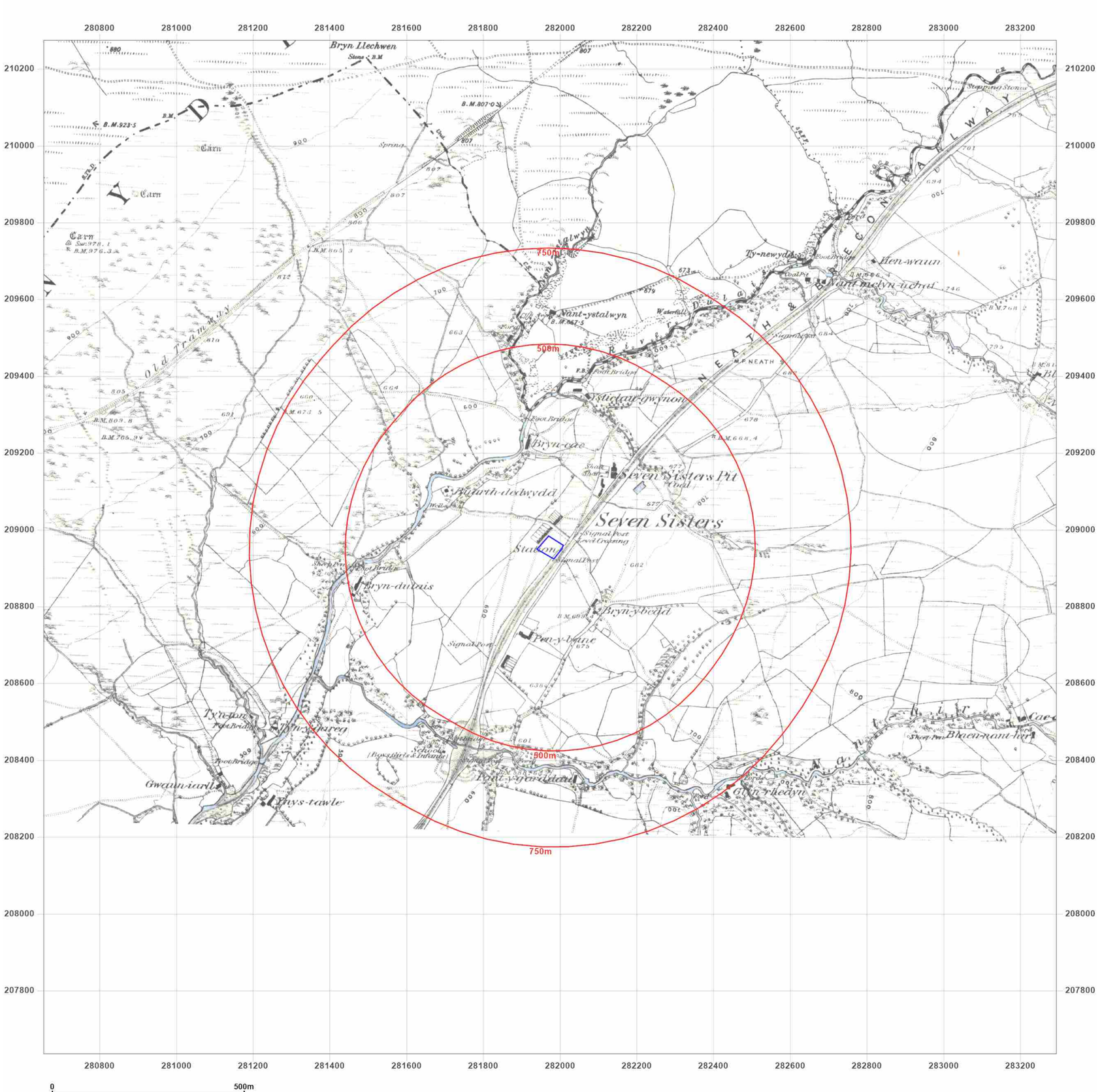


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Map Name: County Series

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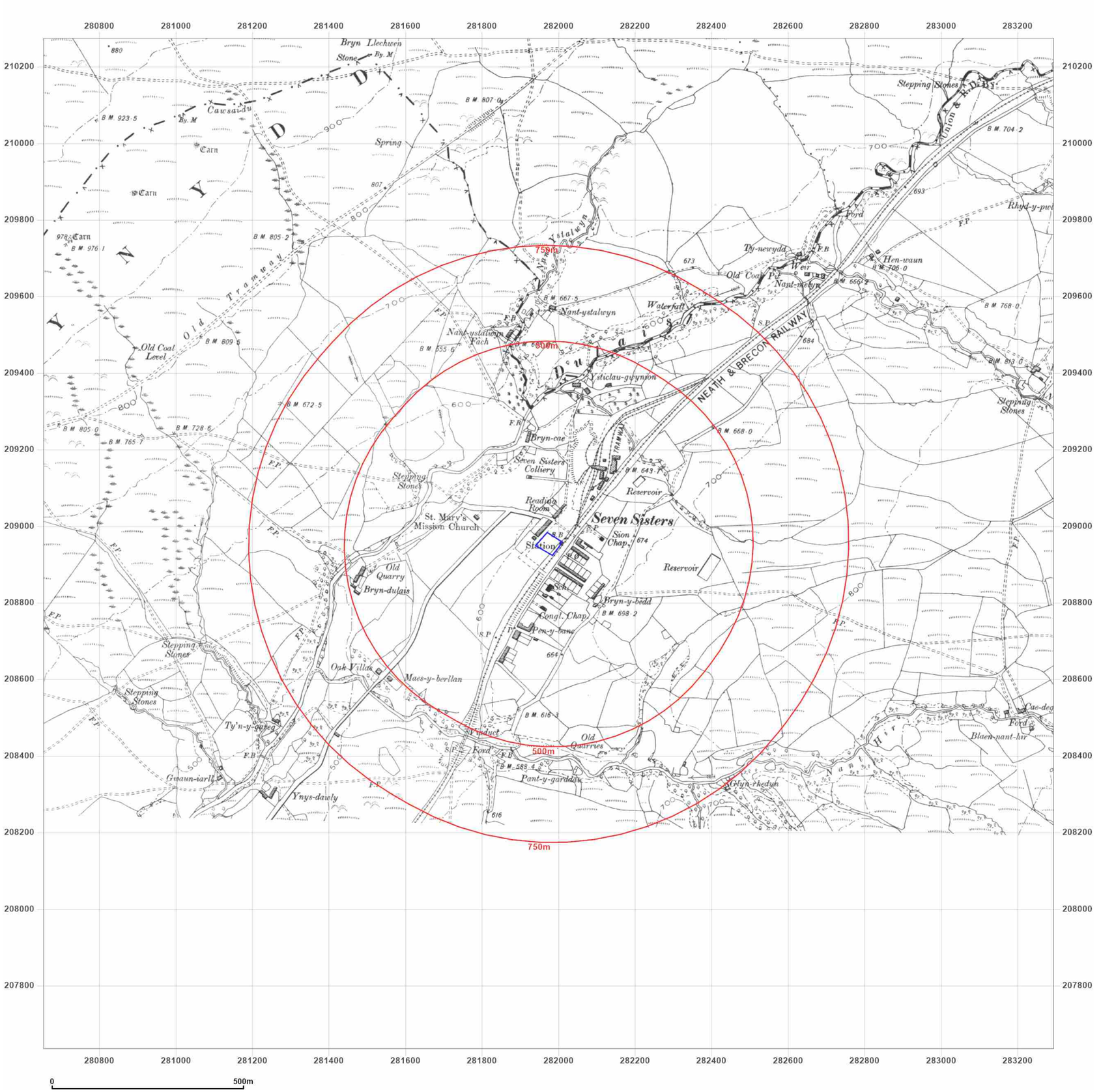
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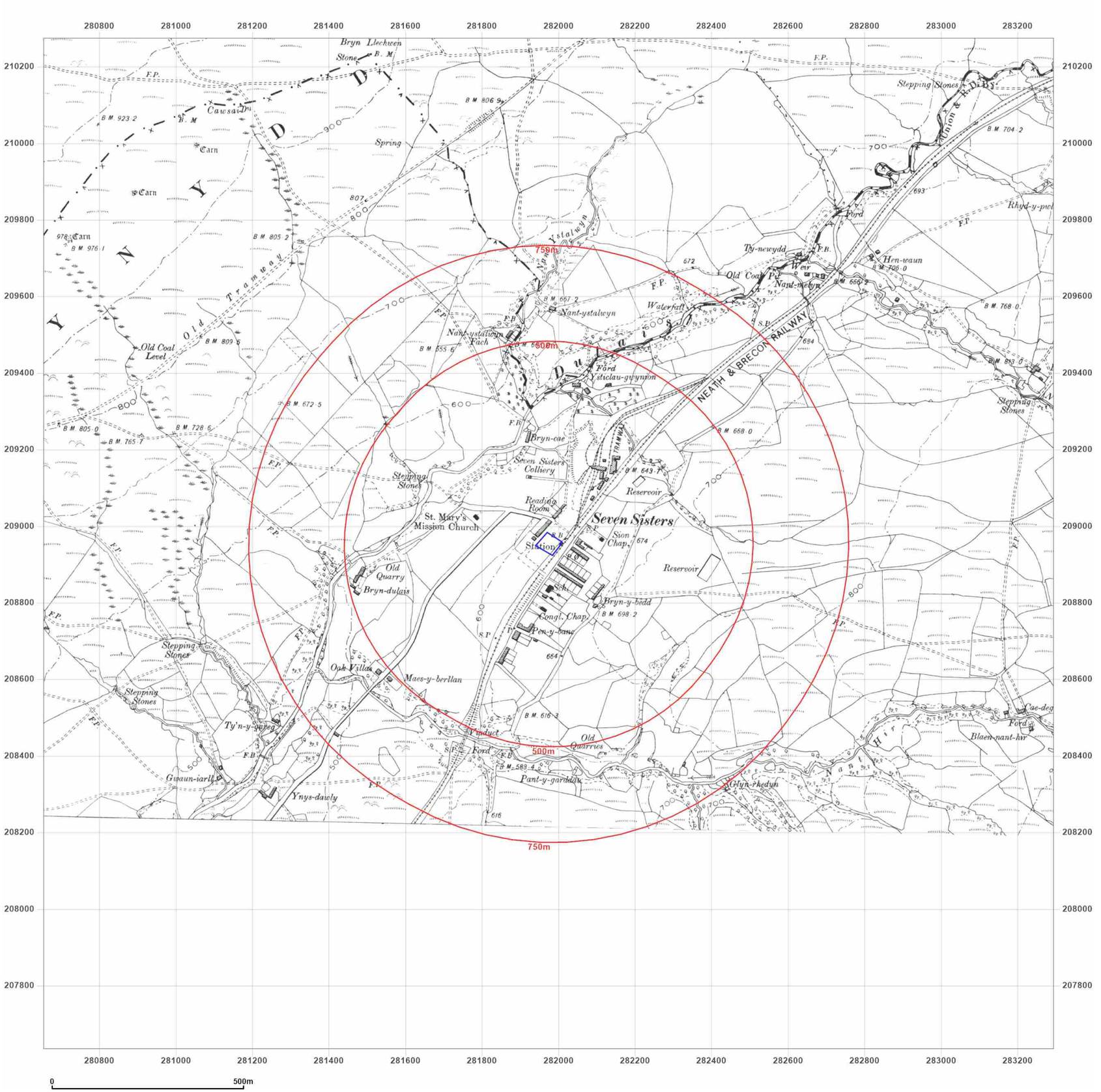
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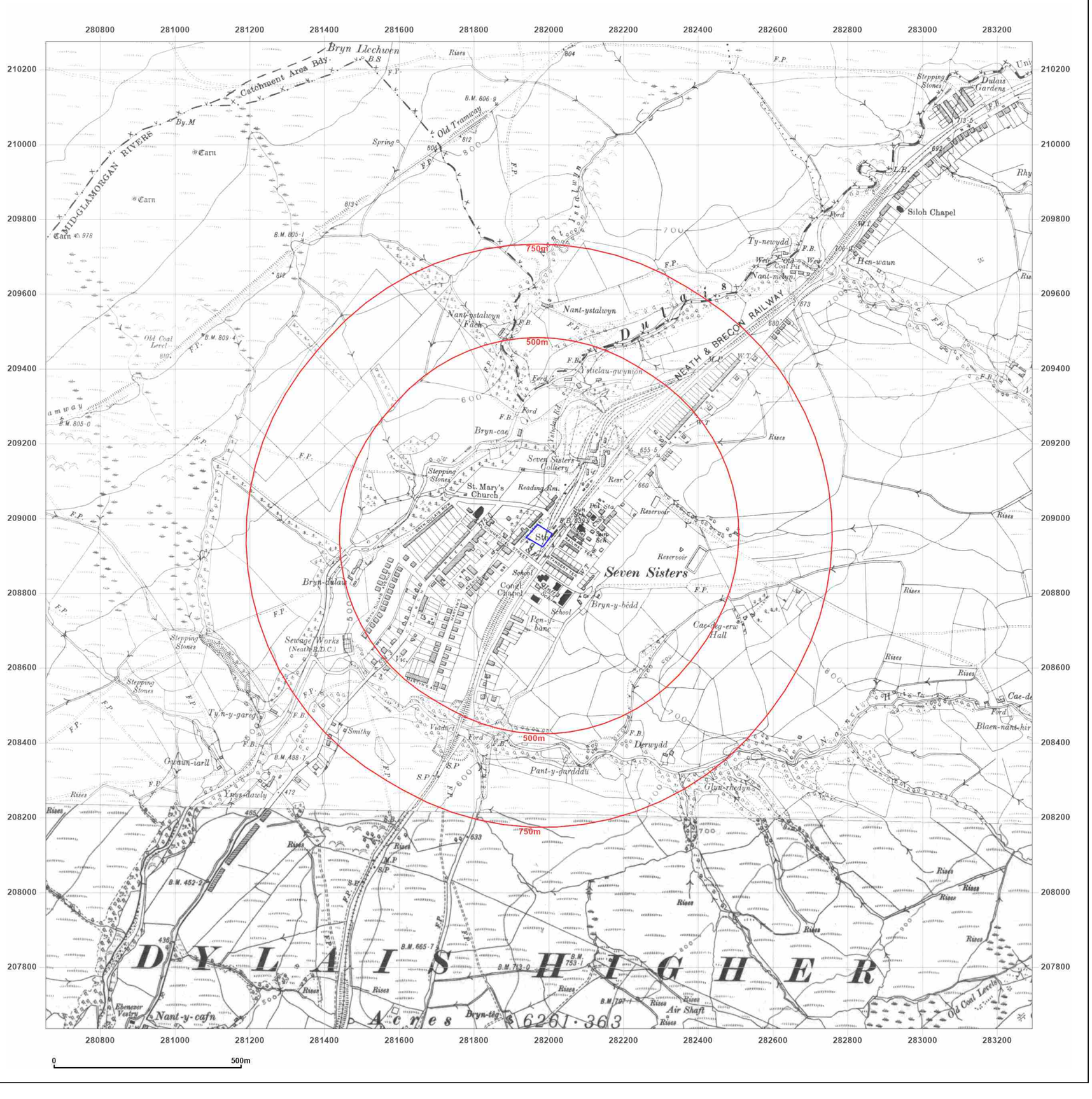
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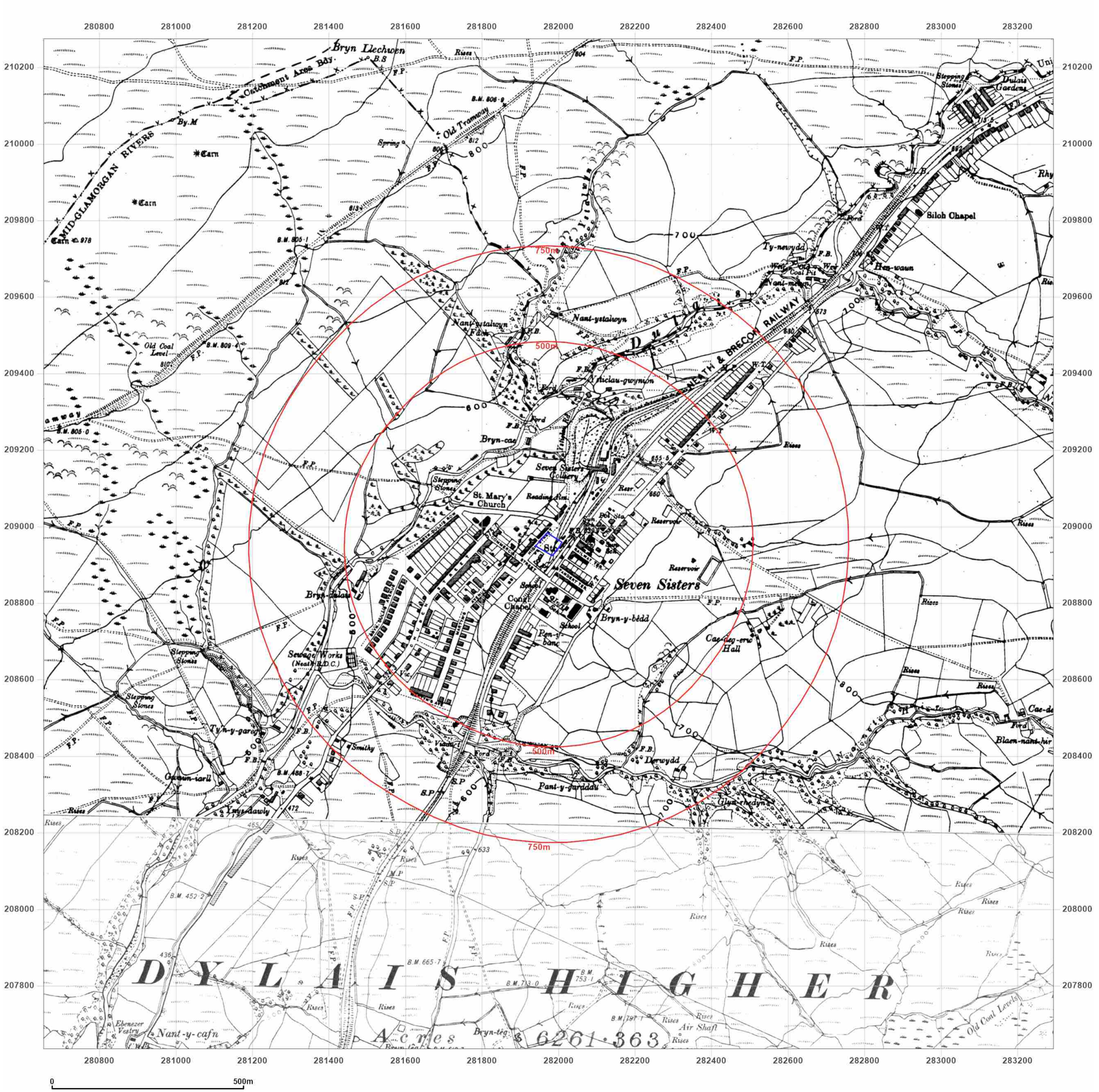
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Map Name: County Series

Map date: **1921**

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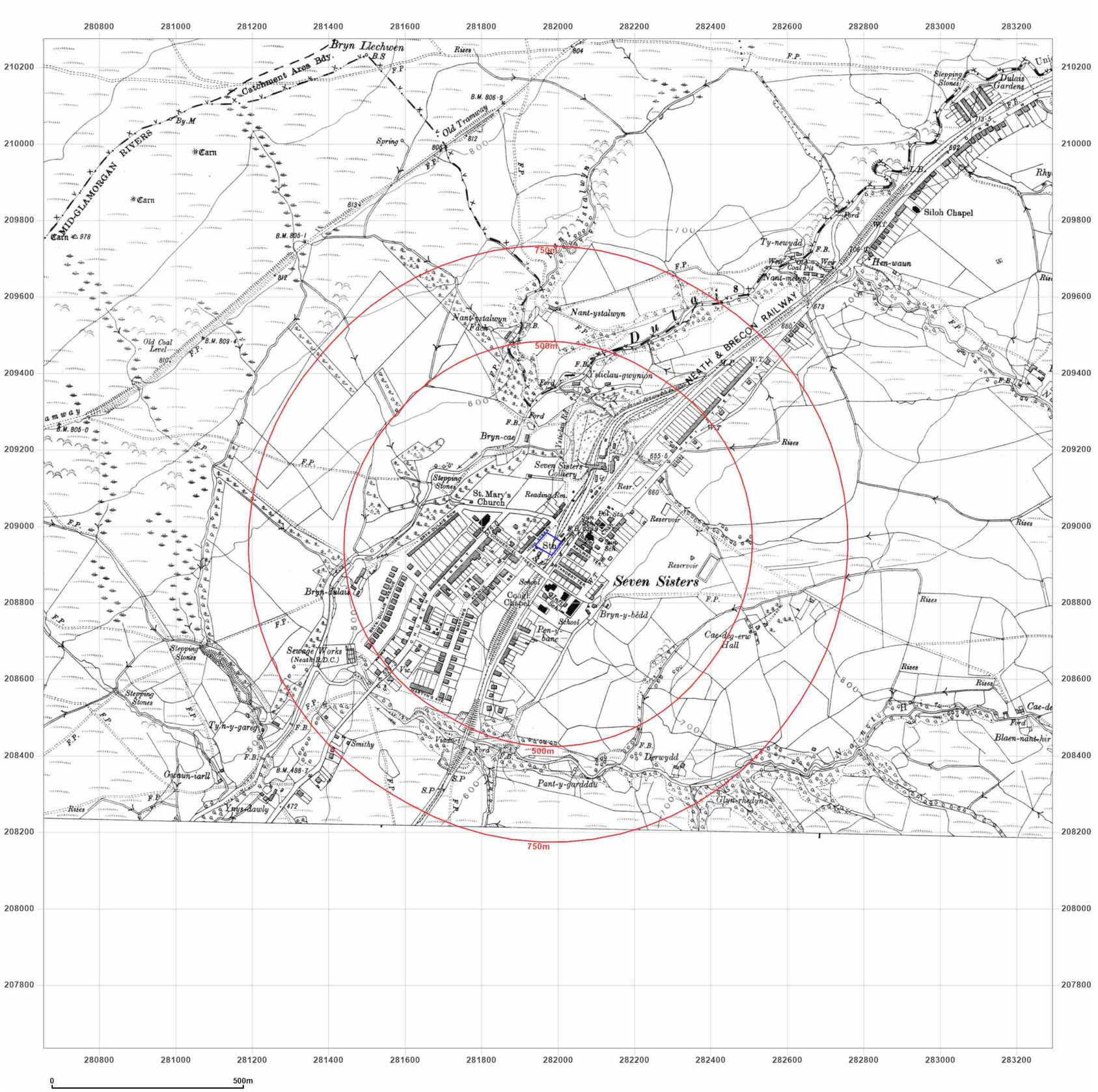
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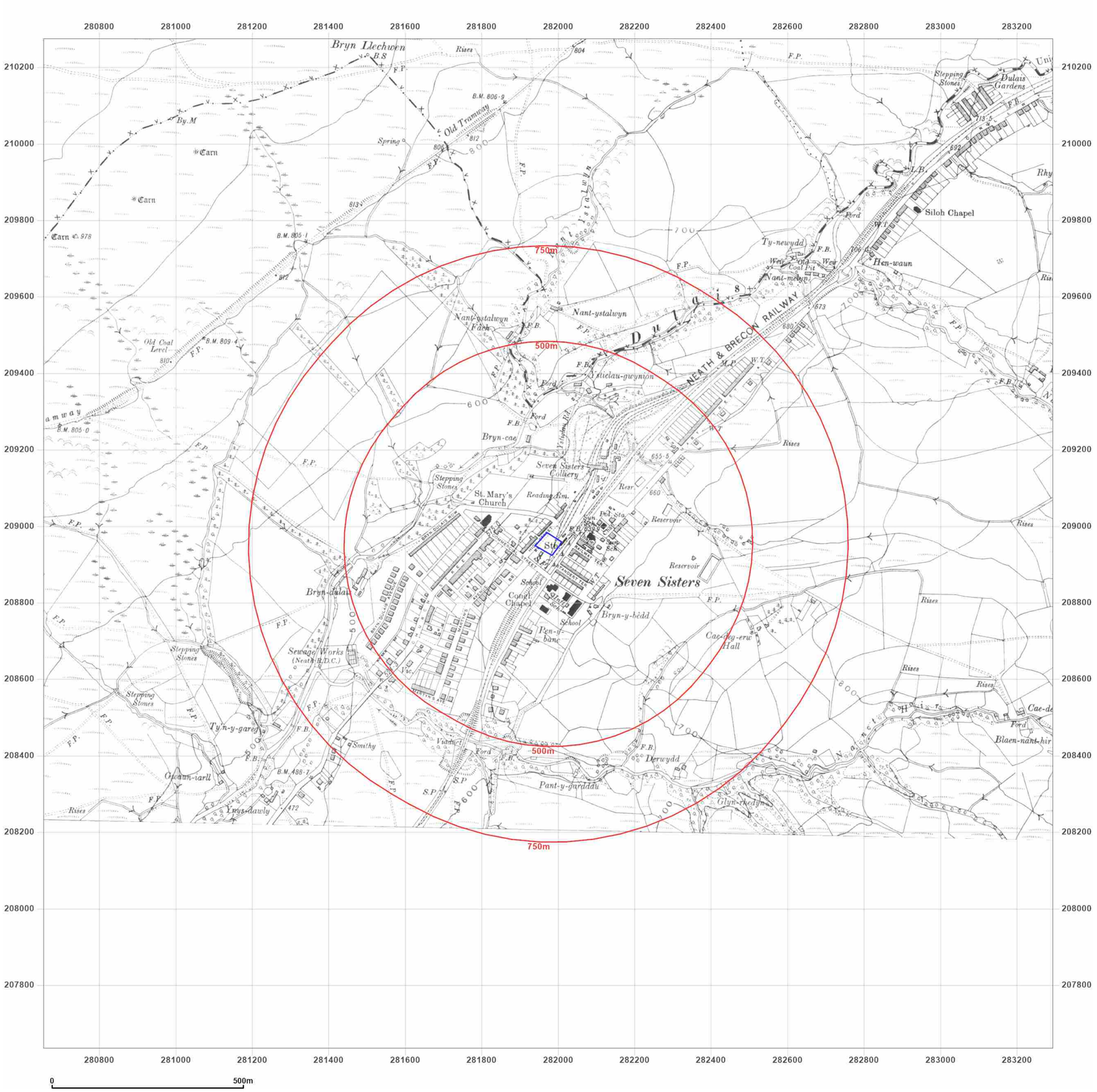
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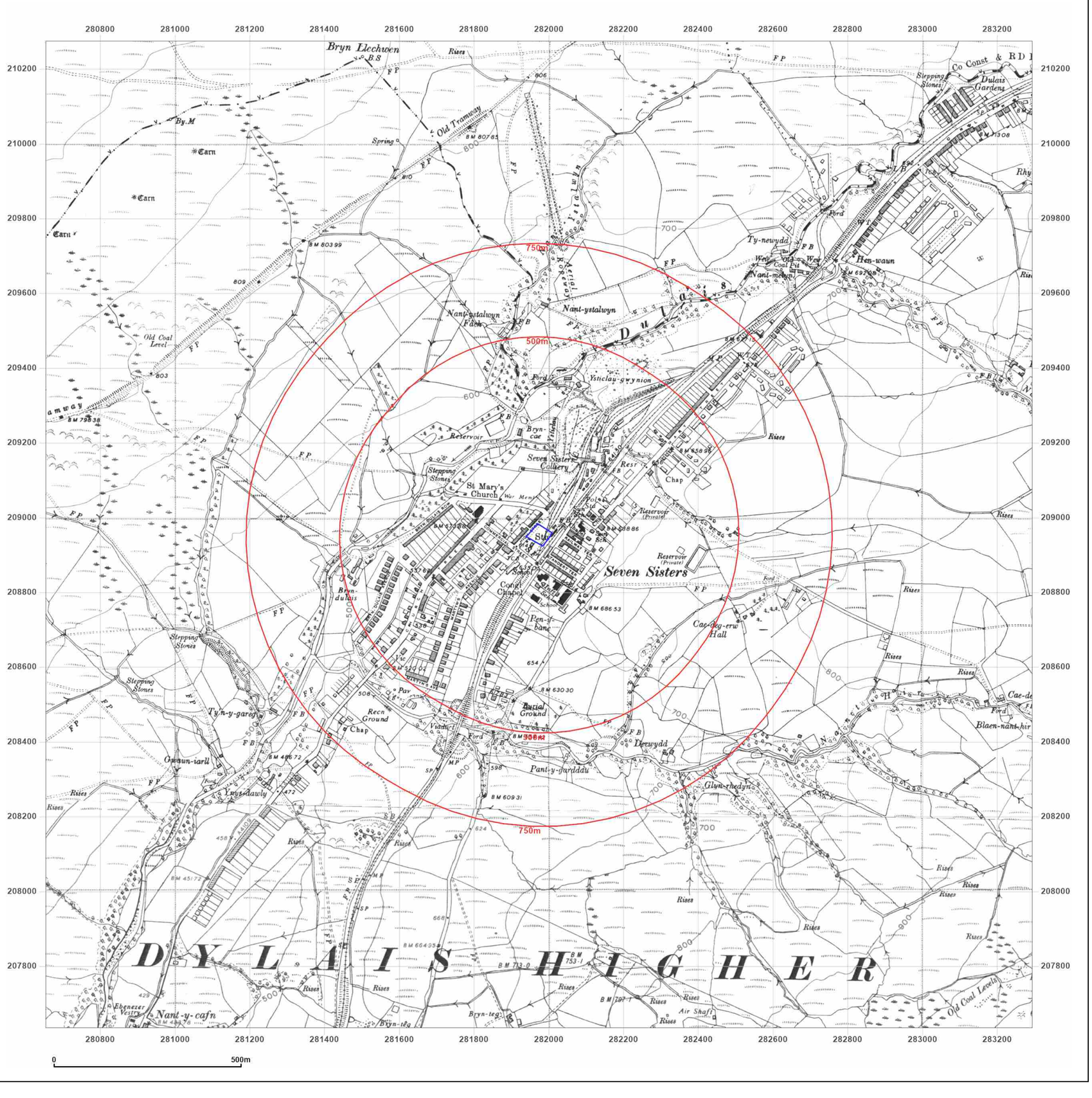
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Map date: **1948**

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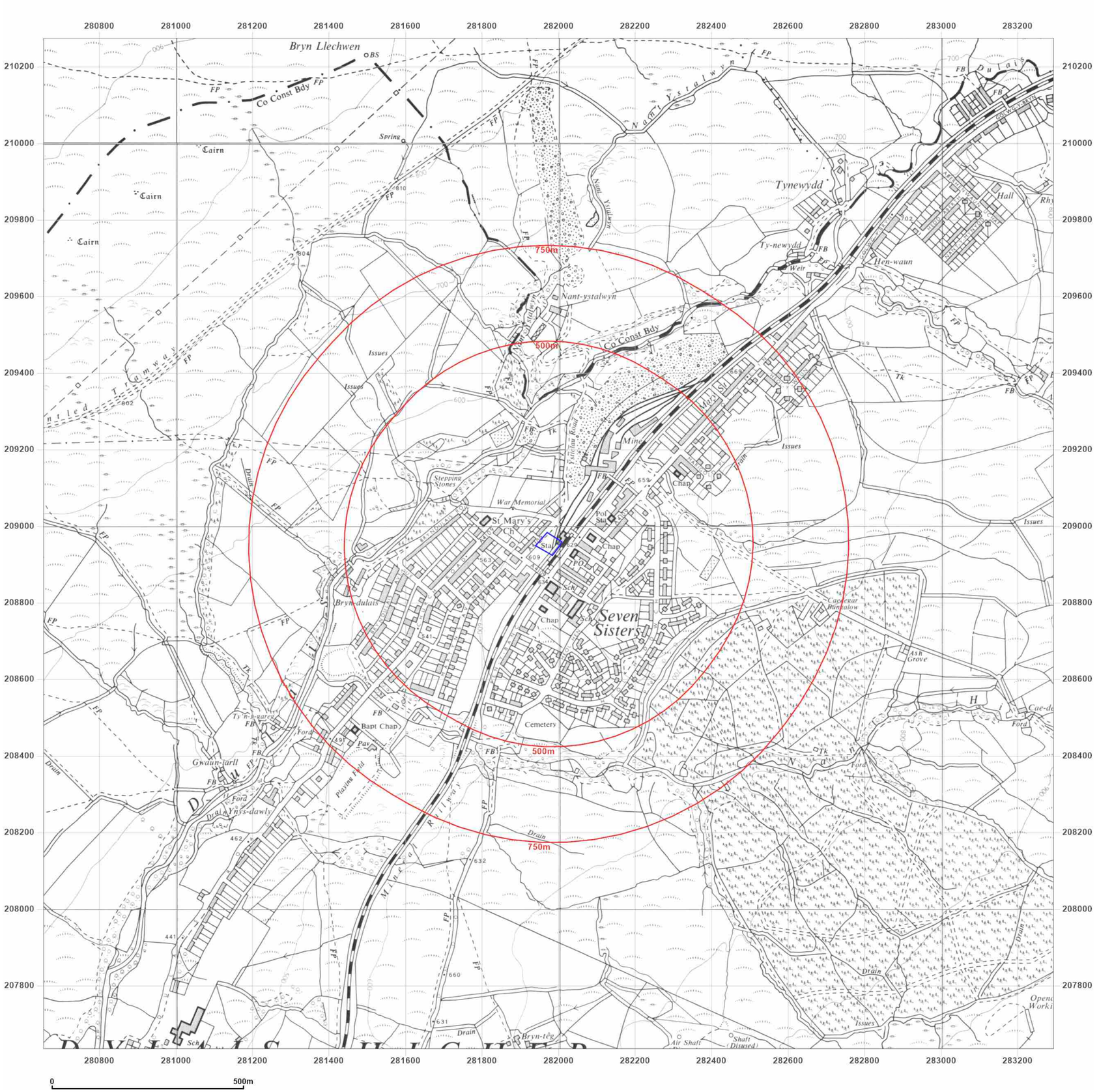
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Map Name: Provisional

Map date: **1964-1965**

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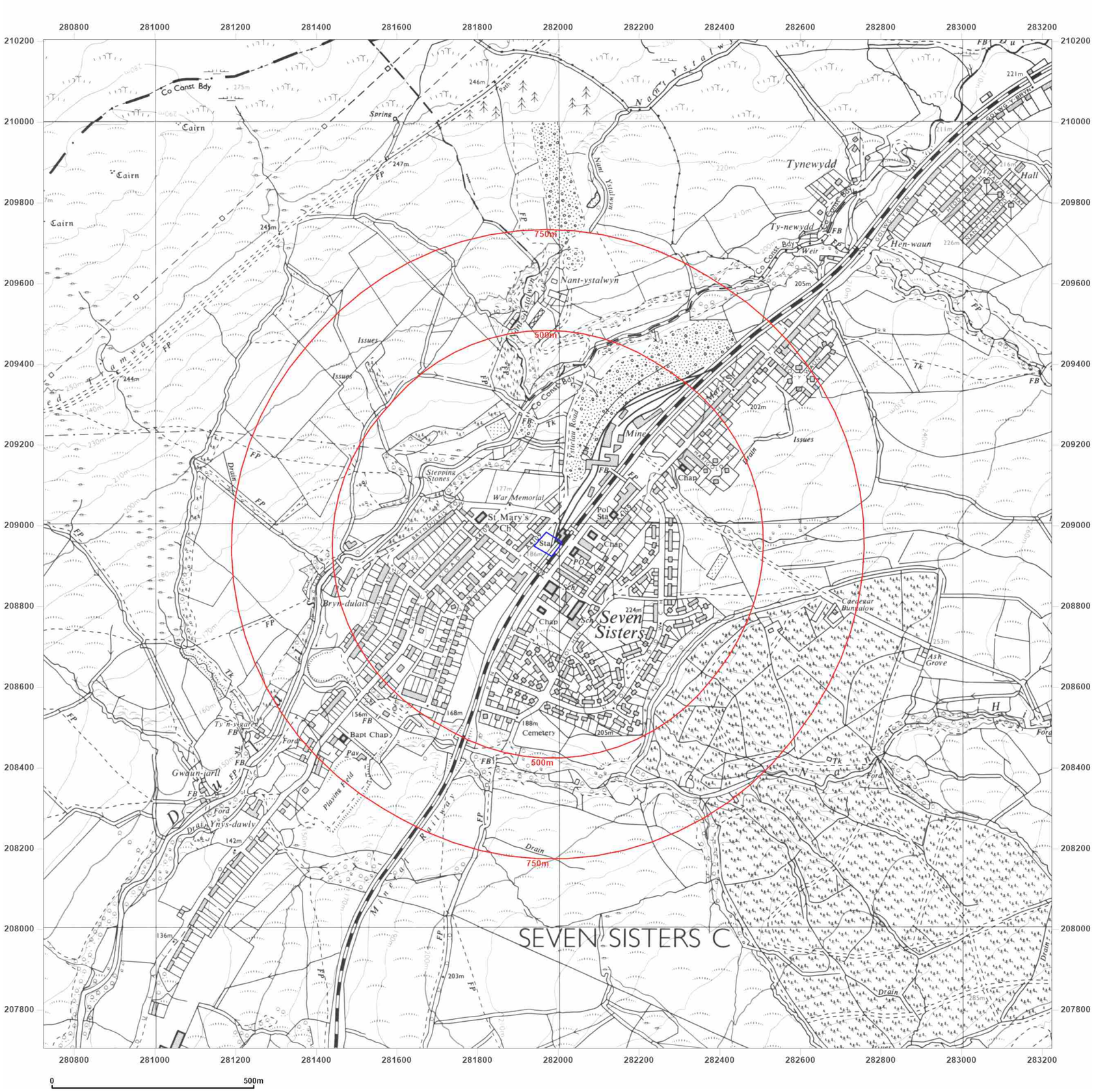
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Map date: **1987-1988**

