 0.05	< 0.05
Benzo(k)fluoranthene	mg/kg	0.05	ISO 17025	0.12	< 0.05	< 0.05	< 0.05	< 0.05
Benzo(a)pyrene	mg/kg	0.05	MCERTS	0.13	< 0.05	< 0.05	< 0.05	< 0.05
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	0.1	< 0.05	< 0.05	< 0.05	< 0.05
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	0.07	< 0.05	< 0.05	< 0.05	< 0.05
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	0.1	< 0.05	< 0.05	< 0.05	< 0.05
Total PAH								
Speciated Total EPA-16 PAHs	mg/kg	0.8	ISO 17025	5.14	0.85	< 0.80	2.26	3.32

Analytical Report Number: 24-022998
Project / Site name: Penyrenglyn

Lab Sample Number				216624	216625	216626	216627	216628
Sample Reference				TP06	TP07	TP08	TP09	TP10
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				1.20	0.60	1.20	0.60	0.30
Date Sampled				29/05/2024	29/05/2024	29/05/2024	29/05/2024	29/05/2024
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
Heavy Metals / Metalloids								
Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	10	11	15	11	8.4
Boron (water soluble)	mg/kg	0.2	MCERTS	< 0.2	0.4	0.2	0.3	0.3
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Chromium (hexavalent)	mg/kg	1.8	MCERTS	-	-	-	-	< 1.8
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	5.7	4.3	5.8	24	6.1
Copper (aqua regia extractable)	mg/kg	1	MCERTS	43	49	44	48	49
Lead (aqua regia extractable)	mg/kg	1	MCERTS	23	25	24	26	16
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	0.4	< 0.3	< 0.3	6.6	< 0.3
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	24	36	41	30	19
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	55	77	99	90	40
Petroleum Hydrocarbons								
TPH Total >C6 - C40 EH_CU+HS_1D_TOTAL	mg/kg	10	NONE	< 10 ~	< 10	< 10	< 10	170 ~
Petroleum Range Organics (C6 - C10) HS_1D_TOTAL	mg/kg	1	ISO 17025	< 1.0 ~	< 1.0	< 1.0	< 1.0	< 1.0 ~
TPH (C10 - C40) EH_CU_1D_TOTAL	mg/kg	10	MCERTS	< 10 ~	< 10	< 10	< 10	170 ~

U/S = Unsuitable Sample I/S = Insufficient Sample ND = Not detected

Analytical Report Number : 24-022998
Project / Site name: Penyrenglyn

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

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

Lab Sample Number	Sample Reference	Sample Number	Depth (m)	Sample Description *
216619	TP01	None Supplied	0.3	Brown loam and clay with gravel and vegetation
216620	TP02	None Supplied	0.6	Brown loam and clay with gravel and vegetation
216621	TP03	None Supplied	1.2	Brown clay and loam with gravel
216622	TP04	None Supplied	0.3	Brown gravely loam with clinker
216623	TP05	None Supplied	0.6	Brown clay and loam with gravel and vegetation
216624	TP06	None Supplied	1.2	Brown clay and loam with gravel and vegetation
216625	TP07	None Supplied	0.6	Brown clay and loam with gravel and vegetation
216626	TP08	None Supplied	1.2	Brown clay and loam with gravel
216627	TP09	None Supplied	0.6	Brown loam and clay with gravel and vegetation
216628	TP10	None Supplied	0.3	Brown loam and clay with gravel and vegetation

Analytical Report Number : 24-022998
Project / Site name: Penyrenglyn

Water matrix abbreviations:
Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Waters (PrW) Final Sewage Effluent (FSE) Landfill Leachate (LL)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Asbestos identification in Soil	Asbestos Identification with the use of polarised light microscopy in conjunction with dispersion staining techniques	In-house method based on HSG 248, 2021	A001B	D	ISO 17025
Organic matter (Automated) in soil	Determination of organic matter in soil by oxidising with potassium dichromate followed by titration with iron (II) sulphate (Walkley Black Method)	In-house method	L009B	D	MCERTS
Moisture Content	Moisture content, determined gravimetrically (up to 30°C)	In-house method	L019B	W	NONE
Stones content of soil	Standard preparation for all samples unless otherwise detailed. Gravimetric determination of stone > 10 mm as % dry weight	In-house method based on British Standard Methods and MCERTS requirements.	L019B	D	NONE
Metals in soil by ICP-OES	Determination of metals in soil by aqua-regia digestion followed by ICP-OES	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil	L038B	D	MCERTS
Boron, water soluble, in soil	Determination of water soluble boron in soil by hot water extract followed by ICP-OES	In-house method based on Second Site Properties version 3	L038B	D	MCERTS
Sulphate, water soluble, in soil (16hr extraction)	Sulphate, water soluble, in soil (16hr extraction)	In-house method	L038B	D	MCERTS
Speciated PAHs and/or Semi-volatile organic compounds in soil	Determination of semi-volatile organic compounds (including PAH) in soil by extraction in dichloromethane and hexane followed by GC-MS	In-house method based on USEPA 8270	L064B	D	MCERTS
Total petroleum hydrocarbons by GC-FID/GC-MS HS in soil	Determination of total petroleum hydrocarbons in soil by GC-FID/GC-MS HS	In-house method	L076B/L088	D/W	MCERTS
Hexavalent chromium in soil	Determination of hexavalent chromium in soil by extraction in NaOH and addition of 1,5 diphenylcarbazide followed by colorimetry	In-house method	L080	W	MCERTS
Monohydric phenols in soil	Determination of phenols in soil by extraction with sodium hydroxide followed by distillation followed by colorimetry	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L080	W	MCERTS
Total cyanide in soil	Determination of total cyanide by distillation followed by colorimetry	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L080	W	MCERTS

Analytical Report Number : 24-022998
Project / Site name: Penyrenglyn

Water matrix abbreviations:
Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Waters (PrW) Final Sewage Effluent (FSE) Landfill Leachate (LL)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
pH in soil (automated)	Determination of pH in soil by addition of water followed by automated electrometric measurement	In-house method	L099	D	MCERTS

For method numbers ending in 'UK' or 'A' analysis have been carried out in our laboratory in the United Kingdom (Watford).
For method numbers ending in 'F' analysis have been carried out in our laboratory in the United Kingdom (East Kilbride).
For method numbers ending in 'PL' or 'B' analysis have been carried out in our laboratory in Poland.
Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received the results obtained are multiplied by a moisture correction factor that is determined gravimetrically using the moisture content which is carried out at a maximum of 30oC.
Unless otherwise indicated, site information, order number, project number, sampling date, time, sample reference and depth are provided by the client. The instructed on date indicates the date on which this information was provided to the laboratory.

Information in Support of Analytical Results

List of HWOL Acronyms and Operators

Acronym	Descriptions
HS	Headspace Analysis
MS	Mass spectrometry
FID	Flame Ionisation Detector
GC	Gas Chromatography
EH	Extractable Hydrocarbons (i.e. everything extracted by the solvent(s))
CU	Clean-up - e.g. by Florisil®, silica gel
1D	GC - Single coil/column gas chromatography
2D	GC-GC - Double coil/column gas chromatography
Total	Aliphatics & Aromatics
AL	Aliphatics
AR	Aromatics
#1	EH_2D_Total but with humics mathematically subtracted
#2	EH_2D_Total but with fatty acids mathematically subtracted
_	Operator - understore to separate acronyms (exception for +)
+	Operator to indicate cumulative e.g. EH+HS_Total or EH_CU+HS_Total

~ - Quality control surrogate recovery outside of limits, other checks applied prior to reporting the data have been accepted. The result should be considered as being deviating and may be compromised.

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Analytical Report Number : 24-023191

Project / Site name:	Penyrenglyn	**Samples received on:**	03/06/2024
Your job number:	B066842	**Samples instructed on/ Analysis started on:**	04/06/2024
Your order number:		**Analysis completed by:**	12/06/2024
Report Issue Number:	1	**Report issued on:**	13/06/2024
Samples Analysed:	4 soil samples - 4 leachate samples		

Signed:

Adam Fenwick
Technical Reviewer
For & on behalf of i2 Analytical Ltd.

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

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

Standard sample disposal times, unless otherwise agreed with the laboratory, are :

soils	- 4 weeks from reporting
leachates	- 2 weeks from reporting
waters	- 2 weeks from reporting
asbestos	- 6 months from reporting

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

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Waste Acceptance Criteria Analytical Results

Report No:	**24-023191**						
					Client:	**TETRATECH**	
Location	**Penyrenglyn**						
Lab Reference (Sample Number)	217595				**Landfill Waste Acceptance Criteria Limits**		
Sampling Date	30/05/2024				Inert Waste Landfill	Stable Non-reactive HAZARDOUS waste in non-hazardous Landfill	Hazardous Waste Landfill
Sample ID	TP01						
Depth (m)	0.30						
Solid Waste Analysis							
TOC (%)**	1.5				3%	5%	6%
Loss on Ignition (%) **	12				--	--	10%
BTEX (µg/kg) **	< 5.0 ~				6000	--	--
Sum of PCBs (mg/kg) **	< 0.007				1	--	--
Mineral Oil (mg/kg) EH_1D_CU_AL	< 10				500	--	--
Total PAH (WAC-17) (mg/kg)	2.60				100	--	--
pH (units)**	7.5				--	>6	--
Acid Neutralisation Capacity (mmol / kg)	0.47				--	To be evaluated	To be evaluated
Eluate Analysis	10:1			10:1	Limit values for compliance leaching test		
(BS EN 12457 - 2 preparation utilising end over end leaching procedure)	mg/l			mg/kg	using BS EN 12457-2 at L/S 10 l/kg (mg/kg)		
Arsenic *	0.00113			0.0113	0.5	2	25
Barium *	0.0180			0.180	20	100	300
Cadmium *	< 0.000100			< 0.00100	0.04	1	5
Chromium *	0.0045			0.045	0.5	10	70
Copper *	0.011			0.11	2	50	100
Mercury *	< 0.000500			< 0.00500	0.01	0.2	2
Molybdenum *	< 0.000400			< 0.00400	0.5	10	30
Nickel *	0.0031			0.031	0.4	10	40
Lead *	< 0.0010			< 0.010	0.5	10	50
Antimony *	< 0.0017			< 0.017	0.06	0.7	5
Selenium *	< 0.0040			< 0.040	0.1	0.5	7
Zinc *	0.012			0.12	4	50	200
Chloride *	0.97			9.7	800	15000	25000
Fluoride*	0.096			0.96	10	150	500
Sulphate *	< 0.045			< 0.45	1000	20000	50000
TDS*	7.9			79	4000	60000	100000
Phenol Index (Monohydric Phenols) *	< 0.010			< 0.10	1	-	-
DOC	3.99			39.9	500	800	1000
Leach Test Information							
Stone Content (%)	< 0.1						
Sample Mass (kg)	0.8						
Dry Matter (%)	94						
Moisture (%)	6.2						

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

*= UKAS accredited (liquid eluate analysis only)

Stated limits are for guidance only and i2 cannot be held responsible for any discrepancies with current legislation

** = MCERTS accredited

Landfill WAC analysis (specifically leaching test results) must not be used for hazardous waste classification purposes as defined by the Waste (England and Wales) Regulations 2011 (as amended) and EA Guidance WM3.
This analysis is only applicable for landfill acceptance criteria (The Environmental Permitting (England and Wales) Regulations) and does not give any indication as to whether a waste may be hazardous or non-hazardous.

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Waste Acceptance Criteria Analytical Results

Report No:	**24-023191**						
					Client: TETRATECH		
Location	**Penyrenglyn**						
Lab Reference (Sample Number)	217596				**Landfill Waste Acceptance Criteria Limits**		
Sampling Date	30/05/2024				Inert Waste Landfill	Stable Non-reactive HAZARDOUS waste in non-hazardous Landfill	Hazardous Waste Landfill
Sample ID	TP03						
Depth (m)	1.20						
Solid Waste Analysis							
TOC (%)**	1.8				3%	5%	6%
Loss on Ignition (%) **	11				--	--	10%
BTEX (µg/kg) **	< 5.0 ~				6000	--	--
Sum of PCBs (mg/kg) **	< 0.007				1	--	--
Mineral Oil (mg/kg) EH_1D_CU_AL	< 10				500	--	--
Total PAH (WAC-17) (mg/kg)	4.40				100	--	--
pH (units)**	7.8				--	>6	--
Acid Neutralisation Capacity (mmol / kg)	0.95				--	To be evaluated	To be evaluated
Eluate Analysis (BS EN 12457 - 2 preparation utilising end over end leaching procedure)	10:1 mg/l			10:1 mg/kg	Limit values for compliance leaching test using BS EN 12457-2 at L/S 10 l/kg (mg/kg)		
Arsenic *	< 0.00100			< 0.0100	0.5	2	25
Barium *	0.0176			0.176	20	100	300
Cadmium *	< 0.000100			< 0.00100	0.04	1	5
Chromium *	0.0037			0.037	0.5	10	70
Copper *	0.0088			0.088	2	50	100
Mercury *	< 0.000500			< 0.00500	0.01	0.2	2
Molybdenum *	< 0.000400			< 0.00400	0.5	10	30
Nickel *	0.0020			0.020	0.4	10	40
Lead *	0.0017			0.017	0.5	10	50
Antimony *	< 0.0017			< 0.017	0.06	0.7	5
Selenium *	< 0.0040			< 0.040	0.1	0.5	7
Zinc *	0.0062			0.062	4	50	200
Chloride *	0.79			7.9	800	15000	25000
Fluoride*	0.090			0.90	10	150	500
Sulphate *	< 0.045			< 0.45	1000	20000	50000
TDS*	6.9			69	4000	60000	100000
Phenol Index (Monohydric Phenols) *	< 0.010			< 0.10	1	-	-
DOC	5.13			51.3	500	800	1000
Leach Test Information							
Stone Content (%)	< 0.1						
Sample Mass (kg)	0.9						
Dry Matter (%)	92						
Moisture (%)	7.6						

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

*= UKAS accredited (liquid eluate analysis only)

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** = MCERTS accredited

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Waste Acceptance Criteria Analytical Results

Report No:	**24-023191**						
					Client:	**TETRATECH**	
Location	**Penyrenglyn**						
Lab Reference (Sample Number)	217597				**Landfill Waste Acceptance Criteria Limits**		
Sampling Date	30/05/2024				Inert Waste Landfill	Stable Non-reactive HAZARDOUS waste in non-hazardous Landfill	Hazardous Waste Landfill
Sample ID	TP07						
Depth (m)	0.60						
Solid Waste Analysis							
TOC (%)**	1.4				3%	5%	6%
Loss on Ignition (%) **	7.0				--	--	10%
BTEX (µg/kg) **	< 5.0				6000	--	--
Sum of PCBs (mg/kg) **	< 0.007				1	--	--
Mineral Oil (mg/kg) EH_1D_CU_AL	< 10				500	--	--
Total PAH (WAC-17) (mg/kg)	< 0.85				100	--	--
pH (units)**	7.0				--	>6	--
Acid Neutralisation Capacity (mmol / kg)	0.00				--	To be evaluated	To be evaluated
Eluate Analysis (BS EN 12457 - 2 preparation utilising end over end leaching procedure)	10:1 mg/l			10:1 mg/kg	Limit values for compliance leaching test using BS EN 12457-2 at L/S 10 l/kg (mg/kg)		
Arsenic *	< 0.00100			< 0.0100	0.5	2	25
Barium *	0.0146			0.146	20	100	300
Cadmium *	< 0.000100			< 0.00100	0.04	1	5
Chromium *	0.0043			0.043	0.5	10	70
Copper *	0.012			0.12	2	50	100
Mercury *	< 0.000500			< 0.00500	0.01	0.2	2
Molybdenum *	< 0.000400			< 0.00400	0.5	10	30
Nickel *	0.0024			0.024	0.4	10	40
Lead *	< 0.0010			< 0.010	0.5	10	50
Antimony *	< 0.0017			< 0.017	0.06	0.7	5
Selenium *	< 0.0040			< 0.040	0.1	0.5	7
Zinc *	0.0053			0.053	4	50	200
Chloride *	0.81			8.1	800	15000	25000
Fluoride*	0.053			0.53	10	150	500
Sulphate *	< 0.045			< 0.45	1000	20000	50000
TDS*	6.3			63	4000	60000	100000
Phenol Index (Monohydric Phenols) *	< 0.010			< 0.10	1	-	-
DOC	4.10			41.0	500	800	1000
Leach Test Information							
Stone Content (%)	< 0.1						
Sample Mass (kg)	0.8						
Dry Matter (%)	93						
Moisture (%)	7.5						

Results are expressed on a dry weight basis, after correction for moisture content where applicable. *= UKAS accredited (liquid eluate analysis only)

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Waste Acceptance Criteria Analytical Results

Report No:	**24-023191**						
					Client:	**TETRATECH**	
Location	**Penyrenglyn**						
Lab Reference (Sample Number)	217598				**Landfill Waste Acceptance Criteria Limits**		
Sampling Date	30/05/2024				Inert Waste Landfill	Stable Non-reactive HAZARDOUS waste in non-hazardous Landfill	Hazardous Waste Landfill
Sample ID	TP10						
Depth (m)	0.30						
Solid Waste Analysis							
TOC (%)**	3.1				3%	5%	6%
Loss on Ignition (%) **	27				--	--	10%
BTEX (µg/kg) **	< 5.0 ~				6000	--	--
Sum of PCBs (mg/kg) **	< 0.007				1	--	--
Mineral Oil (mg/kg) EH_1D_CU_AL	130				500	--	--
Total PAH (WAC-17) (mg/kg)	4.47				100	--	--
pH (units)**	6.6				--	>6	--
Acid Neutralisation Capacity (mmol / kg)	-0.63				--	To be evaluated	To be evaluated
Eluate Analysis (BS EN 12457 - 2 preparation utilising end over end leaching procedure)	10:1 mg/l			10:1 mg/kg	Limit values for compliance leaching test using BS EN 12457-2 at L/S 10 l/kg (mg/kg)		
Arsenic *	< 0.00100			< 0.0100	0.5	2	25
Barium *	0.00962			0.0962	20	100	300
Cadmium *	< 0.000100			< 0.00100	0.04	1	5
Chromium *	0.0020			0.020	0.5	10	70
Copper *	0.014			0.14	2	50	100
Mercury *	< 0.000500			< 0.00500	0.01	0.2	2
Molybdenum *	< 0.000400			< 0.00400	0.5	10	30
Nickel *	0.0021			0.021	0.4	10	40
Lead *	0.0015			0.015	0.5	10	50
Antimony *	< 0.0017			< 0.017	0.06	0.7	5
Selenium *	< 0.0040			< 0.040	0.1	0.5	7
Zinc *	0.0068			0.068	4	50	200
Chloride *	1.1			11	800	15000	25000
Fluoride*	< 0.050			< 0.50	10	150	500
Sulphate *	< 0.045			< 0.45	1000	20000	50000
TDS*	6.0			60	4000	60000	100000
Phenol Index (Monohydric Phenols) *	< 0.010			< 0.10	1	-	-
DOC	4.64			46.4	500	800	1000
Leach Test Information							
Stone Content (%)	< 0.1						
Sample Mass (kg)	0.9						
Dry Matter (%)	84						
Moisture (%)	16						

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

*= UKAS accredited (liquid eluate analysis only)

Stated limits are for guidance only and i2 cannot be held responsible for any discrepancies with current legislation

** = MCERTS accredited

Landfill WAC analysis (specifically leaching test results) must not be used for hazardous waste classification purposes as defined by the Waste (England and Wales) Regulations 2011 (as amended) and EA Guidance WM3.
This analysis is only applicable for landfill acceptance criteria (The Environmental Permitting (England and Wales) Regulations) and does not give any indication as to whether a waste may be hazardous or non-hazardous.

Analytical Report Number : 24-023191
Project / Site name: Penyrenglyn

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

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

Lab Sample Number	Sample Reference	Sample Number	Depth (m)	Sample Description *
217595	TP01	None Supplied	0.3	Brown loam and clay with gravel and vegetation
217596	TP03	None Supplied	1.2	Brown clay and loam with gravel
217597	TP07	None Supplied	0.6	Brown clay and loam with gravel and vegetation
217598	TP10	None Supplied	0.3	Brown loam and clay with gravel and vegetation

Analytical Report Number : 24-023191
Project / Site name: Penyrenglyn

Water matrix abbreviations:
Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Waters (PrW) Final Sewage Effluent (FSE) Landfill Leachate (LL)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
pH at 20°C in soil	Determination of pH in soil by addition of water followed by electrometric measurement	In-house method	L005B	W	MCERTS
Total organic carbon (Automated) in soil	Determination of organic matter in soil by oxidising with potassium dichromate followed by titration with iron (II) sulphate (Walkley Black Method)	In-house method	L009B	D	MCERTS
Moisture Content	Moisture content, determined gravimetrically (up to 30°C)	In-house method	L019B	W	NONE
Stones content of soil	Standard preparation for all samples unless otherwise detailed. Gravimetric determination of stone > 10 mm as % dry weight	In-house method based on British Standard Methods and MCERTS requirements.	L019B	D	NONE
PCB's By GC-MS in soil	Determination of PCB by extraction with hexane followed by GC-MS	In-house method based on USEPA 8082	L027B	D	MCERTS
Total dissolved solids 10:1 WAC	Determination of total dissolved solids in water by electrometric measurement	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L031B	W	ISO 17025
Fluoride 10:1 WAC	Determination of fluoride in leachate by 1:1ratio with a buffer solution followed by Ion Selective Electrode	In-house method based on Use of Total Ionic Strength Adjustment Buffer for Electrode Determination	L033B	W	ISO 17025
Dissolved organic carbon 10:1 WAC	Determination of dissolved organic carbon in leachate by TOC/DOC NDIR Analyser	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L037B	W	NONE
Metals in leachate by ICP-OES	Determination of metals in leachate by acidification followed by ICP-OES	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil	L039B	W	ISO 17025
Sample Preparation		In-house method	L043B	W	NONE
Acid neutralisation capacity of soil	Determination of acid neutralisation capacity by addition of acid or alkali followed by electronic probe	In-house method based on Guidance an Sampling and Testing of Wastes to Meet Landfill Waste Acceptance	L046B	W	NONE
Loss on ignition of soil @ 450°C	Determination of loss on ignition in soil by gravimetrically with the sample being ignited in a muffle furnace	In-house method	L047	D	MCERTS
Speciated PAHs and/or Semi-volatile organic compounds in soil	Determination of semi-volatile organic compounds (including PAH) in soil by extraction in dichloromethane and hexane followed by GC-MS	In-house method based on USEPA 8270	L064B	D	MCERTS
BTEX and/or Volatile organic compounds in soil	Determination of volatile organic compounds in soil by headspace GC-MS	In-house method based on USEPA 8260	L073B	W	MCERTS
Total petroleum hydrocarbons by GC-FID/GC-MS HS in soil	Determination of total petroleum hydrocarbons in soil by GC-FID/GC-MS HS	In-house method	L076B/L088	D/W	NONE
Monohydric phenols 10:1 WAC	Determination of phenols in leachate by distillation followed by colorimetry	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L080	W	ISO 17025

Analytical Report Number : 24-023191
Project / Site name: Penyrenglyn

Water matrix abbreviations:
Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Waters (PrW) Final Sewage Effluent (FSE) Landfill Leachate (LL)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Chloride 10:1 WAC	Determination of Chloride colorimetrically by discrete analyser	In-house based on MEWAM Method ISBN 0117516260	L082B	W	ISO 17025
WAC Leachate 10:1		In-house method	L043B	W	NONE

For method numbers ending in 'UK' or 'A' analysis have been carried out in our laboratory in the United Kingdom (Watford).
For method numbers ending in 'F' analysis have been carried out in our laboratory in the United Kingdom (East Kilbride).
For method numbers ending in 'PL' or 'B' analysis have been carried out in our laboratory in Poland.
Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received the results obtained are multiplied by a moisture correction factor that is determined gravimetrically using the moisture content which is carried out at a maximum of 30oC.
Unless otherwise indicated, site information, order number, project number, sampling date, time, sample reference and depth are provided by the client. The instructed on date indicates the date on which this information was provided to the laboratory.

Information in Support of Analytical Results

List of HWOL Acronyms and Operators

Acronym	Descriptions
HS	Headspace Analysis
MS	Mass spectrometry
FID	Flame Ionisation Detector
GC	Gas Chromatography
EH	Extractable Hydrocarbons (i.e. everything extracted by the solvent(s))
CU	Clean-up - e.g. by Florisil®, silica gel
1D	GC - Single coil/column gas chromatography
2D	GC-GC - Double coil/column gas chromatography
Total	Aliphatics & Aromatics
AL	Aliphatics
AR	Aromatics
#1	EH_2D_Total but with humics mathematically subtracted
#2	EH_2D_Total but with fatty acids mathematically subtracted
_	Operator - understore to separate acronyms (exception for +)
+	Operator to indicate cumulative e.g. EH+HS_Total or EH_CU+HS_Total

~ - Quality control surrogate recovery outside of limits, other checks applied prior to reporting the data have been accepted. The result should be considered as being deviating and may be compromised.

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Analytical Report Number : 24-023470

Project / Site name:	Penyrenglyn	**Samples received on:**	06/06/2024
Your job number:	B066842	**Samples instructed on/ Analysis started on:**	06/06/2024
Your order number:	7015987	**Analysis completed by:**	13/06/2024
Report Issue Number:	1	**Report issued on:**	13/06/2024
Samples Analysed:	4 water samples		

Signed:

Anna Goc
PL Head of Reporting Team
For & on behalf of i2 Analytical Ltd.

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

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

Standard sample disposal times, unless otherwise agreed with the laboratory, are :

soils	- 4 weeks from reporting
leachates	- 2 weeks from reporting
waters	- 2 weeks from reporting
asbestos	- 6 months from reporting

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

Analytical Report Number: 24-023470
Project / Site name: Penyrenglyn

Lab Sample Number				218888	218889	218890	218891
Sample Reference				SW1	SW2	SW3	SW4
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				0.00	0.00	0.00	0.00
Date Sampled				05/06/2024	05/06/2024	05/06/2024	05/06/2024
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Water Analysis)	**Units**	**Limit of detection**	**Accreditation Status**				
General Inorganics							
pH (L099)	pH Units	N/A	ISO 17025	7.4	7.8	8.4	7.6
Total Cyanide (Low Level 1 µg/l)	µg/l	1	NONE	< 1.0	< 1.0	< 1.0	< 1.0
Sulphate as SO_4	mg/l	0.045	ISO 17025	6.47	8.25	17.2	34.1
Total Phenols							
Total Phenols (Monohydric) Low Level	µg/l	1	NONE	< 1.0	< 1.0	< 1.0	< 1.0
Speciated PAHs							
Naphthalene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01
Acenaphthylene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01
Acenaphthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01
Fluorene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01
Phenanthrene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01
Anthracene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01
Fluoranthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01
Pyrene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01
Benzo(a)anthracene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01
Chrysene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01
Benzo(b)fluoranthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01
Benzo(k)fluoranthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01
Benzo(a)pyrene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01
Indeno(1,2,3-cd)pyrene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01
Dibenz(a,h)anthracene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01
Benzo(ghi)perylene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01
Total PAH							
Total EPA-16 PAHs	µg/l	0.16	ISO 17025	< 0.16	< 0.16	< 0.16	< 0.16
Heavy Metals / Metalloids							
Arsenic (dissolved)	µg/l	0.15	ISO 17025	0.21	0.21	0.17	0.26
Cadmium (dissolved)	µg/l	0.02	ISO 17025	< 0.02	< 0.02	< 0.02	0.04
Chromium (dissolved)	µg/l	0.2	ISO 17025	0.4	0.3	0.6	0.8
Copper (dissolved)	µg/l	0.5	ISO 17025	1.6	2.5	3.1	3.8
Lead (dissolved)	µg/l	0.2	ISO 17025	< 0.2	< 0.2	< 0.2	< 0.2
Mercury (dissolved)	µg/l	0.05	ISO 17025	< 0.05	< 0.05	< 0.05	< 0.05
Nickel (dissolved)	µg/l	0.5	ISO 17025	0.7	0.6	0.6	1.5
Zinc (dissolved)	µg/l	0.5	ISO 17025	2.8	2.2	1.6	33
Boron (dissolved)	µg/l	10	ISO 17025	12	13	27	51
Petroleum Hydrocarbons							
TPH (C10 - C40) EH_1D_TOTAL_MS	µg/l	10	NONE	< 10	< 10	< 10	< 10

U/S = Unsuitable Sample I/S = Insufficient Sample ND = Not detected

Analytical Report Number : 24-023470
Project / Site name: Penyrenglyn

Water matrix abbreviations:
Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Waters (PrW) Final Sewage Effluent (FSE) Landfill Leachate (LL)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Metals in water by ICP-MS (dissolved)	Determination of metals in water by acidification followed by ICP-MS. Accredited Matrices: SW, GW, PW except B=SW,GW, Hg=SW,PW, Al=SW,PW	In-house method based on USEPA Method 6020 & 200.8 for the determination of trace elements in water by ICP-MS	L012B	W	ISO 17025
Metals in water by ICP-OES (dissolved)	Determination of metals in water by acidification followed by ICP-OES. Accredited Matrices: SW, GW, PW, PrW (Al, Cu, Fe,Zn)	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil	L039B	W	ISO 17025
Total petroleum hydrocarbons by GC-MS in water	Determination of total petroleum hydrocarbons in water by GC-MS/GC-MS	In-house method	L070B	W	NONE
Monohydric phenols (low level) in water	Determination of phenols in water by continuous flow analyser. Accredited matrices: SW PW GW	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L080	W	NONE
Total cyanide (low level) in water	Determination of total cyanide by distillation followed by colorimetry. Accredited matrices: SW PW GW	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L080	W	NONE
pH at 20°C in water (automated)	Determination of pH in water by electrometric measurement. Accredited matrices: SW PW GW	In-house method	L099	W	ISO 17025
Speciated PAHs and/or Semi-volatile organic compounds in water	Determination of semi-volatile organic compounds (including PAH) in leachate by extraction in dichloromethane followed by GC-MS	In-house method based on USEPA 8270	L102B	W	ISO 17025

Analytical Report Number : 24-023470
Project / Site name: Penyrenglyn

Water matrix abbreviations:
Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Waters (PrW) Final Sewage Effluent (FSE) Landfill Leachate (LL)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Sulphate in water	Determination of sulphate in water after filtration by acidification followed by ICP-OES. Accredited Matrices SW, GW, PW, PrW, LL	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil	L039B	W	ISO 17025

For method numbers ending in 'UK' or 'A' analysis have been carried out in our laboratory in the United Kingdom (Watford).
For method numbers ending in 'F' analysis have been carried out in our laboratory in the United Kingdom (East Kilbride).
For method numbers ending in 'PL' or 'B' analysis have been carried out in our laboratory in Poland.
Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received the results obtained are multiplied by a moisture correction factor that is determined gravimetrically using the moisture content which is carried out at a maximum of 30oC.
Unless otherwise indicated, site information, order number, project number, sampling date, time, sample reference and depth are provided by the client. The instructed on date indicates the date on which this information was provided to the laboratory.

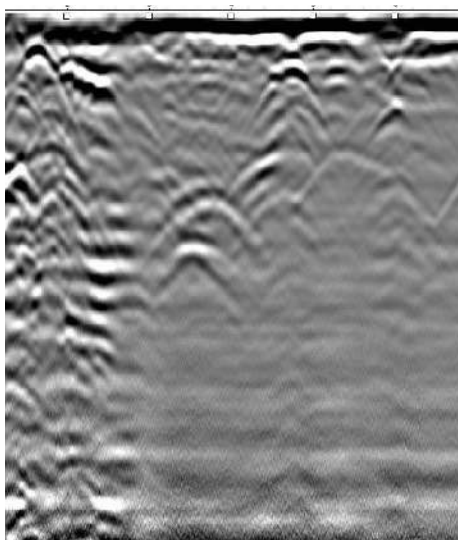
Information in Support of Analytical Results

List of HWOL Acronyms and Operators

Acronym	Descriptions
HS	Headspace Analysis
MS	Mass spectrometry
FID	Flame Ionisation Detector
GC	Gas Chromatography
EH	Extractable Hydrocarbons (i.e. everything extracted by the solvent(s))
CU	Clean-up - e.g. by Florisil®, silica gel
1D	GC - Single coil/column gas chromatography
2D	GC-GC - Double coil/column gas chromatography
Total	Aliphatics & Aromatics
AL	Aliphatics
AR	Aromatics
#1	EH_2D_Total but with humics mathematically subtracted
#2	EH_2D_Total but with fatty acids mathematically subtracted
_	Operator - understore to separate acronyms (exception for +)
+	Operator to indicate cumulative e.g. EH+HS_Total or EH_CU+HS_Total

APPENDIX E: GEOPHYSICAL SURVEY REPORT

atlas geophysical



Pen-yr-Englyn Tip
Geophysical Investigation

Revision II.

This report documents a multi-element Geophysical investigation of an Pen-yr-Englyn coal tip in the Rhonda Valley, South Wales. The aim of the investigation was to determine the depth of tip material as well as determine the nature of the subsurface environment.

Client:	**Tetra Tech Limited**
Project Number:	**AG1990**
Date of issue:	**29th August 2024**

Contents Page No

Distribution Sheet

Tetra Tech
Pen-yr-Englyn Tip
Geophysical Investigation

DISTRIBUTION			
Date:	Issued to	Name	Issue No.
29th August 2024	Tetra Tech	Mr. Nicholas Bool	II.
29th August 2024	Tetra Tech	Mr. Joel May	II.

Report Status/Issue No: **Final/2**		Date of Issue: 9th August 2024
Issued to: Tetra Tech		Project No: AG1990
	Name:	Signature:
Authors:	Alex Birtwisle BSc FGS	
Issued from AGL Location: **Wales**	Unit 12, Swansea Valley Business Park, Ystalyfera, Swansea, SA9 2EB	(t) 01639 87 41 04 (f) 08703 83 55 90 (e) info@atlasgeo.co.uk (w) www.atlasgeo.co.uk

Approval Sheet and Forward

Tetra Tech
Pen-yr-Englyn Tip
Geophysical Investigation

FOREWORD

1. Atlas Geophysical Limited has prepared this report on instruction by Tetra Tech (The Client).

2. This report has been compiled with all reasonable skill, care and diligence within the contract terms with the Client and the limitations of the resources devoted to it by agreement with the Client.