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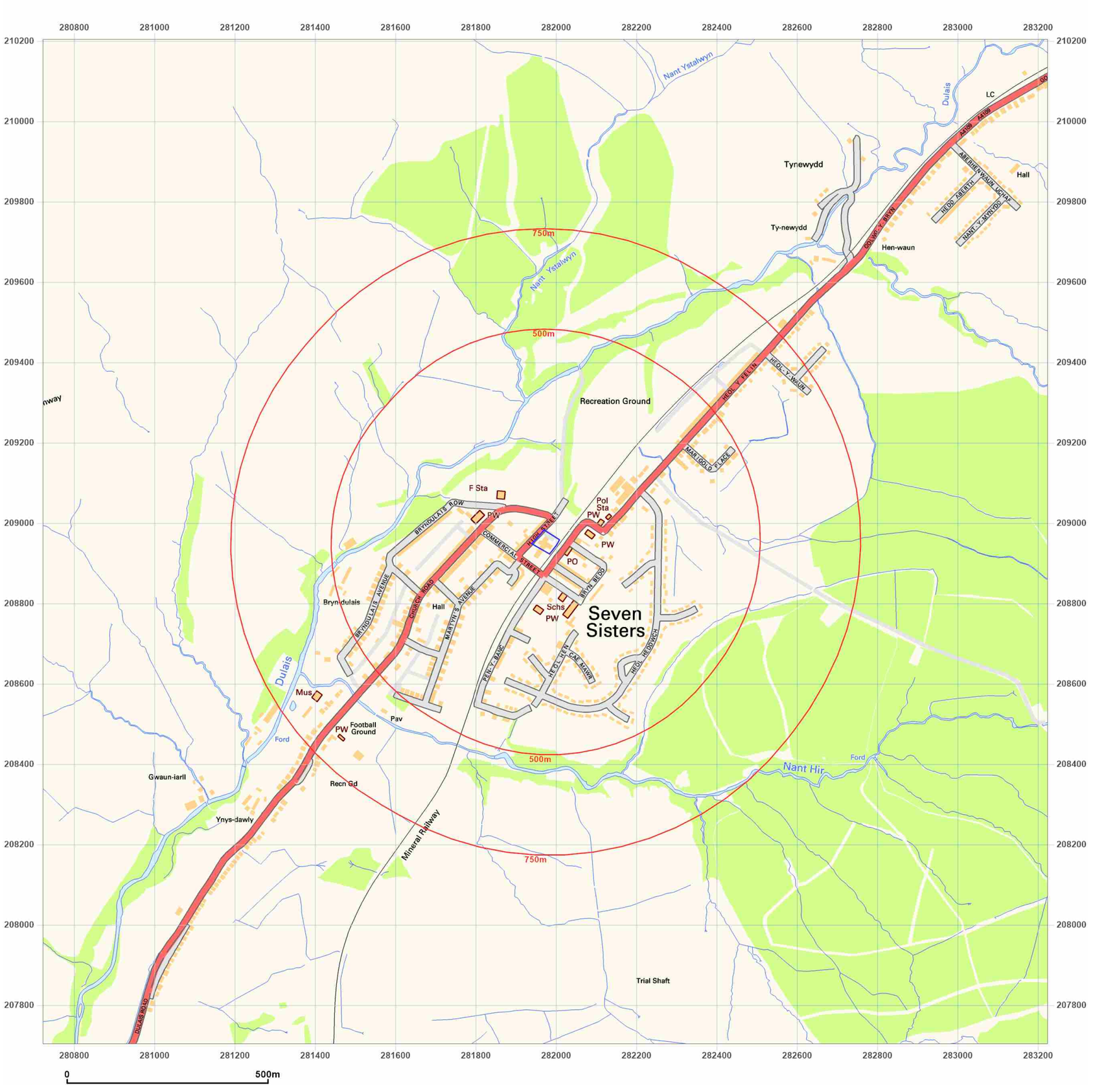
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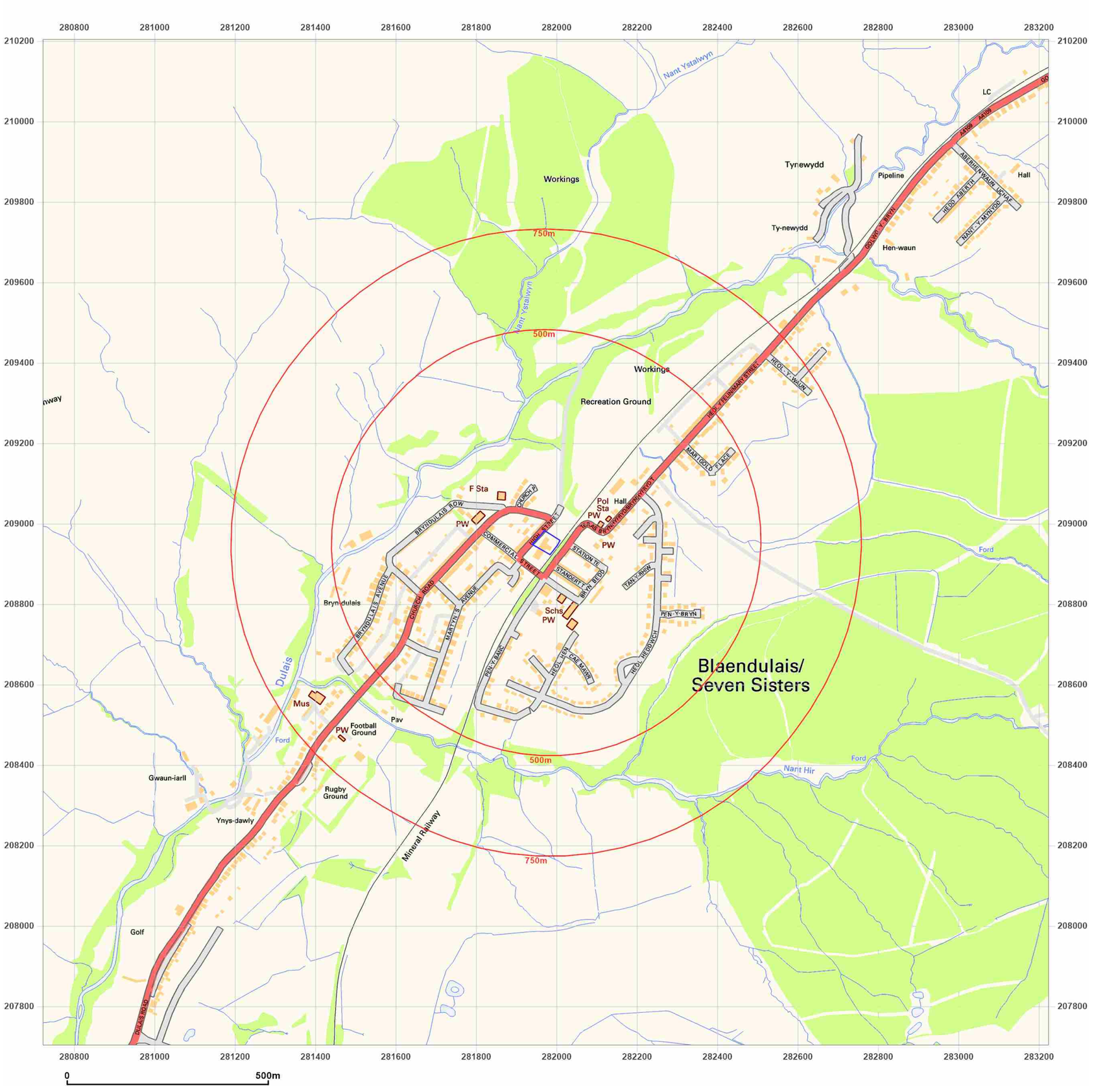
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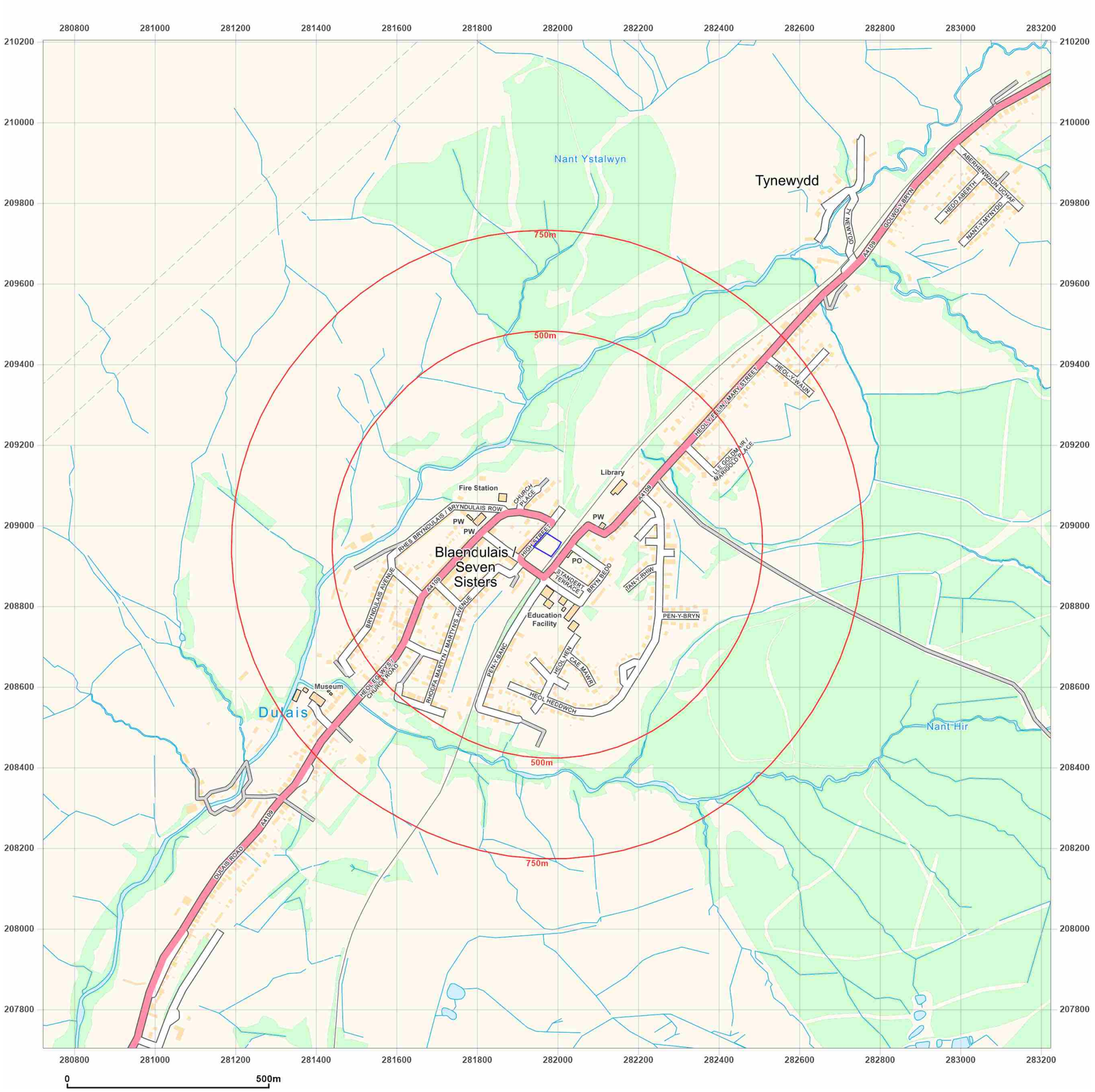
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Cyngor Castell-nedd Port Talbot
Neath Port Talbot Council

Blaendulais

Ground Investigation Report








July 2022

DRAFT

TETRA TECH

Ground Investigation Report

B035256
July, 2022

PRESENTED TO

Neath Port Talbot County Borough Council
The Quays,
Brunel Way,
Neath,
SA11 2GG

PRESENTED BY

Tetra Tech EPT Ltd
5th Flr, Longcross Court
47 Newport Road
Cardiff
CF24 0AD
029 20 829 200
tetratecheurope.com

Prepared by:

James Craddock **May 2022**
Geo-environmental Consultant

Reviewed by:

Nicholas Bool June 2022
Principal Geo-environmental Engineer

Authorised by:

Chris Pugh **June 2022**
Technical Director

EXECUTIVE SUMMARY

The Site	The site is located within the town of Seven Sisters, which is approximately 12 miles northeast of Port Talbot. The site is approximately 0.228ha in area and is centered on National Grid reference (NGR) SN 81942 08914. The approximate postcode for the site is SA10 9DN. The site address is Land opposite, 4 High St, Seven Sisters, Neath SA10 9DN. The site remained undeveloped until circa 1918 when several buildings (unknown uses) appeared on the northern and north-western parts of the site. These remained until a block of residential flats were built sometime between 1962 and 1987. It is anticipated that these flats, following construction, remained relatively unchanged. A small building is shown the south west corner of the site, labelled as PC (Public Convenience), on maps from 1987 to 2003. The PC is not visible on Google Street view (captured May 2011), however, what appears to be an electrical sub-station is present in its location. The surrounding area is dominated by further residential and commercial properties which occupy the south eastern and north eastern site boundaries. The site is bounded to the east by a railway line which had already been constructed at the time of the first OS map publication in 1877 and the A4109 beyond.
Geology	The published geological map for the area, BGS Sheet 231 (1979), and the BGS GeoIndex Onshore online viewer (2021) show the north of the site to be located on recent Glaciofluvial deposits (Diamicton Till). The south of the site is not shown to contain superficial deposits. The underlying bedrock is indicated to comprise South Wales Middle Coal Measures Formation of Carboniferous age characterised by Mudstone, Siltstone and Sandstone. The Coal Authority report for the site indicates that the Gorllwyn Seam outcrops beneath the site and could have been subject to unrecorded shallow mining activities.
Site Investigation	The site investigation was undertaken between 16th and 19th May 2022and comprised: • Two combined dynamic sample and rotary open hole boreholes (BH01 and BH02) to a depth of 30metres, with sampling and SPTs in the upper 10metres. • Twelve windowless sample boreholes (WS01-WS12) to refusal at depths ranging between 0.4 and 2.9m bgl, with regular SPTs and samples taken. • One day of soakaway testing in two trial pits (TP03 and TP04) at depths of 1.4m bgl and 1.1m bgl. • Five TRL DCP locations to obtain indicative CBR values around the site. • Installation of gas/groundwater monitoring standpipes within both boreholes and one windowless sample borehole (WS08). • 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.

Ground Conditions	The sequence of strata encountered beneath the site comprised; • Topsoil • Made Ground – comprising general building demolition material or colliery spoil • Glaciofluvial deposits (Diamicton Till). • South Wales Middle Coal Measures Formation (Mudstone, Siltstone and Sandstone)
Geotechnical Assessment	Traditional shallow foundations (pad or strip) placed with Glacial Deposits may be designed to an allowable net bearing capacity of 120kPa which will result in settlement of no more than 25mm for foundations of no more than 0.50m wide. Given the presence of a significant thickness of variable made ground across the site, the use of suspended floor slabs is recommended. For buried concrete the Design Sulphate Class for the site can be taken as DS-2 and the Aggressive Chemical Environment for Concrete (ACEC) site classification can be taken as AC-2. Dewatering of temporary excavations may not be required but should be anticipated during winter months. A conservative CBR value of 5% is recommended for preliminary pavement design. A number of concrete obstructions were observed across the site including within the proposed building footprint. It will likely be necessary to grub out the existing foundations to allow for construction of any new foundations.
Coal Mining Risk Assessment	The risk assessment indicates that there is a Low Risk of ground instability as a result of deep or shallow recorded/unrecorded mining and mining geology beneath the site. Following the drilling of two rotary openhole boreholes no workings were encountered in the Gorwllyn seam.
Ground Contamination Assessment	Laboratory testing has recorded a limited number of exceedances on beryllium and arsenic, however within the context of the proposed development and the predominant hard standing the recorded concentrations are not considered to pose a significant risk to site users. Elevated concentrations of PAH have also been recorded in the soil derived leachate samples, with a single PAH compound identified within groundwater. However, given the limited nature of the exceedances and the low permeability of the subsurface strata the recorded concentrations are not considered to pose a risk to controlled waters.
Ground Gas Assessment	Ground gas monitoring undertaken on the site has recorded limited concentrations of carbon dioxide and methane within the subsurface. The site has been defined as a Characteristic Situation 1 (Very Low risk) whereby no ground gas protection measures are considered necessary within the context of the proposed development.
Conclusions and Recommendations	Based on the findings of the ground investigation, the following recommendations are outlined: • A Reactive Strategy should be developed for the site to outline the requirements for identification, assessment and management of any areas of

previously unidentified contamination encountered during the development phase;

- Movement of materials on the site should be undertaken in conjunction with a Materials Management Plan in line with the recommendations in the CL:AIRE Code of Practice to confirm any materials utilised on site are geotechnically and chemically suitable for re-use and to ensure all materials leaving site are disposed of at a suitable waste disposal facility;
- It remains the responsibility of the contractor as waste producer to classify any waste materials and identify a suitable off site disposal facility.
- A number of subsurface obstructions were encountered during the ground investigation thought to related to the previous land use as residential flats or the raised embankment on the southern site boundary to provide road access of the railway line. Considerable breaking out of these obstructions cannot be discounted during the construction phase to allow for the construction of new foundations or grubbing out for new areas of hardstanding and associated access.

TABLE OF CONTENTS

1.0 INTRODUCTION 1
1.1 Instruction 1
1.2 Brief 1
1.3 Proposed Development 1
1.4 Report Scope 1
1.5 Limitations 2
2.0 SUMMARY OF SITE INFORMATION 3
2.1 Location 3
2.2 General area context 3
2.3 Site Description 3
2.4 Geology, Hydrogeology, Hydrology and Radon 3
2.4.1 Geology 3
2.4.2 Hydrogeology 4
2.4.3 Radon 4
2.5 Summary of Site History 4
3.0 SITE INVESTIGATION 5
3.1 Scope 5
3.2 Changes in Scope 5
4.0 GROUND CONDITIONS ENCOUNTERED 6
4.1 Strata Encountered 6
4.1.1 Topsoil 7
4.1.2 Made Ground 7
4.1.3 Glacial Deposits 7
4.1.4 Bedrock – South Wales Middle Coal Formation 7
4.2 Groundwater 7
4.3 In Situ Testing 8
4.3.1 Standard Penetration Testing 8
4.3.2 TRL probes 8
4.3.3 Soil Infiltration Testing 8
4.4 Visual or Olfactory Evidence of Contamination 8
4.5 Obstructions 9
5.0 LABORATORY TESTING 10
5.1 Geotechnical Testing 10
5.2 Environmental Testing 10
6.0 GROUNDWATER AND GAS MONITORING 12

6.1 Groundwater Monitoring....12
6.2 Ground Gas Monitoring....12
7.0 SOIL INFILTRATION TESTING....13
7.1 Background....13
7.2 Test Locations....13
7.3 Soil Infiltration Tests....13
7.4 Ground Conditions....14
7.4.1 Depth to groundwater....14
7.4.2 Strata Type....14
7.4.3 Ground Contamination....14
7.5 Constraints and Limitations....14
8.0 COAL MINING RISK ASSESSMENT....15
8.1 Proposed Development.... **Error! Bookmark not defined.**
8.2 Remediation of mine workings.... **Error! Bookmark not defined.**
8.3 Risk assessment and mitigation strategy....16
8.4 Risk assessment and mitigation strategy....25
9.0 GEOTECHNICAL ASSESSMENT....26
9.1 Soil Properties....26
9.1.1 Made Ground....26
9.1.2 Glacial Till (Fine Grained)....26
9.1.3 Glacial Till (Coarse Grained)....27
9.1.4 South Wales Middle Coal Measures Formation....27
10.0 GEOTECHNICAL DESIGN CONSIDERATIONS....28
10.1 Proposed Development....28
10.2 Earthworks....28
10.3 Foundations....28
10.4 Floor Slabs....28
10.5 Chemical Attack on Buried Concrete....28
10.6 Temporary Works....29
10.7 Pavements....29
10.8 Drainage....29
11.0 GROUND CONTAMINATION ASSESSMENT – HUMAN HEALTH....26
11.1 Introduction....26
11.2 Assessment Criteria....26
11.2.1 Generic Assessment Criteria....26
11.2.2 Proposed End Use....27
11.2.3 Soil Organic Matter....27

11.3 Tier 1 – Soil Screening 27
11.4 Asbestos 27
11.4.1 Distribution of Asbestos Identifications ..... **Error! Bookmark not defined.**
12.0 GROUND CONTAMINATION ASSESSMENT – WIDER ENVIRONMENT 28
12.1 Introduction 28
12.2 Assessment Criteria 28
12.2.1 Bioavailability 28
12.3 Soil Derived Leachate Methodology 28
12.4 Tier 1 Screening Assessment – Soil Derived Leachate 29
12.5 Tier 1 Screening Assessment – Groundwater 29
13.0 PRELIMINARY GROUND GAS ASSESSMENT 31
13.1 Introduction 31
13.1.1 Ground Gas Monitoring 31
13.1.2 Land Gas Risk Assessment Methodology 31
13.2 Preliminary Ground Gas Risk Assessment 32
13.2.1 Conceptual Site Model 32
13.2.2 Risk Assessment – Methane and Carbon Dioxide 32
13.2.3 Carbon Monoxide and Hydrogen Sulphide 33
13.2.4 Atmospheric Pressure Trends 33
13.3 Summary and Discussion 33
14.0 WASTE CLASSIFICATION ASSESSMENT 34
14.1.1 Waste Classification 34
14.1.2 Waste Acceptance Criteria 34
14.1.3 Waste Recommendations ..... **Error! Bookmark not defined.**
14.1.4 Materials Management 34
15.0 CONCEPTUAL SITE MODEL AND PRELIMINARY GROUND CONTAMINATION RISK ASSESSMENT 35
15.1 Overview 35
15.2 Current Site Usage and Proposed Development 35
15.3 Conceptual Site Model 35
15.3.1 Potential Sources of Contamination 35
15.3.2 Potential Contaminant Pathways 36
15.3.3 Potential Receptors at Risk 36
15.4 Ground Conditions Risk Assessment 36
16.0 CONCLUSIONS AND RECOMMENDATIONS 39
16.1 Ground Contamination 39
16.1.1 Summary 39

16.1.2 Asbestos 39
16.1.3 Ground Gas 39
16.1.4 Waste 39
16.2 Geotechnical 39
16.3 Soil Infiltration Testing 40
16.4 Recommendations 40
16.4.1 Potential Constraints 40
17.0 NOTES 41
18.0 REFERENCES 42
FIGURES 43
PLATES 48
APPENDICES 49

LIST OF TABLES

Table 2-1 - Surrounding land uses 3
Table 4-1 – Summary of Ground Conditions Encountered 6
Table 4-2 – Summary of Soil Infiltration Testing 8
Table 5-1 - Summary of Geotechnical Testing 10
Table 5-2 - Summary of Environmental Testing 10
Table 6-1- Summary of groundwater levels 12
Table 6-2 – Summary of phase 1 Ground Gas monitoring 12
Table 7-1 Summary of Soil Infiltration Test Locations 13
Table 7-2 Summary of Soil Infiltration Test Results 14
Table 9-1 Summary of Coal Mining Legacy Beneath the Site ..... **Error! Bookmark not defined.**
Table 9-2 – Coal Mining Risk Categories 17
Table 9-1 - Summary of test results within the Made Ground 26
Table 8-2 - Summary of test results within the fine grained Glacial Till deposits 26
Table 10-1 - Summary of Constituents of Concern 27
Table 10-2 – Summary of Asbestos Quantification ..... **Error! Bookmark not defined.**
Table 11-1 – Summary of Exceedances within Soil Derived Leachate Samples 29
Table 11-2 – M-BAT adjusted Screening Values for Heavy Metals – Soil Derived Leachate... **Error! Bookmark not defined.**
Table 11-3 – Summary of Exceedances within Groundwater Samples 29
Table 11-4 – M-BAT adjusted Screening Values for Heavy Metals – Groundwater 30
Table 12-1 –GSV Classification (Modified Wilson and Card Methodology) 32
Table 12-2 –NHBC Traffic Light Classification ..... **Error! Bookmark not defined.**
Table 12-3 – Initial GSV Calculations 33
Table 14-1 –- Potential Sources of Contamination ..... **Error! Bookmark not defined.**
Table 14-2 – CIRIA C552 Qualitative Risk Assessment 37

LIST OF FIGURES

Figure 1- Site Location Plan 44
Figure 2 – Site Investigation Layout Plan 45
Figure 3 – SPT N Value Plot 46

APPENDICES

APPENDIX A – REPORT CONDITIONS 50
APPENDIX B – EXPLORATORY HOLE LOGS 52
APPENDIX C – TRL PROBE TEST RESULTS 53
APPENDIX D – SOIL INFILTRATION TEST RESULTS 54
APPENDIX E – GEOTECHNICAL LABORATORY TEST RESULTS 55
APPENDIX F – CHEMICAL LABORATORY TEST RESULTS 56
APPENDIX G – GROUNDWATER AND GROUND GAS MONITORING DATA 57
APPENDIX H – HAZWASTE ONLINE WASTE CLASSIFICATION REPORT 58
APPENDIX I – CIRIA C552 RISK METHODOLOGY 59

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
AOD	above Ordnance Datum

1.0 INTRODUCTION

1.1 INSTRUCTION

Tetra Tech Environment Planning Transport Ltd (Tt) was commissioned by Neath Port Talbot County Borough Council to undertake a ground investigation for a site known as Blaendulais (known hereafter as “the site”).

The location of the site is shown on Figure 1.

1.2 BRIEF

The brief was to provide an intrusive ground investigation to provide information on the ground conditions and enable a geotechnical assessment and contaminated land risk assessment to support the proposed development of the site.

The work was designed to comprise the following elements:

- Twelve window sample boreholes to a maximum depth of 5.00m bgl with Standard Penetration Tests (SPTs) conducted at 1m intervals throughout the full depth of the holes;
- Two mechanically excavated trial pits to facilitate infiltration tests undertaken to BRE 365;
- Two combined dynamic sample, rotary core and rotary open hole boreholes to a depth of 30metres, with sampling and SPTs in the upper 10 metres;
- Five TRL DCP locations to obtain indicative CBR values around the site;
- Installation of three ground gas and groundwater monitoring wells;
- 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;
- Three return visits to monitor ground gas and groundwater levels;
- Preparation of a Ground Investigation report.

1.3 PROPOSED DEVELOPMENT

It is understood that the proposed development will involve construction of a childcare unit with areas of hardstanding for parking.

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;
- Interpretation of Geotechnical and Environmental laboratory data, including a qualitative ground contamination risk assessment (compliant with CIRIA 552 (CIRIA, 2001) methodology);
- An executive summary of the report to allow a rapid, layman's overview.

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 Neath Port Talbot County Borough Council 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 SUMMARY OF SITE INFORMATION

2.1 LOCATION

The site is located within the town of Seven Sisters, which is approximately 12 miles northeast of Port Talbot. The site is approximately 0.228ha in area and is centered on National Grid reference (NGR) SN 81942 08914.

The approximate postcode for the site is SA10 9DN.

The site address is Land opposite 4 High St, Seven Sisters, Neath SA10 9DN.

A site location plan is presented in Figure 1.

2.2 GENERAL AREA CONTEXT

Table 2-1 - Surrounding land uses

	Description
North	Series of residential and commercial properties
East	Railway line is situated along the eastern boundary with the A4109 beyond.
South	High Street and residential and commercial properties beyond.
West	High Street and residential and commercial properties beyond.

2.3 SITE DESCRIPTION

The site is currently unused however an existing electrical substation is situated in the southwest of the site. The whole site is generally overgrown by bramble, immature trees, long grass and other shrubs and is classified as a Brownfield site. There are also numerous mature trees around the boundaries of the site. The overall topography of the site is generally flat with localised terracing. The highest point being situated on the southern boundary of the site. The site slopes down to the northeast and flattens off for approximately 5m, then is stepped again parallel with the southern boundary of the site. The remainder of the site is relatively flat. It is a reasonable assumption that the stepped nature of the site is due to the construction the adjacent road (Commercial Street) to the south, which rises to provide access over the railway line.

2.4 GEOLOGY, HYDROGEOLOGY, HYDROLOGY AND RADON

2.4.1 Geology

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

- British Geological Survey (BGS) Sheet No.231 Merthyr Tydfil Solid and Drift Edition / Solid Edition etc, 1:50 000 or 1:63,000 scale;
- BGS website (British Geological Survey, 2022); accessed 07/06/2022;
- Coal Authority Interactive Mapper (The Coal Authority, 2021), accessed 07/06/2022.

Made Ground

The BGS interactive mapping does not show the presence of any Made Ground on site. However, due to the known site history and the site being classified as a Brownfield site, Made Ground is anticipated to present beneath the surface across the site. The Made Ground is likely to be comprised of building demolition rubble.

Superficial Geology

The BGS Geoindex indicates that the superficial deposits are present in the northern part of the site. The superficial deposits on site are anticipated to comprise of Glaciofluvial deposits (Diamicton Till). These deposits are sedimentary deposits and glacigenic in origin. They are detrital, created by the action of ice and meltwater, they can form a wide range of deposits.

Solid Geology

The BGS Geoindex indicates that the solid geology underlying the site is comprised of the South Wales Middle Coal Measures Formation (Mudstone, Siltstone and Sandstone) of Carboniferous Age. The BGS Geoindex describes the formation as *"grey, (productive) coal-bearing mudstones/siltstones, with seatearths and minor sandstones".*

The hard copy Geological Survey of Great Britain Merthyr Tydfil map (Sheet 231 1:50,000 Series Drift or Solid) shows a mine entry to the north of the site (circa 100m) with some artificial ground beyond. No coal outcrops are shown to be present beneath the site and the regional geological dip is indicated to be 10 degrees to the south southwest.

The online Coal Authority Interactive map differs to the Geological map and indicates a proved coal seam outcropping beneath the site, trending south-southwest to north northeast close to the western boundary of the site and dipping to the right (east). This is also confirmed in the Coal Authority Report Consultant report, although the seam is indicated to stop circa 50m north of the site. The seam is identified as the Gorllwyn, workable with a bearing of 36 degrees.

2.4.2 Hydrogeology

The South Wales Middle Coal Measures Formation is designated as a Secondary A Aquifer. These are permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers.

The Superficial Deposits of Diamicton Till are 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.

2.4.3 Radon

The BRE document 211 (Scivyer, 2015) mapping coverage for the site area was consulted and indicates that the site is located within an area where no radon protection measures are required for new developments. The entirety of the site is situated within an area where less than 1% of homes are above the action level.

2.5 SUMMARY OF SITE HISTORY

A Desktop study has been previously undertaken by SOCOTEC (Phase 1) and was supplied to Tetra Tech as part of the tender documentation. The site history was outlined in Section 5 of the Socotec report which is summarised below.

The site remained undeveloped until circa 1918 when several buildings (unknown uses) appeared on the northern and north-western parts of the site. These remained until a block of residential flats were built sometime between 1962 and 1987. It is anticipated that these flats, following construction, remained relatively unchanged. A small building is shown the south west corner of the site, labelled as PC (Public Convenience), on maps from 1987 to 2003. The PC is not visible on Google Street view (captured May 2011), however, what appears to be an electrical sub-station is present in its location.

The surrounding area is dominated by further residential and commercial properties which occupy the south eastern and north eastern site boundaries. The site is bounded to the east by a railway line which had already been constructed at the time of the first OS map publication in 1877 and the A4109 beyond.

3.0 SITE INVESTIGATION

The site investigation was undertaken between the 16th and 19th May 2022 and return monitoring visits were undertaken on 2nd, 9th and 15th June 2022 following the completion of the ground investigation.

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:

- Two combined dynamic sample and rotary open hole boreholes (BH01 and BH02) to a depth of 30metres with SPTs.
- Twelve windowless sample boreholes (WS01-WS12) to refusal at depths ranging between 0.4 and 2.9m bgl, with regular SPTs and samples taken.
- One day of soakaway testing in two trial pits (TP03 and TP04) at depths of 1.4m bgl and 1.1m bgl.
- Five TRL DCP locations to obtain indicative CBR values around the site.
- Installation of gas/groundwater monitoring standpipes within both boreholes and one windowless sample borehole (WS08).
- On-site inspection and logging of recovered samples;
- Representative soil samples taken and submitted for geotechnical classification testing;
- Representative soil samples taken, submitted and tested for a suite of potential contaminants;
- Three return visits to monitor ground gas and groundwater levels.

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.

3.2 CHANGES IN SCOPE

Trial pits TP01 and TP02 both encountered probable concrete at depths of 0.6 and 0.7m bgl. Both were re-located and excavated as TP03 and TP04.

4.0 GROUND CONDITIONS ENCOUNTERED

4.1 STRATA ENCOUNTERED

The sequence of strata encountered beneath the site was;

- Topsoil
- Made Ground
- Superficial Glacial Till Deposits
- South Wales Middle Coal Formation

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	Glacial Till Deposits	South Wales Middle Coal Measures
BH01	Ne	0.00 – 1.50	1.50 – 3.50	3.50 – 30.00
BH02	Ne	0.00 – 1.70	1.70 – 3.00	3.00 – 30.00
TP01	Ne	0.00 -0.60	Ne	Ne
TP02	Ne	0.00 -0.70	Ne	Ne
TP03	Ne	0.00 – 0.80	0.80 – 1.40	Ne
TP04	0.00 – 0.30	0.30 – 1.10	Ne	Ne
WS01	Ne	0.00 – 1.10	1.10 – 1.60	Ne
WS02	Ne	0.00 – 2.90	Ne	Ne
WS03	Ne	0.00 – 1.80	Ne	Ne
WS04	Ne	0.00 – 1.60	1.60 – 2.60	Ne
WS05	Ne	0.00 – 1.00	Ne	Ne
WS06	Ne	0.00 - 0.55	Ne	Ne
WS07	Ne	0.00 – 1.00	Ne	Ne
WS08	Ne	0.00 – 1.85	1.85 – 2.80	Ne
WS09	Ne	0.00 – 0.40	Ne	Ne
WS09A	Ne	0.00 – 1.00	Ne	Ne
WS10	Ne	0.00 -0.50	Ne	Ne
WS11	Ne	0.00 – 1.00	Ne	Ne
WS12	Ne	0.00 -0.90	Ne	Ne

4.1.1 Topsoil

Topsoil was encountered in one exploratory hole (TP04) position to a depth of 0.30mbgl and was described as "*Dark brown slightly sandy gravelly CLAY. Sand is fine to coarse. Gravel is angular to subangular of sandstone and limestone.*"

4.1.2 Made Ground

Made Ground was encountered in all the exploratory positions to a maximum depth of 2.90mbgl (WS02, base not proven. These soils were found to be variable in composition and comprised:

- Soft to firm, dark greyish brown, sandy gravelly clay with gravel of brick, concrete, sandstone, mudstone and old building material. 9plastic and metal)
- Light brown sandy cobbly gravel of concrete, brick and old building materials.
- Loose to dense dark brownish black silty sandy gravel of concrete, sandstone, mudstone, rare brick and occasional colliery spoil with low cobble content of the same.

4.1.3 Glacial Deposits

Glacial fluvial deposits were encountered in six exploratory hole positions that penetrated the full thickness of made ground at depths ranging between 0.8 to 1.85m bgl. The thickness of the Glacial fluvial deposits was only proved in the deep boreholes at depths of 3.0m and 3.50m bgl. These soils were found to be variable in composition comprising both fine grained (cohesive) and coarse grained (granular) soils.

The fine grained soils were typically recorded as firm and stiff mottled orangish grey brown sandy gravelly clay.

The coarse grained soils were recorded as medium dense and dense orangish brown clayey sandy gravel or orangish grey brown clayey gravelly sand.

4.1.4 Bedrock – South Wales Middle Coal Formation

Bedrock of South Wales Middle Coal Formation deposits was encountered in the two deep borehole positions at depths of 3.0m and 3.5m bgl. These rocks, were recorded as dark brown medium hard to hard inter bedded mudstone, sandstone and siltstone

Small traces of thin coal seams (>10cm thick) were recorded in BH01 at 5m and 10.2m bgl and in BH02 at 5 mbgl. No other coals seams, backfilled workings or voids were recorded Broken sandstone was recorded in BH02 between 12.0 and 12.3m bgl. .

4.2 GROUNDWATER

Groundwater was encountered in BH01, BH02, TP01 and BH12. Summarised below.

Hole ID	Water Strike Depth (mbgl)	Depth of water after 20 minutes (mbgl)
BH01	3.30	3.30
BH02	5.00	4.95

	8.50	8.50
TP01	0.60	0.55
WS12	0.90	0.88

4.3 IN SITU TESTING

4.3.1 Standard Penetration Testing

Standard Penetration Tests, using a solid cone, were undertaken in two of the boreholes every 1.50m to a maximum depth of 6.50m, and every 1.00m in the dynamic window sample locations, in accordance with BS EN ISO 22476-3 (2005) and BS5930 (2015) to assess the relative density of the superficial deposits encountered within the boreholes.

As stipulated by BS5930:2015, the SPT N-values represented on the borehole logs are the uncorrected results which were obtained in the field, and these are presented on the boreholes logs in Appendix D.

4.3.2 TRL probes

DCP probing to provide California Bearing Ratio values for pavement design was undertaken in five exploratory positions up to 1.0m bgl adjacent to WS01, WS04, WS06, WS07and WS11 where areas of hardstanding have been proposed.

Results are presented in Appendix E.

4.3.3 Soil Infiltration Testing

Two soil infiltration tests were carried out, designated as TP03 and TP04. The tests were undertaken within the Glacial-alluvial deposits and Made Ground. The results of these tests can be found in Appendix D and are summarised in the table below.

Table 4-2 – Summary of Soil Infiltration Testing

Location	Depth	Strata	Hydraulic Conductivity (m/sec)
			Test 1
TP03	0.80 – 1.40	GLACIAL ALLUVIAL	FAILED water level did not fall below the 75% volume line after 6 hours of testing. To record a result the water level is required to fall to 25% of the pits volume.
TP04	0.50 – 1.10	MADE GROUND	FAILED water level did not fall below the 75% volume line after 6 hours of testing. To record a result the water level is required to fall to 25% of the pits volume.

4.4 VISUAL OR OLFACTORY EVIDENCE OF CONTAMINATION

No evidence of contamination.

4.5 OBSTRUCTIONS

A number of the exploratory holes refused shallow on hard strata. Although not visible in many of the boreholes it is suspected that some of these refusals are due to historic concrete slabs or slabs related to the previous buildings on the site. Concrete was encountered in BH02 at 0.40m bgl which stopped the hand pitting requiring the rotary rig to progress through the concrete layer to 0.60m bgl.

TP01 also encountered concrete and a small orange 60mm pipe (drainage) at 0.60mbgl. The hole was terminated on this concrete obstruction.

WS08 and WS04 located on the raised site area on the southern boundary of the site that allows the road to climb over the railway line had refusals in the hand pits due to concrete slab at a depth of 0.20m. These were relocated away from the edge of the embankment closer to the roadside to get allow progress to a reasonable depth before further refusal.

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 E.

Table 5-1 - Summary of Geotechnical Testing

Test	No.	Test Method
Moisture Content	5	BS1377:1990 Part 2:3.2
4 Point Liquid & Plastic Limit	5	BS1377:1990 Part 2:4.3&5.3
PSD: Wet Sieve method	5	BS1377:1990 Part 2:9.2
PSD: Sedimentation by Pipette	3	BS1377:1990 Part 2:9.4
BRE Digest SD1 Suite D (Brownfield site – pyrite present Total Sulphate, Water Soluble Sulphate, Total Sulphur, Water Soluble Nitrate, Water Soluble Chloride, Water Soluble Magnesium and pH determination)	5	BRE SD1:2005

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 F.