3. This report is confidential to the Client and their partners. Atlas Geophysical Limited accepts no responsibility to third parties to whom this report, or any part thereof, is made known. Any such party relies upon the report at their own risk.

4. This report supersedes a draft report issued in July 2024

1. Executive Summary

1.1. A Geophysical investigation was undertaken at the former Pen-yr-Englyn spoil tip associated with the workings of the former Ynysfeio colliery in Treherbert, pursuant to specification document 4021526-BUK-ZZ-00-SP-GE-00001.docx authored by Binnies on behalf of Natural Resources Wales.

1.2. The investigation used the Multichannel Analysis of Surface Waves (MASW) seismic method and Electric Resistance Tomography (ERT) on the recently deforested tip on the flank of Mynydd Ynysfeio. Additional data were acquired using induced electromagnetic conductivity (EM) on a plateau of tip material covering colliery infrastructure, and Ground Penetrating Radar (GPR) was undertaken along the forestry track to the northeast of the survey area.

1.3. Data acquisition took place on the following dates:

26th May to 27th May 2024 - EM data acquisition.

3rd June to 11th June 2024 - MASW data acquisition.

24th June to 27th June 2024 - ERT data acquisition.

2nd July 2024 – GPR data acquisition

1.4. The principal aim of the investigation was to determine the thickness of the tip material and provide information on the ground conditions.

1.5. The MASW and ERT profiles on the hillside were numbered West to East, with Profile 1 being the most westerly, Profile 2 being the most central, and Profile 3 being the most easterly.

1.6. This report provides a technical presentation of the data and interpretation of the geophysical properties and their inferred relationship to the known geology.

1.7. Due to ecological constraints, tall grass, gorse and shrubs could not be cut on the plateau area, thus preventing the ability to acquire coherent EM data.

1.8. The hillside above the plateau, once a conifer plantation, had been felled prior to the geophysical investigation. However, the hillside had not been cleared of brash, which, in some places, was c.2m thick, preventing access to the ground beneath.

1.8.1. There were areas where access to the ground was impossible; therefore, data quality was compromised

1.9. The findings from the geophysical investigation are presented on the accompanying plots at the rear of this report.

1.10. Shear wave velocity analysis suggests four distinct layers within the site, with poorly consolidated tip material overlying a more coherent sedimentary layer. This layer appears to grade into weathered bedrock before transitioning into the bedrock at depth.

2. Introduction

2.1. A Geophysical investigation was undertaken at the former Pen-yr-Englyn spoil tip associated with the workings of the former Ynysfeio colliery in Treherbert, pursuant to specification document 4021526-BUK-ZZ-00-SP-GE-00001.docx authored by Binnies on behalf of Natural Resources Wales.

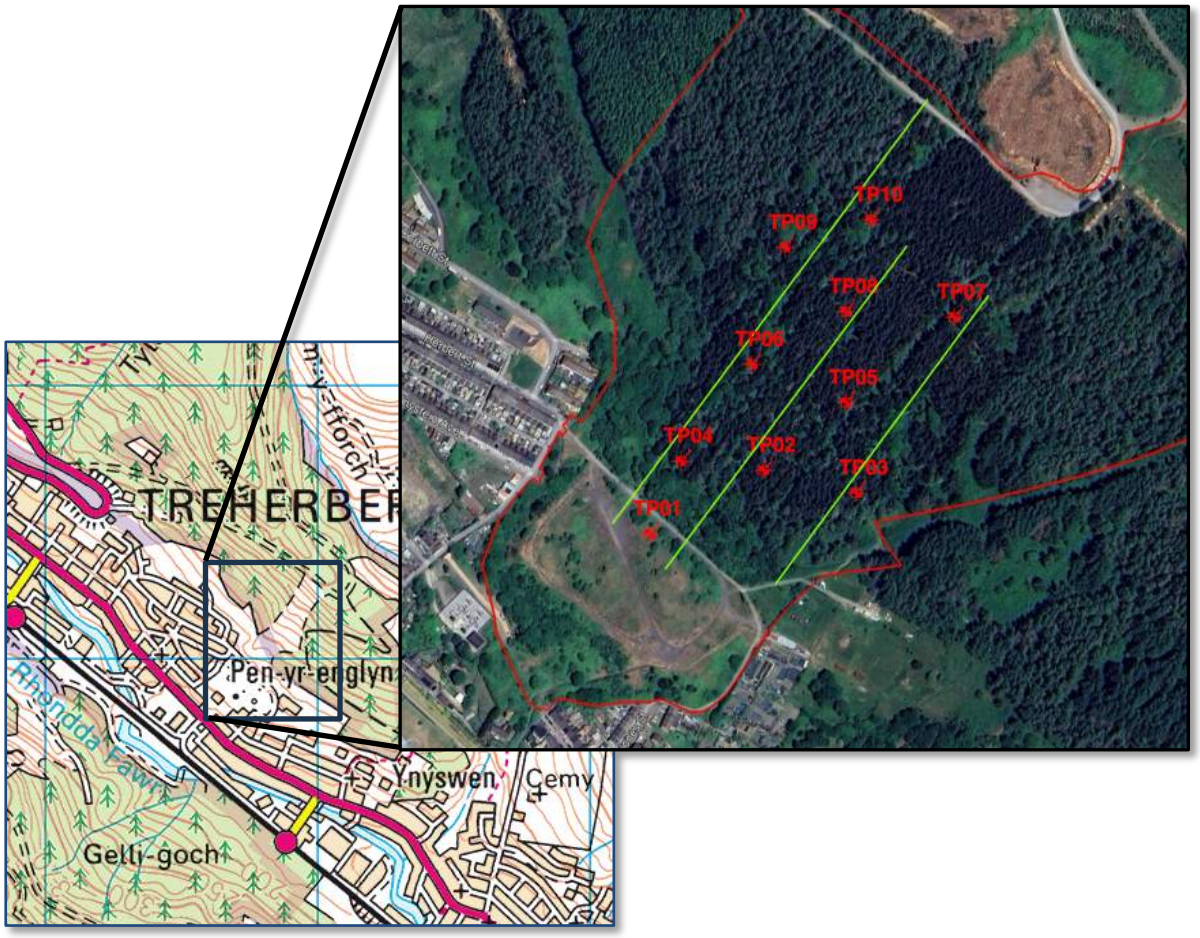


Figure 1: Site Location. Pen-yr-Englyn Tip.

2.2. Access to the highest elevations of the survey area were from the forestry tracks intersecting the A4061 Rhigos Road. Access to the lower elevations of the survey area were from Herbert Street.

2.3. The principal aim of the investigation was to determine the thickness of the tip material and provide information on the ground conditions.

2.4. The MASW and ERT profiles on the hillside were numbered West to East, with Profile 1 being the most westerly, Profile 2 being the most central, and Profile 3 being the most easterly.

2.5. This report provides a technical presentation of the data and interpretation of the geophysical properties and their inferred relationship to the known geology.

3. Background Geology

3.1. The British Geological Survey 1:50,000 maps suggest the bedrock underlying the survey areas consists of sedimentary rocks of the South Wales Upper and Middle Coal Measure Groups. These formations are typically represented by coal-bearing interbedded mudstone, siltstone, sandstone and Ironstone.

3.2. The bedrock within this area is overlain by glaciofluvial material consisting of clay, sand and gravel deposits.

3.3. Historical records suggest that organic material caps the geology on which the mine tailings and tip material were placed.

4. Geophysical Survey Profile Locations

	X	Y	OS Grid	Lat	Long
Profile 1 Upper	294992.687	198244.403	SS9499298244	51°40'23.2573"	-3°31'11.8659"
Profile 1 Lower	294708.114	197936.746	SS9470897936	51°40'13.1105"	-3°31'26.3413"
Profile 2 Upper	294958.087	198150.596	SS9495898150	51°40'20.1987"	-3°31'13.5649"
Profile 2 Lower	294750.839	197909.766	SS9475097909	51°40'12.2664"	-3°31'24.0887"
Profile 3 Upper	295003.147	198116.666	SS9500398116	51°40'19.1312"	-3°31'11.1831"
Profile 3 Lower	294843.922	197891.966	SS9484397891	51°40'11.7533"	-3°31'19.2256"

Figure 2: MASW & ERT Profile Locations

Figure 3: EM Survey Area.

Figure 4: GPR Profile Location.

5. Site Condition and Survey Limitations

5.1. Site conditions were extremely difficult for all aspects of the geophysical survey.

5.1.1. Due to ecological constraints, tall grass, gorse and shrubs could not be cut on the plateau area, thus preventing the ability to acquire data.

5.1.2. It was impossible to traverse the site safely while carrying the EM survey equipment (CMD Explorer) as the transmitter/receiver coils are approximately 4m wide. Therefore, fewer traverses with a greater traverse separation than would otherwise be desired were acquired.

5.1.3. The prevalence of drug paraphernalia, including needles/syringes within the undergrowth, as well as dog excrement, created a health and safety risk we were unable to mitigate without devegetating the site. See Figure 3 below.

Figure 5: Environment of the plateau area showing dense vegetation.

5.2. The hillside above the plateau, once a conifer plantation, had been felled prior to the geophysical investigation. However, the hillside had not been cleared of brash, which, in some places, was c.2m thick, preventing access to the ground beneath.

5.2.1. Both MASW and ERT techniques require unobstructed access to the ground to facilitate data acquisition and accurate results.

5.2.2. There were areas where access to the ground was impossible; therefore, data quality was compromised.

5.2.3. The severity of the slope was manageable with equipment delivered by mechanical methods to strategic points within each survey profile. However, slopes greater than 40° were encountered towards the upper reaches of each profile, preventing access.

5.2.4. The ERT survey could only proceed in areas serviceable by a tracked excavator provided by the client.

5.2.5. The survey was not undertaken in areas where the excavator could not traverse due to the injury risk caused by the manual carrying of the heavy cable reels and 12V automotive batteries required to undertake the survey.

Figure 6: Environment of the Pen-yr-Englyn Tip showing extensive brash mat.

5.2.6. In numerous locations, electrodes could not penetrate the ground or only penetrate dry brash. Data could not be acquired from these electrode positions; thus, obtaining a coherent dataset was compromised.

6. MASW Seismic Survey Methodology

6.1. The MASW Surface Wave Seismic imaging system comprised 2x Geometrics Geode Exploration 24-channel Seismographs coupled to enable 48-channel recording from a 48-channel 4.5Hz Geophone array.

6.2. Multichannel Analysis of Surface Waves (MASW) is a geophysical method used to characterise the Earth's subsurface structure and properties. It is primarily employed in geotechnical and engineering investigations to assess soil and rock properties for various applications, such as site characterisation, foundation design, and seismic hazard assessment.

Figure 7: Example of seismic data acquisition.

6.3. In MASW, seismic waves generated by a seismic source (often a sledgehammer or a mechanical vibrator) are recorded by multiple geophone receivers placed along the ground surface. The receivers record the ground motion caused by the seismic waves as they propagate through the subsurface. Specifically, MASW focuses on

analysing the surface waves that travel along the interface between the soil or rock and the air.

6.4. The recorded data is then processed to extract information about the velocity and attenuation of the surface waves as a function of depth. By analysing the surface wave dispersion characteristics (variation of wave velocity with frequency), MASW techniques can provide insights into the shear wave velocity profile of the subsurface.

6.4.1. This information is valuable for understanding soil and rock properties, including stiffness, density, and layering, which are crucial for engineering and construction projects.

6.5. For profile locations 1 and 2, a spread of 48 geophones spaced 2m apart was rolled along three times to facilitate a maximum profile length of c.288m. For profile location 3, the spread was rolled along four times to facilitate a profile length of c.394m.

6.6. A 4 kg sledgehammer was used as a seismic energy source.

Figure 8: Geometrics Geode Exploration Seismograph

6.7. A total of fifty-three shot locations were recorded between each geophone position. Where possible, off-end shots were recorded at 10m, 30m and 60m beyond the geophone spread. Three shots were recorded and stacked at each location.

6.8. A trigger sensor was attached to the hammer, commanding the seismographs to record seismic wave displacement as it propagates through the geophone spread.

6.9. The measurements acquired by the geophones are digitised by the seismograph and fed into a field computer to be saved for future download and subsequent analysis.

7. MASW Data Analysis

7.1. MASW data analysis involves a combination of signal processing, dispersion curve analysis, interpretation, and quality assessment to extract meaningful information about the subsurface and support various geotechnical and engineering applications. The typical steps are:

7.1.1. **Pre-processing**: Raw data collected from the geophones need to be pre-processed to remove noise and interference. Pre-processing may involve filtering, instrument correction, and other techniques to improve data quality.

7.1.2. **Time-Frequency Analysis**: MASW data is analysed in the frequency domain to identify dispersion curves, representing the variation of surface wave velocity with frequency. Time-frequency analysis techniques such as the Fourier or wavelet transform are commonly used.

7.2. **Dispersion Curve Analysis**.

7.2.1. **Curve Picking**: Dispersion curves are identified from the processed data. This involves manually or automatically picking the arrival times of surface waves at different frequencies.

7.2.2. **Dispersion Curve Inversion**: Inversion techniques convert dispersion data into subsurface shear wave velocity profiles. Various inversion methods, such as the Inversion of Dispersion Curves (IDC) or the extended inversion method, can be employed.

7.3. **Interpretation and Modelling**.

7.3.1. **Subsurface Structure**: The obtained shear wave velocity profiles are interpreted to understand the subsurface structure and lithology. Variations in velocity with depth provide insights into layer thickness, interfaces, and material properties.

7.3.2. **Modelling: Geophysical modelling** software is used to create 2D or 3D models of the subsurface based on MASW data. These models help visualise and interpret the geologic features and can aid in geological and engineering applications.

7.4. **Quality Assessment**.

7.4.1. **Uncertainty Analysis**: Assessing the uncertainty associated with the inversion results is crucial for understanding the reliability of the obtained shear wave velocity profiles. Sensitivity analysis and Monte Carlo simulations are commonly employed for uncertainty quantification.

7.5. **Comparison with Other Data**: MASW results are often compared with other geophysical data (e.g., seismic reflection, borehole logging) and geological information to validate interpretations and improve the understanding of subsurface conditions.

7.6. It should be noted that due to the ground conditions and subsurface environment, it is probable that the results will become less accurate with depth for several reasons:

7.6.1. **Wave Propagation Effects**: As surface waves travel deeper into the subsurface, they encounter increasing heterogeneity and complexity in the geological layers. This can lead to wave scattering, mode conversion, and attenuation, distorting the waveform and making it more challenging to interpret the data accurately.

7.6.2. **Limited Resolution**: MASW surveys are typically most sensitive to the near-surface layers, with the highest resolution in the upper few meters. Deeper layers may be less well resolved due to limitations in the frequency content of the seismic waves and the spatial sampling of the survey.

7.6.3. **Signal-to-Noise Ratio**: As the depth increases, the amplitude of the seismic waves attenuates, while the background noise levels may remain relatively constant. This can decrease the recorded data's signal-to-noise ratio (SNR), making it more difficult to accurately pick dispersion curves and extract reliable shear wave velocity estimates.

7.6.4. **Inversion Uncertainty**: Inverting MASW data to obtain shear wave velocity profiles involves an inverse problem, which can be inherently ill-posed and non-unique. As depth increases, the uncertainties associated with the inversion process may increase, leading to less precise velocity estimates.

7.6.5. **Geological Complexity**: Deeper layers in the subsurface often exhibit greater geological complexity, such as variations in lithology, fracturing, and discontinuities. This complexity can introduce additional uncertainties and challenges in interpreting MASW data accurately.

7.7. **Poisson's Ratio**

7.7.1. Poisson's Ratio (v) is a fundamental material property that describes the ratio of transverse strain to axial strain when a material is subjected to tensile or compressive stress. It quantifies how a material deforms laterally (sideways) when stretched or compressed longitudinally (along its length).

7.7.2. Poisson's Ratio of geological materials can vary widely depending on factors such as mineral composition, porosity, degree of consolidation, and loading conditions. Poisson's Ratio is an essential parameter in geomechanics and rock mechanics as it affects the behaviour of rocks and soils under stress.

7.7.3. For this report, a Poisson's Ratio of **0.33** has been used after consultation with the Client.

7.7.4. However, it should be noted that the actual Poisson's Ratio for the material under investigation might be higher due to the presence of water within the sands and gravels.

8. ERT Methodology

8.1. The ERT system used for this survey was a Syscal Pro multimode resistivity imaging system manufactured by Iris Instruments.

8.2. A 12V automotive battery powers the system.

8.2.1. The system was coupled to an array of 48 electrodes inserted at c.5m centres, creating a 240m planar survey spread.

8.2.2. A Wenner-Schlumberger acquisition sequence was chosen as it is a versatile and practical configuration for ERT surveys, balancing depth of investigation and resolution.

8.2.3. With the Wenner- Schlumberger configuration, the current is injected via the outer electrodes of the array, and the resulting voltage is recorded at the inner electrodes of the array.