Table 5-2 - Summary of Environmental Testing

Test suite	No.
<u>Soil Samples:</u> • Tetra Tech Suite C ○ Heavy metals including Chromium (Hexavalent), Boron (water soluble), Arsenic, Beryllium, Cadmium, Chromium, Copper, Lead, Mercury, Nickel, Selenium, Vanadium and Zinc; ○ Inorganics – including pH, Water soluble Sulphate as SO_4 (2:1 Extract), Cyanide (Easily liberatable- low level); ○ Speciated Petroleum Hydrocarbons (TPH CWG); ○ Speciated Polyaromatic Hydrocarbons (USEPA 16); ○ BTEX and MTBE;	5

○ Asbestos Screen; and, ○ Phenol.	
<u>Soil Derived Leachate Samples and Groundwater Suites</u> • Tetra Tech Leachate Suite C ○ Heavy metals including Antimony, Boron, Arsenic, Beryllium, Cadmium, Chromium, Copper, Lead, Mercury, Nickel, Selenium and Zinc; ○ Inorganics – including pH, Sulphate, Chloride, Nitrite, Nitrate, Total Cyanide, Ammoniacal Nitrogen and NH_3 and NH_4 and Total Alkalinity ○ Speciated Petroleum Hydrocarbons (TPH CWG); ○ Speciated Polyaromatic Hydrocarbons (USEPA 16); ○ BTEX and MTBE; ○ Phenol.	2

6.0 GROUNDWATER AND GAS MONITORING

6.1 GROUNDWATER MONITORING

Groundwater levels were monitored on three occasions following the completion of the ground investigation, on 2nd, 9th, and 15th June. The monitoring data is presented in Appendix G and summarised in **Error! Not a valid bookmark self-reference.** below.

Table 6-1- Summary of groundwater levels

Location	Base of borehole (m bgl)	Depth to water (m bgl)		
		01/06/2022	09/06/2022	15/06/2022
BH01	6.00	3.40	3.40	4.12
BH02	3.40	3.30	3.30	Dry
WS08	1.00	Dry	Dry	Dry

6.2 GROUND GAS MONITORING

Ground gas levels were monitored on three occasions following the completion of the ground investigation, on 2nd, 9th, and 15th June. The monitoring data is presented in Appendix G and in **Error! Not a valid bookmark self-reference.** below.

Table 6-2 – Summary of phase 1 Ground Gas monitoring

Location	Max. Methane (peak) (% vol)	Max. Carbon Dioxide (peak) (% vol)	Min. Oxygen (steady) (% vol)	Max. Carbon Monoxide (steady) (ppm)	Max. Hydrogen Sulphide (steady) (ppm)	Max. Borehole flow (peak) (l/h)
BH01	<0.10	0.80	14.30	<1	<1	0.20
BH02	<0.10	0.90	14.10	<1	<1	0.10
WS08	<0.10	0.60	14.30	<1	<1	0.20

The results indicate measurable concentrations of carbon dioxide (maximum of 0.90%/vol in BH02l) and methane (maximum 0.10%/vol in all exploratory locations).

The maximum gas flow recorded across the monitoring round was a flow of 0.20l/hr, recorded at BH01 and WS08.

The monitoring rounds were undertaken during atmospheric pressure conditions ranging from 994mb to 998mb. A review of atmospheric pressure graphs on weatheronline.co.uk indicates that monitoring was undertaken during periods of steady pressure.

In addition, the ground gas monitoring results indicate hydrogen sulphide concentrations of <1 ppm across all monitoring rounds. Maximum concentrations of carbon monoxide of <1 ppm were recorded.

7.0 SOIL INFILTRATION TESTING

7.1 BACKGROUND

On 7th January 2019, the Welsh Government introduced Schedule 3 of the Flood and Water Management Act 2010 which requires new developments to consider the feasibility of Sustainable Drainage Systems (SuDS) at the design stage. New developments over 100m^2 or including more than one property must obtain approval of the drainage system from the SuDS Approval Body (SAB) prior to the commencement of construction.

To support the assessment study, preliminary soil infiltration testing has been undertaken as part of the site investigation to provide information on the potential infiltration rates within the sub-strata on the site.

Soil infiltration tests have been undertaken in line with BRE 365 (2016) methodology and any deviations from this approach are documented within the following section. Where possible, locations and depths of test pits were determined based on the proposed drainage design.

7.2 TEST LOCATIONS

Two soil infiltration tests were undertaken over a single day of testing. Initially the test locations were identified as TP01 and TP02 with a target depth of 1.50m bgl. Upon excavation of both locations, hard strata was encountered at 0.60m and 0.70m bgl. As a result, the trial pits were terminated with new locations excavated in order to find favorable ground conditions.

Test locations TP03 and TP04 were excavated to 1.40m and 1.10m bgl respectively and did not reach target depth due to encountering hard strata. Infiltration tests were undertaken at these locations with details summarised in table 7-1.

Test locations were securely fenced and covered until the testing period was completed and excavations backfilled in as dug order upon completion

7.3 SOIL INFILTRATION TESTS

Two soil infiltration tests were undertaken within a machine excavated trial pit as summarised in the following table.

Table 7-1 Summary of Soil Infiltration Test Locations

Test Location	Depth to Base (m bgl)	Top of Target Strata (m bgl)	Target strata
TP03	0.80	1.40	GLACIAL TILL
TP04	1.10	0.50	MADE GROUND

No repeat fills were undertaken within either test locations over one day of testing locations due to poor infiltration.

The results of the soil infiltration tests are presented in the following table. Full test results are included in Appendix D of this report.

Table 7-2 Summary of Soil Infiltration Test Results

Test Location	Soil Infiltration Rate (m/s)		
	Test 1	Test 2	Test 3
TP03	Failed	No test conducted	
TP04	Failed	No test conducted	

7.4 GROUND CONDITIONS

7.4.1 Depth to groundwater

Due to the shallow nature of the soil infiltration testing, a trial pit was not excavated adjacent to the test location to identify the groundwater level.

No water strikes were encountered in any of the inspection pits or the exploratory window sample locations. A water strike was encountered in both exploratory borehole locations (BH01 and BH02) at 3.40m bgl and 5.00m respectively with a second water strike being encountered in BH02 at 8.50m bgl.

TP01 also encountered groundwater seepage at a shallow depth of 0.60m bgl rising to 0.58m bgl over 20 minutes. Based on other exploratory hole locations and the strata encountered within TP01, it is likely that this was perched water.

Based on the findings of the fieldworks and post completion monitoring, it is anticipated that groundwater is at least 3.40m bgl or deeper. It should be noted that groundwater levels can vary seasonal and year on year and at the time of investigation the site was dry.

7.4.2 Strata Type

The Alluvial Deposits encountered in TP03 could generally be described as '*Mottled orangish grey sandy gravelly CLAY. Sand is fine to coarse. Gravel is angular to subrounded of sandstone, limestone and rare mudstone.'*

The Made Ground encountered in TP04 could generally be described *as 'light brown laminated weathered colliery shale.'*

Full draft logs of the exploratory pits are included in Appendix B.

7.4.3 Ground Contamination

Significant ground contamination was not identified as part of the ground investigation, a contamination assessment is presented in Sections 11.0 and 12.0.

7.5 CONSTRAINTS AND LIMITATIONS

The information presented above is intended to assess the feasibility of soakaway drainage in order to support the development of the drainage strategy. Further testing, groundwater monitoring and ground investigation may be required to support a full SAB application or to inform the development of the final design process.

Ground conditions can vary throughout the year, including the location of the groundwater table. Consideration should be given to the potential effects of seasonal variation when reviewing the data above. It should be noted that the entirety of the site was dry at the time of investigation.

8.0 COAL MINING RISK ASSESSMENT

At the time of writing the report, Tetra Tech is aware that the proposed development will include the development of a childcare unit (single storey) which will include hard standing areas for car parking and a bin store. It is current understood that the existing substation on site will remain.

All information collated on ground conditions is based on extrapolation from data available on adjacent sites and from literature sources. In summary, the following data sources have been consulted.

- Coal Authority Interactive Map Viewer 2022
- British Geological Survey (BGS) Sheet No. 247 (Swansea) Solid and Drift Edition, 1:50 000 and 1:10,560 scale;
- SOCOTEC Phase 1 Desk Study (report number H1061-21)
- Consultants Coal Mining Report (GS-8293535)
- British Geological Survey Geoindex Online Mapping
- British Geological Survey Borehole Database, comprising borehole logs of shafts and borehole records adjacent to the site.
- Tetra Tech records of borehole drilled on site.

8.1 BGS AND COAL AUTHORITY REPORT SUMMARY

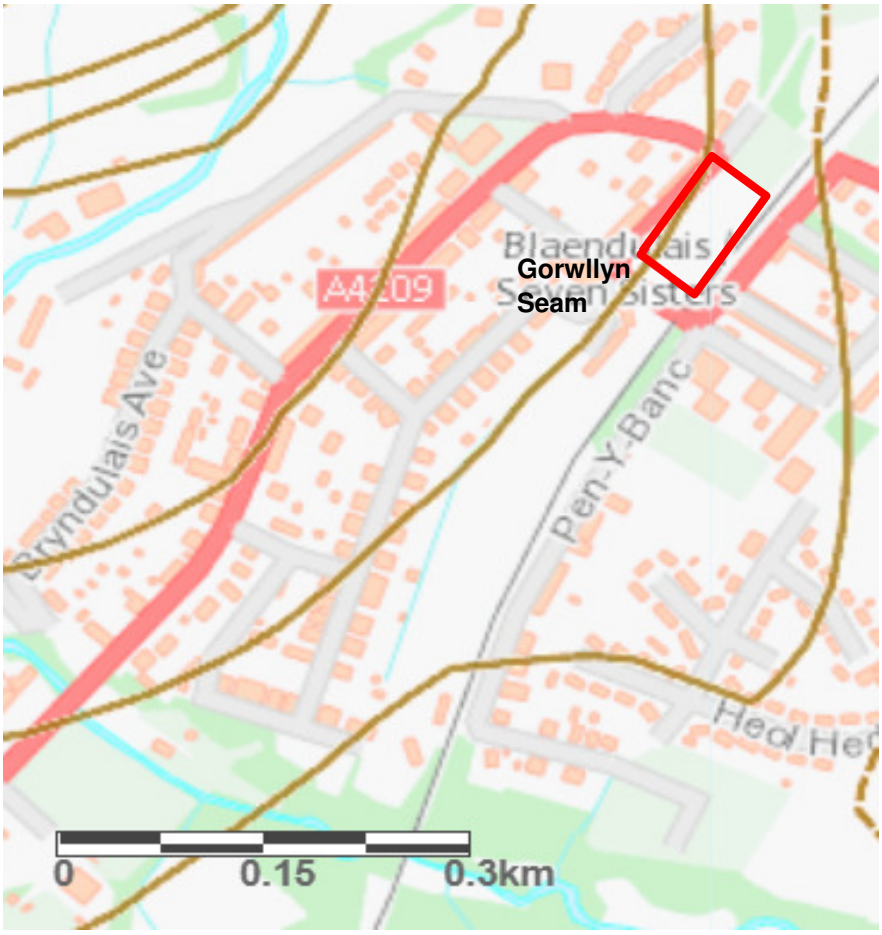
The Coal Authority Consultants Report (provided in Appendix I) states the following:

- Four coal seams lie beneath the property at a shallow depth to 150m depth and were last worked in 1944. Any movement in the ground due to coal mining activity associated with these workings should have stopped by now. In addition, the property is in an area where the Coal Authority believe there is coal at or close to the surface.
- The property also lies within in a surface area that could be affected by underground mining an outcrop seam of coal (Gorllywn).
- The Coal Authority believe that there are not probable unrecorded shallow workings on the site.
- Spine roadways have not been recorded at shallow depth.
- The site is not within influencing distance of current mining activity and the Coal Authority has no plans to grant licenses in the area relating to underground mining. However, reserves of coal exist in the local area which could be worked at some time in the future.
- There are no mine entries recorded within 100metres of the site boundary.
- The Coal Authority is not aware of any damage due to geological faults or other lines of weakness that may have been affected by coal mining.
- The site is not within a boundary of an opencast site from which coal has been removed by opencast methods.
- The property does not lie within 500 metres of the boundary of an opencast site from which coal is being removed by opencast methods and there are no licenses to remove coal by opencast method within.
- The Coal Authority has not received a damage notice or claim for the subject property or any property within 50m of the site since 31st October 1994.
- The Coal Authority has no record of a mine gas emission requiring action within 500m of the enquiry boundary.
- The property has not been subject to remedial works, by or on behalf of the Coal Authority, under its Emergency Surface Hazard Call Out procedures.
- The property is not in an area where a relevant notice has been published under the Coal Industry Act 1975/Coal Industry Act 1994.
- No notices have been given, under section 46 of the Coal Mining Subsidence Act 1991, stating that the land is at risk of subsidence.
- The property is not in an area where a notice to withdraw support. The property is not in an area where a notice has been given under section 41 of the Coal Industry Act 1994, cancelling the entitlement to withdraw support.

The Coal Authority interactive maps were consulted prior to the investigation and show the site to lie within a development high risk area.. The Coal Authority Report identified the following Coal Seams:

- Gorwllyn Coal Seam being present below the site, outcropping 36º. The direction of the outcrop and the thickness is not detailed within the report.

Extract 1: From Coal Authority Interactive Mapping



Given the probable presence of a shallow outcropping coal seam beneath the site, deep boreholes were undertaken as part of the investigation to locate the seam and identify if it had been previously worked.

8.2 RISK ASSESSMENT AND MITIGATION STRATEGY

Table 9-1 summarises the key hazards identified by review of the available data sources, the factors affecting risk posed by each hazard and an assessment of the estimated risk proposed to any redevelopment of the site.

Assessing risks from coal mining is based upon guidance provided by the Coal Authority following a 'risk based' approach implemented through PPG 14 – Development on Unstable Land.

The risk posed has been assessed as one of three categories.

High risk	Based upon the data available there is a significant risk of shallow ground instability associated with coal mining. Investigation will be required as part of the site re-development. Mitigation measures likely to be required.

Moderate risk	Based upon the data available there is a potentially significant risk of shallow ground instability associated with coal mining. Investigation will be required as part of the site re-development. Mitigation measures may be required.
Low risk	Based upon the data available there is a low risk of shallow ground instability associated with coal mining. No further assessment or investigation is recommended.

The table below summarises the potential risks associated with coal mining legacy at the site.

Table 8-1 – Coal Mining Risk Categories

Coal Mining Legacy	Yes	No	Risk Assessment
Underground coal and ironstone mining (recorded)	✓		Required
Shallow (<30m) underground coal and ironstone mining (recorded)	✓		Required
Underground coal and ironstone mining (unrecorded)	✓		Required
Shallow (<30m) underground coal and ironstone mining (unrecorded)	✓		Required
Recorded Mine entries (Shafts and adits)		x	Required
Coal and ironstone mining geology	✓		Required
Record of previous mine gas emissions		x	Not Required
Record of coal mining surface hazard		x	Not Required
Surface mining (recorded/unrecorded)		x	Not Required

Based on the information obtained from this assessment, the following risk assessment has been compiled (Table 8-2), which identifies plausible risks at the site that require mitigation in the context of the proposed end use.

Table 8-2 – Coal Mining Risk Assessment

Hazard	Area of site affected	Factors affecting risk	Risk estimate	Mitigation Recommendation	Risk estimate (post recommendation)
Collapse of workings (recorded and unrecorded) shallow coal seams <30m Coal Mining Seams	Entire Site	The Coal Authority believes that there is potential for coal at or close to the surface which may have been worked in the past from shallow depths (<30m). The Coal Authority recommends that the potential for such should be considered prior to development. The site is located on an outcrop of the Gorwllyn Coal Seam. The Coal Authority Interactive Mapping of the area shows a large part of the site to be in a high-risk development area. This is directly related to the outcropping coal seam that could have been subject to unrecorded mining activity.	Moderate	Drilling of two rotary openhole boreholes to a depth of 30m bgl to confirm whether the depth to the Gorllwyn Seam and whether it has been worked beneath the site at shallow depth. Thin coal seams (>10cm) were recorded in both boreholes at a depth of circa 5mbgl and in BH01 at 10.2m bgl. It is not conclusive whether these represent the Gorllwyn seam. No evidence of working or voiding was detected and given the recorded thickness is unlikely to have been worked. Broken ground was encountered in BH02 at 12.00 to 12.30m bgl. Due to the discreet thickness it is unlikely that this is a working and rather a zone of fractured sandstone. No further mitigation necessary.	Low

Collapse of workings (recorded and unrecorded) deep coal and ironstone seams.	Entire Site	The property is in a surface area that could be affected by underground mining of four seams from shallow (<30m) to 150m depth.	High	Coal seams are present beneath the site. Boreholes drilled to 30m bgl identified thin (>10) coal seams at shallow depth but did not identify any workings or voids. Deeper coal seams, even if worked, are unlikely to impact the surface. No further mitigation necessary.	Low

8.3 RISK ASSESSMENT AND MITIGATION STRATEGY

The risk assessment indicates that there is a **Low Risk** of ground instability as a result of deep or shallow recorded/unrecorded mining and mining geology beneath the site.

There are no recorded mine entries within 100m of the site boundary.

The Consultants Coal Mining Report indicates that the site is within an area of historical coal mining activity. If ground conditions encountered during development appear different to what is present herein, then a specialist should be contacted.

The Gorllwyn Seam was potentially identified in both boreholes (BH01 and BH02) at 5.00m bgl respectively and were found not to be worked.

No further mitigation is deemed necessary.

9.0 GEOTECHNICAL ASSESSMENT

9.1 SOIL PROPERTIES

The ranges of the various soil properties measured are discussed below, to aid in the selection of design values. However, the appropriate choice of characteristic and design values will depend on the particular analysis and design philosophy used and should be selected by the designer.

Where characteristic values are given, these are reasonably conservative estimates of a measured or assessed property that may be used to represent the overall behaviour of the material. Design values are similar but also take into account the ground-structure interaction for a given structure so need to be selected by the designer. It is recommended, however, that design values used do not exceed the characteristic values given in this report.

9.1.1 Made Ground

Made ground deposits were identified in all exploratory hole locations. The SPT-N vs Depth plot for the site is presented in Figure 4. A summary of the in-situ testing is presented below.

Table 9-1 - Summary of test results within the Made Ground

	No. of results	Range (min-max)	Average	Lower quartile	Upper quartile	Charact-eristic value+
SPT N Values	16	0 - 50	35	14	50	14
Undrained shear strength (kPa):						
- from SPT N values[1]	16	0 - 220	154	62	220	62

Notes:
+ suggested characteristic values are appropriate for most normal applications but designers should satisfy themselves that they are suitable for the specific application and design method they are using;
1 Estimated from a correlation by Stroud and Butler (1975)[4]

- The made ground soils are considered too variable to assign characteristic geotechnical values.

9.1.2 Glacial Till (Fine Grained)

Shallow fine grained Glacial Till deposits were identified within four exploratory hole locations immediately below the Made Ground/topsoil deposits and varied in thickness between 0.5m and 2.0m. A summary is presented in the table below.

Table 9-2 - Summary of test results within the fine grained Glacial Till deposits

	No. of results	Range (min-max)	Average	Lower quartile	Upper quartile	Charact-eristic value+
Natural moisture content (m - %)	5	7.6 - 21	14	7.7	18	18
Liquid limit (LL)	5	19 – 39	29	19	34	19

Plastic limit (PL)	5	11 – 16	14	11	16	14
Plasticity index (PI)	5	8 – 23	15	9	18	18
Modified Plasticity Index[1]	5	6 - 18	11	7	14	14
SPT N Values	5	9 – 50	36	19	50	19
Undrained shear strength (kPa):						
- from SPT N values[2]	5	40 - 220	176	154	220	40

Notes:
+ suggested characteristic values are appropriate for most normal applications but designers should satisfy themselves that they are suitable for the specific application and design method they are using;
* Estimated from a correlation from Peck, Hansen and Thornburn, Foundation Engineering, Wiley, 2nd ed., (1974)[(6)]
1 Modified Plasticity Index (I'P) is defined as: I'P = (PI x %passing 425um)/100%;
2 Estimated from a correlation by Stroud and Butler (1975)[(4)]

Due to the presence of obstructions within the made ground only limited SPT's were undertaken in the fine grained Glacial Deposits, of which 3 refused at 50 blows. SPT N values of 9 and 19 were recorded in WS01 and WS08, both undertaken at the top of the unit. However, the undrained shear strength of the soils increases rapidly with depth. Therefore, it is recommended that the following values are taken as design/characteristic values for this material.

- Undrained shear strength 65kPa
- SPT N Value 14
- Angle of shearing resistance, φ 31.3º

9.1.3 Glacial Till (Coarse Grained)

Shallow coarse grained Glacial Till deposits were identified within two exploratory hole locations immediately below the Made Ground/topsoil deposits and varied in thickness between 0.6m and 1.0m. Only three SPT-N values were obtained in the coarse grained Glacial Till deposits, one of 24 and two of 50. For the purposes of design/characteristic values the more conservative 24 value has been used which equates to an angle of shearing resistance of 34.3º.

9.1.4 South Wales Middle Coal Measures Formation

The South Wales Middle Coal Measure were confirmed in 2 exploratory hole locations BH01 and BH02 however it is suspected that many of the windowless sampler SPT refusals may have also been on either dense/very stiff Glacial Till or on the South Wales Middle Coal Measures Formation. All SPT-N tests undertaken in the confirmed South Wales Middle Coal Measures resulted in 50 SPT-N value.

10.0 GEOTECHNICAL DESIGN CONSIDERATIONS

10.1 PROPOSED DEVELOPMENT

The proposed development plan is presented at the end of this report in Figure 3 and comprises a new childcare unit with associated areas of hardstanding for car parking.

10.2 EARTHWORKS

Given the current levels of the site and the terraced nature of some of the area, minor earthworks (cut and fill) are anticipated. The majority of any cut materials are likely to made ground and thus unsuitable for re-use as engineered fill. Given the small scale of the development it would likely be more cost effective to important clean granular fill.

10.3 FOUNDATIONS

Within the area of the proposed building Made Ground was encountered overlying shallow coarse-grained Glacial Till deposits however many of the windowless sample holes refused at shallow depth and concrete was encountered in BH02 at 0.40m bgl. Prior to development existing foundations will need to be grubbed out to allow excavation to the deeper natural deposits. The Made Ground deposits are thick in places, such as WS02 (2.9m bgl) and may be associated with former structures on site such as the toilet block previously located in the vicinity of WS01. Underlying the Glacial Till are the South Wales Middles Coal Measures Formation which was encountered in BH02 at 3.00m bgl.

Based on the above ground conditions and given the relatively low groundwater table it is considered that shallow spread foundations, strip or pads, placed within the shallow fine grained or coarse grained Glacial Till. Foundations should be placed at a minimum of 1.0m bgl but will likely need to be extended deeper where the made ground is of greater thickness and should penetrate the Glacial Deposits by at least 0.3m . Shallow footings may be design to an allowable net bearing pressure of 120kPa, giving a factor of safety greater than 3 against ultimate bearing capacity failure, and should result in settlement less that 25mm for a strip footing of no greater than 0.7m wide or a pad of no more than $1m^2$.

If foundations cross from a fine to a coarse-grained soil, reinforcement of the foundation may be required to prevent differential settlement.

Foundation excavations should be inspected by a suitably experienced engineer or inspector to ensure the founding material is suitable natural deposits. Any Made Ground, soft, loose or otherwise unsuitable material should be excavated and replaced by compacted granular backfill or lean concrete.

10.4 FLOOR SLABS

Due to variable composition, strength/density and thickness of Made Ground (up to 2.90m), ground bearing floor slabs are not considered suitable without treatment. Given the small nature of the development, the use of suspended floor is considered the best option.

10.5 CHEMICAL ATTACK ON BURIED CONCRETE

Chemical tests undertaken on representative samples from the Made Ground and Glacial Till show moderate levels of water-soluble sulphates and generally neutral conditions. Based on these conditions, it is recommended that for foundations the Design Sulphate Class for the site, as defined in BRE Special Digest 1, be taken as DS-2, and the Aggressive Chemical Environment for Concrete (ACEC) site classification be taken as AC-2.

10.6 TEMPORARY WORKS

The four trials pits excavated for the infiltration tests were found to have poor to moderate side wall stability particularly through the made ground deposits. It is considered that shoring or battering of even shallow excavations in the short term will be required. Groundwater is likely to be encountered at deeper depths (3.30m bgl) and dewatering of excavations is unlikely to be required. However, works were carried out in the spring and there may be seasonal variations that result in the need for dewatering.

10.7 PAVEMENTS

Based on the twelve results gathered within the Made Ground, CBR values were in the range of 1% to 45% (average 23%). Given the very variable nature of the results obtained it is recommended a conservative value of 5% is adopted for pavement design within this stratum.

The results within the shallow fine grained and coarse-grained alluvium ranged from 3% to 249%. A CBR value of 5% is recommended for pavement design.

Proof rolling of the formation level will be required and any loose or soft spots should be removed and replaced with an engineer fill, in accordance with a suitable specification. Due to potential obstructions there may also be a requirement to grub out existing foundations and any hard spots identified in the Made Ground deposits. The formation level will also need to be protected during inclement weather from deterioration.

Prior to placement of the founding material and the construction of the road pavement, the sub-formation and formation will need to be inspected and checked in accordance with a suitable specification to ensure the ground conditions are as expected. All testing should be carried out in accordance with DMRB IAN 73/06 to confirm that the ground conditions at the time of construction are consistent with the previous design parameters.

10.8 DRAINAGE

Soakaway testing within the shallow fine grained Glacial Till Made Ground deposits at TP03 and TP04 both failed after a day of testing suggesting the underlying geology is not suitable for soakaway drainage.

11.0 GROUND CONTAMINATION ASSESSMENT – HUMAN HEALTH

11.1 INTRODUCTION

The UK Contaminated Land Regime (CLR) allows for a tiered approach to the assessment of ground contamination which is designed to allow increasingly site-specific assessment. In order to assess the potential risk posed by contaminants contained within the soils at the study area a generic quantitative risk assessment (gQRA) has been undertaken by comparing recorded concentrations of chemical constituents in soil with Generic Assessment Criteria (GAC) to identify whether, at the concentrations recorded, the presence of the constituent has the potential to adversely affect the health of site users (a Tier 1 assessment). GAC are set at levels where potential exposure is deemed to be within acceptable limits.

If the recorded concentrations of a particular constituent are below the GAC then the risk is generally considered to be acceptable and further assessment / or mitigation measures are not required. Where a substance is recorded at concentrations higher than GAC this does not necessarily indicate that a particular risk is present, however, it does typically signify the requirement to undertake further assessment in line with the UK tiered risk assessment framework.

11.2 ASSESSMENT CRITERIA

11.2.1 Generic Assessment Criteria

The following GAC for soils have been utilised for the screening process, in order of preference:

- CL:AIRE published C4SL (DEFRA, 2014);
- CIEH/LQM published S4UL (LQM/CIEH, 2015);
- Tetra Tech internal Tier 1 Screening Criteria (issue 15) derived using the derivation tool CLEA version 1.06, in line with the current UK Contaminated Land Regime.

C4SL are currently available for arsenic, benzene, benzo(a)pyrene, cadmium, chromium VI and lead[1]. The C4SL were originally developed to support the categorisation of sites in accordance with Part 2A are also, based on DEFRA guidance, considered suitable for use during the assessment of sites as part of the planning process.

Where C4SLs are not available, 'Suitable for Use Levels' (S4UL) developed by CIEH/LQM have been used. The S4UL provide GAC based on minimal or tolerable risk intended to be protective of human health for individual or mixtures of substances. It is considered conservative and appropriate to use these values for contaminants for which C4SL are unavailable. GAC for volatile and semi-volatile organic compounds (VOC and SVOC) not presented in the S4UL document are sourced from CL:AIRE (CL:AIRE, January 2010).

Where no published screening values are available Tetra Tech have derived their own values (easily liberatable cyanide).

The CLEA model states that "For most exposure pathways, the contamination is assumed to be at or within one metre of the surface" (Environment Agency, 2009). It is considered that at depths greater than 1.0m, the probability of human exposure via the direct contact pathways are significantly reduced, leaving inhalation of volatile compounds as the dominant pathway with regard to human health risks. Typically, volatile compounds only significantly affect the indoor inhalation pathway. The same screening concentrations have been used for all depths at this stage, though it is noted that these are highly conservative for depths below 1.00m bgl.

[1] Arsenic, benzene, benzo(a)pyrene, cadmium, chromium VI, lead assuming 6% SOM (1% SOM C4SL also published for benzene).

11.2.2 Proposed End Use

Screening criteria have been developed for the following land use scenarios:

- Residential with plant uptake;
- Residential without plant uptake;
- Allotments;
- Public open space (park and residential);
- Commercial / Industrial.

The proposed development on site will consist of a childcare unit with associated outside play areas. As such the following screening assessment has been undertaken against a residential end use without plant uptake.

11.2.3 Soil Organic Matter

For organic contaminants, the generic soil screening values have been derived for a range of concentrations of soil organic matter (1%, 2.5%, 6%). In order to provide a conservative assessment the GAC derived for a 1% SOM have been adopted.

11.3 TIER 1 – SOIL SCREENING

Five soil samples collected from across the site were submitted for chemical laboratory analysis. Full copies of laboratory certificates for all soil analysis are included in Appendix F.

Comparison of the chemical analysis results with the generic assessment criteria for a residential without plant uptake end use has identified the following exceedances, as detailed in Table 11-1.

Table 11-1 - Summary of Constituents of Concern

Constituent of Concern	No. of Samples	Min	Max	SSV	Exceedances	
					No. of exceedances	Location
Arsenic	5	4.2	43.4	40	1	TP02 0.50m
Berylium	5	0.8	2.4	1.7	3	TP01 0.30m WS08 1.90m WS04 1.60m

As summarised in the table above arsenic and berylium have been identified at concentrations which exceed the screening value for a residential without plant uptake end use. Consideration has also been given to the screening values applicable to a public open space (residential) setting to provide additional context to the assessment.

In this scenario the screening value for arsenic is increased to 79mg/kg and beryllium is increased to 2.2mg/kg, whereby only a single exceedance of beryllium it is recorded within WS08 (2.4mg/kg). These elevated concentrations are considered further in Section 15.0.

11.4 ASBESTOS

Asbestos was not identified in any of the samples sent for laboratory analysis. Suspected asbestos containing materials were not identified during the ground investigation.

12.0 GROUND CONTAMINATION ASSESSMENT – WIDER ENVIRONMENT

12.1 INTRODUCTION

The potential for contaminated groundwater on site to adversely affect controlled water receptors (groundwater and surface water bodies) has been assessed at this stage by direct comparison of analytical data from the Tetra Tech ground investigation with relevant Water Quality Standards (WQS).

Similarly, the potential for soil contamination to impact controlled waters has been assessed by comparing analytical data from soil derived leachate tests directly against WQS.

12.2 ASSESSMENT CRITERIA

In light of the environmental setting of the site under consideration. The following water quality standards have been adopted, in order of preference.

- Water Framework Directive (WFD),
- Environmental Quality Standards (EQS);[2]
- WHO 2008 - Petroleum Products in Drinking Water (WHO 2008)
- UK Drinking Water Standards[3].

12.2.1 Bioavailability

For certain heavy metals (copper, zinc, manganese, nickel and lead) the bioavailability of the metal within the water can be calculated to generate a bespoke screening criteria based on other groundwater parameters. This assessment is undertaken utilising the Metal Bioavailability Assessment Tool (M-BAT) which was developed using the $EQS_{(bioavailable)}$ developed in line with the Water Framework Directive.

In the case of copper, zinc, manganese and nickel the assessment takes into account the concentration of calcium, Dissolved Organic Carbon (DOC) and pH of the water sample. The assessment for lead only takes the DOC of the sample into account. A spreadsheet has been developed for the assessment by the UK Technical Advisory Group on the Water Framework Directive.

12.3 SOIL DERIVED LEACHATE METHODOLOGY

Soil derived leachate samples can be used to identify potentially mobile contamination within soil samples collected from the site. It should be noted that the laboratory test methodology indicates a potential mobility of contaminants and is usually considered to reflect a worst-case situation and unlikely to represent on-site conditions.

The laboratory preparation of leachate samples is likely to produce higher concentrations of leachable components than conditions encountered on site and as such the following assessment is considered to be inherently conservative in nature. Furthermore, the resulting data are screened against criteria intended to be protective of water bodies and drinking water supplies and are not intended to assess the potential significance of contaminant mobility.

[2] Where WFD 2015 are not presented revoked WFD 2010 standards are used
[3] WHO 2005; WHO 2008; UK Water Supply Regulations 2010 and 1989 Regulations. Priority given to UK drinking water standards

12.4 TIER 1 SCREENING ASSESSMENT – SOIL DERIVED LEACHATE

Two soil derived leachate samples were screened against a suite of determinants outlined in Section 12.2.

The following table summarises the determinants which have been identified at concentrations in excess of the adopted screening value.

Table 12-1 – Summary of Exceedances within Soil Derived Leachate Samples

Determinant	Units	Maximum	Minimum	Screening Value #	Exceedances	
					No.	Location
Benzo(a)pyrene	µg/l	0.076	<0.005	0.00017	1	WS03 0.7m
Benzo(ghi)perylene	µg/l	0.06	<0.005	0.0082	1	WS03 0.7m
Benzo(b)fluoranthene	µg/l	0.12	0.014	0.017	1	WS03 0.7m
Benzo(k)fluoranthene	µg/l	0.046	<0.008	0.017	1	WS03 0.7m
Fluoranthene	µg/l	0.008	0.09	0.0063	1	TP02 0.5m

Inland water EQS 2015

Five PAH compounds were identified within soil derived leachate samples at concentrations in excess of the adopted screening criteria. The recorded concentrations are considered to be limited within the context of the site setting and the aggressive nature of the leachate testing process. The recorded concentrations are however considered further in Section 15.0.

12.5 TIER 1 SCREENING ASSESSMENT – GROUNDWATER

One groundwater sample was obtained from the monitoring installations on the site and analysed for the suite of determinants outlined in Section 5.2. The results were screened against a suite of determinants outlined in Section 12.2.

The following table summarises the determinants which have been identified at concentrations in excess of the relevant WQS screening criteria.

Table 12-2 – Summary of Exceedances within Groundwater Samples

Determinant	Units	BH01	Screening Value #
Fluoranthene	µg/l	0.007	0.0063[#]
Copper	µg/l	10	1*
Nickel	µg/l	7	4[#]

Inland water EQS 2015
* Freshwater EQS 2015

As can be seen in the table above fluoranthene, copper and nickel have been identified at concentrations in excess of the relevant EQS screening criteria.

As outlined in Section 12.2.1, the bioavailability of certain heavy metals can be taken into account within water samples. The M-BAT assessment tool has been used to determine a screening value taking into account the bioavailability of copper and nickel within the groundwater sample and the results are presented in the following table.

Table 12-3 – M-BAT adjusted Screening Values for Heavy Metals – Groundwater

Determinant	Sample	Concentration (µg/l)	Screening Value (µg/l)	M-BAT Screening Value (µg/l)	Exceedances
Copper	BH01	10	1	7.60	Yes
Nickel	BH01	7	4	16.93	No

The recorded concentrations of copper are therefore considered further within the risk assessment presented in Section 15.0.

13.0 PRELIMINARY GROUND GAS ASSESSMENT

13.1 INTRODUCTION

Three return ground gas monitoring visits were undertaken between the 2nd June and 15th June 2022. Full factual site records of the gas monitoring results are presented in Appendix G and summarised in Section 6.2.

13.1.1 Ground Gas Monitoring

Ground gases are monitored within boreholes on the site recording the following parameters.

- Concentrations of ground gases;
    - Methane (%v/v);
    - Carbon dioxide (%v/v);
    - Oxygen (%v/v);
    - Carbon monoxide (ppm);
    - Hydrogen sulphide (ppm);
- Borehole flow rate (l/hr);
- Depth to groundwater;
- Atmospheric pressure trends;

Where groundwater levels are noted to be above the screened sections of the boreholes the data is not considered to be representative of the ground gas regime and are therefore not used within the risk assessment process.

Atmospheric pressure trends are recorded on site during the monitoring process, but are also noted in the preceding three days, and one day after each monitoring visit. Falls in atmospheric pressure are generally considered to indicate a higher potential for ground gas migration from the sub surface and as such monitoring during periods of falling pressure are considered to represent worst case scenarios as outlined in the CL:AIRE Technical Bulletin TB17 (CL:AIRE, August 2018).

13.1.2 Land Gas Risk Assessment Methodology

The key reference document which has been used to undertake the semi-quantitative land gas assessment presented in this report is CIRIA C665 (CIRIA, 2007). This provides a framework for assessment of land gas risk to buildings/structures with foundations (i.e. houses and/or commercial properties).

The risk assessment process is based on a Source-Pathway-Receptor Conceptual Site Model Methodology, with consideration given to the potential sources likely to be present on the site and the ground gas monitoring regime designed to reflect the scale of the source potential.

The collected data has been used for the purposes of undertaking a semi-quantitative assessment in accordance with the CIRIA 665 methodology. The calculation used to calculate the gas screening value (GSV) for the site, together with the relevant definition of units, is as follows:

GSV (litres of gas/hr) = borehole flow rate (l/hr) x gas concentration (volume/100)

The calculated GSV values are used to determine the Characteristic Situation (CS) for the site in terms of methane and carbon dioxide, based on the conditions outlined in Table 13-1 below.

CS classification is applicable to all buildings, with the exception of low-rise housing with a ventilated underfloor void, in these situations, the NHBC Traffic Light System is adopted. Based on the proposed development, the CS classification is considered the most appropriate.

Table 13-1 –GSV Classification (Modified Wilson and Card Methodology)

Characteristic Situation	Risk Classification	Gas Screening Value Threshold (l/hr)	Additional Considerations
1	Very Low Risk	<0.07	Methane concentration <1% Carbon dioxide <5%
2	Low Risk	<0.7	Borehole flow rate <70 l/hr
3	Moderate Risk	<3.5	-
4	Moderate to High Risk	<15	Quantitative risk assessment required to evaluate scope of protective measures
5	High Risk	<70	-
6	Very High Risk	>70	-

13.2 PRELIMINARY GROUND GAS RISK ASSESSMENT

13.2.1 Conceptual Site Model

The following sections outline the anticipated Source-Pathway- Receptor model associated with the proposed development on site.

Sources

The following potential sources have been identified on and off site.

- Made Ground deposits
- The site is also located within the South Wales Coalfield, with historical mine workings within the vicinity of the site.

Pathways

The following potential pathways have been identified which may act as preferential pathways for ground gas migration:

- The underlying strata have been classified as largely low permeability. Therefore, there is limited potential for horizontal and vertical migration of ground gas;
- Buried service runs and foundations, including sub-floor voids.

Receptors

Within the context of ground gases, the following enclosed structures are considered to represent potential receptors.

- Structures and enclosed areas within proposed development.

13.2.2 Risk Assessment – Methane and Carbon Dioxide

In order to assess the significance of ground gases at the site, measured concentrations and flow rates have been used to derive Gas Screening Values (GSVs). GSVs are the product of gas concentration and gas flow measured in a borehole and provide an indication of the flow of the particular gas in question out of the ground.