8.2.4. The forward model of the array is shown in Figure 7.

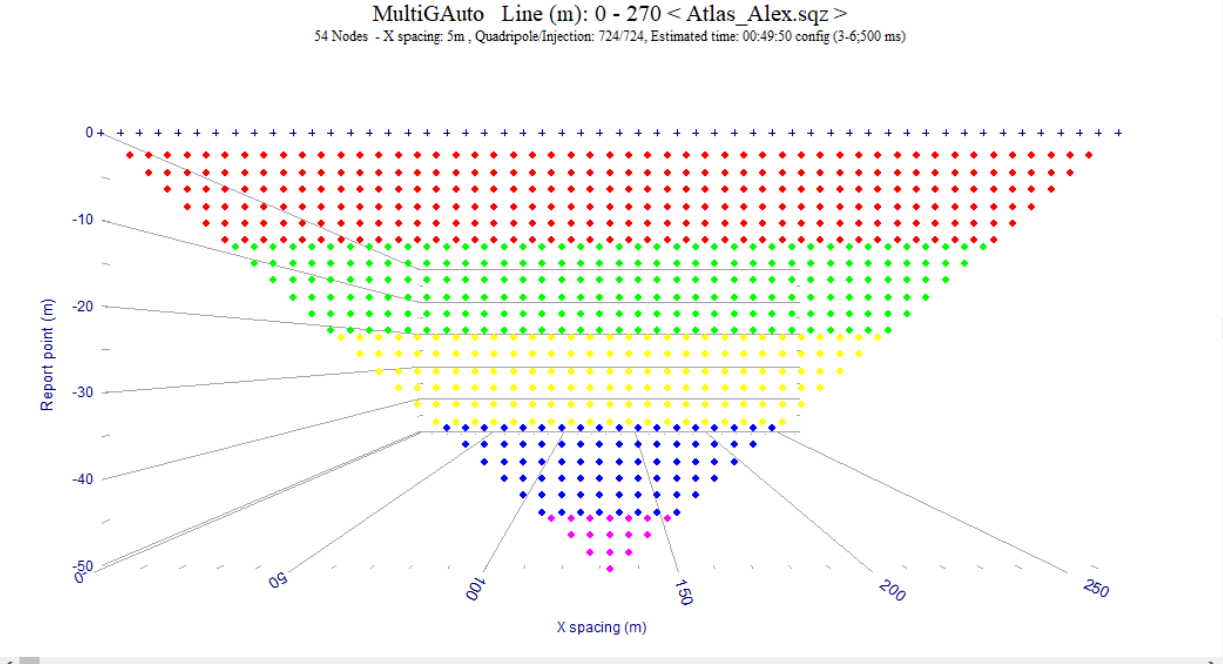


Figure 9: Forward model for the ERT Survey

8.2.5. Results were recorded onto the hard drive of the Syscal Pro system and downloaded for processing and back analysis.

9. ERT Data Analysis

9.1. **Initial processing stages include:**

- **Signal Filtering**: Raw voltage data is often noisy and may require filtering to remove high-frequency noise.
- **Signal Amplification**: The measured voltages may need to be amplified to improve the signal-to-noise ratio.
- **Signal Inversion:** Reconstructing the internal conductivity distribution from the measured boundary voltages.

9.2. **Secondary processing stages include:**

Linearisation: The relationship between conductivity and voltage is nonlinear. Linearisation techniques, such as the Newton-Raphson method, are often used.

Regularization: Due to the ill-posed nature of the inverse problem, regularization techniques (e.g., Tikhonov regularization) are used to stabilize the solution.

9.3. The use of mathematical models to directly compute the conductivity distribution.

9.4. Iterative refinement of the solution based on the difference between measured and computed voltages.

9.5. The reconstructed conductivity data is converted into images, which can be displayed in various formats (2D slices, 3D volumes, etc.).

9.6. Due to exceptionally poor ground conditions, there was low confidence in the quality of data recorded.

10. EM Methodology

10.1. A CMD Explorer manufactured by GF Instruments was used for this investigation.

10.2. The CMD Explorer works on the principle of electromagnetic (EM) induction.

10.2.1. The transmitter coils generate an electromagnetic field that penetrates the ground. The interaction of this field with the soil produces secondary magnetic fields, which are detected by the instrument's receiver coils at three predetermined temporal points as determined by the termination of the primary field.

10.2.2. Assuming electromagnetic waves travel at a constant velocity, a simple speed x time = distance equation can be used to assume that the three recorded points correspond to depths of approximately 1.48m, 2.82m, and 4.49m.

Figure 10: GF Instruments CDM Explorer

10.3. The field acquisition methodology is typically undertaken by walking along a tape measure and manually recording points every metre, but due to inappropriate survey conditions discussed in Section 5, this method was not possible during this survey.

10.3.1. For the purpose of this particular investigation, an RTK-GNSS receiver was worn on a backpack, which fed spatial information to the CMD Explorer acquisition controller, allowing for latitude, longitude and altitude information to be stored with each conductivity measurement.

10.4. The survey was undertaken during wet conditions with considerable standing /pooling water on the ground.

10.4.1. The standing water is likely to negatively impact the quality of the data and the validity of the results.

11. EM Data Analysis

11.1. The conductivity meter's output is a simple ASCII (American Standard Code for Information Interchange) file containing location information alongside the conductivity results recorded by the instrument.

11.2. This information can be tabulated, gridded, contoured, and mapped using third-party analysis tools.

11.3. Due to the distance between traverses, the interpolation between data points is greater than desired.

12. GPR Methodology

12.1. This element of the investigation used a GroundVue 3-8 digital impulse radar system manufacture.

12.1.1. The GV3-8 was connected to a 400 MHz transducer. To satisfy Ofcom legislation, the antenna was ground-coupled at all times.

12.1.2. The GPR system was mounted on a cart and manoeuvred around the site by hand.

12.1.3. A distance encoder on the car allowed the radar to scan at c.30mm intervals.

12.2. Ground-penetrating radar (GPR) methods rely on observing the reflections from short-duration pulses of electromagnetic energy. These pulses (or scans) are transmitted into the ground or structure, and a receiver detects reflections from material boundaries or embedded features. The time between each scan and reflected signal is recorded with a distance between scans to provide a continuous cross-section of the ground or structure. This enables rapid assessment of thickness and condition over large areas.

12.2.1. It is possible to determine the material thickness and construction changes by assessing the amplitude, phase, and scatter of received signals. In many cases, it is often possible to assess cracking and changes in compaction, bond and relative moisture content.

13. GPR Data Analysis

13.1. Significant post-acquisition data processing is required to assist in the analysis of the GPR result. The four primary processing stages involve:

- Declipping the data to rebuild the waveforms that fall beyond the dynamic threshold of the GPR receiver.
- Start-time correction to compensate for signal drift and lift the first half-wave so that *t*=zero and subsequent depths/thickness results are relevant.
- Dynamic correction to compensate for the transmitter/receiver offset.
- Bandpass filters to eliminate extraneous and unwanted frequency interference.
- Noise removal to filter extraneous background/system noise.

13.2. The measurement of thickness or depth relies on multiplying the two-way travel time by the velocity of the radio signals passing through the materials under investigation.

13.2.1. An average velocity value of 0.09 m/ns has been assumed for depth calculations based on hyperbolic curve matching

13.2.2. Caution is advisable with all depth calculations as moisture variations can affect the reliability of such information. It is always recommended that core or trial pit data are used to interpret GPR data more accurately.

13.2.3. The depth measurements should be treated as an approximation, not an absolute value.

14. Findings from the MASW survey.

14.1. The findings from the geophysical investigation are presented in Figures 1 to 6 on Drawing AG1990-01, which is appended to the rear of this report.

14.1.1. Interpretations of the MASW plots are based on the following assumptions regarding Shear Wave Velocity (V_s) vs material type.

Material Type	Vs (m/s)
Soft Clay/Silt	100 - 200
Stiff Clay/Silt	200 - 400
Loose Sand	150 - 250
Medium Dense Sand	250 - 400
Dense Sand	400 - 600
Gravel	300 - 600
Peat/Organic Soils	50 - 150
Alluvium	150 - 300
Shale	600 - 1200
Sandstone	800 - 2000
Limestone	1000 - 2500
Slate	1000 - 2500
Schist	1200 - 3000
Gneiss	2000 - 4000
Basalt	2000 - 5000
Granite	2500 - 6000
Compacted Fill	200 - 400
Loose Fill	100 - 200

14.2. **Figure 1. and Figure 2. Profile 1.**

14.2.1. Shear Wave velocity (V_s) values ranged from 150m/s to 821m/s, with the lowest values recorded within the upper c.12m. The low values are typical of loose fill or unconsolidated tip material.

14.2.2. Two areas of notably low V_s were observed between chainage c.85m to c.120m and again between c.150m and c.175m.

14.2.3. V_s gradually increased until the maximum recorded values were identified at a depth of c.20m to c.30m below ground level.

14.2.4. There appears to be a layer of material c.10m thick beneath the poorly consolidated tip material exhibiting Vs values of between 400m/s and 600m/s, suggesting a moderately well-compacted layer of sands and possibly gravels or weathered bedrock.

14.2.5. A density profile was created using P wave velocity (V_p) and Poisson's Ratio (ν). This is presented in Figure 4.

14.3. **Figure 3. and Figure 4. Profile 2.**

14.3.1. V_s ranged from 150m/s to 835m/s, with the lowest values recorded within the upper c.4m to c.6m.

14.3.2. Such low V_s is contemporary with the values expected for unconsolidated tip material.

14.3.3. Evidence from the MASW results suggests an up-slope thickening of tip material showing varying degrees of compaction.

14.3.4. The velocities gradually increased until the maximum recorded values were identified at a depth of c.14m to c.30m below ground level.

14.3.5. There appears to be a layer of material c.10m thick beneath the poorly consolidated tip material exhibiting Vs values of between 400m/s and 650m/s, suggesting a moderately well-compacted layer of sands and possibly gravels or weathered bedrock.

14.3.6. A density profile was created using P wave velocity (Vp) and Poisson's Ratio (ν). This is presented in Figure 5.

14.4. **Figure 5. and Figure 6. Profile 3.**

14.4.1. V_s ranged from 190m/s to 844m/s, with the lowest values recorded within the upper c.10m. The lowest values were observed between chainages c.160m to c.210m. This corresponds with the area on either side of an access track.

14.4.2. The observed velocities gradually increased until the maximum recorded values were identified at a depth of c.20m to c.25m below ground level.

14.4.3. There appears to be a layer of material c.10m thick beneath the poorly consolidated tip material exhibiting Vs values of between 400m/s and 650m/s, suggesting a moderately well-compacted layer of sands and possibly gravels or weathered bedrock.

14.4.4. A density profile was created using P wave velocity (V_p) and Poisson's Ratio (ν). This is presented in Figure 6.

15. Findings from the ERT Survey

15.1. The ERT results are presented in Figures 7, 8 and 9 on Drawing AG1990-01. Due to exceptionally poor ground conditions, there is very low confidence in the results.

15.2. Where the data was coherent enough to process, there was some stratigraphic correlation with the seismic results.

15.3. **Figure 7. Profile 1.**

15.3.1. Due to excessive resistance recorded at most electrodes within the array, extracting a reliable data plot from the data acquired at Profile 1 was impossible. As discussed in Section 5 of this report, this was caused by the placement of electrodes in brash or loosely consolidated material.

15.4. **Figure 8. Profile 2.**

15.4.1. Profile 2 suffered from degraded data quality due to poor electrode contact. However, information could be extracted from over half the profile length.

15.4.2. There was some stratigraphic correlation with the seismic results, particularly regarding the thickness of the tip material.

15.5. Areas of low resistivity, potentially related to groundwater, were noted at chainages c.110m to c.127m with values of c.56 Ω.m and between chainages c.145m to c.165m with values of 28 Ω.m at depths greater than c.24m below ground level.

15.6. **Figure 9. Profile 3.**

15.7. Profile 3 was the most coherent data acquired using the ERT technique. However, coherent results could not be resolved from the first c.122m of the profile.

15.7.1. As noted in Profile 2, there was some stratigraphic correlation with the seismic survey results.

15.7.2. A large area of low resistivity was observed between chainages c.165m and c.190m with resistivity values of between 25 Ω.m and 52 Ω.m a depth of between c.7m and c.14m.

15.7.3. The area of low resistivity is likely related to porous rocks containing groundwater

16. Findings from the EM survey

16.1. The conductivity results are presented in Figures 10, 11, and 12 on Drawing AG1990-01, which is appended to the rear of this report.

16.2. Due to the distance between traverses, the interpolation between data points is greater than desired. The results presented on drawing AG1990-01 generally represent ground conductivity at the time of the survey during a period of wet weather.

16.3. Values are recorded in millisiemens per metre.

16.4. Typical Ground Conductivity Values can be characterised by the following:

Dry Sandy Soils:
0 to 10 mS/m: Dry, sandy soils generally have very low conductivity because they lack moisture and conductive materials like salts.
Dry Loamy Soils:
5 to 30 mS/m: Loamy soils with a mix of sand, silt, and clay may have slightly higher conductivity, especially if they retain some moisture.
Moist Soils:
20 to 100 mS/m: As soils become moist, their conductivity increases significantly. Moisture allows for better ion movement, enhancing conductivity.
Clay Soils:
30 to 100 mS/m: Clay soils tend to have higher conductivity due to their fine particles and ability to retain water and dissolved ions.
Saline Soils:
100 to 1000 mS/m or more: Soils with high salt content (e.g., coastal areas, saline-affected agricultural land) have very high conductivity due to the abundance of ions in the soil moisture.
Peat Soils:
10 to 50 mS/m: Peat soils, rich in organic material, have variable conductivity depending on their moisture and decomposition levels.
Rock and Gravel:
< 1 mS/m: Solid rock and dry gravel typically have very low conductivity, lacking moisture and conductive pathways.

16.5. The values recorded ranged between 2mS/m (coloured red to indicate low conductivity) to 84mS/m (blue to indicate high conductivity). These values are typical of the ground under investigation.

16.6. Correlation can be drawn between the waterlogged grass areas showing high conductivity values.

16.6.1. The access track running northwest-southeast exhibits generally low conductivity, but with depth, this conductivity increases. This increase is likely caused by the influence of the stream that runs parallel to the track.

17. Findings from the GPR Survey

17.1. The results of the GPR survey are presented in Figure 13, which is based on drawing AG1990-01, which is appended to the rear of this report. Figure 14 interprets the results.

17.2. The access track appears to be constructed of at least three distinct layers of material. The base of the lower foundation or capping layer is between c.0.4m and c.0.8m below ground level.

17.3. It was not possible from the GPR results to ascertain if the forest track is sitting on tip material or is constructed on natural material.

18. Conclusions

18.1. The poor site conditions severely impacted the geophysical survey results' quality, integrity and confidence.

18.2. Evidence from the MASW survey suggests that Profile 1 exhibits a greater depth of poorly consolidated tip material than the other profiles.

18.2.1. Shear wave velocity analysis suggests three distinct layers within the site. Firstly, a poorly consolidated tip material (layer 1) overlying a more coherent sedimentary layer (layer 2). This layer appears to grade into weathered bedrock before transitioning into the bedrock at depth (layer 3).

18.2.2. The GPR results provide useful information regarding the track thickness but do not provide information on whether the track is constructed on tip material or sited directly on weathered bedrock.

18.2.3. While incomplete, the ERT result corroborates the depth values obtained from the seismic survey. It hints at a zone of low resistivity at depth, which is analogous to a perched body of groundwater.