Due to the limited data obtained from the site the worst-case values have been used within the risk assessment.

Based on a maximum flow recorded of 0.2l/hr and the maximum recorded concentration of carbon dioxide (CO_2) and methane (CH_4) during the three monitoring visits, the GSVs have been calculated as presented in Table 13-2.

Table 13-2 – Initial GSV Calculations

	Maximum Concentration (%)	Maximum Flow Rate (l/hr)	GSV (l/hr)	Characteristic Situation (Wilson and Card)
Carbon Dioxide	0.9	0.2	$1.8x10^{-3}$	1 (Low Risk)
Methane	0.1	0.2	$2x10^{-4}$	1 (Low Risk)

These values have been compared with the Revised Wilson and Card Classification presented in Table 13-1.

The risk assessment process indicates the site is representative of Characteristic Situation 1 (Very Low Risk) based on the recorded concentrations of carbon dioxide and methane and maximum flow rates within the sub surface.

13.2.3 Carbon Monoxide and Hydrogen Sulphide

Maximum concentrations of carbon monoxide and hydrogen sulphide were recorded at <1ppm throughout the monitoring period. The recorded concentrations are considered to be suitably low to negate the requirement for additional risk assessment.

13.2.4 Atmospheric Pressure Trends

The monitoring rounds was undertaken during rising, falling and steady pressures with no discernable variation in ground gas monitoring results recorded. The second monitoring round was undertaken following a period of falling pressure.

13.3 SUMMARY AND DISCUSSION

The site has been classified as Characteristic Situation 1 (Very Low Risk) based on the worst-case recorded concentrations of carbon dioxide and methane and maximum flow rates. Site classification of a Characteristic Situation 1 indicates gas protection measures are not required within new developments.

14.0 WASTE CLASSIFICATION ASSESSMENT

Waste classification is a two stage process, with the first step comprising a hazard assessment of the soil quality data in line with the guidance set out in the Environment Agency waste classification technical guidance WM3[4] document. Once the hazardous properties of the materials are known, the second step is to assess the potential performance of the materials in a landfill, undertaken by considering the results of waste acceptance criteria (WAC) testing.

14.1.1 Waste Classification

The chemical analysis data obtained from the ground investigation has been used to make a preliminary assessment of whether soils from the study area would be classified as hazardous waste. The assessment provides an initial indication of the classification of the soils in the event that they are disposed to landfill. Note the decision as to whether soils are deemed to be hazardous waste ultimately rests with the receiving landfill.

The waste classification report is presented as Appendix H. The assessment was undertaken using HazWasteOnline, web-based software for waste classification. The software follows Environment Agency guidance and European regulations. Assessment sheets are presented in Appendix H.

In making the assessment the following assumptions have been made:

- TPH are not derived from petrol or diesel. There was no visual or olfactory evidence of hydrocarbons observed during the ground investigation and the long term presence of the mound on the study area means that storage of such fuels is unlikely to have taken place at the site.

The five samples analysed as part of the ground investigation were of made ground. The initial assessment identified 2no. samples (TP01 at 0.30m and TP03 at 0.55m) that were classified as potentially hazardous as a result of the presence of flammable liquids. After a review of the exploratory hole logs this hazardous property has been removed from all the samples where it was identified by the software as there was no visual or olfactory evidence of flammable liquids such as hydrocarbons observed during the ground investigation. The assessment sheets in Appendix H detail which samples this edit has been applied to.

After this amendment all samples have been classified as **non-hazardous.**

As mentioned above, the second stage of the assessment relates to the identification of a suitable receiving landfill facility based in Waste Acceptance Criteria (WAC) testing data. As present, no such data is available and as such a suitable receiving facility cannot be identified. Should materials be designated for off-site disposal as part of the proposed redevelopment of the site, it is recommended that additional testing is undertaken prior to disposal to include WAC testing to allow for a final classification in consultation with the landfill sites and waste disposal contractors.

14.1.2 Materials Management

Any material excavated on site may be classified as waste and it is the responsibility of the holder of a material to form their own view on whether or not it is waste. This includes determining when waste that has been treated in some way can cease to be classed as waste for a particular purpose.

If site-won material is to be reused on site, or soils other than primary aggregate or aggregatres produced under the WRAP Protocol, imported to site, a Materials Management Plan will be required, signed off by a Qualified Person as defined in the 'Development Industry Code of Practice' (CL:AIRE, 2011).

[4] Environment Agency 2018. Technical Guidance WM3: Guidance on the classification and assessment of waste (Version 1.1).

15.0 CONCEPTUAL SITE MODEL AND PRELIMINARY GROUND CONTAMINATION RISK ASSESSMENT

15.1 OVERVIEW

The information presented in the previous sections of this report have been collated and evaluated to establish an initial qualitative risk assessment for the site. A conceptual model of the site has been generated based on information derived from this Phase 1 Geo-environmental Assessment, supplemented by information attained during the Tetra Tech site walkover.

The site has been considered with regard to current UK legislation and guidance, namely Part 2A of the Environmental Protection Act 1990 and the Contaminated Land (England) Regulations 2006, as amended, and in accordance with current UK good practice guidelines (for example BS10175:2011).

In general, ground contamination can occur through several causes, particularly from historical operations and activities. Contamination can result from either on-site sources or from on-site migration from off-site sources, leading to long term liabilities under recent legislation for any site owner.

For a risk of pollution or environmental harm to occur as a result of ground contamination, all of the following elements must be present:

- Source, i.e. a substance that is capable of causing pollution or harm;
- Pathway, i.e. a route by which the contaminant can reach a target; and
- Receptor (target), i.e. something which could be adversely affected by the contaminant.

If one of these elements is absent there can be no significant risk. If all are present then the magnitude of the risk is a function of the magnitude and mobility of the source, the sensitivity of the receptor and the nature of the migration pathway.

15.2 CURRENT SITE USAGE AND PROPOSED DEVELOPMENT

The proposed development includes the development of a childcare facility with associated external play areas and parking.

15.3 CONCEPTUAL SITE MODEL

The key source, pathways and receptor model is outlined below within the context of potential development of the site.

15.3.1 Potential Sources of Contamination

The main potential sources of contamination on the site are associated with existing features as well as historical land uses on the site as summarised below.

On site Sources

- Made Ground associated with former development on the site;
- Historical colliery workings.
- Existing Electrical Substation

15.3.2 Potential Contaminant Pathways

The following contaminant pathways are considered to potentially be active based on the current site use and proposed development:

Human Exposure Pathways

- Direct dermal contact or ingestion of soils, or inhalation of dust and/or vapours (i.e. human interaction with surface and sub-surface materials).

Environmental Pathways

- Leaching and horizontal or vertical migration through the unsaturated ground, either through permeable sub-surface materials and/or preferential pathways;
- Lateral and vertical migration of groundwater through permeable sub-surface materials and/ or preferential pathways;
- Leaching to surface water run-off/drainage;
- The migration and accumulation of gases or vapours through permeable sub-surface materials and/ or preferential pathways.

15.3.3 Potential Receptors at Risk

The following potential receptors have been identified:

Human Health

- Current site users (currently undeveloped)
- Future site users (childcare unit);
- Site workers during the redevelopment of the site;
- Adjacent site users (residential)

Wider Environment

- Secondary A Aquifer within superficial deposits;
- Surface waters (Dulais River);
- Plant uptake; and
- Building Infrastructure and supply pipes.
- Adjacent Properties

15.4 GROUND CONDITIONS RISK ASSESSMENT

The source, pathway, receptor linkages identified in the previous section are outlined and a qualitative risk assessment shown in the following tables.

The risk assessment considers the site within an area context and assesses potential risks to identified receptors in relation to the existing site setting and the proposed development. CIRIA C552 has been used to define the risk rating presented in the Qualitative Risk Assessment matrix, the methodology for which is presented in Appendix I.

Table 15-1 – CIRIA C552 Qualitative Risk Assessment

This matrix is based on CIRIA C552 risk evaluation methodology, definitions for risk ratings is presented in **Appendix I**						
Source	**Pathway**	**Receptor**	**Consequence of risk being realised**	**Probability of risk being realised**	**Risk Classification**	**Potential risk management requirements**
Made Ground associated with previous development	Direct dermal contact or ingestion of soils, or inhalation of dust and/or vapours	Current site users	Medium	Unlikely	Low Risk	Whilst elevated concentrations of arsenic and beryllium have been recorded in the made ground on site, the concentrations are considered to be relatively marginal and when the site is considered against a Public Open Space (residential) end use only one exceedance of beryllium is identified. It is also understood that the proposed development will consist of a building with play areas consisting of predominant hardstanding / surfacing whereby interaction with the underlying made ground will be limited. Risks to construction workers can be managed with the use of PPE, good hygiene practices and ongoing risk assessments.
		Future site users		Low Risk	Moderate / Low Risk	
		Construction workers		Low Risk	Moderate / Low Risk	
	Leaching and lateral/vertical migration of mobile contaminants	Surface water	Mild	Low Risk	Low Risk	Elevated concentrations of PAH compounds have been recorded in the soil derived leachate samples and whilst these pose a potential risk to groundwater the low permeability

		Groundwater		Low Risk	Low Risk	of the subsurface and aggressive nature of the leachate testing procedure these risks are considered to be limited. A single exceedance of PAH has been recorded in groundwater from the site
Asbestos	Inhalation	Current site users	Medium	Unlikely	Low Risk	Asbestos containing materials have not been identified during the ground investigation.
		Future site users		Unlikely	Low Risk	
		Construction workers		Unlikely	Low Risk	
Ground Gas associated with made ground and colliery workings.	Accumulation of gases and inhalation	Future site users	Severe	Unlikely	Moderate / Low Risk	The results of the ground gas monitoring undertaken across the site indicates that the site is categorised as Characteristic Situation 1 (Very Low Risk). As such, ground gas protection measures are not considered necessary as part of the proposed development.
		Construction workers		Unlikely	Moderate / Low Risk	

16.0 CONCLUSIONS AND RECOMMENDATIONS

16.1 GROUND CONTAMINATION

16.1.1 Summary

Only limited ground contamination has been identified in the made ground on the site however given the conservative nature of the assessment and the understanding that the site will be largely hardstanding / formal surfacing the recorded concentrations are not considered to pose a significant risk to future site users. Risks to construction workers can be managed through the adoption of good hygiene practices and use of PPE during the development.

With regards to the potential for mobile contamination, elevated concentrations of PAH compounds have been recorded in soil derived leachate samples, with a further exceedance recorded in groundwater on the site. However, given the limited nature of the exceedances, the aggressive nature of the testing procedures and low permeability identified during the soil infiltration testing the recorded concentrations are not considered to pose a significant risk to controlled waters.

16.1.2 Asbestos

Asbestos containing materials have not been identified on the site or during subsequent laboratory testing.

16.1.3 Ground Gas

Ground gas monitoring has identified low concentrations of ground gases in the sub surface such that the site has been classified as Characteristic Situation 1 (Very Low Risk), therefore no ground gas protection measures are deemed necessary within the proposed development.

16.1.4 Waste

An initial waste assessment has been undertaken on the five samples obtained during the ground investigation. The results indicated that the majority of samples have been classified as non-hazardous. However, two samples obtained from TP01 and TP05 were initially classified as hazardous due the presence of flammable liquids. After a review of the exploratory hole logs this hazardous property has been removed from all the samples where it was identified by the software as there was no visual or olfactory evidence of flammable liquids such as hydrocarbons observed during the ground investigation therefore all samples have been classified as non-hazardous. This assessment is intended to provide an indicative assessment only. If materials are designated for off-site disposal during the development phase it is recommended that additional testing of the materials/area requiring disposal is undertaken to include WAC testing to identify a suitable receiving landfill facility.

16.2 GEOTECHNICAL

Traditional shallow foundations (pad or strip) placed within the natural fine or coarse grained Glacial Till deposits may be designed to an allowable net bearing capacity of 120kPa which will result in settlement of no more than 25mm for foundations of no more than 0.70m wide. Foundations excavations through the made ground are likely to be unstable and require shoring.

Given the presence of a significant thickness of variable made ground across the site, the use of suspended floor slabs is recommended.

For buried concrete the Design Sulphate Class for the site can be taken as DS-2 and the Aggressive Chemical Environment for Concrete (ACEC) site classification can be taken as AC-2.

Dewatering of temporary excavations may not be required but should be anticipated during winter months.

A conservative CBR value of 5% is recommended for preliminary pavement design.

16.3 SOIL INFILTRATION TESTING

Soil infiltration testing was undertaken in 2no. locations on site, within the Glacial Till deposits. Neither of the tests results in a fall to the 25% effective depth over the testing period (one day). It is therefore not considered suitable for the site to be serviced by soakaway type drainage.

16.4 RECOMMENDATIONS

Based on the findings of the ground investigation, the following recommendations are outlined:

- A Reactive Strategy should be developed for the site to outline the requirements for identification, assessment and management of any areas of previously unidentified contamination encountered during the development phase;
- Movement of materials on the site should be undertaken in conjunction with a Materials Management Plan in line with the recommendations in the CL:AIRE Code of Practice to confirm any materials utilised on site are geotechnically and chemically suitable for re-use and to ensure all materials leaving site are disposed of at a suitable waste disposal facility;
- It remains the responsibility of the contractor as waste producer to classify any waste materials and identify a suitable off site disposal facility.

16.4.1 Potential Constraints

A number of subsurface obstructions were encountered during the ground investigation thought to related to the previous land use as residential flats or the raised embankment on the southern site boundary to provide road access of the railway line. Considerable breaking out of these obstructions cannot be discounted during the construction phase to allow for the construction of new foundations or grubbing out for news areas of hardstanding and associated access.

17.0 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.

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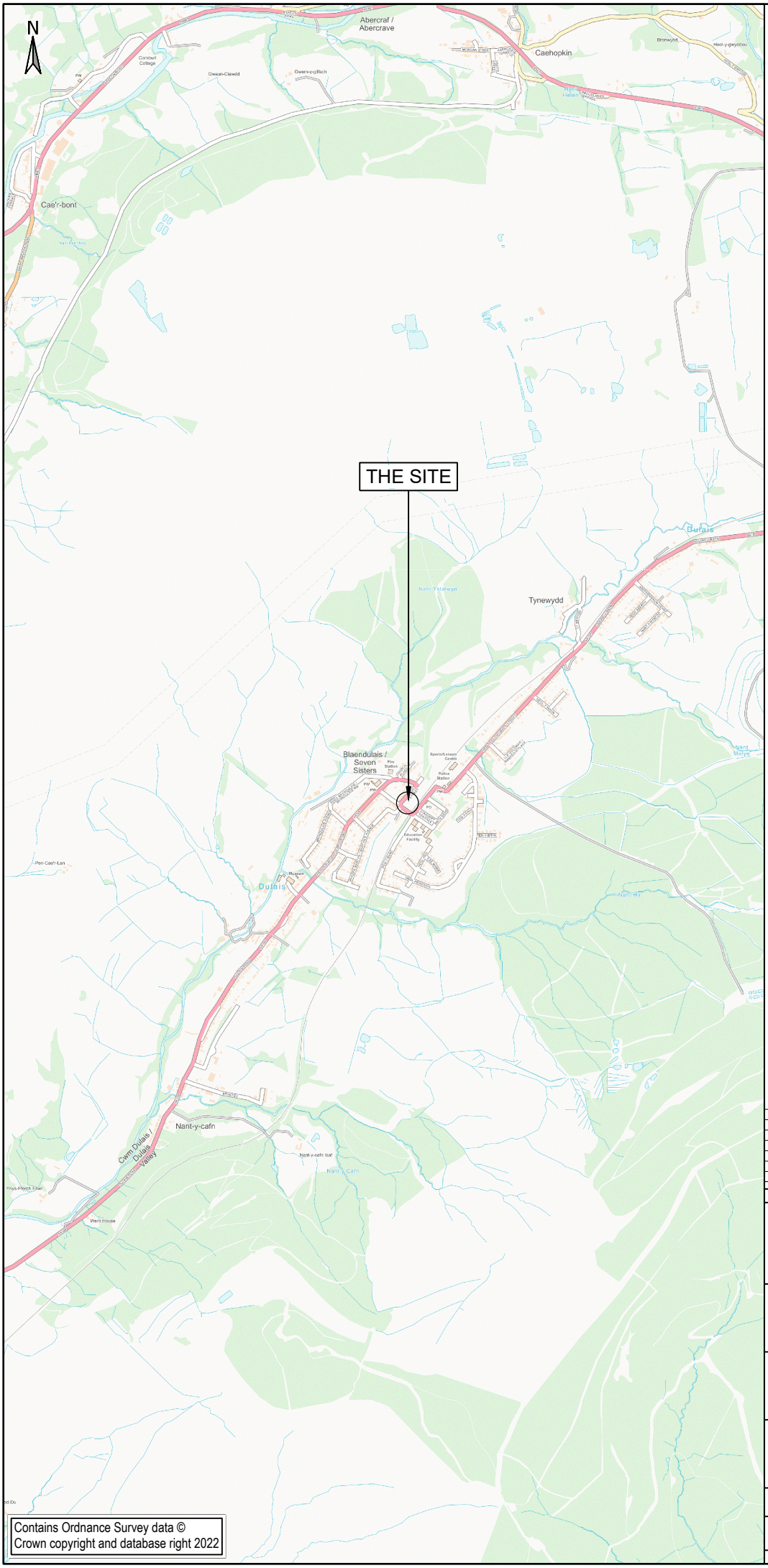
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FIGURES

Figure 1- Site Location Plan



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P01	PRELIMINARY FIRST ISSUE	08.06.2022	PP	GL	NEB

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Issuing Office

Tetra Tech Cardiff

5th Floor, Longcross Court,
47 Newport Road, Cardiff,
United Kingdom, CF24 0AD
Tel: +44 (0)29 2082 9200
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NEATH PORT TALBOT COUNCIL

Project Name

BLAENDULAIS

Sheet Title

SITE LOCATION PLAN

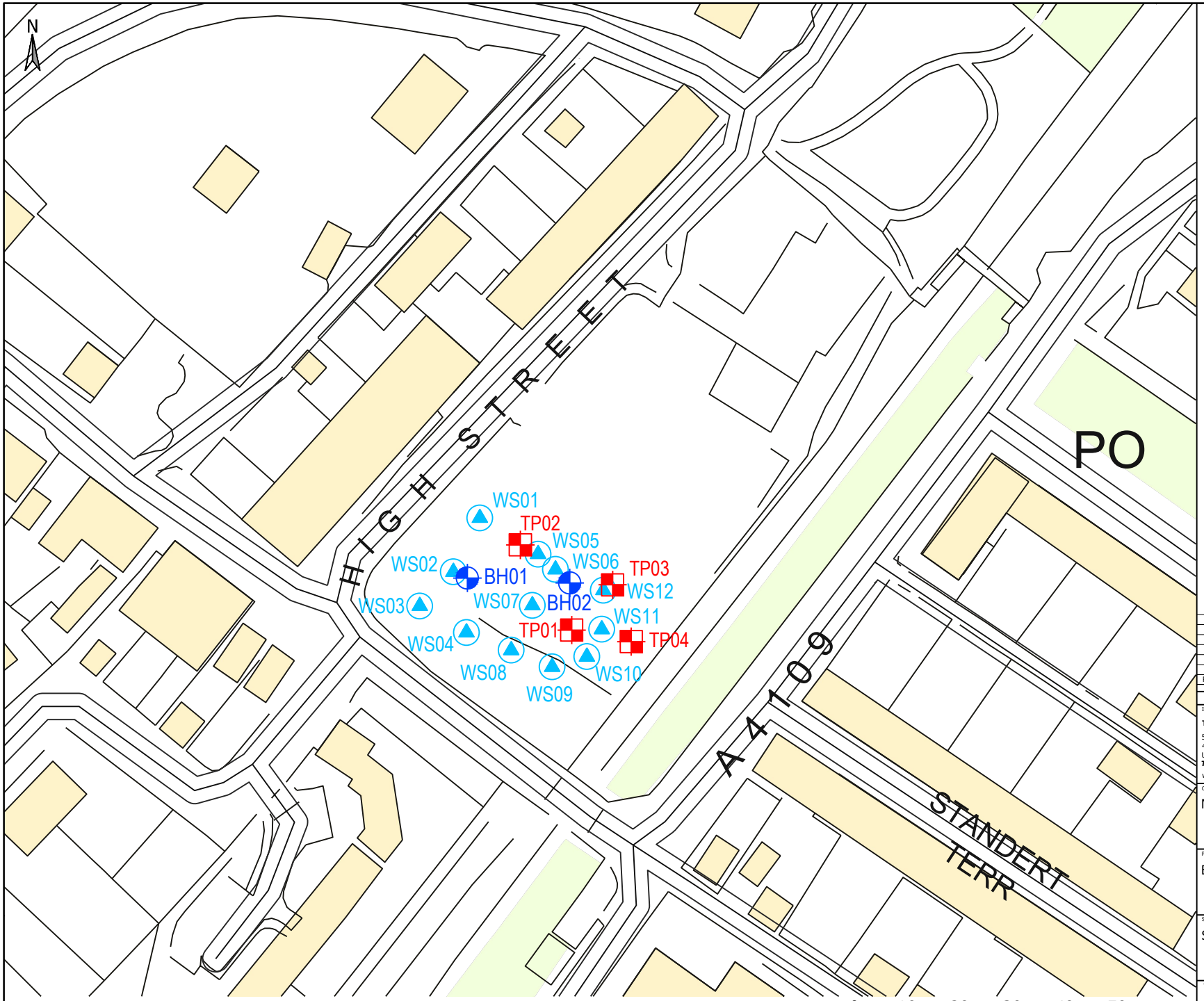
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784-B035256	PP	08.06.22	GL	08.06.22	NEB	08.06.22	1:25,000	S0

Client Project Number	Originator	Volume/System	Level/Location	Type/Code	Role	Number	Revision
B035256	TTE	00	XX	DR	U	0001	P01

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TTE_MT_v1

Figure 2 – Site Investigation Layout Plan



LEGEND:

- TRIAL PIT
- BOREHOLE
- WINDOW SAMPLE

Rev	Description	Date	Drn	Chk	App
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SITE INVESTIGATION LAYOUT PLAN

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784-B035256	PP	27.06.22	GL	27.06.22	NEB	27.06.22	As Shown	S0

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Figure 3 – Proposed Development Plan

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0107

CHURCH ROAD

St Mary's Church

A 4109

A 4109 HIGH ST

HIGH STREET

Brick Row

COMMERCIAL STREET

STATION ROAD

STANDERT TERRACE

BRYN BEDD

Police Station

Church

Chapel

PH

Post Office

Dunraven

Brynglas

School

Blaendulais Primary School

Soar Congregational Church

1 to 14 Hafan Deg

AVENUE

Traffic Parking
Entrance/Exit
Bus Station
Taxis Parking
Staff/Car Parking
External Play Area

NOTES

1. All dimensions in millimetres unless otherwise stated.

Rev	Details	Dr	Ch	Apr	Date

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Castell-nedd Port Talbot
County Borough Council Cyngor Bwrdeistref Sirol
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Nicola Pearce BSc(Hons) DipTP MRTPI
DIRECTOR OF ENVIRONMENT AND REGENERATION
THE QUAYS, BRUNEL WAY
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www.npt.gov.uk

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Childcare Grants
Blaendulais

Drawing Title

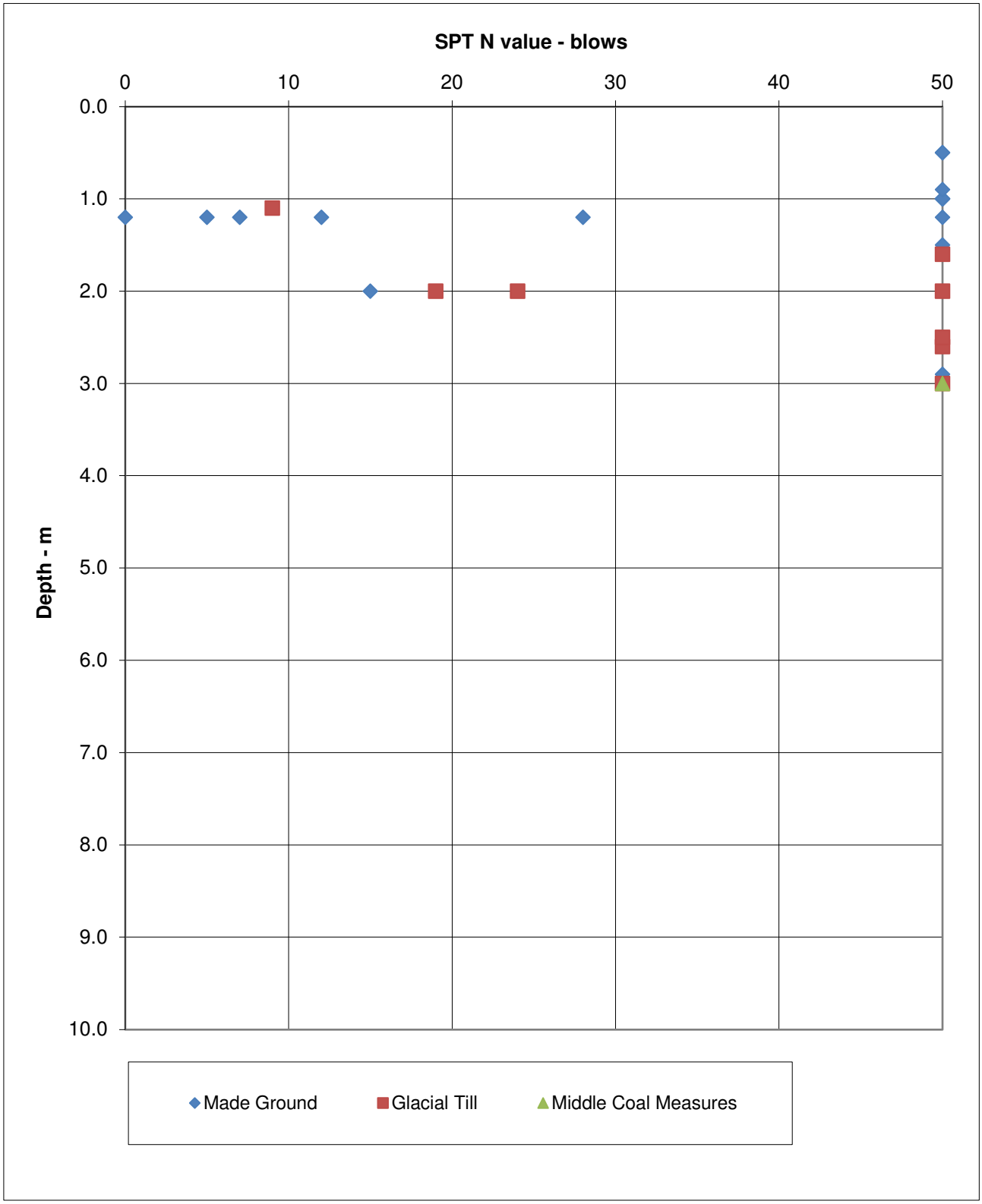
Location Plan

File No.		Property Ref. No.			
Drawn		Checked		Approved	
Date		Date		Date	
Scales	1:1250				

Drawing No. | Rev.

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Figure 4 – SPT-N vs Depth Plot



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Project: **Blaendulais**	Drawing Title: **SPT vs Depth Plot**
Client: **NPTCBC**	Drawing No.: **FIGURE 4**

PLATES



Plate 1 BH01 - 0.00mbgl - 0.40mbgl



Plate 2 BH01 - 0.00mbgl - 0.40mbgl

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5th Floor, Longcross Court
47 Newport Road
Cardiff
CF24 0AD

Tel: 029 20 829200
Fax: 029 20 455321

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Plate 3 BH01 - 1.20mbgl - 2.50mbgl

Plate 4

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Plate 1 BH02 - 0.00mbgl - 0.30mbgl (concrete slab obstruction)



Plate 2 BH02 - 0.00mbgl - 0.30mbgl (concrete slab obstruction)

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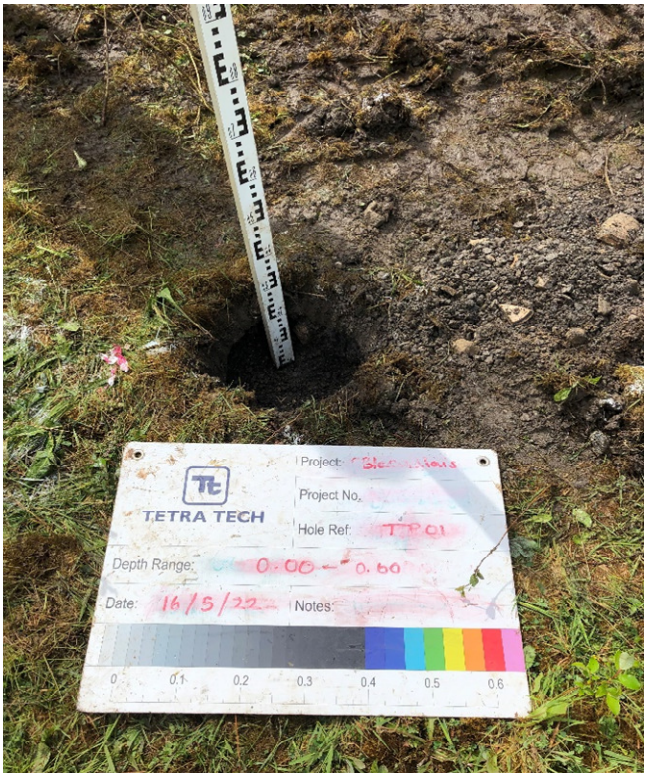


Plate 3 BH02 - 0.00mbgl - 0.30mbgl (concrete slab obstruction)

Plate 4

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CF24 0AD

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Plate 1 TP01 - 0.00mbgl - 1.50mbgl



Plate 2 TP01 - 0.00mbgl - 1.50mbgl

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Plate 3 TP01 - 0.00mbgl - 1.50mbgl



Plate 4 TP01 - 0.00mbgl - 1.50mbgl

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Plate 5 TP01 - 0.00mbgl - 1.50mbgl



Plate 6 TP01 - 0.00mbgl - 1.50mbgl

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Plate 1 TP02 - 0.00mbgl - 0.70mbgl



Plate 2 TP02 - 0.00mbgl - 0.70mbgl

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Plate 3 TP02 - 0.00mbgl - 0.70mbgl



Plate 4 TP02 - 0.00mbgl - 0.70mbgl

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Plate 1 TP03 - 0.00mbgl - 1.40mbgl



Plate 2 TP03 - 0.00mbgl - 1.40mbgl

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Plate 3 TP03 - 0.00mbgl - 1.40mbgl



Plate 4 TP03 - 0.00mbgl - 1.40mbgl

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Plate 1 TP04 - 0.00mbgl - 1.40mbgl



Plate 2 TP04 - 0.00mbgl - 1.40mbgl

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Plate 3 TP04 - 0.00mbgl - 1.40mbgl



Plate 4 TP04 - 0.00mbgl - 1.40mbgl

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Plate 1 WS01 - 0.00mbgl - 0.40mbgl



Plate 2 WS01 - 0.00 - 0.40mbgl

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Plate 3 WS01 - 0.00mbgl - 0.40mbgl



Plate 4 WS01 - 1.10mbgl - 1.60mbgl

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Plate 1 WS02 - 0.00 -1.20mbgl



Plate 2 WS02 - 0.00 -1.20mbgl

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Plate 3 WS02 - 0.00 -1.20mbgl



Plate 4 WS02 - 1.20 - 1.70mbgl

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Plate 5 WS02 - 1.70 - 2.20mbgl



Plate 6 WS02 - 2.20 - 2.90mbgl

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Plate 1 WS03 - 0.00mbgl - 1.00mbgl



Plate 2 WS03 - 0.00mbgl - 1.00mbgl

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5th Floor, Longcross Court
47 Newport Road
Cardiff
CF24 0AD

Tel: 029 20 829200
Fax: 029 20 455321

Environmental Consultancy
Ground Technologies & Investigation

Project :-
Blaendulais

Project No.: B035256



Plate 1 WS04 - 1.20mbgl - 2.00mbgl



Plate 2 WS04 - 2.00mbgl - 2.60mbgl

Tetra Tech
5th Floor, Longcross Court
47 Newport Road
Cardiff
CF24 0AD

Tel: 029 20 829200
Fax: 029 20 455321

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Project :-
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Project No.: B035256



Plate 1 WS05 - 0.00mbgl - 1.00mbgl



Plate 2 WS05 - 0.00mbgl - 1.00mbgl

Tetra Tech
5th Floor, Longcross Court
47 Newport Road
Cardiff
CF24 0AD

Tel: 029 20 829200
Fax: 029 20 455321

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Project :-
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Project No.: B035256



Plate 3 WS05 - 0.00mbgl - 1.00mbgl

Plate 4

Tetra Tech
5th Floor, Longcross Court
47 Newport Road
Cardiff
CF24 0AD

Tel: 029 20 829200
Fax: 029 20 455321

Environmental Consultancy
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Project :-
Blaendulais

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Project No.: B035256



Plate 1 WS06 - 0.00mbgl - 0.55mbgl



Plate 2 WS06 - 0.00mbgl - 0.55mbgl

Tetra Tech
5th Floor, Longcross Court
47 Newport Road
Cardiff
CF24 0AD

Tel: 029 20 829200
Fax: 029 20 455321

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Project :-
Blaendulais

Project No.: B035256



Plate 3 WS06 - 0.00mbgl - 0.55mbgl



Plate 4 WS06 - 0.00mbgl - 0.55mbgl

Tetra Tech
5th Floor, Longcross Court
47 Newport Road
Cardiff
CF24 0AD

Tel: 029 20 829200
Fax: 029 20 455321

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Project :-
Blaendulais

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Project No.: B035256



Plate 1 WS07 - 0.00mbgl - 1.00mbgl



Plate 2 WS07 - 0.00mbgl - 1.00mbgl

Tetra Tech
5th Floor, Longcross Court
47 Newport Road
Cardiff
CF24 0AD

Tel: 029 20 829200
Fax: 029 20 455321

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Ground Technologies & Investigation

Project :-
Blaendulais

Project No.: B035256



Plate 1 WS08 - 0.00mbgl - 1.00mbgl



Plate 2 WS08 - 0.00mbgl - 1.00mbgl

Tetra Tech
5th Floor, Longcross Court
47 Newport Road
Cardiff
CF24 0AD

Tel: 029 20 829200
Fax: 029 20 455321

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Project :-
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Project No.: B035256



Plate 3 WS08 - 1.20mbgl - 2.00mbgl



Plate 4 WS08 - 2.00mbgl - 2.90mbgl

Tetra Tech
5th Floor, Longcross Court
47 Newport Road
Cardiff
CF24 0AD

Tel: 029 20 829200
Fax: 029 20 455321

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Project :-
Blaendulais

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Project No.:	B035256



Plate 1 WS09 - 0.00mbgl - 1.00mbgl



Plate 2 WS09 - 0.00mbgl - 1.00mbgl

Tetra Tech
5th Floor, Longcross Court
47 Newport Road
Cardiff
CF24 0AD

Tel: 029 20 829200
Fax: 029 20 455321

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Project :-
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Project No.: B035256



Plate 3 WS09 - 0.00mbgl - 1.00mbgl

Plate 4

Tetra Tech
5th Floor, Longcross Court
47 Newport Road
Cardiff
CF24 0AD

Tel: 029 20 829200
Fax: 029 20 455321

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Project :-
Blaendulais

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Project No.: B035256



Plate 1 WS10 - 0.00mbgl - 0.50mbgl



Plate 2 WS10 - 0.00mbgl - 0.50mbgl

Tetra Tech
5th Floor, Longcross Court
47 Newport Road
Cardiff
CF24 0AD

Tel: 029 20 829200
Fax: 029 20 455321

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Project :-
Blaendulais

Project No.: B035256



Plate 3 WS10 - 0.00mbgl - 0.50mbgl

Plate 4

Tetra Tech
5th Floor, Longcross Court
47 Newport Road
Cardiff
CF24 0AD

Tel: 029 20 829200
Fax: 029 20 455321

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Project :-
Blaendulais

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Project No.: B035256



Plate 1 WS11 - 0.00mbgl - 1.10mbgl



Plate 2 WS11 - 0.00mbgl - 1.10mbgl

Tetra Tech
5th Floor, Longcross Court
47 Newport Road
Cardiff
CF24 0AD

Tel: 029 20 829200
Fax: 029 20 455321

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Project :-
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Project No.: B035256



Plate 1 WS12 - 0.00mbgl - 0.90mbgl



Plate 2 WS12- 0.00mbgl - 0.90mbgl

Tetra Tech
5th Floor, Longcross Court
47 Newport Road
Cardiff
CF24 0AD

Tel: 029 20 829200
Fax: 029 20 455321

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Ground Technologies & Investigation

Project :-
Blaendulais

Project No.: B035256



Plate 3 WS12 - 0.00mbgl - 0.90mbgl

Plate 4

Tetra Tech
5th Floor, Longcross Court
47 Newport Road
Cardiff
CF24 0AD

Tel: 029 20 829200
Fax: 029 20 455321

Environmental Consultancy
Ground Technologies & Investigation

TETRA TECH

Project :-
Blaendulais

0

Project No.: B035256

APPENDICES

APPENDIX A – REPORT CONDITIONS

APPENDIX A - REPORT CONDITIONS

GROUND INVESTIGATION

This report is produced solely for the benefit of Neath Port Talbot Council 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: **Blaendulais**

Location: **Seven Sisters**

Client: **Neath Port Talbot County Borough Council**

Location Details			
Easting:	281931.88	Northing:	208920.45
Level:	186.72mAOD	Depth:	30.00m
Logger:	Gabriel Lloyd	Type:	WS+RO
		Inclination:	°

Status: FINAL

Borehole Number: **BH01**

Sheet 1 of 3

Method, Plant and Crew					Diameter		Casing		Groundwater					
From (m)	To (m)	Type	Plant Used	Crew	Depth (m)	Diam (mm)	Depth(m)	Diam (mm)	Strike (m)	Casing (m)	Sealed (m)	Rose To (m)	Time (mins)	Remarks
0.00	3.50	Window Sampler	Klemm	Apex Drilling Services	1.20	300	4.00	100	3.40	-	-	0.00	0	
3.50	30.00	Rotary Open Hole	Klemm	Apex Drilling Services	30.00	96								

Scale: 1:50
Checked By: NEB
Approved By: CBP
Start Date: 17/05/2022
Finish Date: 17/05/2022

Strata Description	Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Inst / Backfill	Samples and Testing: Depth (m)	Ref	Tests / Results
Grass over, dark grey sandy gravelly CLAY. Sand is fine to coarse. Gravel is angular to sub angular of sandstone, mudstone, brick, concrete and plastic. (MADE GROUND) MGR								SPT(C) 1.20m, N=0 (1,0/0,0,0,0)
Medium dense becoming dense orangish grey brown, clayey sandy GRAVEL. Sand is fine to coarse. Gravel is angular to sub rounded of sandstone, siltstone and mudstone. TILL		1.50	185.22					SPT(C) 2.50m, N=50 (25 for 55mm/50 for 35mm)
Dark brown medium hard to hard sandstone, mudstone and siltstone. (SOUTH WALES MIDDLE COAL MEASURES FORMATION) *.... Small traces of very thin coal seams (>10cm).*		3.00	183.72					SPT(C) 3.00m, N=50 (25 for 30mm/50 for 25mm) SPT(C) 4.00m, N=50 (25 for 15mm/50 for 10mm)

Observations / Remarks

1. Dynamic sampling to 3.50mbgl, with limited recovery due to the large cobbles and boulders. 2. Rotary open holed from 3.50mbgl to 30.00mbgl. 3. Ground water encountered at 3.40mbgl. 4. Standpipe installed. 5. *Based on drillers description and limited returns.

Sampling Runs

From (m)	To (m)	Diam (mm)	Recovery %	Remarks
1.20	2.50		75	
2.50	3.50		0	

Hammer Information

Serial No.	Energy Ratio %
T44	

Project Number: **784-B035256**

TETRA TECH

Project: **Blaendulais**

Location: **Seven Sisters**

Client: **Neath Port Talbot County Borough Council**

Location Details			
Easting:	281931.88	Northing:	208920.45
Level:	186.72mAOD	Depth:	30.00m
Logger:	Gabriel Lloyd	Type:	WS+RO
		Inclination:	°

Status: FINAL

Borehole Number: **BH01**

Sheet 2 of 3

Method, Plant and Crew					Diameter		Casing		Drilling Progress by Time				
From (m)	To (m)	Type	Plant Used	Crew	Depth (m)	Diam (mm)	Depth(m)	Diam (mm)	Date	Time	Depth (m)	Casing (m)	Water (m)
0.00	3.50	Window Sampler	Klemm	Apex Drilling Services	1.20	300	4.00	100					
3.50	30.00	Rotary Open Hole	Klemm	Apex Drilling Services	30.00	96							

Scale:	1:50
Checked By:	NEB
Approved By:	CBP
Start Date:	17/05/2022
Finish Date:	17/05/2022

Strata Description	Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Inst / Backfill	Samples, Tests and Rotary Coring: Depth (m)	Ref	Tests / Results
Dark brown medium hard to hard sandstone, mudstone and siltstone. (SOUTH WALES MIDDLE COAL MEASURES FORMATION) *.... Small traces of very thin coal seams (>10cm).*								

11
12
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16
17
18
19
20

Observations / Remarks

1. Dynamic sampling to 3.50mbgl, with limited recovery due to the large cobbles and boulders. 2. Rotary open holed from 3.50mbgl to 30.00mbgl. 3. Ground water encountered at 3.40mbgl. 4. Standpipe installed. 5. *Based on drillers description and limited returns.

Flushing

From (m)	To (m)	Return Min %	Colour	Type

Hammer Information

Serial No.	Energy Ratio %
T44	

Groundwater

Strike (m)	Casing (m)	Sealed (m)	Time (min)	Rose To (m)	Remarks

Project Number: **784-B035256**

TETRA TECH

Project: **Blaendulais**

Location: **Seven Sisters**

Client: **Neath Port Talbot County Borough Council**

Location Details			
Easting:	281931.88	Northing:	208920.45
Level:	186.72mAOD	Depth:	30.00m
Logger:	Gabriel Lloyd	Type:	WS+RO
		Inclination:	°

Status: FINAL

Borehole Number: **BH01**

Sheet 3 of 3

Method, Plant and Crew					Diameter		Casing		Drilling Progress by Time				
From (m)	To (m)	Type	Plant Used	Crew	Depth (m)	Diam (mm)	Depth(m)	Diam (mm)	Date	Time	Depth (m)	Casing (m)	Water (m)
0.00	3.50	Window Sampler	Klemm	Apex Drilling Services	1.20	300	4.00	100					
3.50	30.00	Rotary Open Hole	Klemm	Apex Drilling Services	30.00	96							

Scale:	1:50
Checked By:	NEB
Approved By:	CBP
Start Date:	17/05/2022
Finish Date:	17/05/2022

Strata Description	Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Inst / Backfill	Samples, Tests and Rotary Coring: Depth (m)	Ref	Tests / Results
Dark brown medium hard to hard sandstone, mudstone and siltstone. (SOUTH WALES MIDDLE COAL MEASURES FORMATION)								
EOH at 30.00m - Reached Required Depth.		30.00	156.72					

21 22 23 24 25 26 27 28 29 30

Observations / Remarks

1. Dynamic sampling to 3.50mbgl, with limited recovery due to the large cobbles and boulders. 2. Rotary open holed from 3.50mbgl to 30.00mbgl. 3. Ground water encountered at 3.40mbgl. 4. Standpipe installed. 5. *Based on drillers description and limited returns.

Flushing

From (m)	To (m)	Return Min %	Colour	Type

Hammer Information

Serial No.	Energy Ratio %
T44	

Groundwater

Strike (m)	Casing (m)	Sealed (m)	Time (min)	Rose To (m)	Remarks

Project Number: **784-B035256**

TETRA TECH

Project: **Blaendulais**

Location: **Seven Sisters**

Client: **Neath Port Talbot County Borough Council**

Location Details			
Easting:	281951.37	Northing:	298919.51
Level:	186.72mAOD	Depth:	30.00m
Logger:	Gabriel Lloyd	Type:	WS+RO
		Inclination:	°

Status: FINAL

Borehole Number: **BH02**

Sheet 1 of 3

Method, Plant and Crew					Diameter		Casing		Groundwater						Scale:	1:50
From (m)	To (m)	Type	Plant Used	Crew	Depth (m)	Diam (mm)	Depth(m)	Diam (mm)	Strike (m)	Casing (m)	Sealed (m)	Rose To (m)	Time (mins)	Remarks	Checked By:	NEB
0.00	3.50	Window Sampler	Klemm	Apex Drilling Services	1.20	300	3.00	100	5.00	-	-	0.00	0		Approved By:	CBP
3.50	30.00	Rotary Open Hole	Klemm	Apex Drilling Services	3.00	96			8.50	-	-	0.00	0		Start Date:	18/05/2022
															Finish Date:	18/05/2022

Strata Description	Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Inst / Backfill	Samples and Testing: Depth (m)	Ref	Tests / Results
Grass over, grey sandy gravelly CLAY. Sand is fine to coarse. Gravel is angular to subangular of sandstone, mudstone, brick, metal and concrete. (MADE GROUND) MGR *..... Hard concrete at 0.40 to 0.60m bgl.*						1.30 1.30 - 2.50	ES1 B1	SPT(C) 1.20m, N=50 (25 for 55mm/50 for 20mm)
Orangish grey brown clayey gravelly SAND. Sand is fine to coarse. Gravel is fine to coarse of subangular to subrounded of sandstone, siltstone and mudstone. TILL		1.70	185.02					SPT(C) 2.00m, N=50 (25 for 30mm/50 for 20mm)
								SPT(C) 3.00m, N=50 (25 for 40mm/50 for 30mm)
Dark brown medium hard to hard inter bedded mudstone, sandstone and siltstone. (SOUTH WALES MIDDLE COAL MEASURES FORMATION)		3.50	183.22					SPT(C) 3.50m, N=50 (25 for 15mm/50 for 5mm)
.... Small traces of thin coal seams (>10cm).								SPT(C) 5.00m, N=50 (25 for 5mm/50 for 10mm)
								SPT(C) 6.50m, N=50 (25 for 0mm/50 for 0mm)

Observations / Remarks

1. Dynamic sampling to 3.00mbgl, with limited recovery due to the large cobbles and boulders. 2. Rotary open holed from 3.00mbgl to 30.00mbgl. 3. Ground water encountered at 5.00mbgl and 8.50mbgl. 4. Standpipe installed. 5. *Based on drillers description and limited returns

Sampling Runs

From (m)	To (m)	Diam (mm)	Recovery %	Remarks
1.20	2.50		100	
2.50	3.00		0	

Hammer Information

Serial No.	Energy Ratio %
T44	

Project Number: **784-B035256**

TETRA TECH

Project: **Blaendulais**

Location: **Seven Sisters**

Client: **Neath Port Talbot County Borough Council**

Location Details			
Easting:	281951.37	Northing:	298919.51
Level:	186.72mAOD	Depth:	30.00m
Logger:	Gabriel Lloyd	Type:	WS+RO
		Inclination:	°

Status: FINAL

Borehole Number: **BH02**

Sheet 2 of 3

Method, Plant and Crew					Diameter		Casing		Drilling Progress by Time				
From (m)	To (m)	Type	Plant Used	Crew	Depth (m)	Diam (mm)	Depth(m)	Diam (mm)	Date	Time	Depth (m)	Casing (m)	Water (m)
0.00	3.50	Window Sampler	Klemm	Apex Drilling Services	1.20	300	3.00	100					
3.50	30.00	Rotary Open Hole	Klemm	Apex Drilling Services	3.00	96							

Scale:	1:50
Checked By:	NEB
Approved By:	CBP
Start Date:	18/05/2022
Finish Date:	18/05/2022

Strata Description	Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Inst / Backfill	Samples, Tests and Rotary Coring: Depth (m)	Ref	Tests / Results
Dark brown medium hard to hard inter bedded mudstone, sandstone and siltstone. (SOUTH WALES MIDDLE COAL MEASURES FORMATION)								
BROKEN SANDSTONE*		12.00	174.72					
SANDSTONE*		12.30	174.42					

11 12 13 14 15 16 17 18 19 20

Observations / Remarks

1. Dynamic sampling to 3.00mbgl, with limited recovery due to the large cobbles and boulders. 2. Rotary open holed from 3.00mbgl to 30.00mbgl. 3. Ground water encountered at 5.00mbgl and 8.50mbgl. 4. Standpipe installed. 5. *Based on drillers description and limited returns

Flushing

From (m)	To (m)	Return Min %	Colour	Type

Groundwater

Strike (m)	Casing (m)	Sealed (m)	Time (min)	Rose To (m)	Remarks
5.00	-	-	0	0.00	
8.50	-	-	0	0.00	

Hammer Information

Serial No.	Energy Ratio %
T44	

Project Number: **784-B035256**

TETRA TECH

Project: **Blaendulais**

Location: **Seven Sisters**

Client: **Neath Port Talbot County Borough Council**

Location Details			
Easting:	281951.37	Northing:	298919.51
Level:	186.72mAOD	Depth:	30.00m
Logger:	Gabriel Lloyd	Type:	WS+RO
		Inclination:	°

Status: FINAL

Borehole Number: **BH02**

Sheet 3 of 3

Method, Plant and Crew					Diameter		Casing		Drilling Progress by Time				
From (m)	To (m)	Type	Plant Used	Crew	Depth (m)	Diam (mm)	Depth(m)	Diam (mm)	Date	Time	Depth (m)	Casing (m)	Water (m)
0.00	3.50	Window Sampler	Klemm	Apex Drilling Services	1.20	300	3.00	100					
3.50	30.00	Rotary Open Hole	Klemm	Apex Drilling Services	3.00	96							

Scale:	1:50
Checked By:	NEB
Approved By:	CBP
Start Date:	18/05/2022
Finish Date:	18/05/2022

Strata Description	Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Inst / Backfill	Samples, Tests and Rotary Coring: Depth (m)	Ref	Tests / Results
SANDSTONE*								
EOH at 30.00m - Reached Required Depth		30.00	156.72					

21 22 23 24 25 26 27 28 29 30

Observations / Remarks

1. Dynamic sampling to 3.00mbgl, with limited recovery due to the large cobbles and boulders. 2. Rotary open holed from 3.00mbgl to 30.00mbgl. 3. Ground water encountered at 5.00mbgl and 8.50mbgl. 4. Standpipe installed. 5. *Based on drillers description and limited returns

Flushing

From (m)	To (m)	Return Min %	Colour	Type

Hammer Information

Serial No.	Energy Ratio %
T44	

Groundwater

Strike (m)	Casing (m)	Sealed (m)	Time (min)	Rose To (m)	Remarks

Project Number: **784-B035256**

TETRA TECH

Project:	**Blaendulais**
Location:	**Seven Sisters**
Client:	**Neath Port Talbot County Borough Council**

Location Details

Easting: 281951.73 Northing: 208910.54
Level: 186.71mAOD Depth: 0.60m
Logger: Gabriel Lloyd Type: TP

Status: FINAL

Pit Number: **TP01**

Sheet 1 of 1

Hole Information

Pit Dimensions: 1.60m x 0.45m
Orientation: °
Shoring:
Stability:
Plant:

Groundwater

Strike (m)	Rose To (m)	After (mins)	Remarks
0.60	0.58	20	

Scale:	1:25
Checked By:	NEB
Approved By:	CBP
Start Date:	16/05/2022
Finish Date:	16/05/2022

Strata Description	Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Backfill	Samples and Testing: Depth (m)	Ref	Tests / Results
Dark greyish brown, sandy gravelly CLAY. Sand is fine to coarse. Gravel is angular to subangular of brick, concrete, sandstone, mudstone and building material. (MADE GROUND) MGR						0.10 - 0.40 0.30	B1 ES1	
EOH at 0.60m - Encountered Concrete Obstruction		0.60	186.11					

Observations / Remarks

1. Refusal at 0.60mbgl due to concrete obstruction. 2. Water strike at 0.60mbgl and rose to 0.58mbgl after 20 minutes. 3. Backfilled with arisings.

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Project Number: **784-B035256**

TETRA TECH

Project: **Blaendulais**

Location: **Seven Sisters**

Client: **Neath Port Talbot County Borough Council**

Location Details

Easting: 281941.96 Northing: 208926.75

Level: 186.77mAOD Depth: 0.70m

Logger: Gabriel Lloyd Type: TP

Status: FINAL

Pit Number: **TP02**

Sheet 1 of 1

Hole Information

Pit Dimensions: 1.40m x 0.50m

Orientation: °

Shoring: None

Stability: Stable

Plant: JCB 3CX

Groundwater

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

Scale: 1:25

Checked By: NEB

Approved By: CBP

Start Date: 16/05/2022

Finish Date: 16/05/2022

Strata Description	Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Backfill	Samples and Testing: Depth (m)	Ref	Tests / Results
Dark greyish brown, sandy gravelly CLAY. Sand is fine to coarse. Gravel is angular to subangular of brick, concrete, sandstone, mudstone and building material. (MADE GROUND) MGR						0.30 - 0.70 0.50	B1 ES1	
EOH at 0.70m - Encountered Hard Strata.		0.70	186.07					

Observations / Remarks

1. Refusal at 0.70mbgl due to hard strata. 2. No water encountered. Backfilled with arisings.

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029 2082 9200

Project Number

784-B035256

TETRA TECH

Project: **Blaendulais**	Location Details	Status	Pit Number
Location: **Seven Sisters**	Easting: 281959.51 Northing: 208919.15	FINAL	**TP03**
Client: **Neath Port Talbot County Borough Council**	Level: 186.70mAOD Depth: 1.40m Logger: Gabriel Lloyd Type: TP		Sheet 1 of 1

Hole Information

Pit Dimensions: 1.30m × 0.55m

Orientation: °
Shoring: None
Stability: None
Plant: JCB 3CX

Groundwater

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

Scale: 1:25
Checked By: NEB
Approved By: CBP
Start Date: 16/05/2022
Finish Date: 16/05/2022

Strata Description	Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Backfill	Samples and Testing: Depth (m)	Ref	Tests / Results
Dark greyish brown, sandy gravelly CLAY. Sand is fine to coarse. Gravel is angular to subangular of brick, concrete, sandstone, mudstone and old building material. (MADE GROUND) MGR						0.00 - 0.10 0.25 - 0.50 0.55	B1 B2 ES1	
Organish grey clayey slightly sandy GRAVEL. Sand is fine to coarse. Gravel is angular to subrounded of sandstone, limestone and rare mudstone with frequent cobbles. (GLACIAL TILL) TILL		0.80	185.90			0.80 - 1.00	B3	
EOH at 1.40m - Encountered Hard Strata.		1.40	185.30					

Observations / Remarks

1. Refusal at 1.40mbgl due to hard strata. 2. No water encountered. Backfilled with arisings.

Longcross Court,
Cardiff,
CF24 0AD

029 2082 9200

Project Number

784-B035256

TETRA TECH

Project: **Blaendulais**

Location: **Seven Sisters**

Client: **Neath Port Talbot County Borough Council**

Location Details

Easting: 281963.07 Northing: 208908.35

Level: 186.72mAOD Depth: 1.10m

Logger: Gabriel Lloyd Type: TP

Status: FINAL

Pit Number: **TP04**

Sheet 1 of 1

Hole Information

Pit Dimensions: 1.30m x 0.50m

Orientation: °

Shoring: None

Stability: None

Plant: JCB 3CX

Groundwater

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

Scale: 1:25

Checked By: NEB

Approved By: CBP

Start Date: 16/05/2022

Finish Date: 16/05/2022

Strata Description	Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Backfill	Samples and Testing: Depth (m)	Ref	Tests / Results
Dark brown slightly sandy gravelly CLAY. Sand is fine to coarse. Gravel is angular to subangular of sandstone and limestone (TOPSOIL). TOP						0.10 - 0.30	B1	
Dark grey silty sandy GRAVEL. Sand is fine to coarse. Gravel is angular of colliery spoil, plastic and metal. (MADE GROUND) MGR		0.30	186.42			0.30	ES1	
Light brown tabular sub-angular to angular fine to coarse GRAVEL of fine grained mudstone (MADE GROUND) MGR		0.50	186.22			0.50 - 0.80	B2	
						0.80	ES2	
EOH at 1.10m - Encountered Hard Strata.		1.10	185.62					

Observations / Remarks

1. Refusal at 1.10mbgl due to hard strata. 2. No water encountered. Backfilled with arisings.

Longcross Court,
Cardiff,
CF24 0AD

029 2082 9200

Project Number: **784-B035256**

TETRA TECH

3URMHFW Blaendulais

/RFDWLRQ Seven Sisters

&OLHQW Neath Port Talbot County Borough Council

/RFDWLRQ DQG HLOV

(DVWLQJ ˇ 1RUWKLQJ ˆ

/HYHO ˇ P$2' 'HSWK ˇ P

/RJJHG *DULHO /DVHG :6

,QFOLQDWLRQ ..

6KHHW

WS01

6KHHW RI

0HWKRG DQG &UHZ

)URP	7R P	7\SH	3ODQW 8VHG &UHZ	'HSWK P	'LDP PP
	ˇ	,QVSHFWLRQ 3LW 'QDPLF :LQGRZOHVV	*HQHUDO *DULHO :DOHV *U	ˇ	ˇ

'LDPHWHU &DVLQJ *URXQGZDWHU

'HSWK P	'LDP PP	6WULNH P	&DVLQJ P	&DOHG P	&RVH P	7LPH PLQV	5HPDUNV

6FDOH ˇ

&KHFNHG %\ 1(%

$SSURYHG %\ &%3

6WDUW 'DWH ˇ

)LQLVK 'DWH ˇ

6WUDWD 'HVFULSWLRQ	/HJHQG	GHSWK	5HGXFHG /HYHO P$2'	:DWHU ,QVW /HYHO PAOD	NIL OD	6DPSOHV DQG 7HVWLQJ HSWK	P5HI	7HVWV 5HVXOWV
*UDVV RYHUO GURZQ LQ&GJ\DHOO &/$< 0HGLXP WR FRDUVH VDQG*UDYHO LW IRXQG EHORZ VXUJLFDO RI EULFN SOWDV WDLO DQG JODVV &REEOHV DQG*5$9(/ 0*5		ˇ	ˇ			ˇ	% (6	
)LUP WR KDUG GDUN EURZQ \HOORZLVK &OD\ &REEOHV DQG*UDYHO LV VWRQH\ EXLOGHU&RQFUHWH 7,//		ˇ	ˇ				% (6	637 6 P 1 ˇ
EOH at 1.60m - Refused on hard strata.								637 6 ˇ P ˇ ˇ IRU PP

2EVHUYDWLRQV 5HPDUNV

5HIXVDO PEJOWKHDWKHU 1RWZDHQWHUXHG %DFNILOOHGQZLWK

6DPSOLQJ 5XQV

)URP	7R P	'LDP PP	%HFRYHU\ 5HPDUNV
	ˇ	ˇ	

+DPPHU ,QIRUPD

6HDO 1R (QHUJ\ 1R

'$7 ˇ ˇ

3URMHFW 1XPEHU

784-B035256

TETRA TECH

Project: Blaendulais

Location: Seven Sisters

Client: Neath Port Talbot County Borough Council

Location Details

Easting: 281929.22 Northing: 208921.62

Level: 186.66mAOD Depth: 2.90m

Logger: Gabriel Lloyd +Gabriel Iloyd Type: WS

Inclination: °

Status

FINAL

Borehole Number

WS02

Sheet 1 of 1

Scale: 1:50

Checked By: NEB

Approved By: CBP

Start Date: 19/05/2022

Finish Date: 19/05/2022

Method, Plant and Crew

From (m)	To (m)	Type	Plant Used	Crew
0.00	1.20	Inspection Pit	Hand Digging Tools	South Wales Ground Testing
1.20	2.90	Dynamic Windowless Sampling	Window Sample Rig	South Wales Ground Testing

Diameter

Depth (m)	Diam (mm)
1.20	300
2.00	90
2.90	80

Casing

Depth(m)	Diam (mm)

Groundwater

Strike (m)	Casing (m)	Sealed (m)	Rose To (m)	Time (mins)	Remarks

Strata Description	Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Inst / Backfill	Samples and Testing: Depth (m)	Ref	Tests / Results
Dark brownish black sandy silty gravelly CLAY. Sand is fine to coarse. Gravel is angular to subangular, fine to coarse of brick and concrete. (MADE GROUND) MGR						0.30 0.30	B1 ES1	
Light brown mottled orange gravelly SAND. Sand is fine to coarse. Gravel is angular to subangular of brick and concrete. (MADE GROUND) MGR		0.60	186.06			0.80 0.80	B2 ES2	
Stiff becoming hard light greyish brown, slightly gravelly CLAY. Sand is fine to coarse. Gravel is angular to subangular of mudstone, sandstone and rare concrete/brick. (MADE GROUND) MGR		1.20	185.46					SPT(S) 1.20m, N=5 (1,1/1,1,1,2)
								SPT(S) 2.00m, N=15 (1,2/3,4,3,5)
EOH at 2.90m - Refused on Hard Strata.		2.90	183.76					SPT(S) 2.90m, 50 (17,20/50 for 105mm)

Observations / Remarks

1. Refusal at 2.90mbgl due to hard strata. 2. No water encountered. Backfilled with arisings.

Sampling Runs

From (m)	To (m)	Diam (mm)	Recovery %	Remarks
1.20	2.00	90	100	
2.00	2.90	80	95	

Hammer Information

Serial No.	Energy Ratio %
DART346	68

Project Number

784-B035256

TETRA TECH

Project: Blaendulais

Location: Seven Sisters

Client: Neath Port Talbot County Borough Council

Location Details

Easting: 281922.83 Northing: 208915.12

Level: 186.91mAOD Depth: 1.80m

Logger: Gabriel lloyd +Gabriel Lloyd Type: WS

Inclination: °

Status

FINAL

Borehole Number

WS03

Sheet 1 of 1

Scale: 1:50

Checked By: NEB

Approved By: CBP

Start Date: 19/05/2022

Finish Date: 19/05/2022

Method, Plant and Crew

From (m)	To (m)	Type	Plant Used	Crew
0.00	1.20	Inspection Pit	Hand digging tools	South Wales Ground Testing
1.20	1.80	Dynamic Windowless Sampling	Window sample rig	South Wales ground Testing

Diameter

Depth (m)	Diam (mm)
1.20	300
1.80	90

Casing

Depth(m)	Diam (mm)

Groundwater

Strike (m)	Casing (m)	Sealed (m)	Rose To (m)	Time (mins)	Remarks

Strata Description	Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Inst / Backfill	Samples and Testing: Depth (m)	Ref	Tests / Results
Light brown sandy cobbly GRAVEL. Sand is fine to coarse, Gravel is angular to subangular, fine to coarse of concrete, brick and old building material. (MADEGROUND) MGR						0.30 0.30	B1 ES1	
Loose becoming dense dark brownish black silty sandy GRAVEL with low cobble content. Sand is fine to coarse. Gravel is angular to subangular of concrete, sandstone, mudstone and rare brick. (MADE GROUND) MGR		0.55	186.36			0.70 0.70	B2 ES2	SPT(S) 1.20m, N=7 (1,2/2,1,2,2) SPT(S) 1.50m, 60 (10,14/60 for 170mm)
EOH at 1.80m - Refused on Hard Strata.		1.80	185.11					

Observations / Remarks

1. Refusal at 1.80mbgl due to hard strata. 2. No water encountered. Backfilled with arisings.

Sampling Runs

From (m)	To (m)	Diam (mm)	Recovery %	Remarks
1.20	1.80	90	100	

Hammer Information

Serial No.	Energy Ratio %
DART346	68

Project Number

784-B035256

TETRA TECH

Project: Blaendulais

Location: Seven Sisters

Client: Neath Port Talbot County Borough Council

Location Details

Easting: 281931.70 Northing: 208910.08

Level: 187.63mAOD Depth: 2.60m

Logger: Gabriel lloyd +Gabriel lloud Type: WS

Inclination: °

Status

FINAL

Borehole Number

WS04

Sheet 1 of 1

Scale: 1:50

Checked By: NEB

Approved By: CBP

Start Date: 19/05/2022

Finish Date: 19/05/2022

Method, Plant and Crew

From (m)	To (m)	Type	Plant Used	Crew
0.00	1.20	Inspection Pit	Window Samplr Rig	South Wales Ground Testing
1.20	2.60	Dynamic Windowless Sampling	Window Smaple Rig	South Wales Ground Testing

Diameter

Depth (m)	Diam (mm)
1.20	300
2.00	90
2.60	80

Casing

Depth(m)	Diam (mm)

Groundwater

Strike (m)	Casing (m)	Sealed (m)	Rose To (m)	Time (mins)	Remarks

Strata Description	Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Inst / Backfill	Samples and Testing: Depth (m)	Ref	Tests / Results
Stiff dark greyish brown, silty very sandy gravelly CLAY. Sand is fine to coarse. Gravel is angular to sub angular of brick, concrete, sandstone and mud stone. (MADE GROUND) MGR						0.10 - 0.50 0.30	B1 ES1	SPT(S) 1.20m, N=12 (4,2/3,3,3,3)
Medium dense becoming dense orangish brown, clayey sandy GRAVEL. Sand is fine to coarse. Gravel is angular to sub rounded of sandstone, siltstone and rare mudstone. (GLACIAL TILL) TILL		1.60	186.03			1.60 1.60 - 2.60	ES2 B2	SPT(S) 2.00m, N=24 (6,7/6,5,6,7)
EOH at 2.60m - Refused on Hard Strata.		2.60	185.03					SPT(S) 2.60m, 50 (18,19/50 for 170mm)

Observations / Remarks

1. Concrete obstruction located in initial hand pit at 0.20m bgl. Hole relocated closer to highway on southern boundary. 2. Refusal at 2.60mbgl due to hard strata. 3. No water encountered. Backfilled with arisings.

Sampling Runs

From (m)	To (m)	Diam (mm)	Recovery %	Remarks
1.20	2.00	90	90	
2.00	2.60	80	100	

Hammer Information

Serial No.	Energy Ratio %
DART346	68

Project Number

784-B035256

TETRA TECH

Project: Blaendulais

Location: Seven Sisters

Client: Neath Port Talbot County Borough Council

Location Details

Easting: 281945.33 Northing: 208924.98

Level: 186.80mAOD Depth: 1.00m

Logger: Gabriel Lloyd Type: WS

Inclination: °

Status

FINAL

Borehole Number

WS05

Sheet 1 of 1

Method, Plant and Crew					Diameter		Casing		Groundwater						
From (m)	To (m)	Type	Plant Used	Crew	Depth (m)	Diam (mm)	Depth(m)	Diam (mm)	Strike (m)	Casing (m)	Sealed (m)	Rose To (m)	Time (mins)	Remarks
0.00	1.00	Inspection Pit	Window sample Rig	South Wales Ground Testing	1.00	300								

Scale: 1:50

Checked By: NEB

Approved By: CBP

Start Date: 18/05/2022

Finish Date: 18/05/2022

Strata Description	Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Inst / Backfill	Samples and Testing: Depth (m)	Ref	Tests / Results
Dark greyish brown, sandy gravelly CLAY. Sand is fine to coarse. Gravel is angular to subangular of brick, concrete, sandstone, mudstone and old building material. (MADE GROUND)						0.00 - 0.20	B1	
		0.20	186.60			0.20 - 0.60	B2	
MGR						0.40	ES1	
Dense dark to light brown, silty very sandy GRAVEL. Sand is fine to coarse. Gravel is angular to subangular of sandstone, mudstone, brick and concrete. (MADE GROUND). MGR								
		1.00	185.80					SPT(S) 1.00m, 50 (22,23/50 for 10mm)
EOH at 1.00m - Refused on Hard Strata.								

1 2 3 4 5 6 7 8 9 10

Observations / Remarks

1. Refusal at 1.00mbgl due to hard strata. 2. No water encountered. Backfilled with arisings.

Sampling Runs

From (m)	To (m)	Diam (mm)	Recovery %	Remarks

Hammer Information

Serial No.	Energy Ratio %
DART346	68

Project Number

784-B035256

TETRA TECH

Project: Blaendulais

Location: Seven Sisters

Client: Neath Port Talbot County Borough Council

Location Details

Easting: 281948.66 Northing: 208922.07

Level: 186.79mAOD Depth: 0.55m

Logger: Gabriel Lloyd Type: WS

Inclination: °

Status

FINAL

Borehole Number

WS06

Sheet 1 of 1

Scale: 1:50

Checked By: NEB

Approved By: CBP

Start Date: 18/05/2022

Finish Date: 18/05/2022

Method, Plant and Crew

From (m)	To (m)	Type	Plant Used	Crew
0.00	0.55	Inspection Pit	Hand digging Tools	South Wales Ground Testing

Diameter

Depth (m)	Diam (mm)
0.55	300

Casing

Depth(m)	Diam (mm)

Groundwater

Strike (m)	Casing (m)	Sealed (m)	Rose To (m)	Time (mins)	Remarks

Strata Description	Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Inst / Backfill	Samples and Testing: Depth (m)	Ref	Tests / Results
Grass over, dark grey silty very sandy gravelly CLAY. Sand is fine to coarse. Gravel is angular to sub angular of brick, concrete, sandstone, mud stone, metal and glass. (MADE GROUND) MGR		0.30	186.49			0.00 - 0.20 0.20 0.30 - 0.60	B1 ES1 B2	
Light to dark brown silty sandy GRAVEL. Sand is fine to coarse. Gravel is angular to sub angular, fine to coarse of sandstone, concrete and rare brick. (MADE GROUND) MGR		0.55	186.24					SPT(S) 0.50m, 50 (48 for 82mm/50 for 5mm)
EOH at 0.55m - Refused on Hard Strata								

1 2 3 4 5 6 7 8 9 10

Observations / Remarks

1. Refusal at 0.55mbgl due to hard strata. 2. No water encountered. Backfilled with arisings.

Sampling Runs

From (m)	To (m)	Diam (mm)	Recovery %	Remarks

Hammer Information

Serial No.	Energy Ratio %
DART346	68

Project Number

784-B035256

TETRA TECH

Project: Blaendulais

Location: Seven Sisters

Client: Neath Port Talbot County Borough Council

Location Details

Easting: 281944.24 Northing: 208915.24

Level: 186.74mAOD Depth: 1.00m

Logger: Gabriel Lloyd Type: WS

Inclination: °

Status

FINAL

Borehole Number

WS07

Sheet 1 of 1

Method, Plant and Crew					Diameter		Casing		Groundwater						
From (m)	To (m)	Type	Plant Used	Crew	Depth (m)	Diam (mm)	Depth(m)	Diam (mm)	Strike (m)	Casing (m)	Sealed (m)	Rose To (m)	Time (mins)	Remarks
0.00	1.00	Inspection Pit	Window Sample Rig	South Wales Ground Testing	1.00	300								

Scale: 1:50

Checked By: NEB

Approved By: CBP

Start Date: 18/05/2022

Finish Date: 18/05/2022

Strata Description	Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Inst / Backfill	Samples and Testing: Depth (m)	Ref	Tests / Results
Grass over dark grey sandy GRAVEL & COBBLES of subangular to angular sandstone, mudstone, concrete and brick. (MADE GROUND) MGR						0.00 - 0.70	B1	
						0.50	ES1	
EOH at 1.00m - Refused on Hard strata.		1.00	185.74					SPT(S) 1.00m, 50 (18,24/50 for 70mm)

Observations / Remarks

1. Refusal at 0.60mbgl due to hard strata. 2. No water encountered. Backfilled with arisings.

Sampling Runs

From (m)	To (m)	Diam (mm)	Recovery %	Remarks

Hammer Information

Serial No.	Energy Ratio %
DART346	68

Project Number

784-B035256

TETRA TECH

Project: Blaendulais

Location: Seven Sisters

Client: Neath Port Talbot County Borough Council

Location Details

Easting: 281940.22 Northing: 208906.72

Level: 187.93mAOD Depth: 2.80m

Logger: Gabriel lloyd Type: WS

Inclination: °

Status

FINAL

Borehole Number

WS08

Sheet 1 of 1

Scale: 1:50

Checked By: NEB

Approved By: CBP

Start Date: 19/05/2022

Finish Date: 19/05/2022

Method, Plant and Crew

From (m)	To (m)	Type	Plant Used	Crew
0.00	1.20	Inspection Pit	Hand Digging Tools	South Wales Ground Testing
1.20	1.85	Dynamic Windowless Sampling	Window Sample Rig	South Wales Ground Testing
1.85	2.80	Dynamic Windowless Sampling		

Diameter

Depth (m)	Diam (mm)
1.00	300
2.00	90
2.80	80

Casing

Depth(m)	Diam (mm)

Groundwater

Strike (m)	Casing (m)	Sealed (m)	Rose To (m)	Time (mins)	Remarks
2.80	-	-	0.00	0	

Strata Description	Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Inst / Backfill	Samples and Testing: Depth (m)	Ref	Tests / Results
Dark brownish grey, sandy gravelly CLAY. Sand is fine to coarse. Gravel is angular to sub angular of sandstone, concrete, brick and occasional plastic and metal. (MADE GROUND) MGR						0.10 - 0.50	B1	
						0.50	ES1	
Dense dark grey sandy clayey GRAVEL. Sand is fine to coarse. Gravel is angular of colliery spoil, old building material and metal. (MADE GROUND) MGR		1.00	186.93			1.00 - 1.85	B2	
						1.10	ES2	SPT(S) 1.20m, N=28 (4,4/5,6,10,7)
Stiff mottled orangish grey brown, sandy gravelly CLAY. Sand is fine to coarse. Gravel is angular to subrounded of sandstone and mudstone. (GLACIAL TILL) TILL		1.85	186.08			1.85 - 2.80	B3	
						1.90	ES3	SPT(S) 2.00m, N=19 (8,5/5,4,5,5)
EOH at 2.80m - Refused on Hard Strata		2.80	185.13					SPT(S) 2.90m, 50 (22,23/50 for 40mm)

1 2 3 4 5 6 7 8 9 10

Observations / Remarks

1. Concrete obstruction located in initial hand pit at 0.20m bgl. Hole relocated closer to highway on southern boundary. 2. Refusal at 2.80mbgl due to hard strata. 3. Groundwater encountered at 2.80m bgl. Backfilled with arisings.

Sampling Runs

From (m)	To (m)	Diam (mm)	Recovery %	Remarks
1.00	2.00	90	100	
2.00	2.80	80	100	

Hammer Information

Serial No.	Energy Ratio %
DART346	68

Project Number

784-B035256

TETRA TECH

Project: Blaendulais

Location: Seven Sisters

Client: Neath Port Talbot County Borough Council

Location Details

Easting: 281948.02 Northing: 208903.54

Level: 188.06mAOD Depth: 0.40m

Logger: Gabriel Lloyd Type: WS

Inclination: °

Status

FINAL

Borehole Number

WS09

Sheet 1 of 1

Scale: 1:50

Checked By: NEB

Approved By: CBP

Start Date: 18/05/2022

Finish Date: 18/05/2022

Method, Plant and Crew

From (m)	To (m)	Type	Plant Used	Crew
0.00	0.40	Inspection Pit	Hand Digging Tools	South Wales Ground Testing

Diameter

Depth (m)	Diam (mm)
0.40	300

Casing

Depth(m)	Diam (mm)

Groundwater

Strike (m)	Casing (m)	Sealed (m)	Rose To (m)	Time (mins)	Remarks

Strata Description	Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Inst / Backfill	Samples and Testing: Depth (m)	Ref	Tests / Results
Dark brownish grey, silty sandy clayey GRAVEL. Sand is fine to coarse. Gravel is fine to coarse, angular of metal, concrete and sandstone. (MADE GROUND) MGR								
		0.40	187.66					
EOH at 0.40m - Refused on Concrete Obstruction								

1 2 3 4 5 6 7 8 9 10

Observations / Remarks

1. Concrete obstruction located in initial hand pit at 0.20m bgl. Hole relocated closer to highway on southern boundary. 2. Refusal at 0.40mbgl due to hard strata. 3. No water encountered. Backfilled with arisings.