18.2.4. The results from the EM survey are dominated by areas of standing or ponding water during the survey.

Appendix I. MASW Shear Wave Results

Figure 1. Profile 1. Shear Wave Results (m/s)

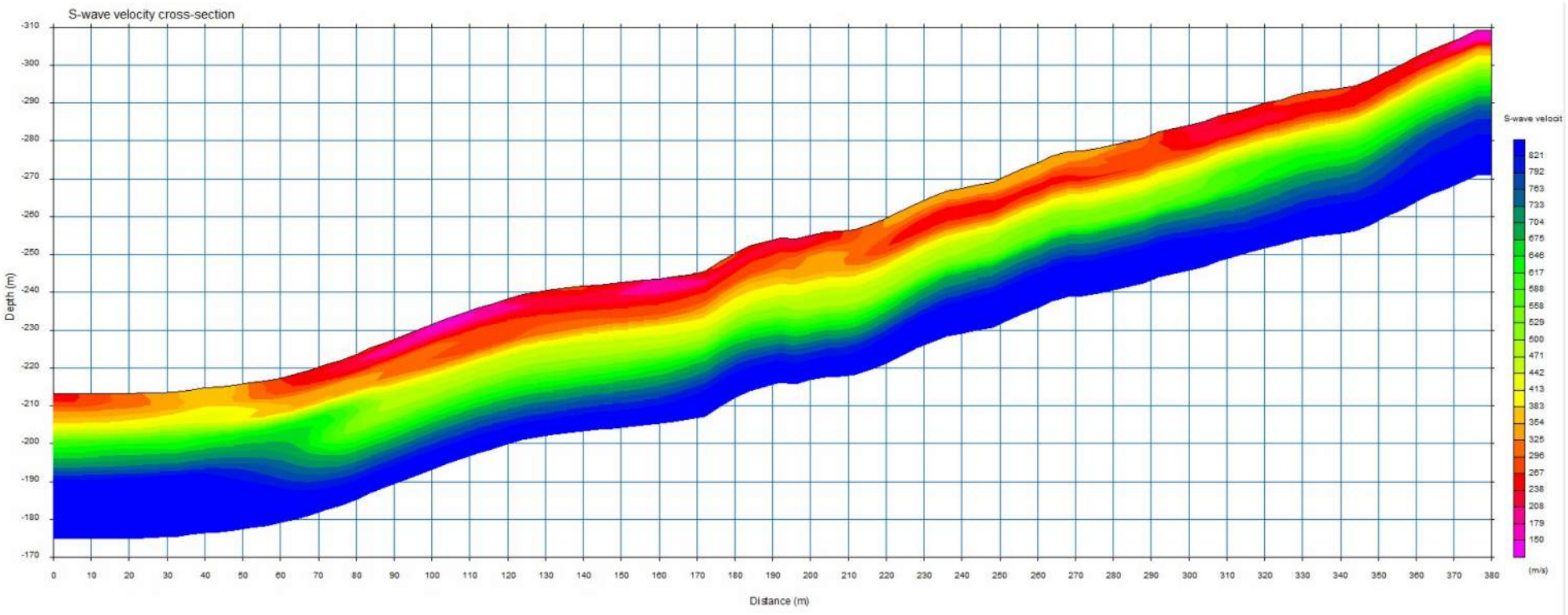


Figure 2. Profile 2. Shear Wave Results (m/s)

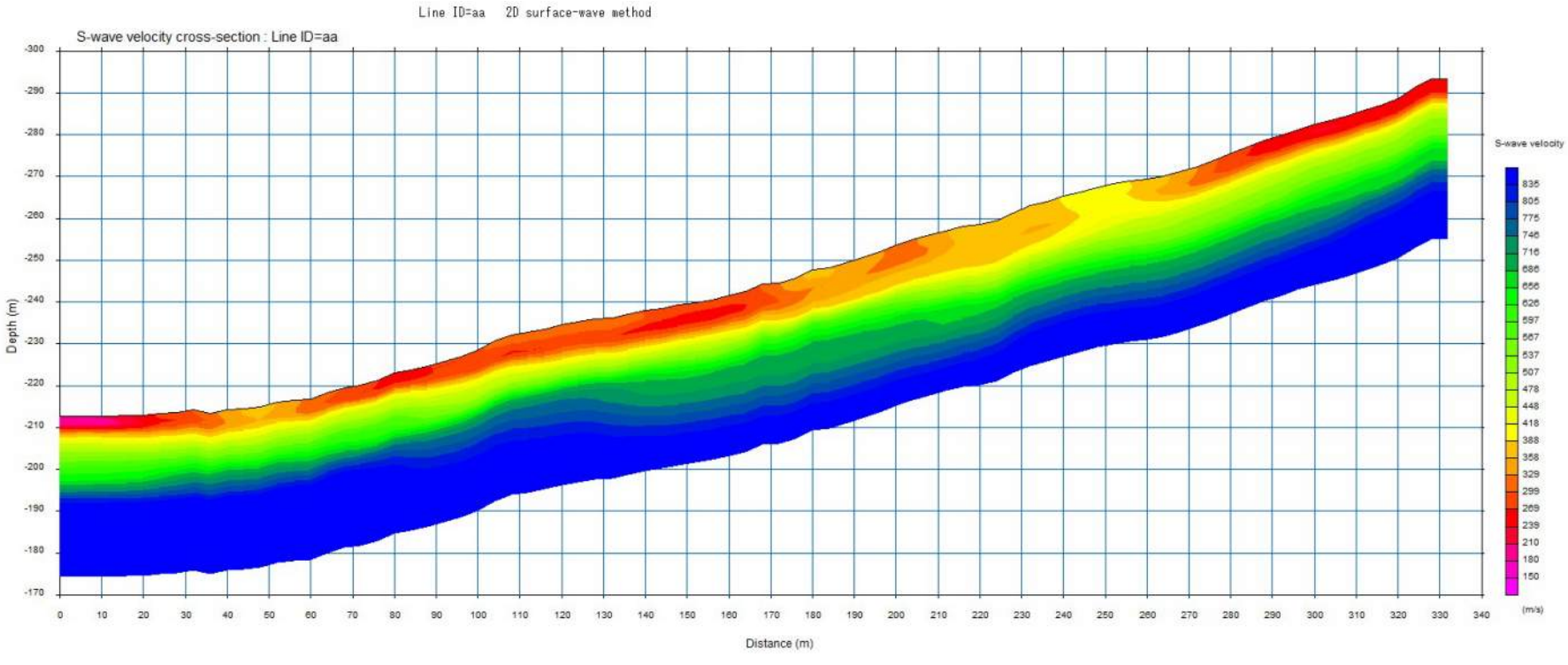
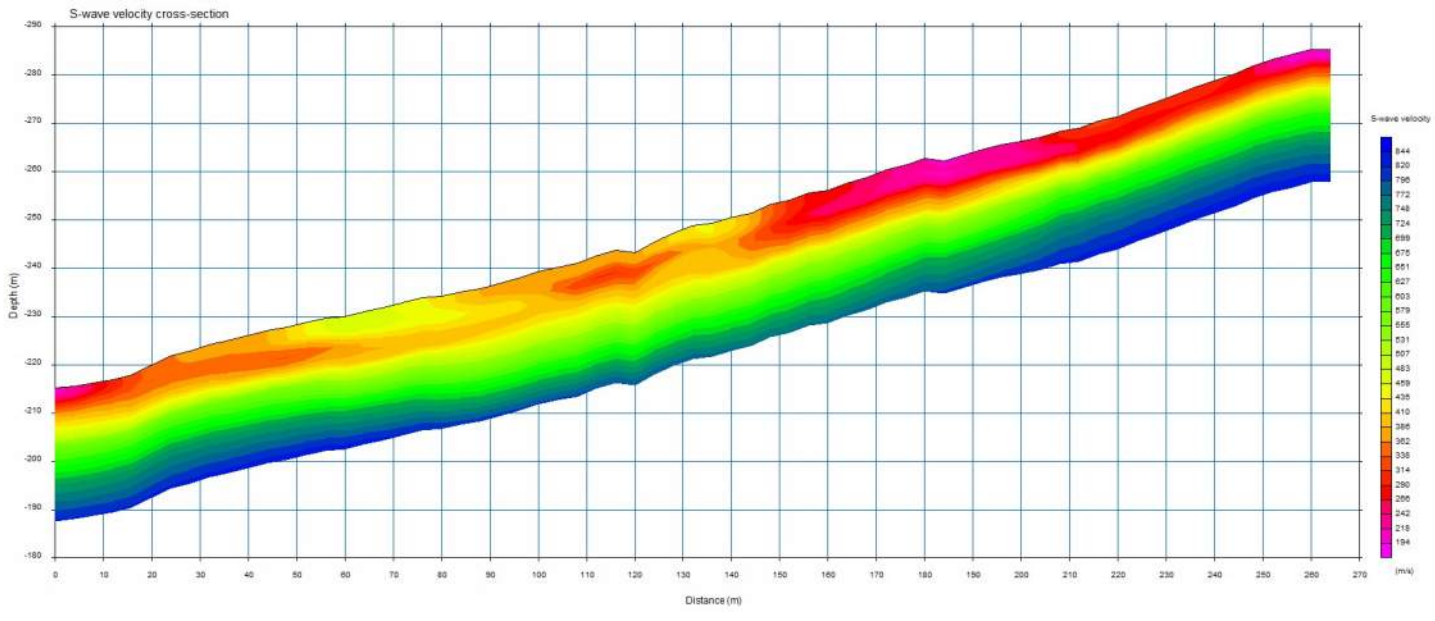


Figure 3. Profile 3. Shear Wave Results (m/s)



Appendix II. MASW Density Results

Figure 4. Profile 1. Density Results (kg/m3))

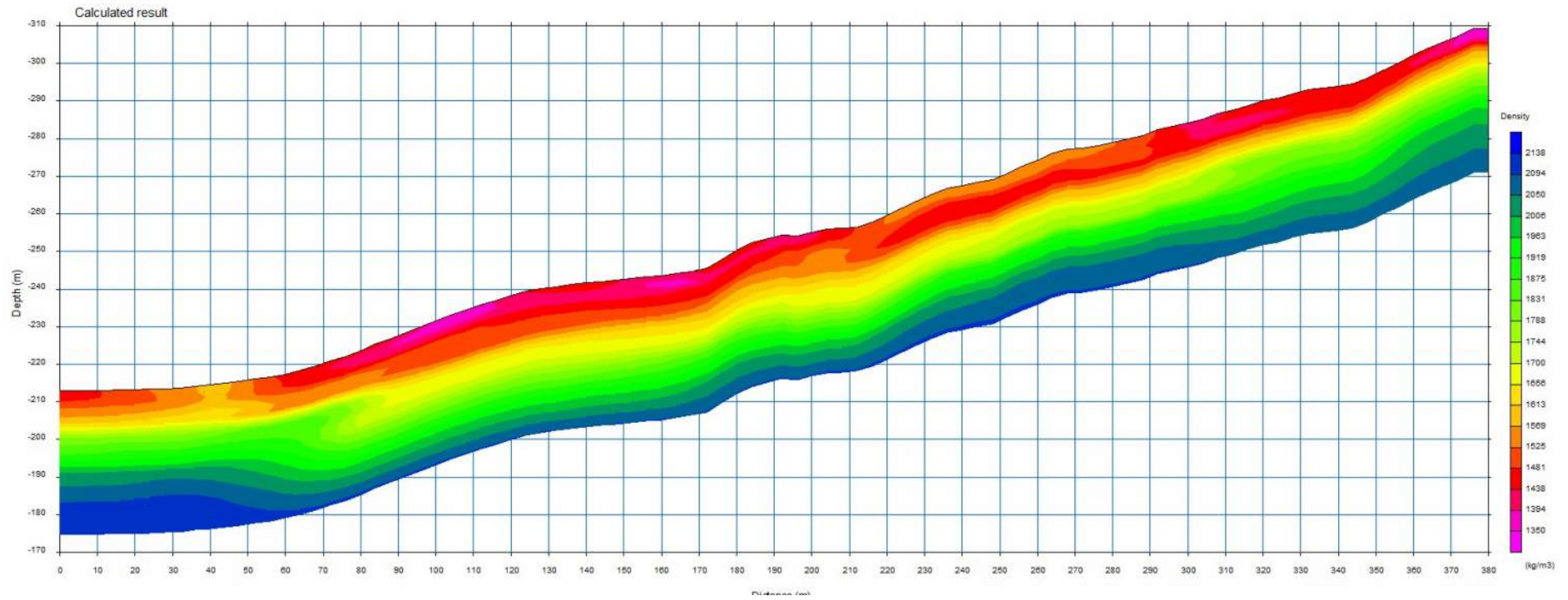


Figure 5. Profile 2. Density Results (kg/m3))