Sampling Runs

From (m)	To (m)	Diam (mm)	Recovery %	Remarks

Hammer Information

Serial No.	Energy Ratio %

Project Number

784-B035256

TETRA TECH

Project: Blaendulais

Location: Seven Sisters

Client: Neath Port Talbot County Borough Council

Location Details

Easting: 281948.02 Northing: 208903.54

Level: 188.06mAOD Depth: 1.00m

Logger: Gabriel Lloyd Type: WS

Inclination: °

Status

FINAL

Borehole Number

WS09A

Sheet 1 of 1

Scale: 1:50

Checked By: NEB

Approved By: CBP

Start Date: 18/05/2022

Finish Date: 18/05/2022

Method, Plant and Crew					Diameter		Casing		Groundwater					
From (m)	To (m)	Type	Plant Used	Crew	Depth (m)	Diam (mm)	Depth(m)	Diam (mm)	Strike (m)	Casing (m)	Sealed (m)	Rose To (m)	Time (mins)	Remarks
0.00	1.00	Inspection Pit	Hand Digging Tools	South Wales Ground Testing	1.00	300								

Strata Description	Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Inst / Backfill	Samples and Testing		
						Depth (m)	Ref	Tests / Results
Dark brown silty sandy clayey GRAVEL. Sand is fine to coarse. Gravel is fine to coarse, angular to sub angular of sandstone, and rare concrete and brick. (MADE GROUND) MGR						0.10 - 0.30 0.30	B1 ES1	
EOH at 1.00m - Refused on Hard Strata.		1.00	187.06					SPT(S) 1.00m, 50 (15,18/50 for 180mm)

1 2 3 4 5 6 7 8 9 10

Observations / Remarks

1. Refusal at 1.00mbgl due to hard strata. 2. No water encountered. Backfilled with arisings.

Sampling Runs				
From (m)	To (m)	Diam (mm)	Recovery %	Remarks

Hammer Information	
Serial No.	Energy Ratio %
DART346	68

Project Number

784-B035256

TETRA TECH

Project: Blaendulais

Location: Seven Sisters

Client: Neath Port Talbot County Borough Council

Location Details

Easting: 281954.64 Northing: 208905.49

Level: 186.88mAOD Depth: 0.50m

Logger: Gabriel Lloyd Type: WS

Inclination: °

Status

FINAL

Borehole Number

WS10

Sheet 1 of 1

Method, Plant and Crew					Diameter		Casing		Groundwater						
From (m)	To (m)	Type	Plant Used	Crew	Depth (m)	Diam (mm)	Depth(m)	Diam (mm)	Strike (m)	Casing (m)	Sealed (m)	Rose To (m)	Time (mins)	Remarks
0.00	0.50	Inspection Pit	Hand Digging Tools	South Wales Ground Testing	0.50	300								

Scale: 1:50

Checked By: NEB

Approved By: CBP

Start Date: 18/05/2022

Finish Date: 18/05/2022

Strata Description	Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Inst / Backfill	Samples and Testing: Depth (m)	Ref	Tests / Results
Grass over, dark brown sandy very gravelly CLAY. Sand is fine to coarse. Gravel is angular to subangular of sandstone and rare plastic. (MADE GROUND) MGR						0.00 - 0.50	B1	
						0.40	ES1	SPT(S) 0.50m, 50 (22,23/50 for 40mm)
EOH at 0.50m - Refused on Hard Strata.		0.50	186.38					

Observations / Remarks

1. Refusal at 0.50mbgl due to hard strata. 2. No water encountered. Backfilled with arisings.

Sampling Runs

From (m)	To (m)	Diam (mm)	Recovery %	Remarks

Hammer Information

Serial No.	Energy Ratio %
DART346	68

Project Number

784-B035256

TETRA TECH

Project: Blaendulais

Location: Seven Sisters

Client: Neath Port Talbot County Borough Council

Location Details

Easting: 281957.48 Northing: 208910.69

Level: 186.72mAOD Depth: 1.10m

Logger: Gabriel Lloyd Type: WS

Inclination: °

Status

FINAL

Borehole Number

WS11

Sheet 1 of 1

Method, Plant and Crew					Diameter		Casing		Groundwater						
From (m)	To (m)	Type	Plant Used	Crew	Depth (m)	Diam (mm)	Depth(m)	Diam (mm)	Strike (m)	Casing (m)	Sealed (m)	Rose To (m)	Time (mins)	Remarks
0.00	1.10	Inspection Pit	Hand Digginf Tools	South Wales Ground Testing	1.00 1.10	300 90								

Scale: 1:50

Checked By: NEB

Approved By: CBP

Start Date: 18/05/2022

Finish Date: 18/05/2022

Strata Description	Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Inst / Backfill	Samples and Testing: Depth (m)	Ref	Tests / Results
Grass over, sandy gravelly CLAY. Sand is fine to coarse. Garvel is angular to subangualr of sandstone, concrete, brick and colliery spoil. (MADE GROUND) MGR						0.10 - 0.30 0.30	B1 ES1	
								SPT(S) 1.00m, 50 (15,22/50 for 85mm)
EOH at 1.10m - Refused on Hard Strata.		1.10	185.62					

1 2 3 4 5 6 7 8 9 10

Observations / Remarks

1. Refusal at 1.10mbgl due to hard strata. 2. No water encountered. Backfilled with arisings.

Sampling Runs

From (m)	To (m)	Diam (mm)	Recovery %	Remarks

Hammer Information

Serial No.	Energy Ratio %
DART346	68

Project Number

784-B035256

TETRA TECH

Project: Blaendulais

Location: Seven Sisters

Client: Neath Port Talbot County Borough Council

Location Details

Easting: 281957.77 Northing: 208918.12

Level: 186.71mAOD Depth: 0.90m

Logger: Gabriel Lloyd Type: WS

Inclination: °

Status

FINAL

Borehole Number

WS12

Sheet 1 of 1

Method, Plant and Crew					Diameter		Casing		Groundwater						
From (m)	To (m)	Type	Plant Used	Crew	Depth (m)	Diam (mm)	Depth(m)	Diam (mm)	Strike (m)	Casing (m)	Sealed (m)	Rose To (m)	Time (mins)	Remarks
0.00	0.90	Inspection Pit	Hand Digginf Tools	South Wales Ground Testing	0.90	300			0.90	-	-	0.00	0	

Scale: 1:50

Checked By: NEB

Approved By: CBP

Start Date: 18/05/2022

Finish Date: 18/05/2022

Strata Description	Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Inst / Backfill	Samples and Testing: Depth (m)	Ref	Tests / Results
Grass over, clayey gravelly SAND. Sand is fine to coarse. Gravel is angular of metal, sandstone, brick and occasional plastic (MADE GROUND) MGR						0.10 - 0.30 0.15 0.30 - 0.90 0.40	B1 ES1 B2 ES2	
		0.30	186.41					
Dark greyish brown, silty sandy GRAVEL. Sand is fine to coarse. Gravel is angular of limestone, sandstone, plastic, brick and concrete. (MADE GROUND). MGR								
		0.90	185.81	▼				SPT(S) 0.90m, 50 (18,20/50 for 30mm)
EOH at 0.90m - Refused on Hard Strata.								

Observations / Remarks

1. Refusal at 0.90mbgl due to hard strata. 2. Water strike at 0.90m bgl Backfilled with arisings.

Sampling Runs				
From (m)	To (m)	Diam (mm)	Recovery %	Remarks

Hammer Information	
Serial No.	Energy Ratio %
DART346	68

Project Number

784-B035256

APPENDIX C – TRL PROBE TEST RESULTS

Tetra Tech Environment

5th Floor, Longcross Court, 47 Newport Road, Cardiff
Tel: 02920 829200
Fax: 02920 455321
Environmental Consultancy
Ground Engineering Services

TETRA TECH

PROJECT No.:	B035256
PROJECT NAME:	Blaendulais
CLIENT:	Neath Port Talbort Council
FIGURE No.:	TRL01 / WS06

DCP-CBR Corellation

$Log_{10}(CBR) = 2.48-1.057 \times Log_{10}$ (mm/blow)

DCP -Modulus E Corellation

$E = 17.6\ (CBR)^{0.64}$ MPa

In situ CBR by TRL Probe

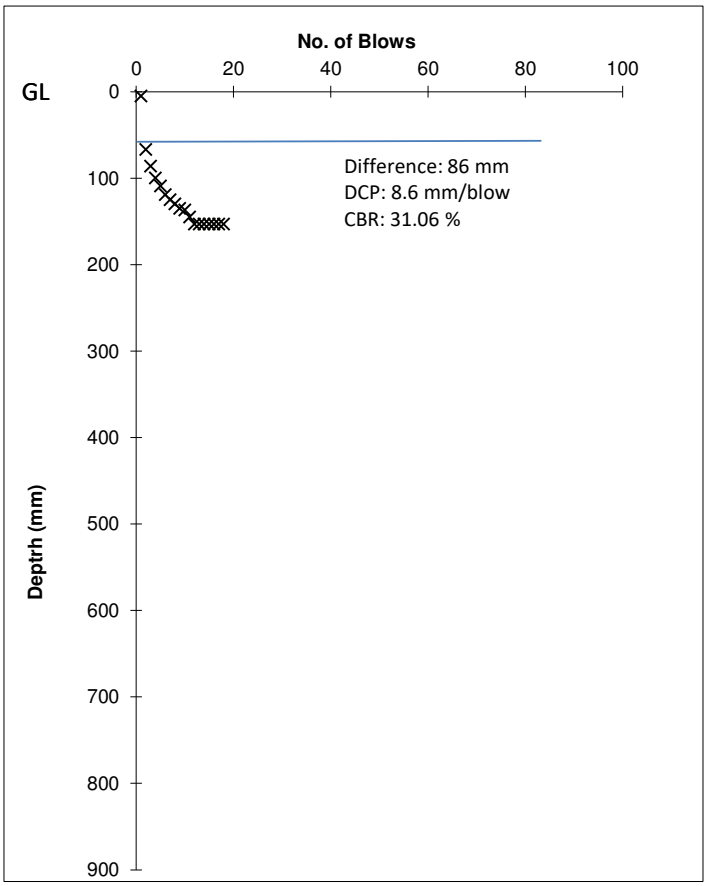
Reference: TRL01 Position: 1 Date: 19th May 2022

mm per blow	Σ Blows	Reading on Scale (mm)	Depth from Ground Level (mm)	mm per blow	Σ Blows	Reading on Scale (mm)	Depth from Ground Level (mm)
5	1	60	5				
62	2	122	67				
19	3	141	86				
14	4	155	100				
9	5	164	109				
10	6	174	119				
6	7	180	125				
5	8	185	130				
5	18	190	135				
2	19	192	137				
8	39	200	145				
8	59	208	153				
	60	208	153				
	70	208	153				
	71	208	153				
	81	208	153				
	82	208	153				
	83	208	153				
-208	93	0	-55				
	20		-55				
	21		-55				
	22		-55				
	23		-55				
	24		-55				
	25		-55				
	26		-55				
	27		-55				
	28		-55				

Test started at: 0 m below ground level

Zero Reading: 55 mm

Zero reading = start depth below ground surface



Data compiled by: CS
Data checked by: NEB

Tetra Tech Environment

5th Floor, Longcross Court, 47 Newport Road, Cardiff
Tel: 02920 829200
Fax: 02920 455321
Environmental Consultancy
Ground Engineering Services

TETRA TECH

PROJECT No.:	B035256
PROJECT NAME:	Blaendulais
CLIENT:	Neath Port Talbot Council
FIGURE No.:	TRL02 / WS01

DCP-CBR Corellation

$Log_{10}(CBR) = 2.48\text{-}1.057 \times Log_{10}$ (mm/blow)

DCP -Modulus E Corellation

$E = 17.6\ (CBR)^{0.64}$ MPa

In situ CBR by TRL Probe

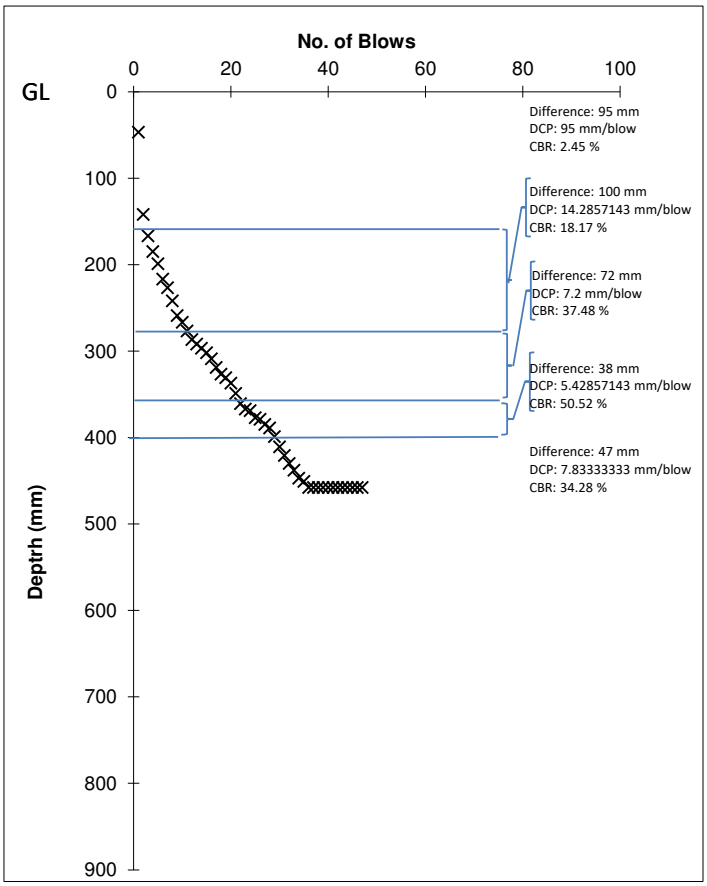
Reference: TRL02 / WS01 Position: 1 Date: 19th May 2022

mm per blow	Σ Blows	Reading on Scale (mm)	Depth from Ground Level (mm)	mm per blow	Σ Blows	Reading on Scale (mm)	Depth from Ground Level (mm)
47	1	90	47				
95	2	185	142				
25	3	210	167				
18	4	228	185				
14	5	242	199				
18	6	260	217				
10	7	270	227				
15	8	285	242				
17	18	302	259				
8	19	310	267				
10	39	320	277				
10	59	330	287				
5	60	335	292				
5	70	340	297				
5	71	345	302				
7	81	352	309				
10	82	362	319				
8	83	370	327				
4	93	374	331				
6	20	380	337				
12	21	392	349				
12	22	404	361				
6	23	410	367				
2	24	412	369				
8	25	420	377				
2	26	422	379				
6	27	428	385				
4	28	432	389				
10		442					
12		454					
10		464					
9		473					
8		481					
9		490					
4		494					
7		501					
		501					
		501					
		501					
		501					
		501					
		501					
		501					
		501					
		501					
		501					
		501					
-501							

Test started at: 0 m below ground level

Zero Reading: 43 mm

Zero reading = start depth below ground surface



Data compiled by: CS
Data checked by: NEB

Tetra Tech Environment

5th Floor, Longcross Court, 47 Newport Road, Cardiff
Tel: 02920 829200
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Environmental Consultancy
Ground Engineering Services

TETRA TECH

PROJECT No.:	B035256
PROJECT NAME:	Blaendulais
CLIENT:	Neath Port Talbot Council
FIGURE No.:	TRL03 / WS11

DCP-CBR Corellation

$Log_{10}(CBR) = 2.48-1.057 \times Log_{10}$ (mm/blow)

DCP -Modulus E Corellation

$E = 17.6\ (CBR)^{0.64}$ MPa

In situ CBR by TRL Probe

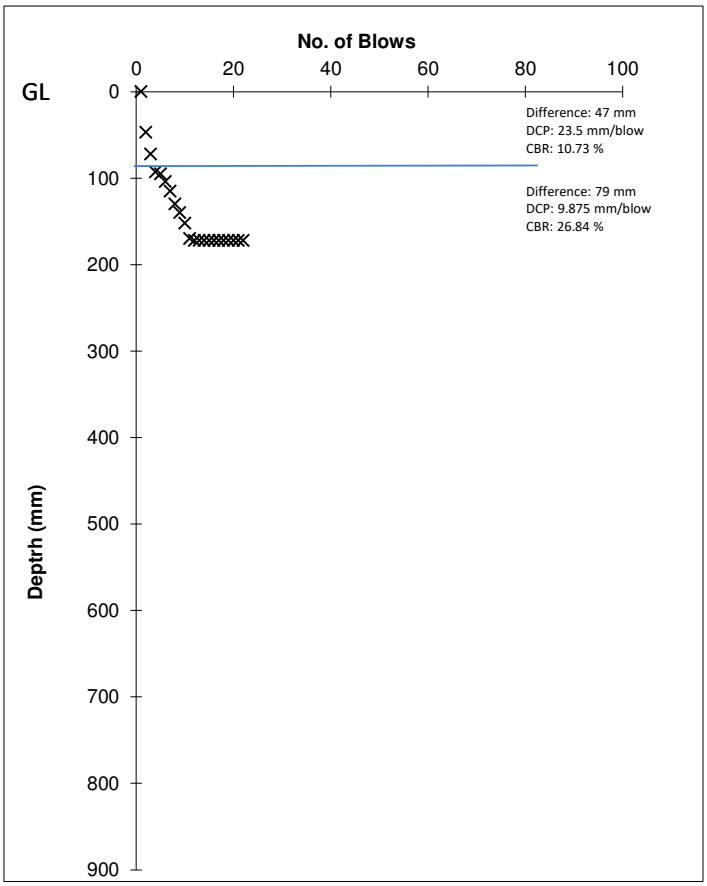
Reference: TRL03 Position: 1 Date: 19th May 2022

Test started at: 0 m below ground level

Zero Reading: 50 mm

Zero reading = start depth below ground surface

mm per blow	Σ Blows	Reading on Scale (mm)	Depth from Ground Level (mm)	mm per blow	Σ Blows	Reading on Scale (mm)	Depth from Ground Level (mm)
	1	50					
47	2	97	47				
25	3	122	72				
21	4	143	93				
2	5	145	95				
9	6	154	104				
11	7	165	115				
15	8	180	130				
10	18	190	140				
12	19	202	152				
18	39	220	170				
2	59	222	172				
	60	222	172				
	70	222	172				
	71	222	172				
	81	222	172				
	82	222	172				
	83	222	172				
	93	222	172				
	20	222	172				
	21	222	172				
	22	222	172				
-222	23		-50				
	24		-50				
	25		-50				
	26		-50				
	27		-50				
	28		-50				



Data compiled by: GL
Data checked by: NEB

Tetra Tech Environment

5th Floor, Longcross Court, 47 Newport Road, Cardiff
Tel: 02920 829200
Fax: 02920 455321
Environmental Consultancy
Ground Engineering Services

TETRA TECH

PROJECT No.:	B035256
PROJECT NAME:	Blaendulais
CLIENT:	Neath Port Talbot Council
FIGURE No.:	TRL04 / WS07

DCP-CBR Corellation

$Log_{10}(CBR) = 2.48-1.057 \times Log_{10}$ (mm/blow)

DCP -Modulus E Corellation

$E = 17.6\ (CBR)^{0.64}$ MPa

In situ CBR by TRL Probe

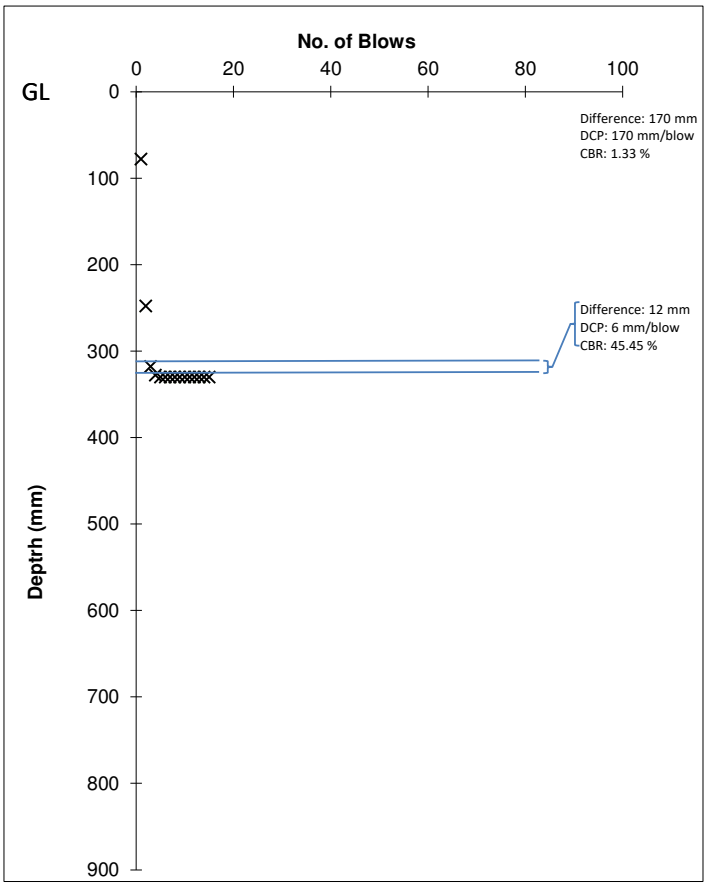
Reference: TRL04 Position: 1 Date: 19th May 2022

mm per blow	Σ Blows	Reading on Scale (mm)	Depth from Ground Level (mm)	mm per blow	Σ Blows	Reading on Scale (mm)	Depth from Ground Level (mm)
78	1	110	78				
170	2	280	248				
70	3	350	318				
10	4	360	328				
2	5	362	330				
	6	362	330				
	7	362	330				
	8	362	330				
	18	362	330				
	19	362	330				
	39	362	330				
	59	362	330				
	60	362	330				
	70	362	330				
	71	362	330				
-362	81		-32				
	82		-32				
	83		-32				
	93	0	-32				
	20		-32				
	21		-32				
	22		-32				
	23		-32				
	24		-32				
	25		-32				
	26		-32				
	27		-32				
	28		-32				

Test started at: 0 m below ground level

Zero Reading: 32 mm

Zero reading = start depth below ground surface



Data compiled by: GL
Data checked by: NEB

Tetra Tech Environment

5th Floor, Longcross Court, 47 Newport Road, Cardiff
Tel: 02920 829200
Fax: 02920 455321
Environmental Consultancy
Ground Engineering Services

TETRA TECH

PROJECT No.:	B035256
PROJECT NAME:	Blaendulais
CLIENT:	Neath Port Talbort Council
FIGURE No.:	TRL05 / WS04

DCP-CBR Corellation

$Log_{10}(CBR) = 2.48-1.057 \times Log_{10}$ (mm/blow)

DCP -Modulus E Corellation

$E = 17.6\ (CBR)^{0.64}$ MPa

In situ CBR by TRL Probe

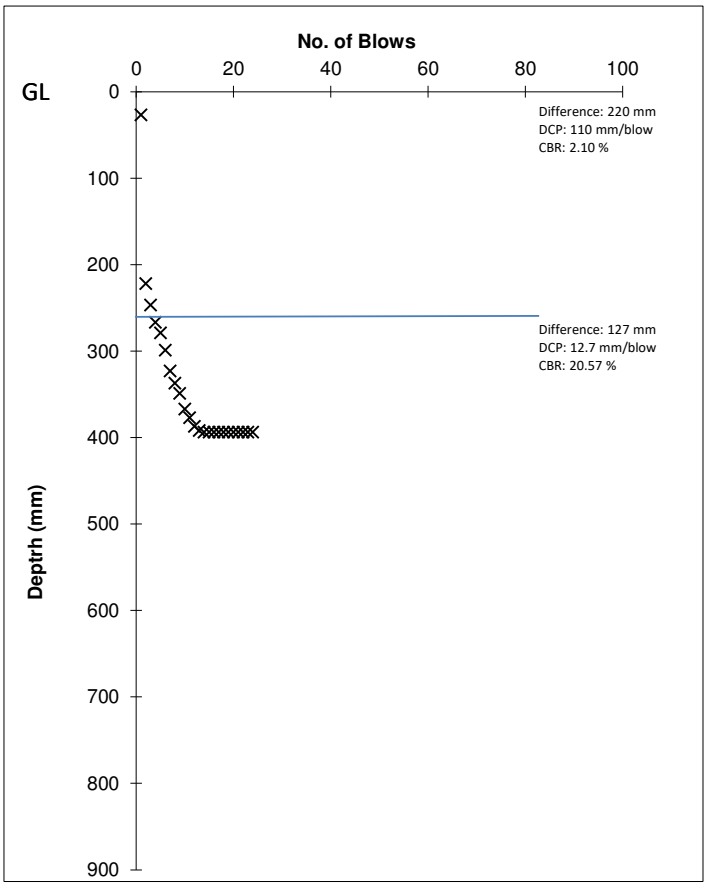
Reference: TRL05 Position: 1 Date: 19th May 2022

mm per blow	Σ Blows	Reading on Scale (mm)	Depth from Ground Level (mm)	mm per blow	Σ Blows	Reading on Scale (mm)	Depth from Ground Level (mm)
27	1	90	27				
195	2	285	222				
25	3	310	247				
20	4	330	267				
12	5	342	279				
20	6	362	299				
24	7	386	323				
14	8	400	337				
12	18	412	349				
18	19	430	367				
10	39	440	377				
10	59	450	387				
5	60	455	392				
2	70	457	394				
	71	457	394				
	81	457	394				
	82	457	394				
	83	457	394				
	93	457	394				
	20	457	394				
	21	457	394				
	22	457	394				
	23	457	394				
	24	457	394				
-457	25		-63				
	26		-63				
	27		-63				
	28		-63				

Test started at: 0 m below ground level

Zero Reading: 63 mm

Zero reading = start depth below ground surface



Data compiled by: GL
Data checked by: NEB

APPENDIX D – SOIL INFILTRATION TEST RESULTS

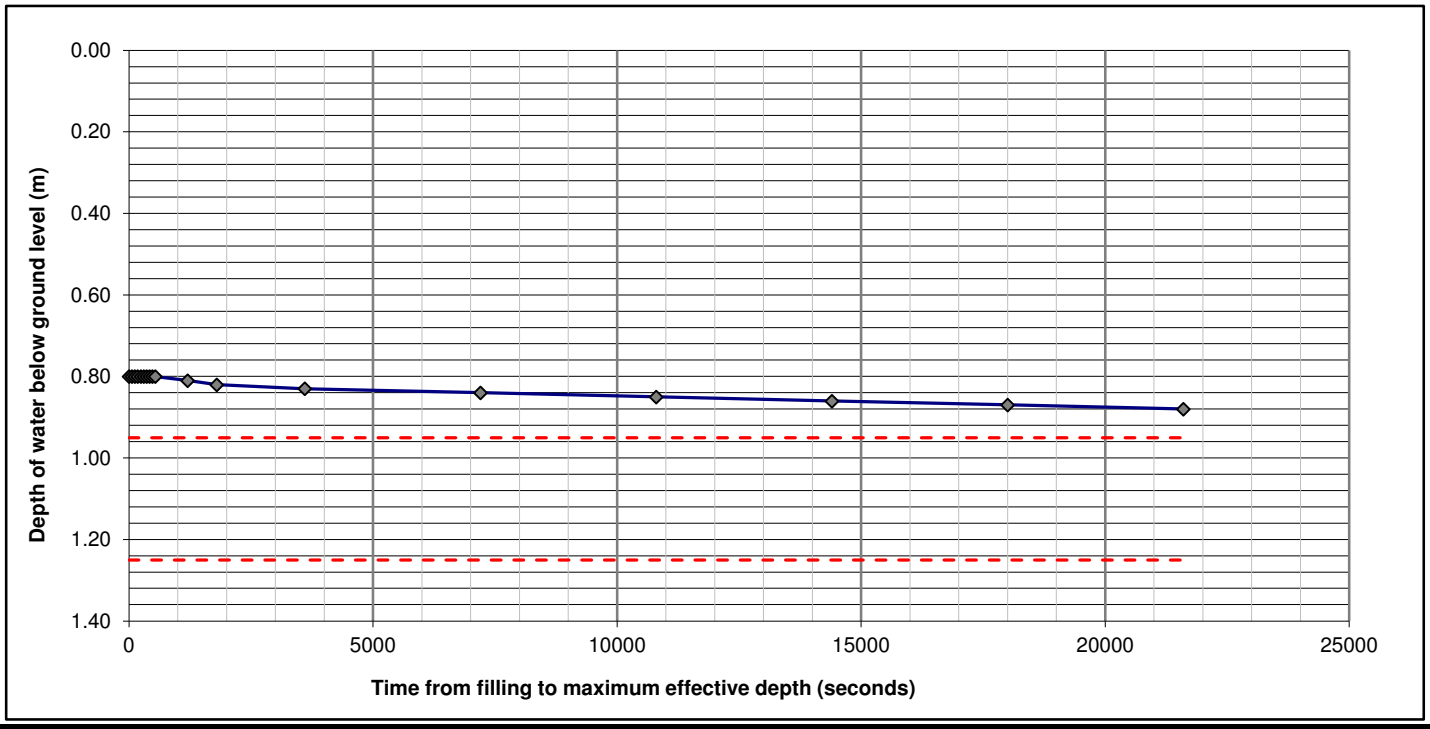
Tetra Tech

Environmental Consultancy
Ground Engineering Services

TETRA TECH

DATE:	16/05/2022
PROJECT No:	B035642
PROJECT NAME:	Blaendulais
CLIENT:	Neath Port Talbort Council
TRIAL PIT ID:	TP01
TEST NUMBER:	1

SOAKAWAY TEST - SOIL INFILTRATION RATE/PERMEABILITY CALCULATION



Time Elapsed (s)	Time Elapsed (mins)	Distance to water surface from ground level (m)
0	0.00	0.800
60	1.00	0.800
120	2.00	0.800
180	3.00	0.800
240	4.00	0.800
300	5.00	0.800
360	6.00	0.800
420	7.00	0.800
480	8.00	0.800
540	9.00	0.800
1200	20.00	0.810
1800	30.00	0.820
3600	60.00	0.830
7200	120.00	0.840
10800	180.00	0.850
14400	240.00	0.860
18000	300.00	0.870
21600	360.00	0.880

PIT LENGTH (m):	1.30	**Pit construction**
PIT WIDTH (m):	0.50	
PIT DEPTH (m):	1.40	

INPUT PARAMETERS:		
Total volume of pit	(m^3)	0.39
Pit volume between 75% and 25% depths = L x W x ½D	(m^3)	0.20
Effective depth of Pit	(m)	0.60
Proportion of pit volume occupied by gravel solids	(0-1)	0.00
Maximum potential volume of Water	(m^3)	0.39
Level of water in pit at 75% effective depth (p_{75})	(m)	0.15
Level of water in pit at 25% effective depth (p_{25})	(m)	0.45
Effective volume between 75% & 25% depth $Vp_{75\text{-}25}$ = V x Pg	(m^3)	0.20
Surface area of pit up to 50% effective depth (A_{p50})	(m^2)	1.73
Time at 75% effective depth (p_{75})	(s)	#N/A
Time at 25% effective depth (p_{25})	(s)	#N/A
Time for outflow for 75% and 25% effective depth (Tp75-25)	(s)	#N/A

OUTPUT:			
SOIL INFILTRATION RATE (f)	$\frac{V_{p75-25}}{A_{p50} \times T_{p75-25}}$	(m/s)	**#N/A**

WATER INPUT: 350 L in 1 minute

GEOLOGY OF TEST SECTION:

Mottled orangish brown grey, sandy gravelly CLAY. Sand is fine to coarse. Gravel is angular to subrounded of sandstone and siltstone. High cobble content.

Compiled by: GL
Checked by: NEB

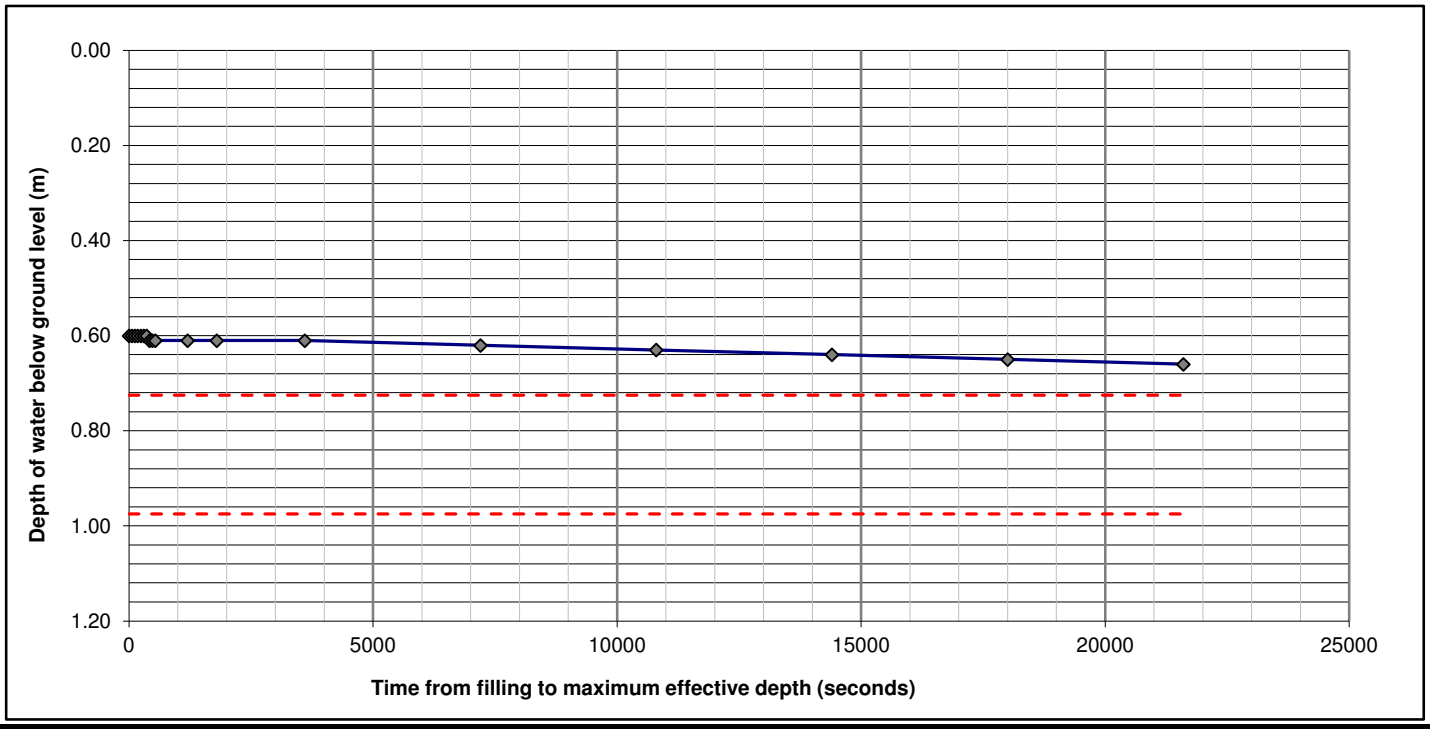
Tetra Tech

Environmental Consultancy
Ground Engineering Services

TETRA TECH

DATE:	16/05/2022
PROJECT No:	B035642
PROJECT NAME:	Blaendulais
CLIENT:	Neath Port Talbot Council
TRIAL PIT ID:	TP04
TEST NUMBER:	1

SOAKAWAY TEST - SOIL INFILTRATION RATE/PERMEABILITY CALCULATION



Time Elapsed (s)	Time Elapsed (mins)	Distance to water surface from ground level (m)
0	0.00	0.600
60	1.00	0.600
120	2.00	0.600
180	3.00	0.600
240	4.00	0.600
300	5.00	0.600
360	6.00	0.600
420	7.00	0.610
480	8.00	0.610
540	9.00	0.610
1200	20.00	0.610
1800	30.00	0.610
3600	60.00	0.610
7200	120.00	0.620
10800	180.00	0.630
14400	240.00	0.640
18000	300.00	0.650
21600	360.00	0.660

PIT LENGTH (m):	1.20	**Pit construction**
PIT WIDTH (m):	0.45	
PIT DEPTH (m):	1.10	

INPUT PARAMETERS:		
Total volume of pit	(m^3)	0.27
Pit volume between 75% and 25% depths = L x W x ½D	(m^3)	0.14
Effective depth of Pit	(m)	0.50
Proportion of pit volume occupied by gravel solids	(0-1)	0.00
Maximum potential volume of Water	(m^3)	0.27
Level of water in pit at 75% effective depth (p_{75})	(m)	0.13
Level of water in pit at 25% effective depth (p_{25})	(m)	0.38
Effective volume between 75% & 25% depth $Vp_{75\text{-}25}$ = V x Pg	(m^3)	0.14
Surface area of pit up to 50% effective depth (A_{p50})	(m^2)	1.37
Time at 75% effective depth (p_{75})	(s)	#N/A
Time at 25% effective depth (p_{25})	(s)	#N/A
Time for outflow for 75% and 25% effective depth (Tp75-25)	(s)	#N/A

OUTPUT:			
SOIL INFILTRATION RATE (f)	$\frac{V_{p75-25}}{A_{p50} \times T_{p75-25}}$	(m/s)	**#N/A**

WATER INPUT: 350 L in 1 minute

GEOLOGY OF TEST SECTION:

Mottled orangish brown grey, sandy gravelly CLAY (Looks Laminted) Sand is fine to coarse. Gravel is angular to subrounded of sandstone and siltstone and colliery Spoil . High cobble content. (MADE GROUND)

Compiled by: GL
Checked by: NEB

APPENDIX E – GEOTECHNICAL LABORATORY TEST RESULTS

Laboratory Report

UKAS TESTING 2788

GSTL GEOTECHNICAL SITE & TESTING LABORATORIES A PHENNA GROUP COMPANY

Contract Number: 59665

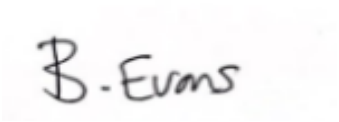
Client Ref: **784-B035256**
Client PO:

Client: **Tetra Tech**
5th Floor
Longcross Court
47 Newport Road
Cardiff
CF24 0AD

Contract Title: **Blaendulais**
For the attention of: **Gabriel Lloyd**

Date Received: **24-05-2022**
Date Completed: **18-06-2022**
Report Date: **18-06-2022**

This report has been checked and approved by:



Brendan Evans
Office Administrator

Test Description	Qty
Moisture Content BS 1377:1990 - Part 2 : 3.2 - * UKAS	5
4 Point Liquid & Plastic Limit BS 1377:1990 - Part 2 : 4.3 & 5.3 - * UKAS	5
PSD Wet & Dry Sieve method BS 1377:1990 - Part 2 : 9.2 - * UKAS	5
PSD: Sedimentation by pipette carried out with Wet Sieve (Wet Sieve must also be selected) BS 1377:1990 - Part 2 : 9.4 - * UKAS	3
BRE Full Suite **includes pH, water & acid soluble sulphate, total sulphur, magnesium, chloride and nitrate** Sub-contracted Test	5
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

This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced except in full, without the prior written approval of the laboratory.