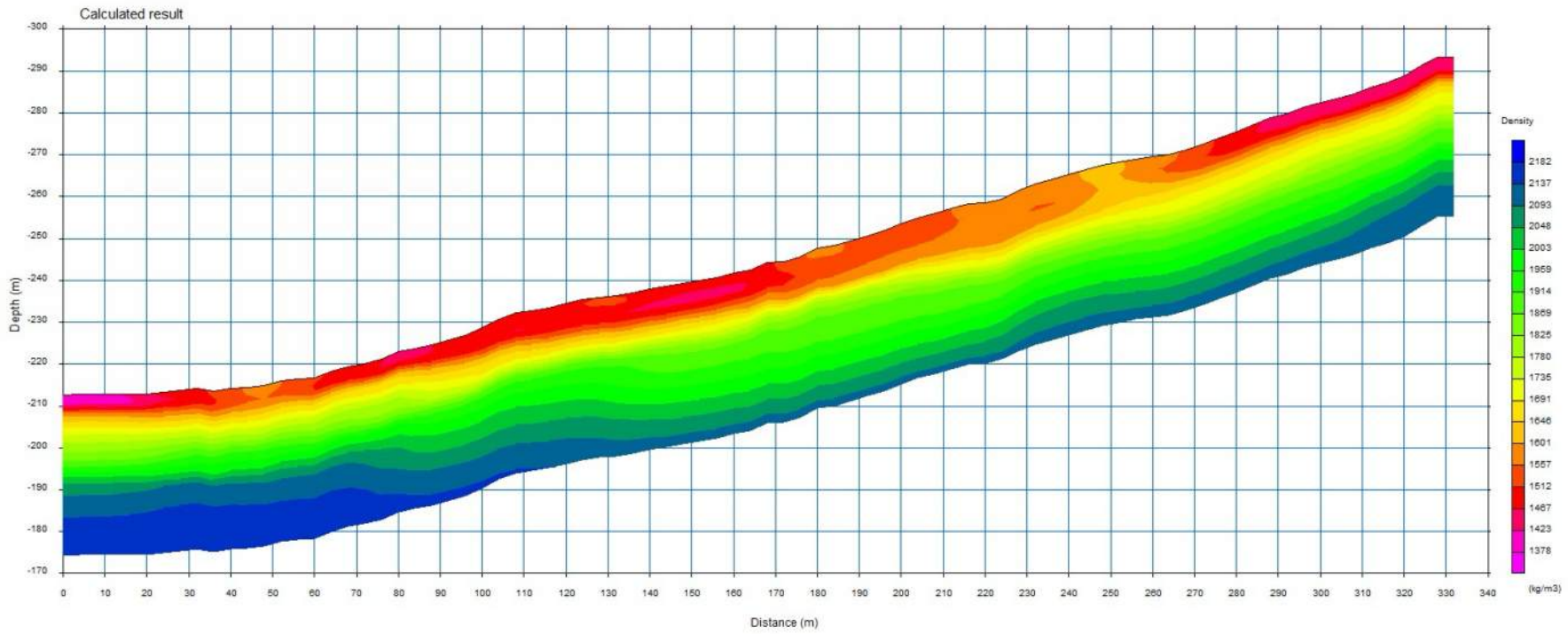
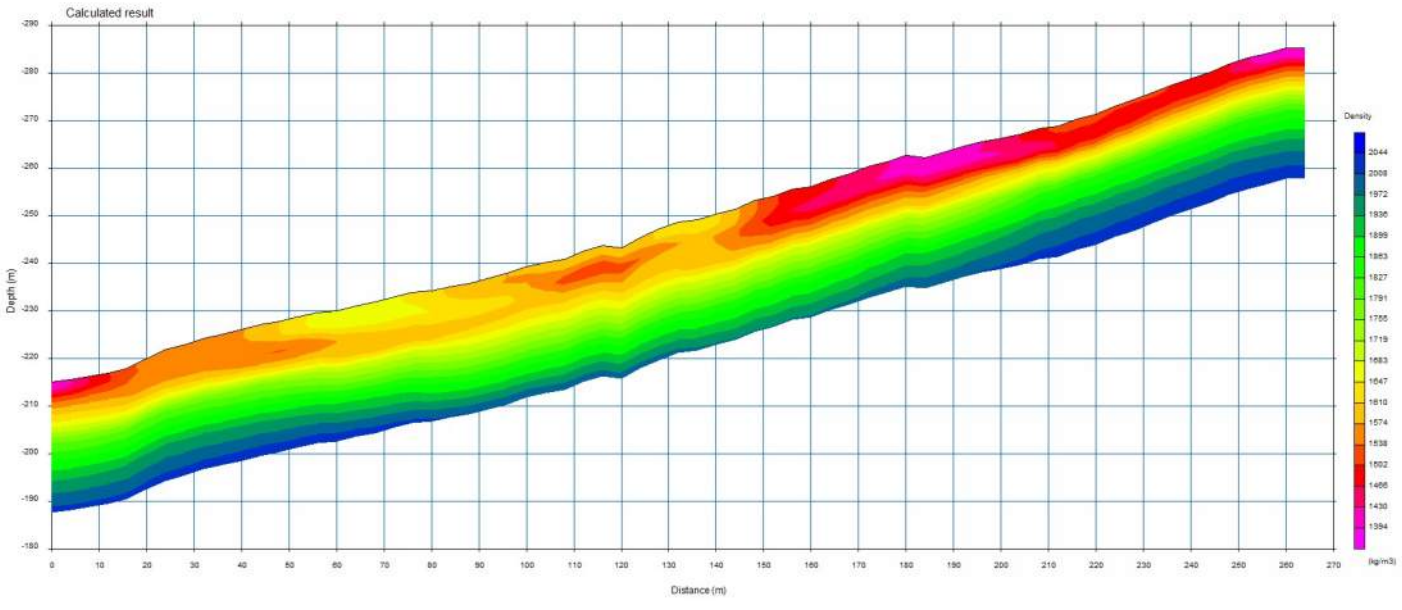
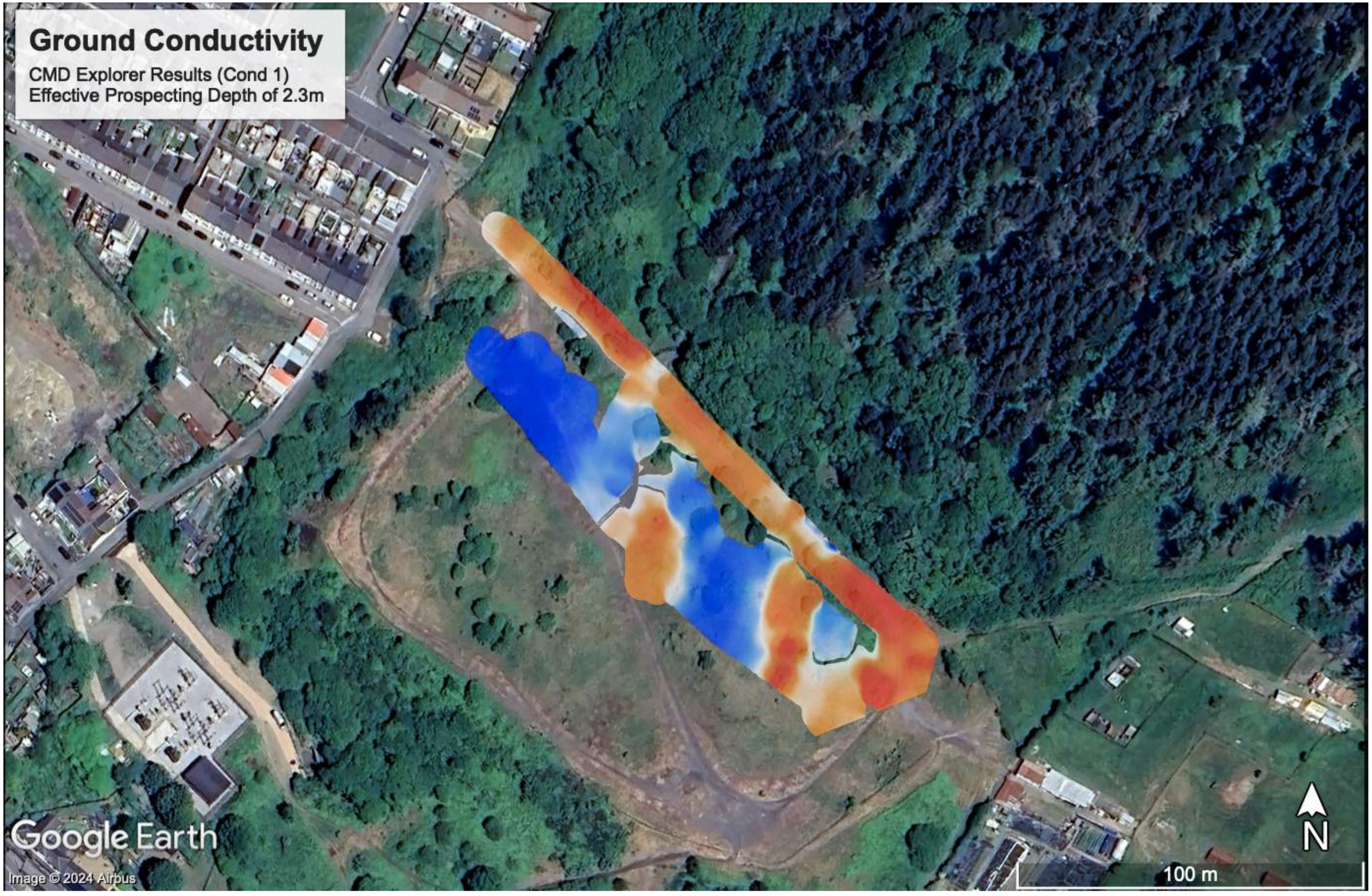
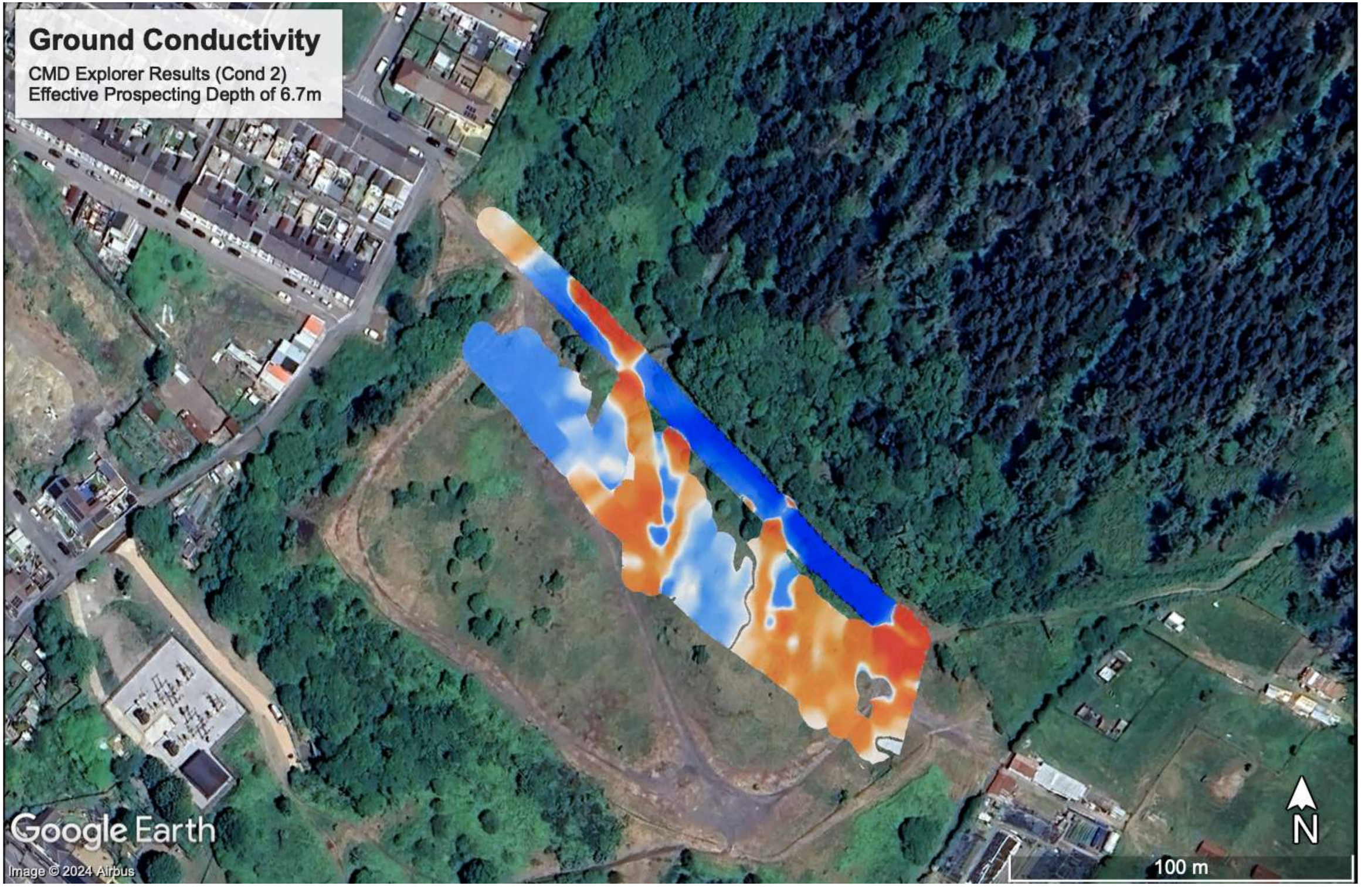


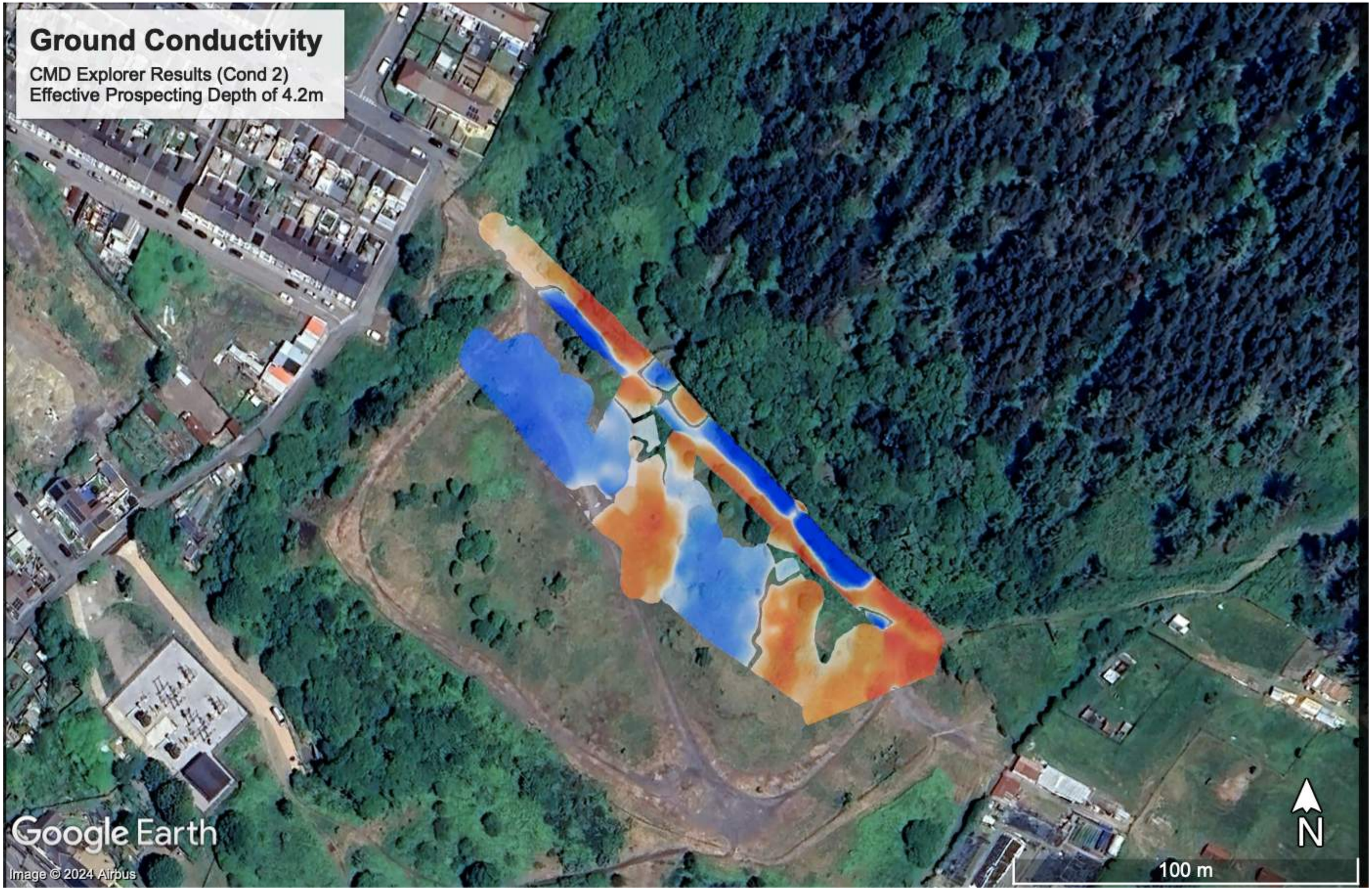
Figure 6. Profile 3. Density Results (kg/m3))



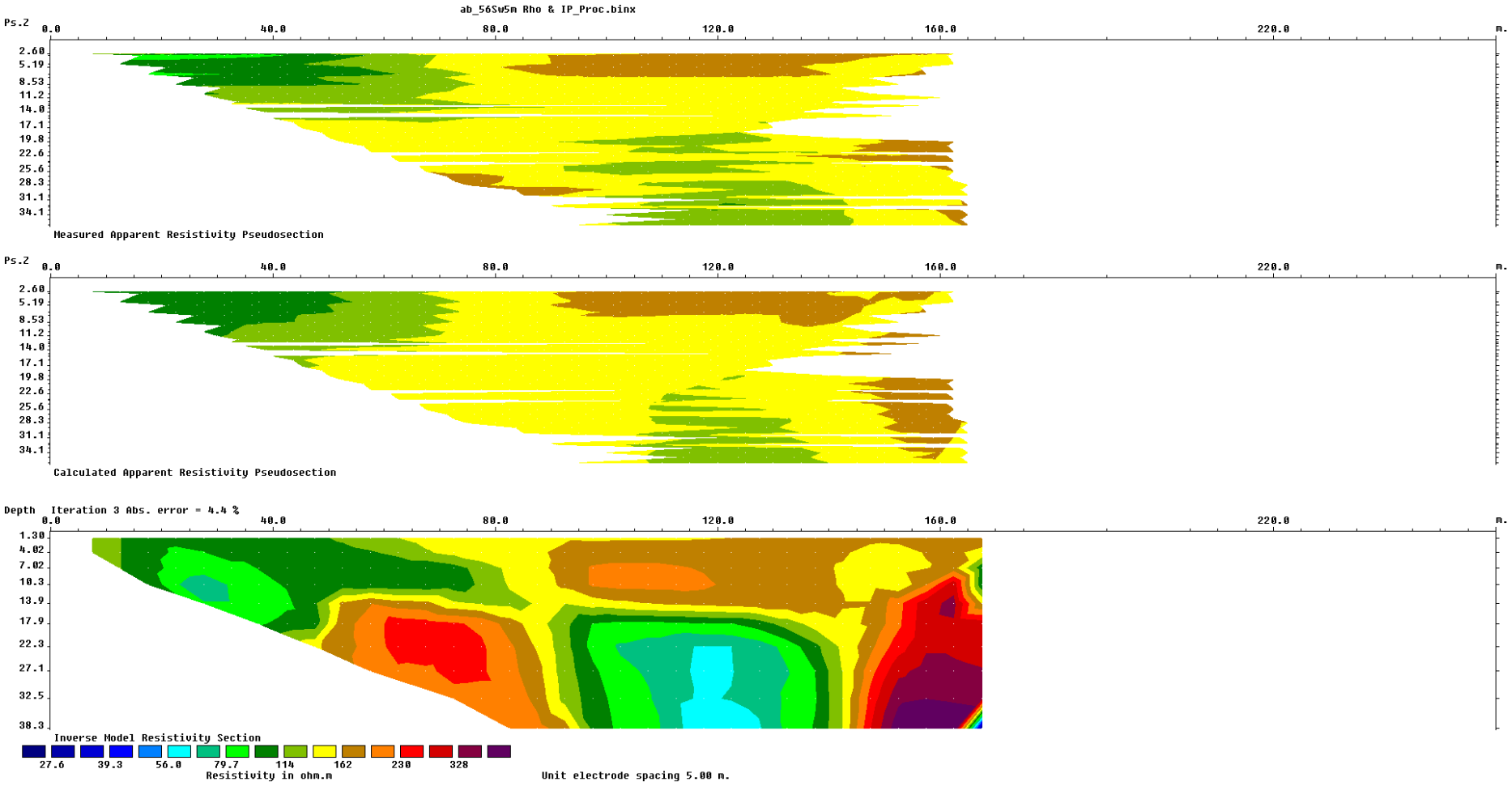
Appendix III. Electromagnetic Results

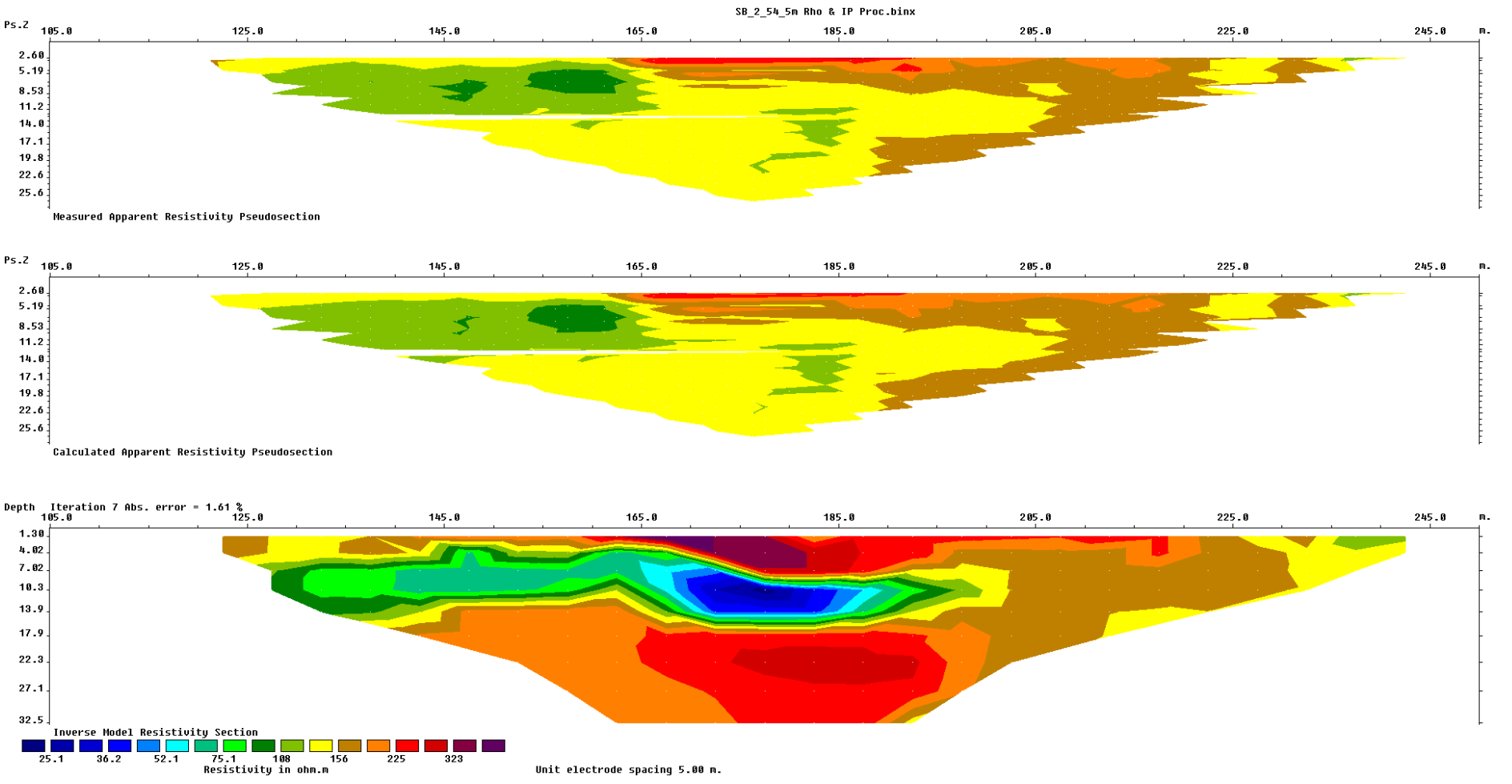

Ground Conductivity
CMD Explorer Results (Cond 1)
Effective Prospecting Depth of 2.3m
Google Earth
Image © 2024 Airbus
N
100 m