Approved Signatories:
Brendan Evans (Office Administrator) - Emma Sharp (Business Support Manager) - Paul Evans (Director)
Richard John (Quality/Technical Manager) - Shaun Jones (Laboratory manager) - Shaun Thomas (Site Manager)
Wayne Honey (Health and Safety Coordinator/ Quality Assistant)

GEO Site & Testing Services Ltd
Unit 3-4, Heol Aur, Dafen Ind Estate, Dafen, Llanelli, Carmarthenshire SA14 8QN
Tel: 01554 784040 Fax: 01554 784041 info@gstl.co.uk gstl.co.uk

GSTL GEOTECHNICAL SITE & TESTING LABORATORIES	Summary of Soil Descriptions	
Contract Number	59665	
Site Name	Blaendulais	
Client Reference	784-B035256	

Sample/Hole Reference	Sample Number	Sample Type	Depth (m)			Descriptions
TP03		B	0.80	-	1.00	Brown silty fine to coarse sandy clayey fine to coarse GRAVEL with cobbles
TP04		B	0.50	-	0.80	Brown slightly silty/ clayey fine to coarse sandy fine to coarse GRAVEL
BH02		B	1.30	-	2.50	Brown slightly silty clayey fine to coarse gravelly fine to coarse SAND
WS01A		B	1.10	-	1.60	Brown fine to coarse gravelly CLAY
WS07		B	0.10	-	0.70	Brown slightly silty clayey fine to coarse sandy fine to coarse GRAVEL with cobbles
WS08		B	1.85	-	2.80	Brown silty sandy gravelly CLAY
WS04		B	1.60	-	2.60	Brown silty fine to coarse gravelly CLAY
WS02		B	0.80	-		Black slightly silty/ clayey fine to coarse gravelly fine to coarse SAND
				-		
				-		
				-		
				-		
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				-		
				-		
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GSTL
GEOTECHNICAL SITE & TESTING LABORATORIES

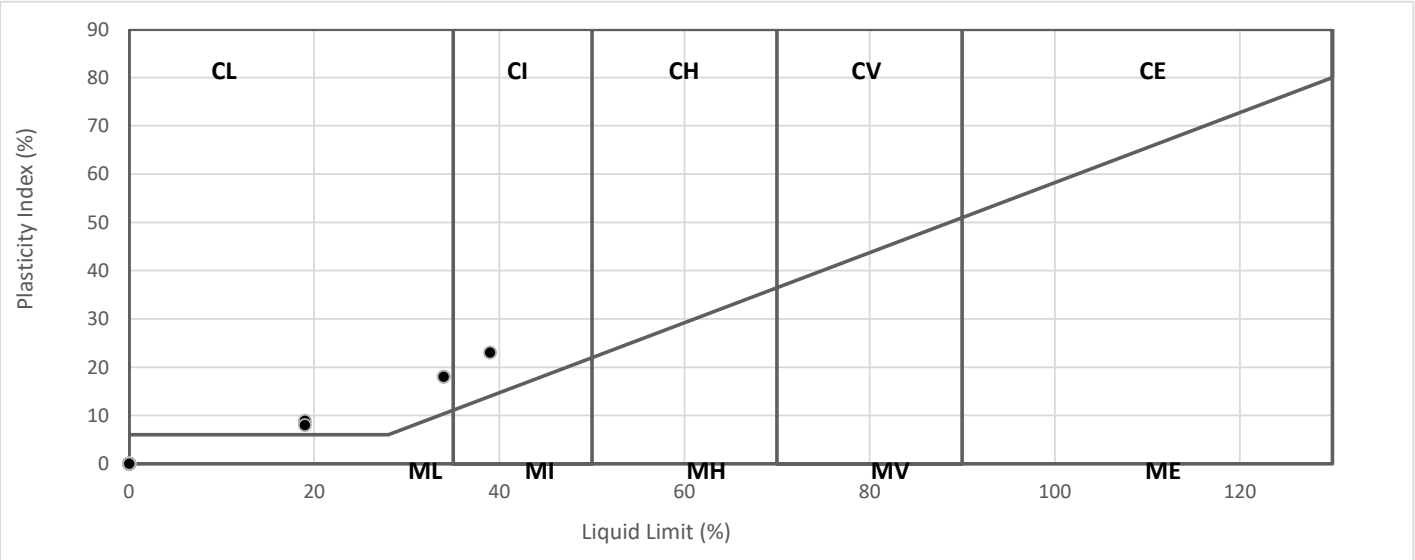
NATURAL MOISTURE, LIQUID LIMIT, PLASTIC LIMIT AND PLASTICITY INDEX
(BS 1377:1990 - Part 2 : 4.3 & 5.3)

Contract Number	59665
Project Location	Blaendulais
Date Tested	13/06/2022

Sample/Hole Reference	Sample Number	Sample Type	Depth (m)			Moisture Content %	Liquid Limit %	Plastic Limit %	Plasticity index %	Passing 0.425mm %	Remarks
TP03		B	0.80	-	1.00	16	34	16	18	41	CL Low Plasticity
BH02		B	1.30	-	2.50	7.6	19	10	9	61	CL Low Plasticity
WS01A		B	1.10	-	1.60	21	34	16	18	80	CL Low Plasticity
WS08		B	1.85	-	2.80	7.7	19	11	8	88	CL Low Plasticity
WS04		B	1.60	-	2.60	18	39	16	23	79	CI Intermediate Plasticity
				-							
				-							
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Symbols: NP : Non Plastic # : Liquid Limit and Plastic Limit Wet Sieved

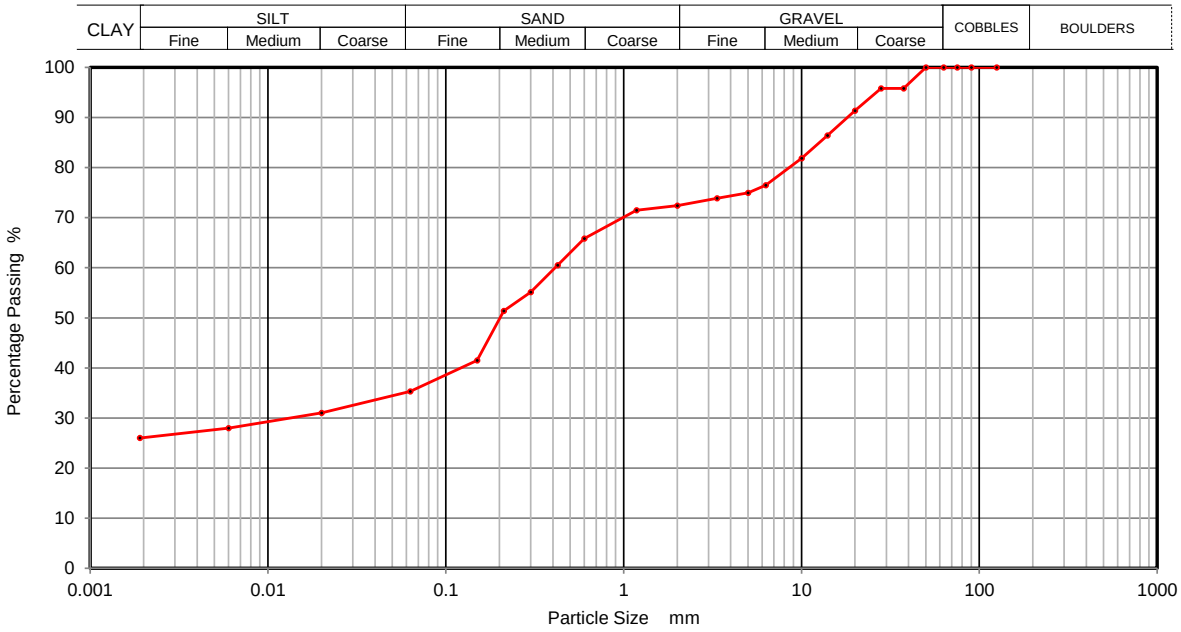
PLASTICITY CHART FOR CASAGRANDE CLASSIFICATION
BS 5930:1999+A2:2010



Operators			
Darcy Etheridge			

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	59665
		Borehole/Pit No.	BH02
Site Name	Blaendulais	Sample No.	
Soil Description	*See description sheet	Depth Top	1.30
		Depth Base	2.50
Date Tested	14/06/2022	Sample Type	B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0200	31
90	100	0.0060	28
75	100	0.0020	26
63	100		
50	100		
37.5	96		
28	96		
20	91		
14	86		
10	82		
6.3	76		
5	75		
3.35	74		
2	72		
1.18	71		
0.6	66		
0.425	61		
0.3	55		
0.212	51		
0.15	41		
0.063	35		

Sample Proportions	% dry mass
Cobbles	0
Gravel	28
Sand	37
Silt	9
Clay	26

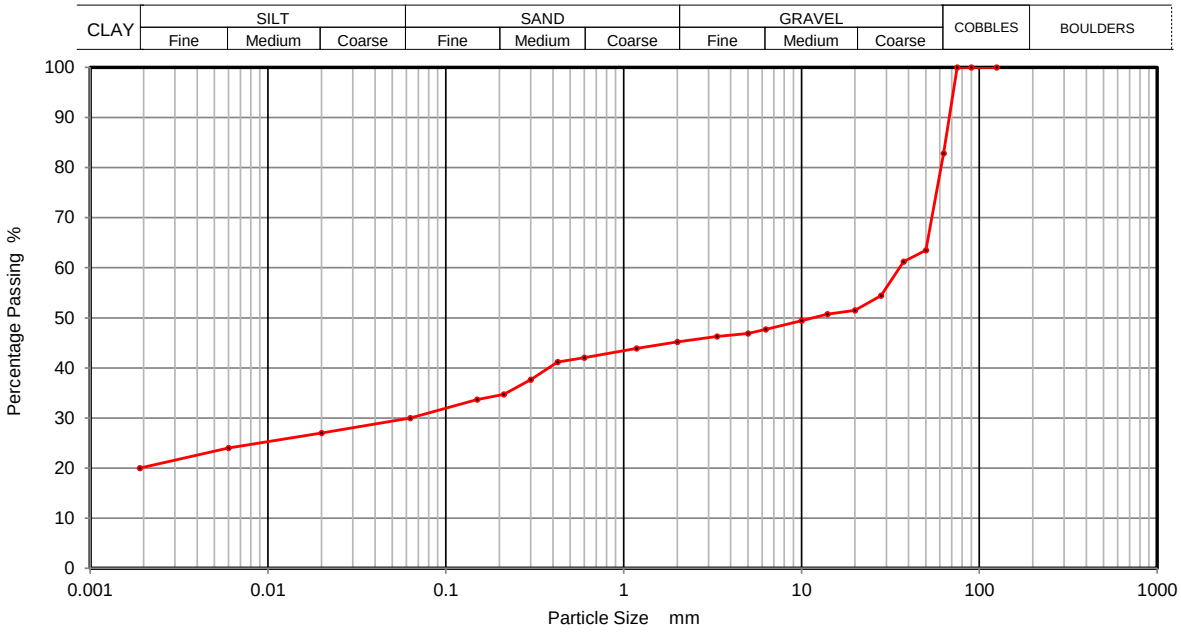
Remarks

Preparation and testing in accordance with BS1377 unless noted below

Operator				
David Edwards				

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	59665
		Borehole/Pit No.	TP03
Site Name	Blaendulais	Sample No.	
Soil Description	*See description sheet	Depth Top	0.80
		Depth Base	1.00
Date Tested	14/06/2022	Sample Type	B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0200	27
90	100	0.0060	24
75	100	0.0020	20
63	83		
50	63		
37.5	61		
28	54		
20	51		
14	51		
10	49		
6.3	48		
5	47		
3.35	46		
2	45		
1.18	44		
0.6	42		
0.425	41		
0.3	38		
0.212	35		
0.15	34		
0.063	30		

Sample Proportions	% dry mass
Cobbles	17
Gravel	38
Sand	15
Silt	10
Clay	20

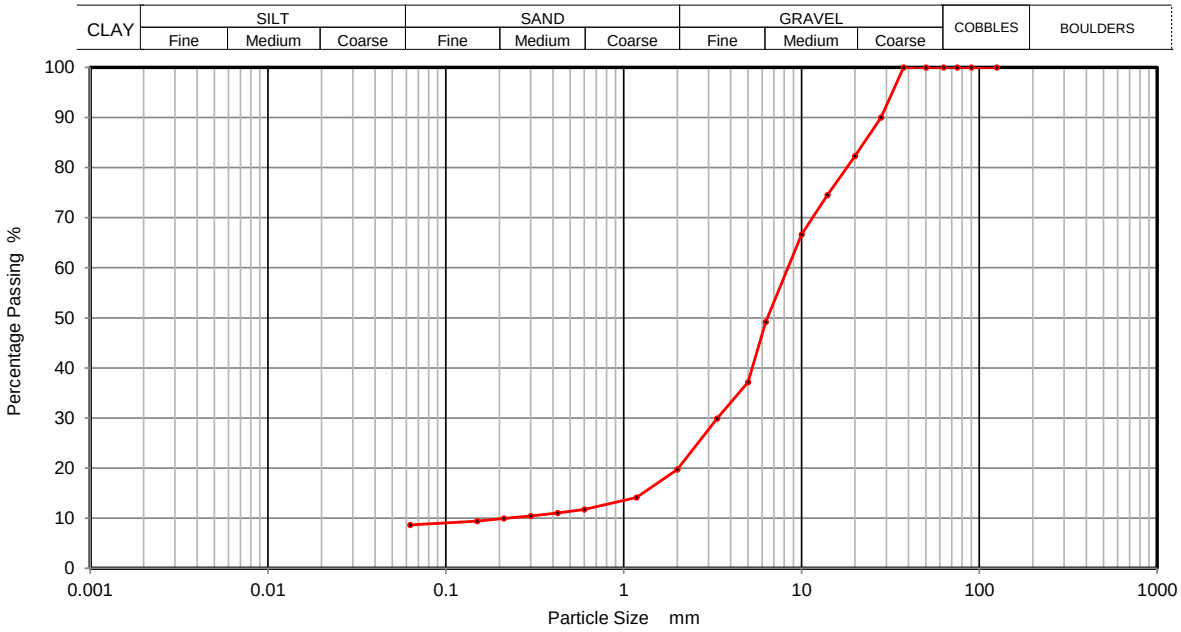
Remarks

Preparation and testing in accordance with BS1377 unless noted below

Operator				
David Edwards				

UKAS TESTING 2788

GSTL GEOTECHNICAL SITE & TESTING LABORATORIES	**PARTICLE SIZE DISTRIBUTION** **BS 1377 Part 2:1990** **Wet Sieve, Clause 9.2**	Contract Number	59665
		Borehole/Pit No.	TP04
Site Name	Blaendulais	Sample No.	
Soil Description	*See description sheet	Depth Top	0.50
		Depth Base	0.80
Date Tested	14/06/2022	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	100		
28	90		
20	82		
14	75		
10	67		
6.3	49		
5	37		
3.35	30		
2	20		
1.18	14		
0.6	12		
0.425	11		
0.3	10		
0.212	10		
0.15	9		
0.063	9		

Sample Proportions	% dry mass
Cobbles	0
Gravel	80
Sand	11
Silt and Clay	9

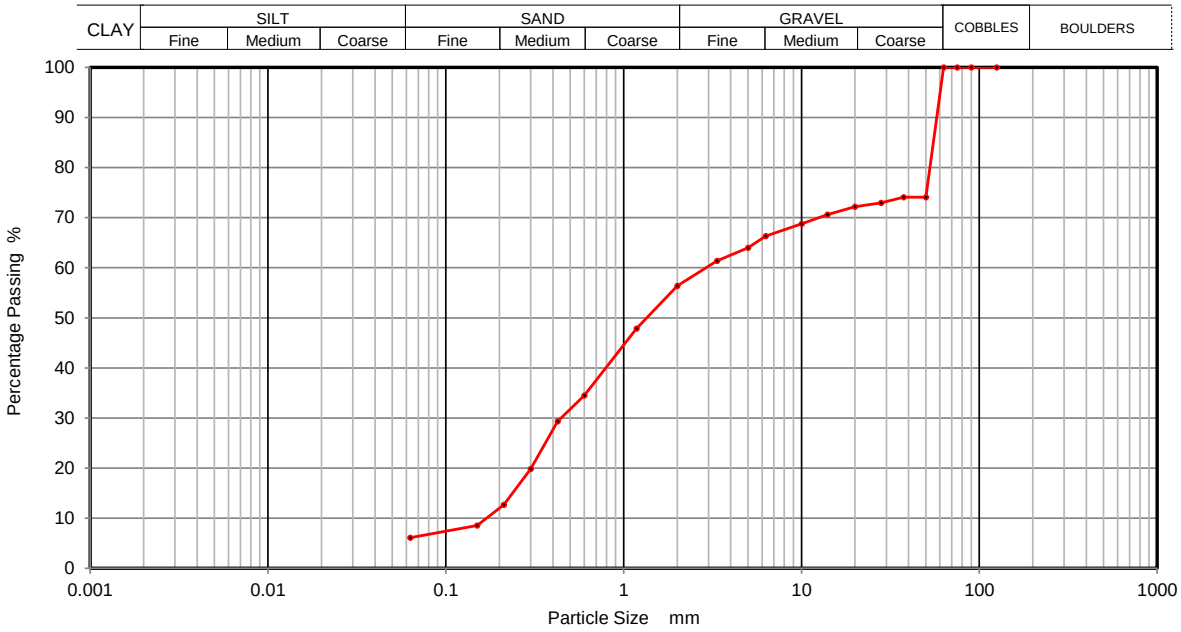
Remarks

Preparation and testing in accordance with BS1377 unless noted below

Operator				
David Edwards				

UKAS TESTING
2788

GSTL GEOTECHNICAL SITE & TESTING LABORATORIES	**PARTICLE SIZE DISTRIBUTION** **BS 1377 Part 2:1990** **Wet Sieve, Clause 9.2**	Contract Number	59665
		Borehole/Pit No.	WS02
Site Name	Blaendulais	Sample No.	
Soil Description	*See description sheet	Depth Top	0.80
		Depth Base	
Date Tested	14/06/2022	Sample Type	B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	74		
37.5	74		
28	73		
20	72		
14	71		
10	69		
6.3	66		
5	64		
3.35	61		
2	56		
1.18	48		
0.6	34		
0.425	29		
0.3	20		
0.212	13		
0.15	9		
0.063	6		

Sample Proportions	% dry mass
Cobbles	0
Gravel	44
Sand	50
Silt and Clay	6

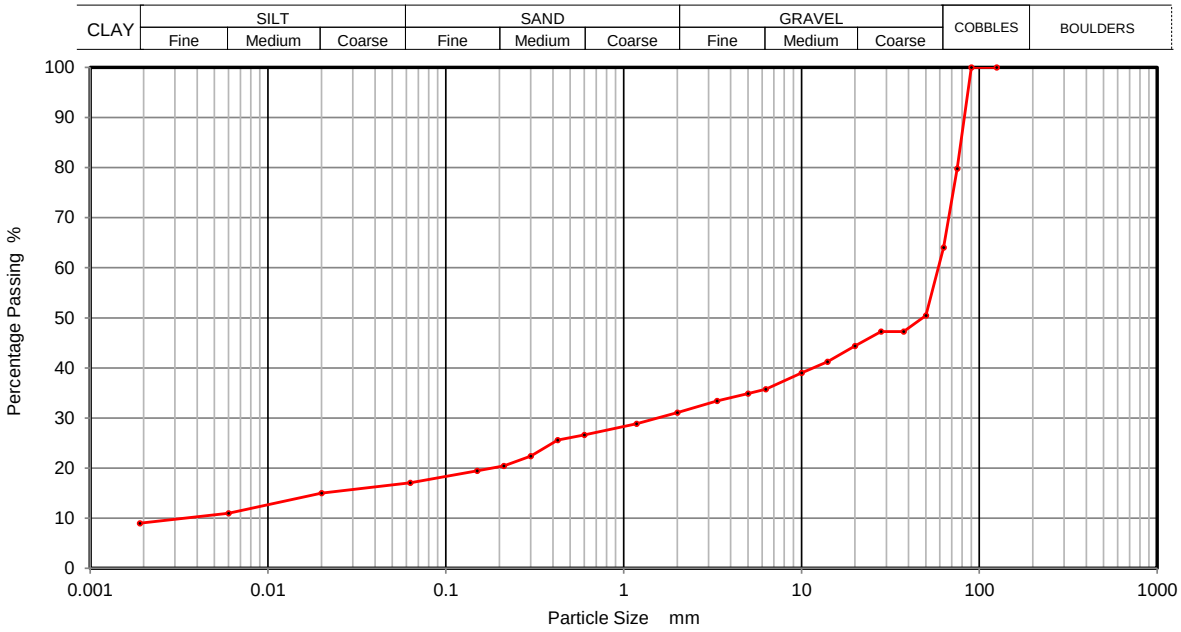
Remarks

Preparation and testing in accordance with BS1377 unless noted below

Operator				
David Edwards				

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	59665
		Borehole/Pit No.	WS07
Site Name	Blaendulais	Sample No.	
Soil Description	*See description sheet	Depth Top	0.10
		Depth Base	0.70
Date Tested	14/06/2022	Sample Type	B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0200	15
90	100	0.0060	11
75	80	0.0020	9
63	64		
50	50		
37.5	47		
28	47		
20	44		
14	41		
10	39		
6.3	36		
5	35		
3.35	33		
2	31		
1.18	29		
0.6	27		
0.425	26		
0.3	22		
0.212	20		
0.15	19		
0.063	17		

Sample Proportions	% dry mass
Cobbles	36
Gravel	33
Sand	14
Silt	8
Clay	9

Remarks

Preparation and testing in accordance with BS1377 unless noted below

Operator				
David Edwards				

UKAS TESTING
2788

2531

ANALYTICAL TEST REPORT

Contract no: 110034

Contract name: Blaendulais

Client reference: -

Clients name: Geo Site & Testing Services

Clients address: Unit 3 and 4 Heol Aur
Dafen Industrial Estate, Dafen
Llanelli, Carmarthenshire
SA14 8QN

Samples received: 06 June 2022

Analysis started: 06 June 2022

Analysis completed: 13 June 2022

Report issued: 13 June 2022

Key

U	UKAS accredited test
M	MCERTS & UKAS accredited test
$	Test carried out by an approved subcontractor
I/S	Insufficient sample to carry out test
N/S	Sample not suitable for testing

Approved by:

Megan Harris

Senior Reporting Administrator

Chemtech Environmental Limited

SOILS

Lab number			110034-1	110034-2	110034-3	110034-4	110034-5
Sample id			BH02	WS01A	WS06	WS07	WS12
Depth (m)			1.30-2.50	1.10-1.60	0.30-0.60	0.10-0.70	0.30-0.90
Date sampled			-	-	-	-	-
Test	**Method**	**Units**					
pH	CE004 [U]	units	6.9	7.4	8.6	7.3	7.3
Magnesium (2:1 water soluble)	CE061	mg/l Mg	1.7	<1	4.5	4.8	6.5
Chloride (2:1 water soluble)	CE049 [U]	mg/l Cl	2.5	2.4	12	1.7	1.4
Nitrate (2:1 water soluble)	CE049 [U]	mg/l NO_3	<1	<1	<1	<1	1.2
Sulphate (2:1 water soluble)	CE061 [U]	mg/l SO_4	18	<10	978	128	112
Sulphate (total)	CE062 [U]	mg/kg SO_4	582	163	3999	530	369
Sulphate (total)	CE062 [U]	% w/w SO_4	0.06	0.02	0.40	0.05	0.04
Sulphur (total)	CE119	mg/kg S	523	<100	2511	255	245
Sulphur (total)	CE119	% w/w S	0.05	<0.01	0.25	0.03	0.02

Chemtech Environmental Limited

METHOD DETAILS

METHOD	SOILS	METHOD SUMMARY	SAMPLE	STATUS	LOD	UNITS
CE004	pH	Based on BS 1377, pH Meter	As received	U	-	units
CE061	Magnesium (2:1 water soluble)	Aqueous extraction, ICP-OES	Dry		1	mg/l Mg
CE049	Chloride (2:1 water soluble)	Aqueous extraction, IC-COND	Dry	U	1	mg/l Cl
CE049	Nitrate (2:1 water soluble)	Aqueous extraction, IC-COND	Dry	U	1	mg/l NO_3
CE061	Sulphate (2:1 water soluble)	Aqueous extraction, ICP-OES	Dry	U	10	mg/l SO_4
CE062	Sulphate (total)	Acid extraction, ICP-OES	Dry	U	100	mg/kg SO_4
CE062	Sulphate (total)	Acid extraction, ICP-OES	Dry	U	0.01	% w/w SO_4
CE119	Sulphur (total)	Acid extraction, ICP-OES	Dry		100	mg/kg S
CE119	Sulphur (total)	Acid extraction, ICP-OES	Dry		0.01	% w/w S

Chemtech Environmental Limited

DEVIATING SAMPLE INFORMATION

Comments
Sample deviation is determined in accordance with the UKAS note "Guidance on Deviating Samples" and based on reference standards and laboratory trials.
For samples identified as deviating, test result(s) may be compromised and may not be representative of the sample at the time of sampling.
Chemtech Environmental Ltd cannot be held responsible for the integrity of sample(s) received if Chemtech Environmental Ltd did not undertake the sampling. Such samples may be deviating.

Key

N	No (not deviating sample)
Y	Yes (deviating sample)
NSD	Sampling date not provided
NST	Sampling time not provided (waters only)
EHT	Sample exceeded holding time(s)
IC	Sample not received in appropriate containers
HP	Headspace present in sample container
NCF	Sample not chemically fixed (where appropriate)
OR	Other (specify)

Lab ref	Sample id	Depth (m)	Deviating	Tests (Reason for deviation)
110034-1	BH02	1.30-2.50	Y	All (NSD)
110034-2	WS01A	1.10-1.60	Y	All (NSD)
110034-3	WS06	0.30-0.60	Y	All (NSD)
110034-4	WS07	0.10-0.70	Y	All (NSD)
110034-5	WS12	0.30-0.90	Y	All (NSD)

Chemtech Environmental Limited

ADDITIONAL INFORMATION

Notes

Opinions and interpretations expressed herein are outside the UKAS accreditation scope.
Unless otherwise stated, Chemtech Environmental Ltd was not responsible for sampling.
All testing carried out at Unit 6 Parkhead, Stanley, DH9 7YB, except for subcontracted testing.
Methods, procedures and performance data are available on request.
Results reported herein relate only to the material supplied to the laboratory.
This report shall not be reproduced except in full, without prior written approval.
Samples will be disposed of 4 weeks from initial receipt unless otherwise instructed.
For soils and solids, all results are reported on a dry basis. Samples dried at no more than 30°C in a drying cabinet.
Analytical results are inclusive of stones, where applicable.

APPENDIX F – CHEMICAL LABORATORY TEST RESULTS

Element Materials Technology
Unit 3 Deeside Point
Zone 3
Deeside Industrial Park
Deeside
CH5 2UA

P: +44 (0) 1244 833780
F: +44 (0) 1244 833781
W: www.element.com

Tetra Tech
5th Floor, Longcross Court
47 Newport Rd
Cardiff
Cardiff
UK
CF24 OAD

Attention :	Nicholas Bool
Date :	31st May, 2022
Your reference :	784-B035256
Our reference :	Test Report 22/8081 Batch 1
Location :	Blaeudulais
Date samples received :	18th May, 2022
Status :	Final Report
Issue :	1

Five samples were received for analysis on 18th May, 2022 of which three were scheduled for analysis. Please find attached our Test Report which should be read with notes at the end of the report and should include all sections if reproduced. Interpretations and opinions are outside the scope of any accreditation, and all results relate only to samples supplied.
All analysis is carried out on as received samples and reported on a dry weight basis unless stated otherwise. Results are not surrogate corrected.

Authorised By:

Liza Klebe
Project Co-ordinator

Please include all sections of this report if it is reproduced

Client Name: Tetra Tech
Reference: 784-B035256
Location: Blaeudulais
Contact: Nicholas Bool
EMT Job No: 22/8081

Report : Solid

Solids: V=60g VOC jar, J=250g glass jar, T=plastic tub

EMT Sample No.	1-3	4-6	7-9									
Sample ID	TP01	TP02	TP03									
Depth	0.30	0.50	0.55									
COC No / misc												
Containers	V J T	V J T	J T									
Sample Date	16/05/2022	16/05/2022	16/05/2022									
Sample Type	Soil	Soil	Soil									
Batch Number	1	1	1									
Date of Receipt	18/05/2022	18/05/2022	18/05/2022									

Please see attached notes for all abbreviations and acronyms

				LOD/LOR	Units	Method No.
Arsenic #	35.7	43.4	16.9	<0.5	mg/kg	TM30/PM15
Beryllium	2.1	0.8	1.2	<0.5	mg/kg	TM30/PM15
Cadmium #	0.3	0.2	0.6	<0.1	mg/kg	TM30/PM15
Chromium #	35.5	39.9	29.1	<0.5	mg/kg	TM30/PM15
Copper #	87	62	292_{AA}	<1	mg/kg	TM30/PM15
Lead #	37	38	87	<5	mg/kg	TM30/PM15
Mercury #	<0.1	0.3	<0.1	<0.1	mg/kg	TM30/PM15
Nickel #	18.4	26.0	24.3	<0.7	mg/kg	TM30/PM15
Selenium #	<1	1	1	<1	mg/kg	TM30/PM15
Vanadium	21	17	24	<1	mg/kg	TM30/PM15
Water Soluble Boron #	0.8	0.3	0.4	<0.1	mg/kg	TM74/PM32
Zinc #	143	91	239	<5	mg/kg	TM30/PM15
PAH MS						
Naphthalene #	<0.04	0.04	0.07	<0.04	mg/kg	TM4/PM8
Acenaphthylene	<0.03	0.03	0.04	<0.03	mg/kg	TM4/PM8
Acenaphthene #	<0.05	<0.05	<0.05	<0.05	mg/kg	TM4/PM8
Fluorene #	<0.04	<0.04	<0.04	<0.04	mg/kg	TM4/PM8
Phenanthrene #	0.05	0.50	0.41	<0.03	mg/kg	TM4/PM8
Anthracene #	<0.04	0.14	0.09	<0.04	mg/kg	TM4/PM8
Fluoranthene #	0.13	0.95	0.79	<0.03	mg/kg	TM4/PM8
Pyrene #	0.10	0.68	0.58	<0.03	mg/kg	TM4/PM8
Benzo(a)anthracene #	0.15	0.58	0.49	<0.06	mg/kg	TM4/PM8
Chrysene #	0.13	0.66	0.55	<0.02	mg/kg	TM4/PM8
Benzo(bk)fluoranthene #	0.21	1.12	0.98	<0.07	mg/kg	TM4/PM8
Benzo(a)pyrene #	0.09	0.51	0.44	<0.04	mg/kg	TM4/PM8
Indeno(123cd)pyrene #	0.07	0.41	0.36	<0.04	mg/kg	TM4/PM8
Dibenzo(ah)anthracene #	<0.04	0.10	0.09	<0.04	mg/kg	TM4/PM8
Benzo(ghi)perylene #	0.07	0.35	0.30	<0.04	mg/kg	TM4/PM8
PAH 16 Total	1.0	6.1	5.2	<0.6	mg/kg	TM4/PM8
Benzo(b)fluoranthene	0.15	0.81	0.71	<0.05	mg/kg	TM4/PM8
Benzo(k)fluoranthene	0.06	0.31	0.27	<0.02	mg/kg	TM4/PM8
PAH Surrogate % Recovery	90	89	92	<0	%	TM4/PM8

Client Name: Tetra Tech
Reference: 784-B035256
Location: Blaeudulais
Contact: Nicholas Bool
EMT Job No: 22/8081

Report : Solid

Solids: V=60g VOC jar, J=250g glass jar, T=plastic tub

Please see attached notes for all abbreviations and acronyms

EMT Sample No.	1-3	4-6	7-9	LOD/LOR	Units	Method No.
Sample ID	TP01	TP02	TP03			
Depth	0.30	0.50	0.55			
COC No / misc						
Containers	V J T	V J T	J T			
Sample Date	16/05/2022	16/05/2022	16/05/2022			
Sample Type	Soil	Soil	Soil			
Batch Number	1	1	1			
Date of Receipt	18/05/2022	18/05/2022	18/05/2022			
TPH CWG						
Aliphatics						
>C5-C6 (HS_1D_AL)#	<0.1 SV	<0.1	<0.1 SV	<0.1	mg/kg	TM36/PM12
>C6-C8 (HS_1D_AL)#	<0.1 SV	<0.1	<0.1 SV	<0.1	mg/kg	TM36/PM12
>C8-C10 (HS_1D_AL)	<0.1 SV	<0.1	<0.1 SV	<0.1	mg/kg	TM36/PM12
>C10-C12 (EH_CU_1D_AL)#	<0.2	<0.2	<0.2	<0.2	mg/kg	TM5/PM8/PM16
>C12-C16 (EH_CU_1D_AL)#	<4	<4	<4	<4	mg/kg	TM5/PM8/PM16
>C16-C21 (EH_CU_1D_AL)#	<7	<7	<7	<7	mg/kg	TM5/PM8/PM16
>C21-C35 (EH_CU_1D_AL)#	<7	<7	<7	<7	mg/kg	TM5/PM8/PM16
>C35-C44 (EH_1D_AL)	<7	<7	<7	<7	mg/kg	TM5/PM8/PM16
Total aliphatics C5-44 (EH+HS_1D_AL)	<26	<26	<26	<26	mg/kg	TM5/TM36/PM8/PM12/PM16
Aromatics						
>C5-EC7 (HS_1D_AR)#	<0.1 SV	<0.1	<0.1 SV	<0.1	mg/kg	TM36/PM12
>EC7-EC8 (HS_1D_AR)#	<0.1 SV	<0.1	<0.1 SV	<0.1	mg/kg	TM36/PM12
>EC8-EC10 (HS_1D_AR)#	<0.1 SV	<0.1	<0.1 SV	<0.1	mg/kg	TM36/PM12
>EC10-EC12 (EH_CU_1D_AR)#	<0.2	<0.2	<0.2	<0.2	mg/kg	TM5/PM8/PM16
>EC12-EC16 (EH_CU_1D_AR)#	<4	<4	<4	<4	mg/kg	TM5/PM8/PM16
>EC16-EC21 (EH_CU_1D_AR)#	<7	<7	25	<7	mg/kg	TM5/PM8/PM16
>EC21-EC35 (EH_CU_1D_AR)#	145	<7	119	<7	mg/kg	TM5/PM8/PM16
>EC35-EC44 (EH_1D_AR)	29	<7	14	<7	mg/kg	TM5/PM8/PM16
Total aromatics C5-44 (EH+HS_1D_AR)	174	<26	158	<26	mg/kg	TM5/TM36/PM8/PM12/PM16
Total aliphatics and aromatics(C5-44) (EH+HS_CU_1D_Total)	174	<52	158	<52	mg/kg	TM5/TM36/PM8/PM12/PM16
MTBE#	<5 SV	<5	<5 SV	<5	ug/kg	TM36/PM12
Benzene#	<5 SV	<5	<5 SV	<5	ug/kg	TM36/PM12
Toluene#	<5 SV	<5	<5 SV	<5	ug/kg	TM36/PM12
Ethylbenzene#	<5 SV	<5	<5 SV	<5	ug/kg	TM36/PM12
m/p-Xylene#	<5 SV	<5	<5 SV	<5	ug/kg	TM36/PM12
o-Xylene#	<5 SV	<5	<5 SV	<5	ug/kg	TM36/PM12
Total Phenols HPLC	0.37	0.15	<0.15	<0.15	mg/kg	TM26/PM21B
Hexavalent Chromium#	<0.3	<0.3	<0.3	<0.3	mg/kg	TM38/PM20
Sulphate as SO4 (2:1 Ext)#	0.0568	0.0048	0.0289	<0.0015	g/l	TM38/PM20
Chromium III	35.5	39.9	29.1	<0.5	mg/kg	NONE/NONE
Free Cyanide	<0.5	<0.5	<0.5	<0.5	mg/kg	TM89/PM45
Fraction Organic Carbon	0.019	0.017	0.242	<0.001	None	TM21/PM24
pH#	8.16	8.24	7.72	<0.01	pH units	TM73/PM11

Client Name: Tetra Tech
Reference: 784-B035256
Location: Blaeudulais
Contact: Nicholas Bool
EMT Job No: 22/8081

Report : CEN 10:1 1 Batch

Solids: V=60g VOC jar, J=250g glass jar, T=plastic tub

Please see attached notes for all abbreviations and acronyms

EMT Sample No.	4-6										LOD/LOR	Units	Method No.
Sample ID	TP02												
Depth	0.50												
COC No / misc													
Containers	V J T												
Sample Date	16/05/2022												
Sample Type	Soil												
Batch Number	1												
Date of Receipt	18/05/2022												
Dissolved Antimony #	<2										<2	ug/l	TM30/PM14
Dissolved Arsenic #	<2.5										<2.5	ug/l	TM30/PM14
Dissolved Barium #	8										<3	ug/l	TM30/PM14
Dissolved Beryllium #	<0.5										<0.5	ug/l	TM30/PM14
Dissolved Boron #	<12										<12	ug/l	TM30/PM14
Dissolved Cadmium #	<0.5										<0.5	ug/l	TM30/PM14
Dissolved Chromium #	<1.5										<1.5	ug/l	TM30/PM14
Dissolved Copper #	<7										<7	ug/l	TM30/PM14
Dissolved Lead #	<5										<5	ug/l	TM30/PM14
Dissolved Mercury #	<1										<1	ug/l	TM30/PM14
Dissolved Molybdenum #	2										<2	ug/l	TM30/PM14
Dissolved Nickel #	<2										<2	ug/l	TM30/PM14
Dissolved Selenium #	<3										<3	ug/l	TM30/PM14
Dissolved Zinc #	<3										<3	ug/l	TM30/PM14
PAH MS													
Naphthalene	<0.1										<0.1	ug/l	TM4/PM30
Acenaphthylene	<0.005										<0.005	ug/l	TM4/PM30
Acenaphthene	<0.005										<0.005	ug/l	TM4/PM30
Fluorene	<0.005										<0.005	ug/l	TM4/PM30
Phenanthrene	<0.005										<0.005	ug/l	TM4/PM30
Anthracene	<0.005										<0.005	ug/l	TM4/PM30
Fluoranthene	0.008										<0.005	ug/l	TM4/PM30
Pyrene	<0.005										<0.005	ug/l	TM4/PM30
Benzo(a)anthracene	0.012										<0.005	ug/l	TM4/PM30
Chrysene	0.011										<0.005	ug/l	TM4/PM30
Benzo(bk)fluoranthene	0.019										<0.008	ug/l	TM4/PM30
Benzo(a)pyrene	<0.005										<0.005	ug/l	TM4/PM30
Indeno(123cd)pyrene	<0.005										<0.005	ug/l	TM4/PM30
Dibenzo(ah)anthracene	<0.005										<0.005	ug/l	TM4/PM30
Benzo(ghi)perylene	<0.005										<0.005	ug/l	TM4/PM30
PAH 16 Total	<0.173										<0.173	ug/l	TM4/PM30
Benzo(b)fluoranthene	0.014										<0.008	ug/l	TM4/PM30
Benzo(k)fluoranthene	<0.008										<0.008	ug/l	TM4/PM30
PAH Surrogate % Recovery	75										<0	%	TM4/PM30

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EMT Sample No.	4-6												
Sample ID	TP02												
Depth	0.50												
COC No / misc													
Containers	V J T												
Sample Date	16/05/2022												
Sample Type	Soil												
Batch Number	1												
Date of Receipt	18/05/2022												

Please see attached notes for all abbreviations and acronyms

		LOD/LOR	Units	Method No.
TPH CWG				
Aliphatics				
>C5-C6	<10	<10	ug/l	TM36/PM69
>C6-C8	<10	<10	ug/l	TM36/PM69
>C8-C10	<10	<10	ug/l	TM36/PM69
>C10-C12	<5	<5	ug/l	TM5/PM16/PM30
>C12-C16	<10	<10	ug/l	TM5/PM16/PM30
>C16-C21	<10	<10	ug/l	TM5/PM16/PM30
>C21-C35	<10	<10	ug/l	TM5/PM16/PM30
Total aliphatics C5-35	<10	<10	ug/l	TM5/TM36/PM16/PM30/PM69
Aromatics				
>C5-EC7	<10	<10	ug/l	TM36/PM69
>EC7-EC8	<10	<10	ug/l	TM36/PM69
>EC8-EC10	<10	<10	ug/l	TM36/PM69
>EC10-EC12	<5	<5	ug/l	TM5/PM16/PM30
>EC12-EC16	<10	<10	ug/l	TM5/PM16/PM30
>EC16-EC21	<10	<10	ug/l	TM5/PM16/PM30
>EC21-EC35	<10	<10	ug/l	TM5/PM16/PM30
Total aromatics C5-35	<10	<10	ug/l	TM5/TM36/PM16/PM30/PM69
Total aliphatics and aromatics(C5-35)	<10	<10	ug/l	TM5/TM36/PM16/PM30/PM69
MTBE	<5	<5	ug/l	TM36/PM69
Benzene	<5	<5	ug/l	TM36/PM69
Toluene	<5	<5	ug/l	TM36/PM69
Ethylbenzene	<5	<5	ug/l	TM36/PM69
m/p-Xylene	<5	<5	ug/l	TM36/PM69
o-Xylene	<5	<5	ug/l	TM36/PM69
Total Phenols HPLC	<0.05	<0.05	mg/l	TM26/PM0
Sulphate as SO4 #	1.2	<0.5	mg/l	TM38/PM0
Chloride #	<0.3	<0.3	mg/l	TM38/PM0
Nitrate as NO3 #	0.5	<0.2	mg/l	TM38/PM0
Nitrite as NO2 #	<0.02	<0.02	mg/l	TM38/PM0
Ammoniacal Nitrogen as NH3 #	<0.03	<0.03	mg/l	TM38/PM0
Ammoniacal Nitrogen as NH4 #	<0.03	<0.03	mg/l	TM38/PM0
Total Cyanide #	<0.01	<0.01	mg/l	TM89/PM0
Dissolved Organic Carbon	<2	<2	mg/l	TM60/PM0
pH	7.15	<0.01	pH units	TM73/PM0
Total Alkalinity as CaCO3	62	<1	mg/l	TM75/PM0

Client Name: Tetra Tech
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Note:

Asbestos Screen analysis is carried out in accordance with our documented in-house methods PM042 and TM065 and HSG 248 by Stereo and Polarised Light Microscopy using Dispersion Staining Techniques and is covered by our UKAS accreditation. Detailed Gravimetric Quantification and PCOM Fibre Analysis is carried out in accordance with our documented in-house methods PM042 and TM131 and HSG 248 using Stereo and Polarised Light Microscopy and Phase Contrast Optical Microscopy (PCOM). Asbestos sub-samples are retained for not less than 6 months from the date of analysis unless specifically requested.