Ground Conductivity
CMD Explorer Results (Cond 2)
Effective Prospecting Depth of 6.7m
Google Earth
Image © 2024 Airbus
N
100 m


Ground Conductivity
CMD Explorer Results (Cond 2)
Effective Prospecting Depth of 4.2m
Google Earth
Image © 2024 Airbus
N
100 m

Appendix IV. EM Results


ab_56Sw5m Rho & IP_Proc.binx
Ps.Z
0.0
40.0
80.0
120.0
160.0
220.0
m.
2.60
5.19
8.53
11.2
14.0
17.1
19.8
22.6
25.6
28.3
31.1
34.1
Measured Apparent Resistivity Pseudosection
Ps.Z
0.0
40.0
80.0
120.0
160.0
220.0
m.
2.60
5.19
8.53
11.2
14.0
17.1
19.8
22.6
25.6
28.3
31.1
34.1
Calculated Apparent Resistivity Pseudosection
Depth
Iteration 3 Abs. error = 4.4 %
0.0
40.0
80.0
120.0
160.0
220.0
m.
1.30
4.02
7.02
10.3
13.9
17.9
22.3
27.1
32.5
38.3
Inverse Model Resistivity Section
27.6
39.3
56.0
79.7
114
162
230
328
Resistivity in ohm.m
Unit electrode spacing 5.00 m.


SB_2_54_5m Rho & IP Proc.binx
Ps.Z
105.0
125.0
145.0
165.0
185.0
205.0
225.0
245.0
m.
2.60
5.19
8.53
11.2
14.0
17.1
19.8
22.6
25.6
Measured Apparent Resistivity Pseudosection
Ps.Z
105.0
125.0
145.0
165.0
185.0
205.0
225.0
245.0
m.
2.60
5.19
8.53
11.2
14.0
17.1
19.8
22.6
25.6
Calculated Apparent Resistivity Pseudosection
Depth
Iteration 7 Abs. error = 1.61 %
105.0
125.0
145.0
165.0
185.0
205.0
225.0
245.0
m.
1.30
4.02
7.02
10.3
13.9
17.9
22.3
27.1
32.5
Inverse Model Resistivity Section
25.1
36.2
52.1
75.1
108
156
225
323
Resistivity in ohm.m
Unit electrode spacing 5.00 m.

Seismic (P Wave) Results

Figure 1. Profile 1 P Wave Velocity Profile

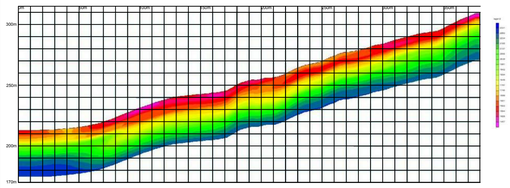


Figure 2. Profile 1 Basic Interpretation.

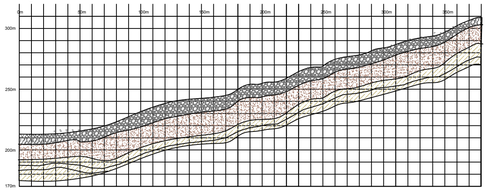


Figure 3. Profile 2 P Wave Velocity Profile

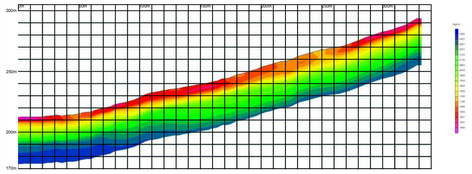


Figure 4. Profile 2 Basic Interpretation

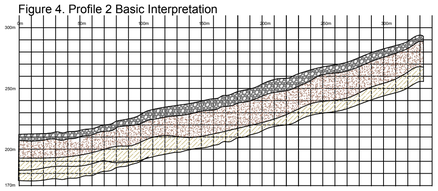


Figure 5. Profile 3 P Wave Velocity Profile

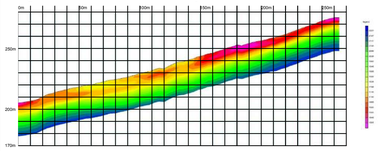
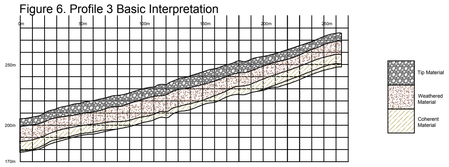


Figure 6. Profile 3 Basic Interpretation



ERT Results

Figure 7. ERT Resuts from Profile 1.

NO RESULTS TO DISPLAY.

Figure 8. ERT Results from Profile 2.

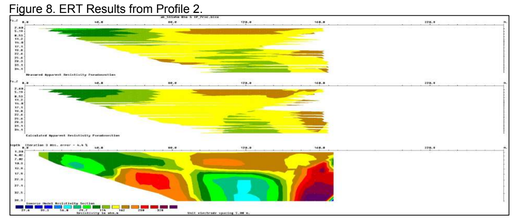
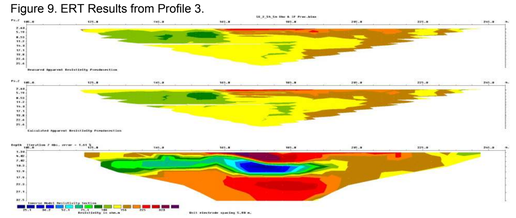
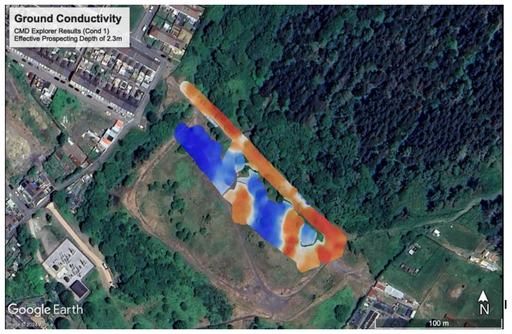


Figure 9. ERT Results from Profile 3.



EM (Conductivity) Results

Figure 10.



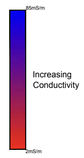


Figure 11.

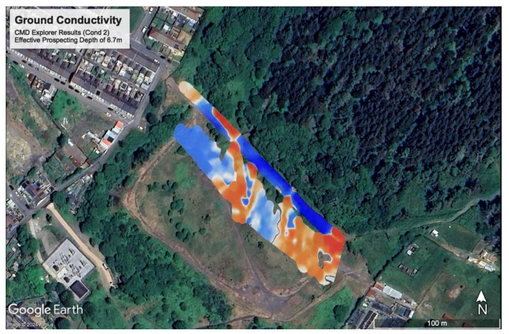
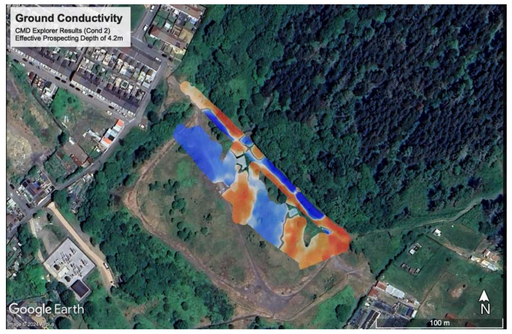


Figure 12.



Ground Radar Results

Figure 13. 400 MHz Radargram

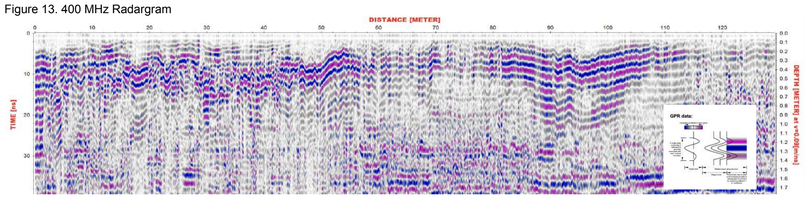


Figure14. Interpretation of Radargram

./Screenshots/Screenshot 2024-08-09 at 17.54.26.png

Two layers of compacted granular material.

Foundation/Capping Layer

Track Construction Depth:
c.0.39m to c.0.82m (average c0.058m).

General Notes

This drawing should be read in conjunction with Atlas Geophysical Report AG1990_Final_Report.

Seismic interpretation shown in Figures 2, 4 and 6 are based on a three layer model which provides a basic interpretation of the bulk velocities. There may be inconsistancies with this interpretation based on varying levles of compaction within the tip material and underlying weathered rock.

ERT Results are not of high enough quality to create a structural interpretation.

No.	Revision/Issue	Date
1.	Drawing dependencies renamed	29/8/24

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Project: Pen Yr Englyn Tip

Drawing: Geophysical Survey Results

Client: Tetra Tech Ltd

Project	Sheet
AG1990	AG1990-01
Date: June 2024	
Scale: Not To Scale	

Appendix F Summary results of slope stability analyses

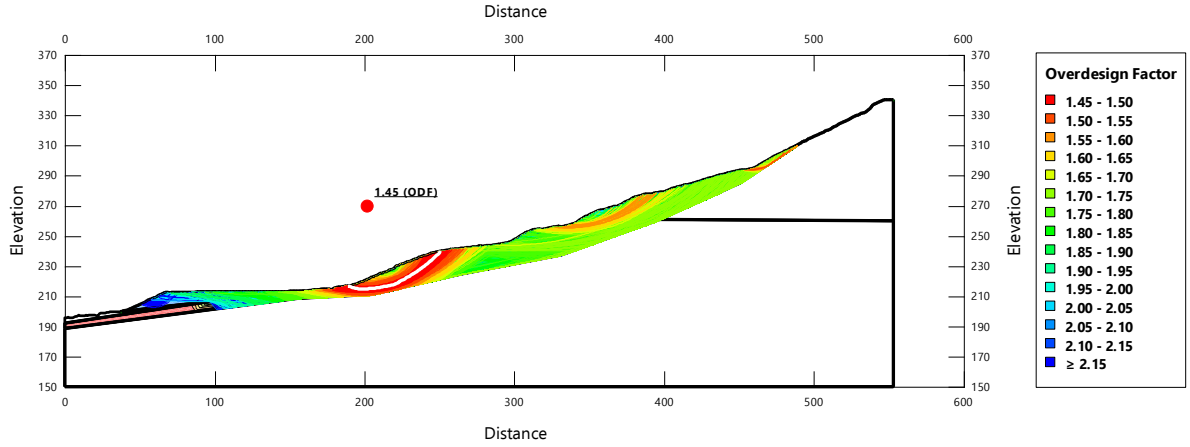


Figure F1: Profile 1 with Pore pressure ratio R_u = 0

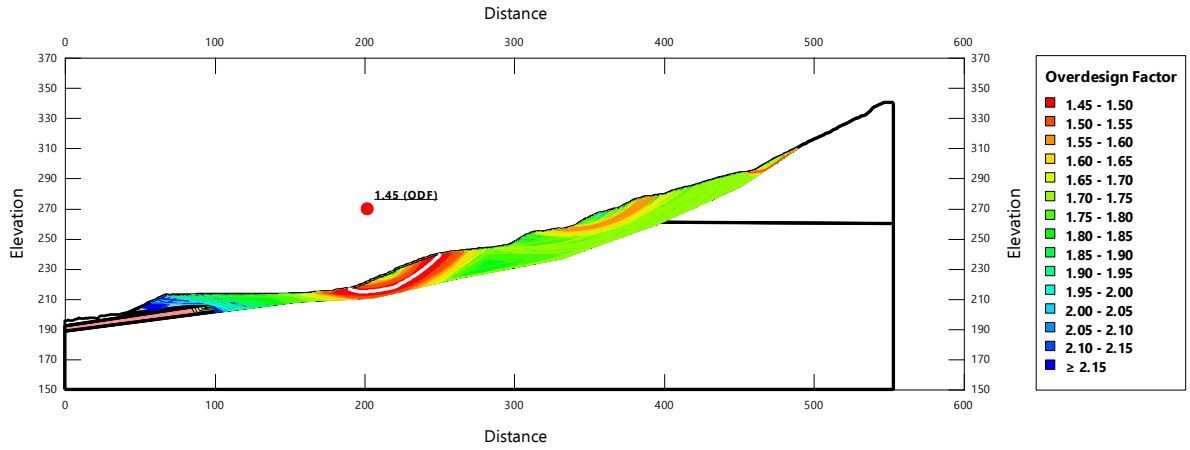


Figure F2: Profile 1 with Pore pressure ratio R_u = 0.25

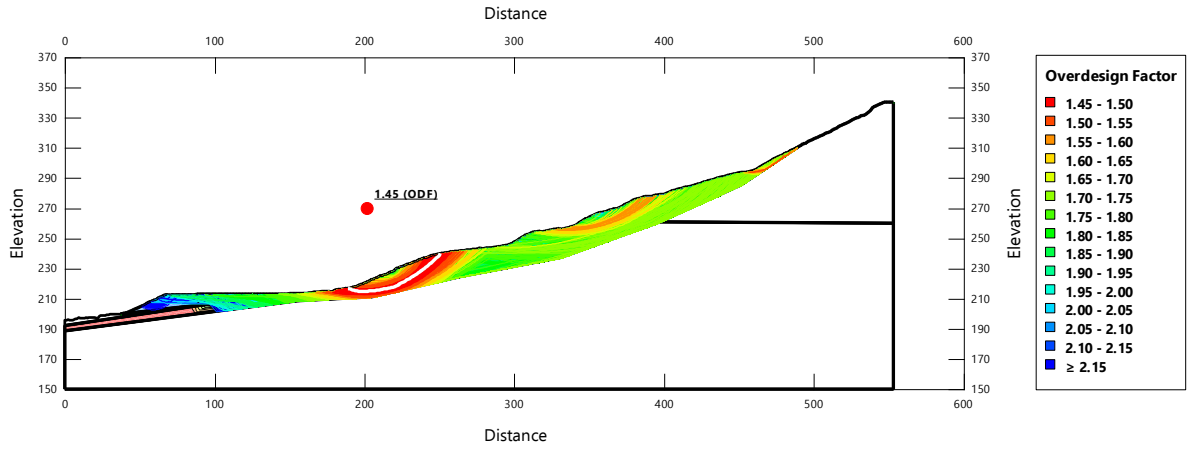


Figure F3: Profile 1 with Pore pressure ratio R_u = 0.545

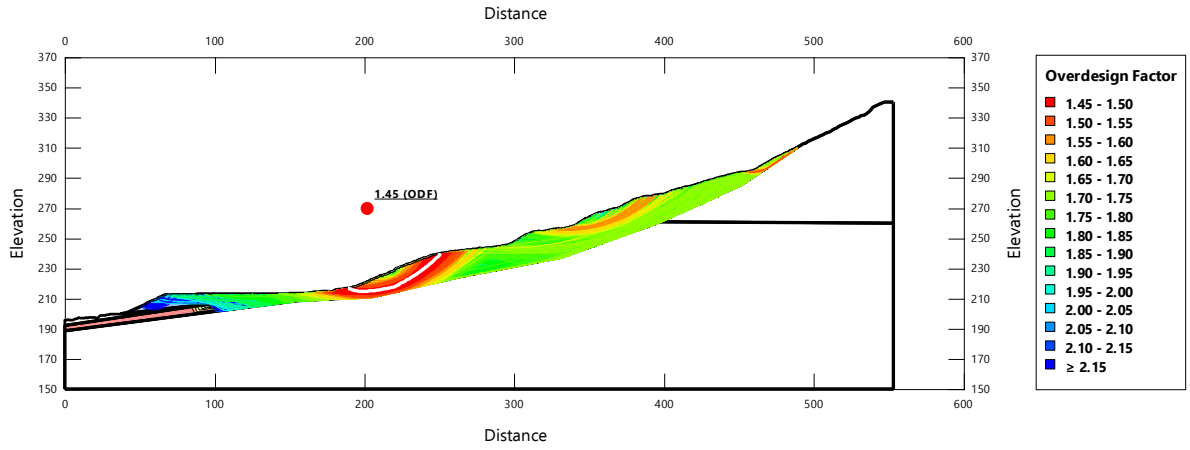


Figure F4: Profile 2 with Pore pressure ratio R_u = 0

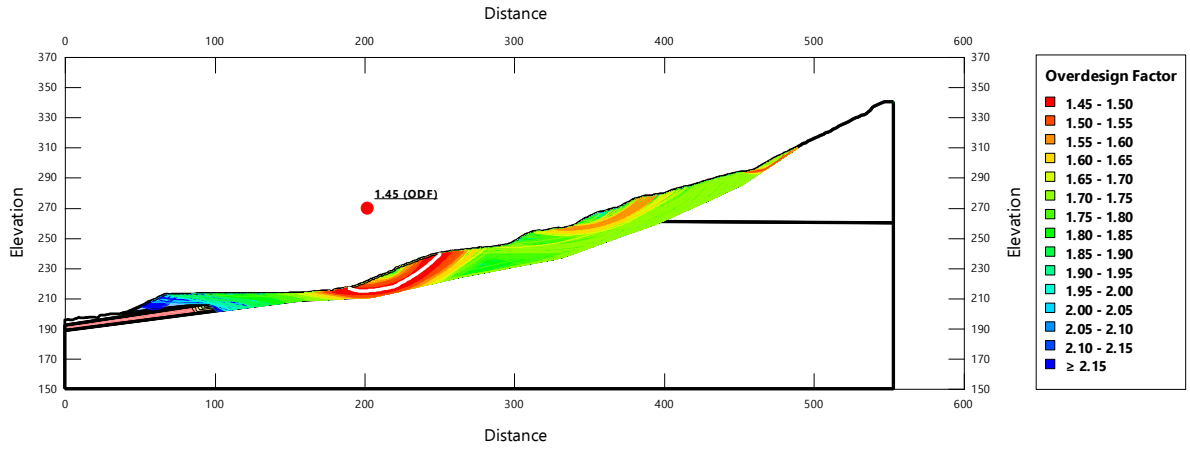


Figure F5: Profile 2 with Pore pressure ratio R_u = 0.25

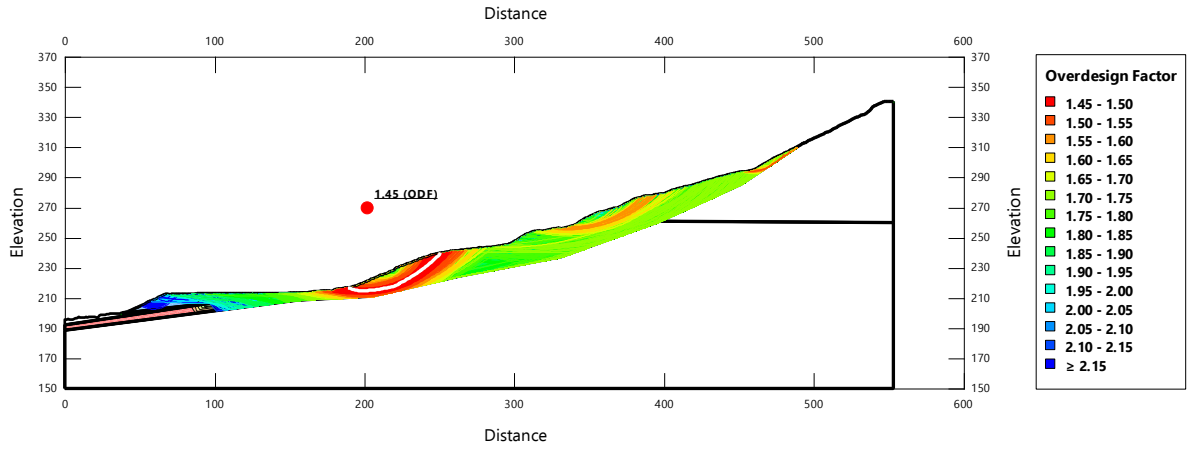


Figure F6: Profile 2 with Pore pressure ratio R_u = 0.545

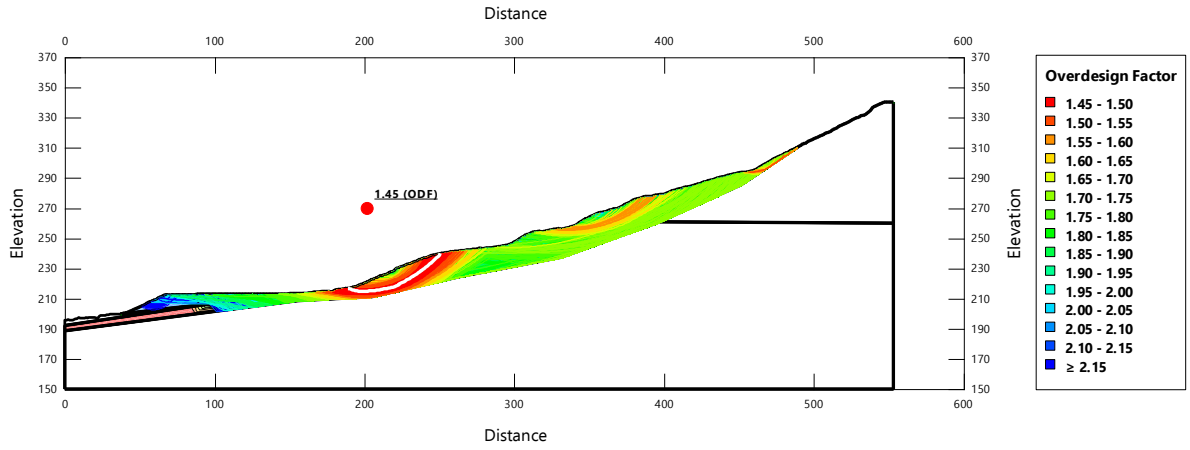


Figure F7: Profile 3 with Pore pressure ratio R_u = 0

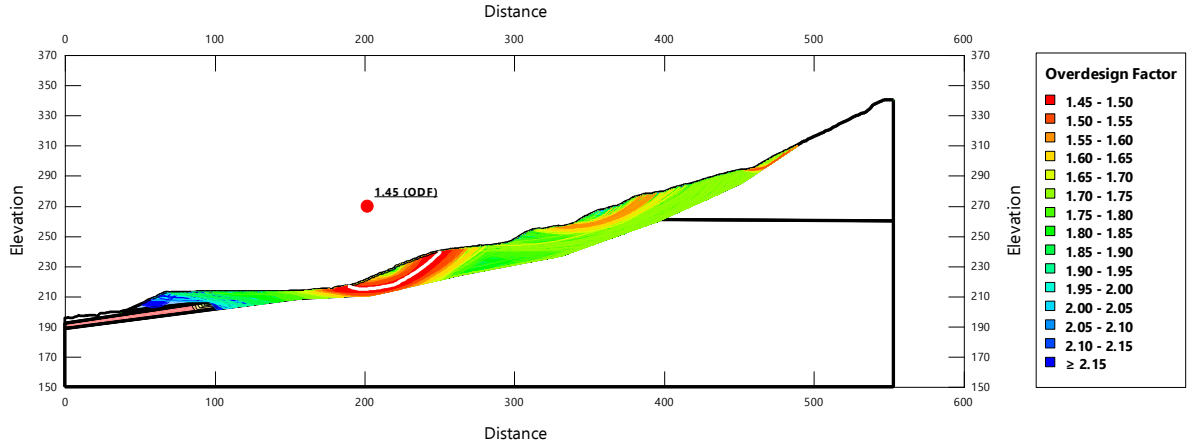


Figure F8: Profile 3 with Pore pressure ratio R_u = 0.25

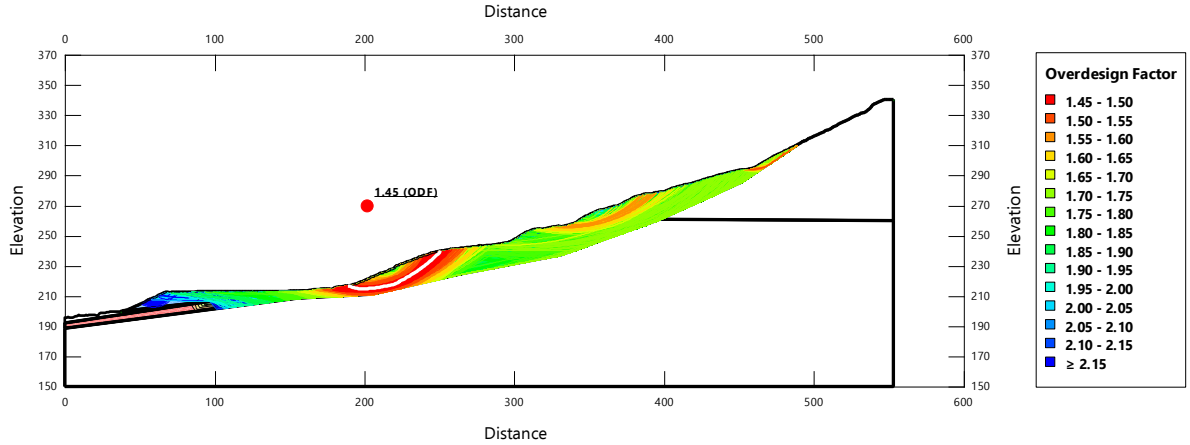
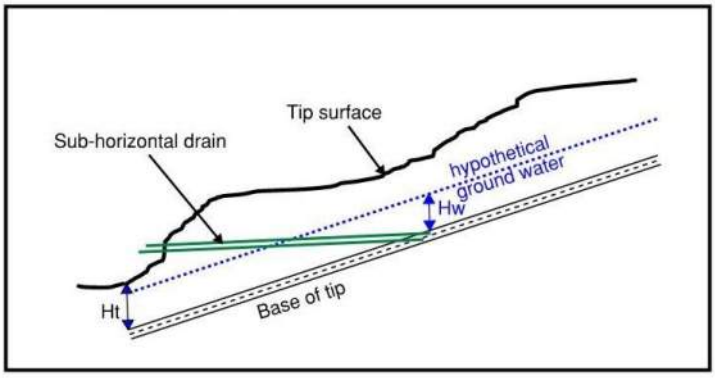


Figure F9: Profile 3 with Pore pressure ratio R_u = 0.545

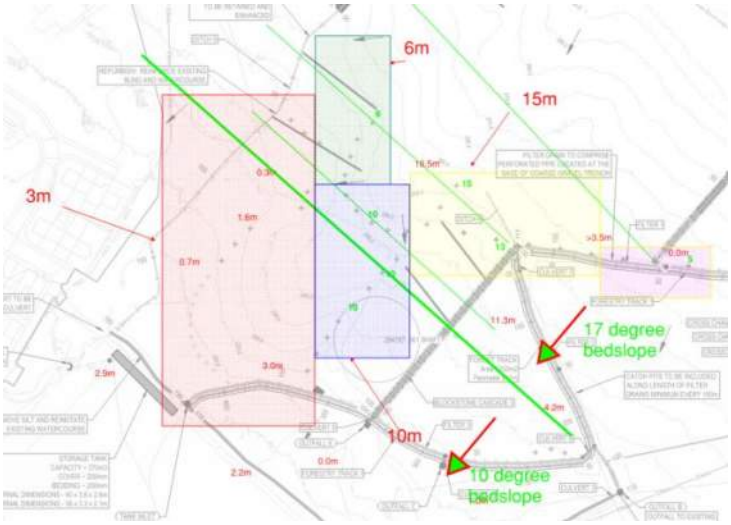
Appendix G Drainage calculations

The function of the internal drainage system is to intercept internal water flows and prevent accumulation of ground water within the tipped mass. It is proposed to install drains at a shallow angle to intercept ground water flowing near the base of the tipped mass, see Figure 14, reproduced below.



Lengths of drains

The length of an individual drain is governed by the tip base angle and its depth, Ht, at its outflow. The base angle ranges from 10° near the plateau to 17.3° towards the upper parts of the tip. Therefore, these values have been assumed for the lower and upper halves of the tip area, respectively.



The above extract from Binnies Drawing 4021526-BUK-ZZ-00-DR-C-00010 uses data from the historic boreholes extrapolated across the site to estimate approximate tip depths, Ht, in the parts of the site where drains are proposed. The division of bed slope into lower and upper parts is also shown.

Using this data, the approximate lengths of drains in each area are as follows.

	Ht = 3m	Ht = 5m	Ht = 6m	Ht = 10m	Ht = 15m
Drain length for bed slope = 10°, m	18.0	30.1	36.1	60.1	90.2
Drain length for bed slope = 17.3°, m	10.0	16.6	19.9	33.2	49.8

And the lengths of the drains are:

Ht	Base angle, degrees	Drain length	Number in zone	Aggregate length, n
3	10.0	18.0	35	612.5
6	17.3	19.9	8	152.0
10	10.0	60.0	13	780.0
10	17.3	33.2	14	448.0
15	17.3	49.8	11	550.0
TOTALS			**81**	**2542.5**

Drain capacities

Take drain length of 40.0m. This is almost 10m longer than the average length of all the drains of 31m so is conservative.

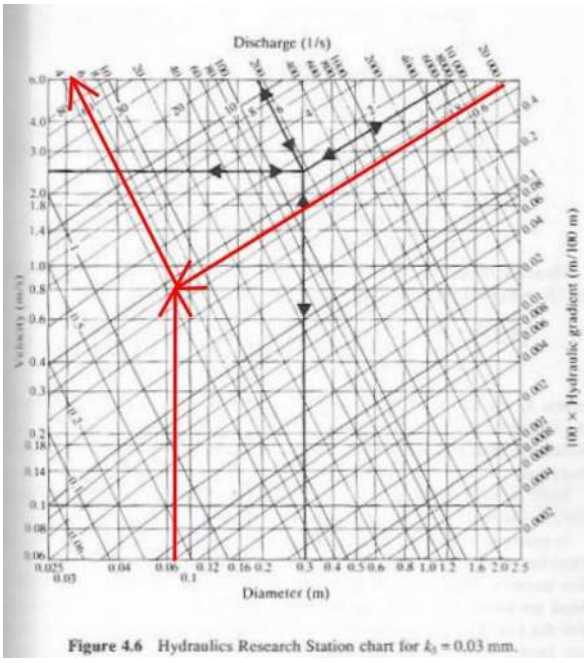


Figure 4.6 Hydraulics Research Station chart for k_s = 0.03 mm.

The Hydraulics Research Station chart for estimating pipe capacities has been used (chart above) to show that the full capacity of a 40m long 75mm diameter smooth pipe could be up to 20 litres/second with a head of 5m (R_u = 0.25) at the base of the tip. In practice, observations show that the ground water within the tipped mass is not likely to be this deep and, once the drains were established, it is unlikely to rise this high.

Flows required to reduce water in tip

The calculation given in CIRIA Report 113, Control of Ground water for temporary works, for an unconfined aquifer has been used to estimate the flow required to maintain a depression of ground

water level from 5m above the tip base to 1m above the base. As shown by the stability calculations, this would give a satisfactory factor of safety.

Case 3 *Partial penetration by a single row of wellpoints of an unconfined aquifer (gravity flow) midway between two equidistant and parallel line sources* (Figure 19).

$$Q = \left[\left(0.73 + 0.27\frac{(H - h_0)}{H}\right)\frac{kx}{R_0}(H^2 - h_0^2)\right]$$

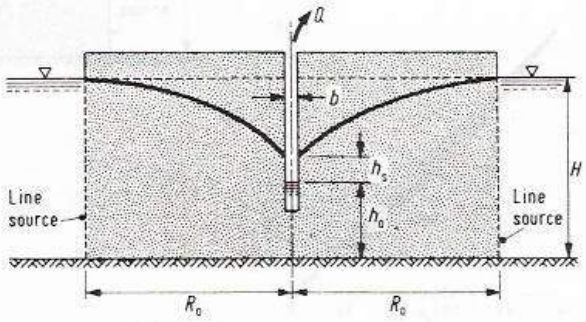


Figure 19

CIRIA Report 113 21

In this calculation,
H = 5m, H0 =1m
Diameter, b = 0.075, Soil permeability, k = 10^{-6} m/s as in Table 2.
Ro, radius of influence = 1500 x H x √k = 7.5m
And Q needed to lower water table from 5m to 1m above base = 3.03 x 10^{-3} l/s
Which is considerably less than capacity.
This calculation gives an indication that drains spaced at 10m can provide sufficient drain capacity to lower ground water significantly in the tip.
It can be noted that the average D_{10} particle size diameter of the 13 particle size distribution analyses available for the mine waste was 0.23mm, from which a permeability of 5.3 x 10^{-4}m/s can be estimated using Hazen's formula. The above calculation is, therefore, probably conservative and the drains should be more effective than this estimate suggests.

The total flow from all 81 drains would be = 81 x 3.03 x 10^{-3} = 0.25l/s