The LOQ of the Asbestos Quantification is 0.001% dry fibre of dry mass of sample.

Where the sample is not taken by a Element Materials Technology consultant, Element Materials Technology cannot be responsible for inaccurate or unrepresentative sampling.

EMT Job No.	Batch	Sample ID	Depth	EMT Sample No.	Analyst Name	Date Of Analysis	Analysis	Result
22/8081	1	TP01	0.30	3	Remigiusz Blichowski	26/05/2022	**General Description (Bulk Analysis)**	Light brown clay
					Remigiusz Blichowski	26/05/2022	**Asbestos Fibres**	NAD
					Remigiusz Blichowski	26/05/2022	**Asbestos ACM**	NAD
					Remigiusz Blichowski	26/05/2022	**Asbestos Type**	NAD
22/8081	1	TP02	0.50	6	Remigiusz Blichowski	26/05/2022	**General Description (Bulk Analysis)**	brown loose soild and stone
					Remigiusz Blichowski	26/05/2022	**Asbestos Fibres**	NAD
					Remigiusz Blichowski	26/05/2022	**Asbestos ACM**	NAD
					Remigiusz Blichowski	26/05/2022	**Asbestos Type**	NAD
22/8081	1	TP03	0.55	9	Remigiusz Blichowski	26/05/2022	**General Description (Bulk Analysis)**	Brown loose sand and stone
					Remigiusz Blichowski	26/05/2022	**Asbestos Fibres**	NAD
					Remigiusz Blichowski	26/05/2022	**Asbestos ACM**	NAD
					Remigiusz Blichowski	26/05/2022	**Asbestos Type**	NAD

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EMT Job No.	Batch	Sample ID	Depth	EMT Sample No.	Analysis	Reason
No deviating sample report results for job 22/8081						

Please note that only samples that are deviating are mentioned in this report. If no samples are listed it is because none were deviating.
Only analyses which are accredited are recorded as deviating if set criteria are not met.

EMT Job No.: 22/8081

SOILS and ASH

Please note we are only MCERTS accredited (UK soils only) for sand, loam and clay and any other matrix is outside our scope of accreditation.

Where an MCERTS report has been requested, you will be notified within 48 hours of any samples that have been identified as being outside our MCERTS scope. As validation has been performed on clay, sand and loam, only samples that are predominantly these matrices, or combinations of them will be within our MCERTS scope. If samples are not one of a combination of the above matrices they will not be marked as MCERTS accredited.

It is assumed that you have taken representative samples on site and require analysis on a representative subsample. Stones will generally be included unless we are requested to remove them.

All samples will be discarded one month after the date of reporting, unless we are instructed to the contrary. Asbestos samples are retained for 6 months.

If you have not already done so, please send us a purchase order if this is required by your company.

Where appropriate please make sure that our detection limits are suitable for your needs, if they are not, please notify us immediately.

All analysis is reported on a dry weight basis unless stated otherwise. Limits of detection for analyses carried out on as received samples are not moisture content corrected. Results are not surrogate corrected. Samples are dried at 35°C ±5°C unless otherwise stated. Moisture content for CEN Leachate tests are dried at 105°C ±5°C. Ash samples are dried at 37°C ±5°C.

Where Mineral Oil or Fats, Oils and Grease is quoted, this refers to Total Aliphatics C10-C40.

Where a CEN 10:1 ZERO Headspace VOC test has been carried out, a 10:1 ratio of water to wet (as received) soil has been used.

% Asbestos in Asbestos Containing Materials (ACMs) is determined by reference to HSG 264 The Survey Guide - Appendix 2 : ACMs in buildings listed in order of ease of fibre release.

Sufficient amount of sample must be received to carry out the testing specified. Where an insufficient amount of sample has been received the testing may not meet the requirements of our accredited methods, as such accreditation may be removed.

Negative Neutralization Potential (NP) values are obtained when the volume of NaOH (0.1N) titrated (pH 8.3) is greater than the volume of HCl (1N) to reduce the pH of the sample to 2.0 - 2.5. Any negative NP values are corrected to 0.

The calculation of Pyrite content assumes that all oxidisable sulphides present in the sample are pyrite. This may not be the case. The calculation may be an overesitimate when other sulphides such as Barite (Barium Sulphate) are present.

WATERS

Please note we are not a UK Drinking Water Inspectorate (DWI) Approved Laboratory .

ISO17025 accreditation applies to surface water and groundwater and usually one other matrix which is analysis specific, any other liquids are outside our scope of accreditation.

As surface waters require different sample preparation to groundwaters the laboratory must be informed of the water type when submitting samples.

Where Mineral Oil or Fats, Oils and Grease is quoted, this refers to Total Aliphatics C10-C40.

STACK EMISSIONS

Where an MCERTS report has been requested, you will be notified within 48 hours of any samples that have been identified as being outside our MCERTS scope. As validation for Dioxins and Furans and Dioxin like PCBs has been performed on XAD-2 Resin, only samples which use this resin will be within our MCERTS scope.

Where appropriate please make sure that our detection limits are suitable for your needs, if they are not, please notify us immediately.

DEVIATING SAMPLES

All samples should be submitted to the laboratory in suitable containers with sufficient ice packs to sustain an appropriate temperature for the requested analysis. The temperature of sample receipt is recorded on the confirmation schedules in order that the client can make an informed decision as to whether testing should still be undertaken.

SURROGATES

Surrogate compounds are added during the preparation process to monitor recovery of analytes. However low recovery in soils is often due to peat, clay or other organic rich matrices. For waters this can be due to oxidants, surfactants, organic rich sediments or remediation fluids. Acceptable limits for most organic methods are 70 - 130% and for VOCs are 50 - 150%. When surrogate recoveries are outside the performance criteria but the associated AQC passes this is assumed to be due to matrix effect. Results are not surrogate corrected.

DILUTIONS

A dilution suffix indicates a dilution has been performed and the reported result takes this into account. No further calculation is required.

BLANKS

Where analytes have been found in the blank, the sample will be treated in accordance with our laboratory procedure for dealing with contaminated blanks.

NOTE

Data is only reported if the laboratory is confident that the data is a true reflection of the samples analysed. Data is only reported as accredited when all the requirements of our Quality System have been met. In certain circumstances where all the requirements of the Quality System have not been met, for instance if the associated AQC has failed, the reason is fully investigated and documented. The sample data is then evaluated alongside the other quality control checks performed during analysis to determine its suitability. Following this evaluation, provided the sample results have not been effected, the data is reported but accreditation is removed. It is a UKAS requirement for data not reported as accredited to be considered indicative only, but this does not mean the data is not valid.
Where possible, and if requested, samples will be re-extracted and a revised report issued with accredited results. Please do not hesitate to contact the laboratory if further details are required of the circumstances which have led to the removal of accreditation.
Laboratory records are kept for a period of no less than 6 years.

REPORTS FROM THE SOUTH AFRICA LABORATORY

Any method number not prefixed with SA has been undertaken in our UK laboratory unless reported as subcontracted.

Measurement Uncertainty

Measurement uncertainty defines the range of values that could reasonably be attributed to the measured quantity. This range of values has not been included within the reported results. Uncertainty expressed as a percentage can be provided upon request.

Customer Provided Information

Sample ID and depth is information provided by the customer.

ABBREVIATIONS and ACRONYMS USED

#	ISO17025 (UKAS Ref No. 4225) accredited - UK.
SA	ISO17025 (SANAS Ref No.T0729) accredited - South Africa
B	Indicates analyte found in associated method blank.
DR	Dilution required.
M	MCERTS accredited.
NA	Not applicable
NAD	No Asbestos Detected.
ND	None Detected (usually refers to VOC and/SVOC TICs).
NDP	No Determination Possible
SS	Calibrated against a single substance
SV	Surrogate recovery outside performance criteria. This may be due to a matrix effect.
W	Results expressed on as received basis.
+	AQC failure, accreditation has been removed from this result, if appropriate, see 'Note' on previous page.
>>	Results above calibration range, the result should be considered the minimum value. The actual result could be significantly higher.
*	Analysis subcontracted to an Element Materials Technology approved laboratory.
AD	Samples are dried at 35°C ±5°C
CO	Suspected carry over
LOD/LOR	Limit of Detection (Limit of Reporting) in line with ISO 17025 and MCERTS
ME	Matrix Effect
NFD	No Fibres Detected
BS	AQC Sample
LB	Blank Sample
N	Client Sample
TB	Trip Blank Sample
OC	Outside Calibration Range
AA	x5 Dilution

HWOL ACRONYMS AND OPERATORS USED

HS	Headspace Analysis.
EH	Extractable Hydrocarbons - i.e. everything extracted by the solvent.
CU	Clean-up - e.g. by florisil, silica gel.
1D	GC - Single coil gas chromatography.
Total	Aliphatics & Aromatics.
AL	Aliphatics only.
AR	Aromatics only.
2D	GC-GC - Double coil gas chromatography.
#1	EH_Total but with humics mathematically subtracted
#2	EU_Total but with fatty acids mathematically subtracted
_	Operator - underscore to separate acronyms (exception for +).
+	Operator to indicate cumulative e.g. EH+HS_Total or EH_CU+HS_Total
MS	Mass Spectrometry.

EMT Job No: 22/8081

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/SANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
PM4	Gravimetric measurement of Natural Moisture Content and % Moisture Content at either 35°C or 105°C. Calculation based on ISO 11465:1993(E) and BS1377-2:1990.	PM0	No preparation is required.			AR	
TM4	Modified USEPA 8270D v5:2014 method for the solvent extraction and determination of PAHs by GC-MS.	PM30	Water samples are extracted with solvent using a magnetic stirrer to create a vortex.			AR	Yes
TM4	Modified USEPA 8270D v5:2014 method for the solvent extraction and determination of PAHs by GC-MS.	PM8	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required.			AR	Yes
TM4	Modified USEPA 8270D v5:2014 method for the solvent extraction and determination of PAHs by GC-MS.	PM8	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required.	Yes		AR	Yes
TM5	Modified 8015B v2:1996 method for the determination of solvent Extractable Petroleum Hydrocarbons (EPH) within the range C8-C40 by GCFID. For waters the solvent extracts dissolved phase plus a sheen if present.	PM16/PM30	Fractionation into aliphatic and aromatic fractions using a Rapid Trace SPE/Water samples are extracted with solvent using a magnetic stirrer to create a vortex.			AR	Yes
TM5	Modified 8015B v2:1996 method for the determination of solvent Extractable Petroleum Hydrocarbons (EPH) within the range C8-C40 by GCFID. For waters the solvent extracts dissolved phase plus a sheen if present.	PM8/PM16	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required/Fractionation into aliphatic and aromatic fractions using a Rapid Trace SPE.			AR	Yes
TM5	Modified 8015B v2:1996 method for the determination of solvent Extractable Petroleum Hydrocarbons (EPH) within the range C8-C40 by GCFID. For waters the solvent extracts dissolved phase plus a sheen if present.	PM8/PM16	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required/Fractionation into aliphatic and aromatic fractions using a Rapid Trace SPE.	Yes		AR	Yes
TM5/TM36	please refer to TM5 and TM36 for method details	PM16/PM30/PM69	please refer to PM16/PM30 and PM69 for method details			AR	Yes
TM5/TM36	please refer to TM5 and TM36 for method details	PM8/PM12/PM16	please refer to PM8/PM16 and PM12 for method details			AR	Yes
TM21	Modified BS 7755-3:1995, ISO10694:1995 Determination of Total Organic Carbon or Total Carbon by combustion in an Eltra TOC furnace/analyser in the presence of oxygen. The CO2 generated is quantified using infra-red detection. Organic Matter (SOM) calculated as per EA MCERTS Chemical Testing of Soil, March 2012 v4.	PM24	Dried and ground solid samples are washed with hydrochloric acid, then rinsed with deionised water to remove the mineral carbon before TOC analysis.			AD	Yes

EMT Job No: 22/8081

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/SANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
TM26	Determination of phenols by Reversed Phased High Performance Liquid Chromatography and Electro-Chemical Detection.	PM0	No preparation is required.			AR	Yes
TM26	Determination of phenols by Reversed Phased High Performance Liquid Chromatography and Electro-Chemical Detection.	PM21B	As Received samples are extracted in Methanol: Water (60:40) by reciprocal shaker.			AR	Yes
TM30	Determination of Trace Metals by ICP-OES (Inductively Coupled Plasma – Optical Emission Spectrometry): WATERS by Modified USEPA Method 200.7, Rev. 4.4, 1994; Modified EPA Method 6010B, Rev.2, Dec 1996; Modified BS EN ISO 11885:2009: SOILS by Modified USEP 6010B, Rev.2, Dec.1996; Modified EPA Method 3050B, Rev.2, Dec.1996	PM14	Preparation of waters and leachates for metals by ICP OES/ICP MS. Samples are filtered for Dissolved metals, and remain unfiltered for Total metals then acidified	Yes		AR	Yes
TM30	Determination of Trace Metals by ICP-OES (Inductively Coupled Plasma – Optical Emission Spectrometry): WATERS by Modified USEPA Method 200.7, Rev. 4.4, 1994; Modified EPA Method 6010B, Rev.2, Dec 1996; Modified BS EN ISO 11885:2009: SOILS by Modified USEP 6010B, Rev.2, Dec.1996; Modified EPA Method 3050B, Rev.2, Dec.1996	PM15	Acid digestion of dried and ground solid samples using Aqua Regia refluxed at 112.5 °C. Samples containing asbestos are not dried and ground.			AD	Yes
TM30	Determination of Trace Metals by ICP-OES (Inductively Coupled Plasma – Optical Emission Spectrometry): WATERS by Modified USEPA Method 200.7, Rev. 4.4, 1994; Modified EPA Method 6010B, Rev.2, Dec 1996; Modified BS EN ISO 11885:2009: SOILS by Modified USEP 6010B, Rev.2, Dec.1996; Modified EPA Method 3050B, Rev.2, Dec.1996	PM15	Acid digestion of dried and ground solid samples using Aqua Regia refluxed at 112.5 °C. Samples containing asbestos are not dried and ground.	Yes		AD	Yes
TM36	Modified US EPA method 8015B v2:1996. Determination of Gasoline Range Organics (GRO) in the carbon chain range of C4-12 by headspace GC-FID. MTBE by GCFID co-elutes with 3-methylpentane if present and therefore can give a false positive. Positive MTBE results will be re-run using GC-MS to double check, when requested.	PM12	Modified US EPA method 5021A v2:2014. Preparation of solid and liquid samples for GC headspace analysis.			AR	Yes
TM36	Modified US EPA method 8015B v2:1996. Determination of Gasoline Range Organics (GRO) in the carbon chain range of C4-12 by headspace GC-FID. MTBE by GCFID co-elutes with 3-methylpentane if present and therefore can give a false positive. Positive MTBE results will be re-run using GC-MS to double check, when requested.	PM12	Modified US EPA method 5021A v2:2014. Preparation of solid and liquid samples for GC headspace analysis.	Yes		AR	Yes
TM36	Modified US EPA method 8015B v2:1996. Determination of Gasoline Range Organics (GRO) in the carbon chain range of C4-12 by headspace GC-FID. MTBE by GCFID co-elutes with 3-methylpentane if present and therefore can give a false positive. Positive MTBE results will be re-run using GC-MS to double check, when requested.	PM69	One part soil is mixed with 10 parts water in a vial leaving no headspace. The mixture is shaken and then left to leach for 24 hours before VOC analysis.			AR	Yes
TM38	Soluble Ion analysis using Discrete Analyser. Modified US EPA methods: Chloride 325.2 (1978), Sulphate 375.4 (Rev.2 1993), o-Phosphate 365.2 (Rev.2 1993), TON 353.1 (Rev.2 1993), Nitrite 354.1 (1971), Hex Cr 7196A (1992), NH4+ 350.1 (Rev.2 1993) – All anions comparable to BS ISO 15923-1: 2013l	PM0	No preparation is required.	Yes		AR	Yes
TM38	Soluble Ion analysis using Discrete Analyser. Modified US EPA methods: Chloride 325.2 (1978), Sulphate 375.4 (Rev.2 1993), o-Phosphate 365.2 (Rev.2 1993), TON 353.1 (Rev.2 1993), Nitrite 354.1 (1971), Hex Cr 7196A (1992), NH4+ 350.1 (Rev.2 1993) – All anions comparable to BS ISO 15923-1: 2013l	PM20	Extraction of dried and ground or as received samples with deionised water in a 2:1 water to solid ratio using a reciprocal shaker for all analytes except hexavalent chromium. Extraction of as received sample using 10:1 ratio of 0.2M sodium hydroxide to soil for hexavalent chromium using a reciprocal shaker.	Yes		AD	Yes

EMT Job No: 22/8081

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/SANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
TM38	Soluble Ion analysis using Discrete Analyser. Modified US EPA methods: Chloride 325.2 (1978), Sulphate 375.4 (Rev.2 1993), o-Phosphate 365.2 (Rev.2 1993), TON 353.1 (Rev.2 1993), Nitrite 354.1 (1971), Hex Cr 7196A (1992), NH4+ 350.1 (Rev.2 1993) – All anions comparable to BS ISO 15923-1: 2013l	PM20	Extraction of dried and ground or as received samples with deionised water in a 2:1 water to solid ratio using a reciprocal shaker for all analytes except hexavalent chromium. Extraction of as received sample using 10:1 ratio of 0.2M sodium hydroxide to soil for hexavalent chromium using a reciprocal shaker.	Yes		AR	Yes
TM60	TC/TOC analysis of Waters by High Temperature Combustion followed by NDIR detection. Based on the following modified standard methods: USEPA 9060A (2002), APHA SMEWW 5310B:1999 22nd Edition, ASTM D 7573, and USEPA 415.1.	PM0	No preparation is required.			AR	Yes
TM65	Asbestos Bulk Identification method based on HSG 248 Second edition (2021)	PM42	Modified SCA Blue Book V.12 draft 2017 and WM3 1st Edition v1.1:2018. Solid samples undergo a thorough visual inspection for asbestos fibres prior to asbestos identification using TM065.	Yes		AR	
TM73	Modified US EPA methods 150.1 (1982) and 9045D Rev. 4 - 2004) and BS1377-3:1990. Determination of pH by Metrohm automated probe analyser.	PM0	No preparation is required.			AR	Yes
TM73	Modified US EPA methods 150.1 (1982) and 9045D Rev. 4 - 2004) and BS1377-3:1990. Determination of pH by Metrohm automated probe analyser.	PM11	Extraction of as received solid samples using one part solid to 2.5 parts deionised water.	Yes		AR	No
TM74	Analysis of water soluble boron (20:1 extract) by ICP-OES.	PM32	Hot water soluble boron is extracted from dried and ground samples using a 20:1 ratio.	Yes		AD	Yes
TM75	Modified US EPA method 310.1 (1978). Determination of Alkalinity by Metrohm automated titration analyser.	PM0	No preparation is required.			AR	Yes
TM89	Modified USEPA method OIA-1667 (1999). Determination of cyanide by Flow Injection Analyser. Where WAD cyanides are required a Ligand displacement step is carried out before analysis.	PM0	No preparation is required.	Yes		AR	Yes
TM89	Modified USEPA method OIA-1667 (1999). Determination of cyanide by Flow Injection Analyser. Where WAD cyanides are required a Ligand displacement step is carried out before analysis.	PM45	As received solid samples are extracted with 1M NaOH by orbital shaker for Cyanide, Sulphide and Thiocyanate analysis.			AR	Yes
NONE	No Method Code	NONE	No Method Code			AD	Yes

EMT Job No: 22/8081

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/SANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
NONE	No Method Code	PM17	Modified method BS EN12457-2:2002 As received solid samples are leached with water in a 10:1 water to soil ratio for 24 hours, the moisture content of the sample is included in the ratio.				
NONE	No Method Code	PM4	Gravimetric measurement of Natural Moisture Content and % Moisture Content at either 35°C or 105°C. Calculation based on ISO 11465:1993(E) and BS1377-2:1990.			AR	

Element Materials Technology
Unit 3 Deeside Point
Zone 3
Deeside Industrial Park
Deeside
CH5 2UA

P: +44 (0) 1244 833780
F: +44 (0) 1244 833781
W: www.element.com

Tetra Tech
5th Floor, Longcross Court
47 Newport Rd
Cardiff
Cardiff
UK
CF24 OAD

Attention :	Nicholas Bool
Date :	10th June, 2022
Your reference :	784-B035256
Our reference :	Test Report 22/8276 Batch 1
Location :	Blaeudulais
Date samples received :	20th May, 2022
Status :	Final Report
Issue :	1

Thirteen samples were received for analysis on 20th May, 2022 of which one was scheduled for analysis. Please find attached our Test Report which should be read with notes at the end of the report and should include all sections if reproduced. Interpretations and opinions are outside the scope of any accreditation, and all results relate only to samples supplied.
All analysis is carried out on as received samples and reported on a dry weight basis unless stated otherwise. Results are not surrogate corrected.

Authorised By:

Phil Sommerton BSc
Senior Project Manager

Please include all sections of this report if it is reproduced

Element Materials Technology Environmental UK Limited
Registered in England and Wales
Registered Office: 3rd Floor Davidson Building, 5 Southampton Street, London WC2E 7HA
Company Registration No: 11371415

Client Name: Tetra Tech
Reference: 784-B035256
Location: Blaeudulais
Contact: Nicholas Bool
EMT Job No: 22/8276

Report : CEN 10:1 1 Batch

Solids: V=60g VOC jar, J=250g glass jar, T=plastic tub

Please see attached notes for all abbreviations and acronyms

EMT Sample No.	31-33										LOD/LOR	Units	Method No.
Sample ID	WS03												
Depth	0.70												
COC No / misc													
Containers	V J T												
Sample Date	18/05/2022												
Sample Type	Soil												
Batch Number	1												
Date of Receipt	20/05/2022												
Dissolved Antimony #	<2										<2	ug/l	TM30/PM14
Dissolved Arsenic #	2.7										<2.5	ug/l	TM30/PM14
Dissolved Barium #	16										<3	ug/l	TM30/PM14
Dissolved Beryllium #	<0.5										<0.5	ug/l	TM30/PM14
Dissolved Boron #	<12										<12	ug/l	TM30/PM14
Dissolved Cadmium #	<0.5										<0.5	ug/l	TM30/PM14
Dissolved Chromium #	<1.5										<1.5	ug/l	TM30/PM14
Dissolved Copper #	<7										<7	ug/l	TM30/PM14
Dissolved Lead #	<5										<5	ug/l	TM30/PM14
Dissolved Mercury #	<1										<1	ug/l	TM30/PM14
Dissolved Molybdenum #	3										<2	ug/l	TM30/PM14
Dissolved Nickel #	<2										<2	ug/l	TM30/PM14
Dissolved Selenium #	<3										<3	ug/l	TM30/PM14
Dissolved Zinc #	<3										<3	ug/l	TM30/PM14
PAH MS													
Naphthalene	0.4										<0.1	ug/l	TM4/PM30
Acenaphthylene	0.014										<0.005	ug/l	TM4/PM30
Acenaphthene	0.127										<0.005	ug/l	TM4/PM30
Fluorene	0.074										<0.005	ug/l	TM4/PM30
Phenanthrene	0.127										<0.005	ug/l	TM4/PM30
Anthracene	0.024										<0.005	ug/l	TM4/PM30
Fluoranthene	0.090										<0.005	ug/l	TM4/PM30
Pyrene	0.066										<0.005	ug/l	TM4/PM30
Benzo(a)anthracene	0.023										<0.005	ug/l	TM4/PM30
Chrysene	0.108										<0.005	ug/l	TM4/PM30
Benzo(bk)fluoranthene	0.166										<0.008	ug/l	TM4/PM30
Benzo(a)pyrene	0.076										<0.005	ug/l	TM4/PM30
Indeno(123cd)pyrene	0.062										<0.005	ug/l	TM4/PM30
Dibenzo(ah)anthracene	0.015										<0.005	ug/l	TM4/PM30
Benzo(ghi)perylene	0.060										<0.005	ug/l	TM4/PM30
PAH 16 Total	1.432										<0.173	ug/l	TM4/PM30
Benzo(b)fluoranthene	0.120										<0.008	ug/l	TM4/PM30
Benzo(k)fluoranthene	0.046										<0.008	ug/l	TM4/PM30
PAH Surrogate % Recovery	76										<0	%	TM4/PM30

Client Name: Tetra Tech
Reference: 784-B035256
Location: Blaeudulais
Contact: Nicholas Bool
EMT Job No: 22/8276

Report : CEN 10:1 1 Batch

Solids: V=60g VOC jar, J=250g glass jar, T=plastic tub

Please see attached notes for all abbreviations and acronyms

EMT Sample No.	31-33										LOD/LOR	Units	Method No.
Sample ID	WS03												
Depth	0.70												
COC No / misc													
Containers	V J T												
Sample Date	18/05/2022												
Sample Type	Soil												
Batch Number	1												
Date of Receipt	20/05/2022												
TPH CWG													
Aliphatics													
>C5-C6	<10										<10	ug/l	TM36/PM69
>C6-C8	<10										<10	ug/l	TM36/PM69
>C8-C10	<10										<10	ug/l	TM36/PM69
>C10-C12	<5										<5	ug/l	TM5/PM16/PM30
>C12-C16	<10										<10	ug/l	TM5/PM16/PM30
>C16-C21	<10										<10	ug/l	TM5/PM16/PM30
>C21-C35	<10										<10	ug/l	TM5/PM16/PM30
Total aliphatics C5-35	<10										<10	ug/l	TM5/TM36/PM16/PM30/PM69
Aromatics													
>C5-EC7	<10										<10	ug/l	TM36/PM69
>EC7-EC8	<10										<10	ug/l	TM36/PM69
>EC8-EC10	<10										<10	ug/l	TM36/PM69
>EC10-EC12	<5										<5	ug/l	TM5/PM16/PM30
>EC12-EC16	<10										<10	ug/l	TM5/PM16/PM30
>EC16-EC21	<10										<10	ug/l	TM5/PM16/PM30
>EC21-EC35	<10										<10	ug/l	TM5/PM16/PM30
Total aromatics C5-35	<10										<10	ug/l	TM5/TM36/PM16/PM30/PM69
Total aliphatics and aromatics(C5-35)	<10										<10	ug/l	TM5/TM36/PM16/PM30/PM69
MTBE	<5										<5	ug/l	TM36/PM69
Benzene	<5										<5	ug/l	TM36/PM69
Toluene	<5										<5	ug/l	TM36/PM69
Ethylbenzene	<5										<5	ug/l	TM36/PM69
m/p-Xylene	<5										<5	ug/l	TM36/PM69
o-Xylene	<5										<5	ug/l	TM36/PM69
Total Phenols HPLC	<0.05										<0.05	mg/l	TM26/PM0
Sulphate as SO4 #	4.3										<0.5	mg/l	TM38/PM0
Chloride #	1.9										<0.3	mg/l	TM38/PM0
Nitrate as NO3 #	1.5										<0.2	mg/l	TM38/PM0
Nitrite as NO2 #	<0.02										<0.02	mg/l	TM38/PM0
Ammoniacal Nitrogen as NH3 #	<0.03										<0.03	mg/l	TM38/PM0
Ammoniacal Nitrogen as NH4 #	0.03										<0.03	mg/l	TM38/PM0
Total Cyanide #	<0.01										<0.01	mg/l	TM89/PM0
Dissolved Organic Carbon	4										<2	mg/l	TM60/PM0
pH	8.38										<0.01	pH units	TM73/PM0
Total Alkalinity as CaCO3	90										<1	mg/l	TM75/PM0

Client Name: Tetra Tech

Reference: 784-B035256

Location: Blaeudulais

Contact: Nicholas Bool

Matrix : CEN 10:1 1 Batch

EMT Job No.	Batch	Sample ID	Depth	EMT Sample No.	Analysis	Reason
22/8276	1	WS03	0.70	31-33	Cyanide	Sample holding time exceeded

Please note that only samples that are deviating are mentioned in this report. If no samples are listed it is because none were deviating.

Only analyses which are accredited are recorded as deviating if set criteria are not met.

NOTES TO ACCOMPANY ALL SCHEDULES AND REPORTS

EMT Job No.: 22/8276

SOILS and ASH

Please note we are only MCERTS accredited (UK soils only) for sand, loam and clay and any other matrix is outside our scope of accreditation.

Where an MCERTS report has been requested, you will be notified within 48 hours of any samples that have been identified as being outside our MCERTS scope. As validation has been performed on clay, sand and loam, only samples that are predominantly these matrices, or combinations of them will be within our MCERTS scope. If samples are not one of a combination of the above matrices they will not be marked as MCERTS accredited.

It is assumed that you have taken representative samples on site and require analysis on a representative subsample. Stones will generally be included unless we are requested to remove them.

All samples will be discarded one month after the date of reporting, unless we are instructed to the contrary. Asbestos samples are retained for 6 months.

If you have not already done so, please send us a purchase order if this is required by your company.

Where appropriate please make sure that our detection limits are suitable for your needs, if they are not, please notify us immediately.

All analysis is reported on a dry weight basis unless stated otherwise. Limits of detection for analyses carried out on as received samples are not moisture content corrected. Results are not surrogate corrected. Samples are dried at 35°C ±5°C unless otherwise stated. Moisture content for CEN Leachate tests are dried at 105°C ±5°C. Ash samples are dried at 37°C ±5°C.

Where Mineral Oil or Fats, Oils and Grease is quoted, this refers to Total Aliphatics C10-C40.

Where a CEN 10:1 ZERO Headspace VOC test has been carried out, a 10:1 ratio of water to wet (as received) soil has been used.

% Asbestos in Asbestos Containing Materials (ACMs) is determined by reference to HSG 264 The Survey Guide - Appendix 2 : ACMs in buildings listed in order of ease of fibre release.

Sufficient amount of sample must be received to carry out the testing specified. Where an insufficient amount of sample has been received the testing may not meet the requirements of our accredited methods, as such accreditation may be removed.

Negative Neutralization Potential (NP) values are obtained when the volume of NaOH (0.1N) titrated (pH 8.3) is greater than the volume of HCl (1N) to reduce the pH of the sample to 2.0 - 2.5. Any negative NP values are corrected to 0.

The calculation of Pyrite content assumes that all oxidisable sulphides present in the sample are pyrite. This may not be the case. The calculation may be an overesitimate when other sulphides such as Barite (Barium Sulphate) are present.

WATERS

Please note we are not a UK Drinking Water Inspectorate (DWI) Approved Laboratory .

ISO17025 accreditation applies to surface water and groundwater and usually one other matrix which is analysis specific, any other liquids are outside our scope of accreditation.

As surface waters require different sample preparation to groundwaters the laboratory must be informed of the water type when submitting samples.

Where Mineral Oil or Fats, Oils and Grease is quoted, this refers to Total Aliphatics C10-C40.

STACK EMISSIONS

Where an MCERTS report has been requested, you will be notified within 48 hours of any samples that have been identified as being outside our MCERTS scope. As validation for Dioxins and Furans and Dioxin like PCBs has been performed on XAD-2 Resin, only samples which use this resin will be within our MCERTS scope.

Where appropriate please make sure that our detection limits are suitable for your needs, if they are not, please notify us immediately.

DEVIATING SAMPLES

All samples should be submitted to the laboratory in suitable containers with sufficient ice packs to sustain an appropriate temperature for the requested analysis. The temperature of sample receipt is recorded on the confirmation schedules in order that the client can make an informed decision as to whether testing should still be undertaken.

SURROGATES

Surrogate compounds are added during the preparation process to monitor recovery of analytes. However low recovery in soils is often due to peat, clay or other organic rich matrices. For waters this can be due to oxidants, surfactants, organic rich sediments or remediation fluids. Acceptable limits for most organic methods are 70 - 130% and for VOCs are 50 - 150%. When surrogate recoveries are outside the performance criteria but the associated AQC passes this is assumed to be due to matrix effect. Results are not surrogate corrected.

DILUTIONS

A dilution suffix indicates a dilution has been performed and the reported result takes this into account. No further calculation is required.

BLANKS

Where analytes have been found in the blank, the sample will be treated in accordance with our laboratory procedure for dealing with contaminated blanks.

NOTE

Data is only reported if the laboratory is confident that the data is a true reflection of the samples analysed. Data is only reported as accredited when all the requirements of our Quality System have been met. In certain circumstances where all the requirements of the Quality System have not been met, for instance if the associated AQC has failed, the reason is fully investigated and documented. The sample data is then evaluated alongside the other quality control checks performed during analysis to determine its suitability. Following this evaluation, provided the sample results have not been effected, the data is reported but accreditation is removed. It is a UKAS requirement for data not reported as accredited to be considered indicative only, but this does not mean the data is not valid.
Where possible, and if requested, samples will be re-extracted and a revised report issued with accredited results. Please do not hesitate to contact the laboratory if further details are required of the circumstances which have led to the removal of accreditation.
Laboratory records are kept for a period of no less than 6 years.

REPORTS FROM THE SOUTH AFRICA LABORATORY

Any method number not prefixed with SA has been undertaken in our UK laboratory unless reported as subcontracted.

Measurement Uncertainty

Measurement uncertainty defines the range of values that could reasonably be attributed to the measured quantity. This range of values has not been included within the reported results. Uncertainty expressed as a percentage can be provided upon request.

Customer Provided Information

Sample ID and depth is information provided by the customer.

ABBREVIATIONS and ACRONYMS USED

#	ISO17025 (UKAS Ref No. 4225) accredited - UK.
SA	ISO17025 (SANAS Ref No.T0729) accredited - South Africa
B	Indicates analyte found in associated method blank.
DR	Dilution required.
M	MCERTS accredited.
NA	Not applicable
NAD	No Asbestos Detected.
ND	None Detected (usually refers to VOC and/SVOC TICs).
NDP	No Determination Possible
SS	Calibrated against a single substance
SV	Surrogate recovery outside performance criteria. This may be due to a matrix effect.
W	Results expressed on as received basis.
+	AQC failure, accreditation has been removed from this result, if appropriate, see 'Note' on previous page.
>>	Results above calibration range, the result should be considered the minimum value. The actual result could be significantly higher.
*	Analysis subcontracted to an Element Materials Technology approved laboratory.
AD	Samples are dried at 35°C ±5°C
CO	Suspected carry over
LOD/LOR	Limit of Detection (Limit of Reporting) in line with ISO 17025 and MCERTS
ME	Matrix Effect
NFD	No Fibres Detected
BS	AQC Sample
LB	Blank Sample
N	Client Sample
TB	Trip Blank Sample
OC	Outside Calibration Range

HWOL ACRONYMS AND OPERATORS USED

HS	Headspace Analysis.
EH	Extractable Hydrocarbons - i.e. everything extracted by the solvent.
CU	Clean-up - e.g. by florisil, silica gel.
1D	GC - Single coil gas chromatography.
Total	Aliphatics & Aromatics.
AL	Aliphatics only.
AR	Aromatics only.
2D	GC-GC - Double coil gas chromatography.
#1	EH_Total but with humics mathematically subtracted
#2	EU_Total but with fatty acids mathematically subtracted
_	Operator - underscore to separate acronyms (exception for +).
+	Operator to indicate cumulative e.g. EH+HS_Total or EH_CU+HS_Total
MS	Mass Spectrometry.

EMT Job No: 22/8276

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/SANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
PM4	Gravimetric measurement of Natural Moisture Content and % Moisture Content at either 35°C or 105°C. Calculation based on ISO 11465:1993(E) and BS1377-2:1990.	PM0	No preparation is required.			AR	
TM4	Modified USEPA 8270D v5:2014 method for the solvent extraction and determination of PAHs by GC-MS.	PM30	Water samples are extracted with solvent using a magnetic stirrer to create a vortex.			AR	Yes
TM5	Modified 8015B v2:1996 method for the determination of solvent Extractable Petroleum Hydrocarbons (EPH) within the range C8-C40 by GCFID. For waters the solvent extracts dissolved phase plus a sheen if present.	PM16/PM30	Fractionation into aliphatic and aromatic fractions using a Rapid Trace SPE/Water samples are extracted with solvent using a magnetic stirrer to create a vortex.			AR	Yes
TM5/TM36	please refer to TM5 and TM36 for method details	PM16/PM30/PM69	please refer to PM16/PM30 and PM69 for method details			AR	Yes
TM26	Determination of phenols by Reversed Phased High Performance Liquid Chromatography and Electro-Chemical Detection.	PM0	No preparation is required.			AR	Yes
TM30	Determination of Trace Metals by ICP-OES (Inductively Coupled Plasma – Optical Emission Spectrometry): WATERS by Modified USEPA Method 200.7, Rev. 4.4, 1994; Modified EPA Method 6010B, Rev.2, Dec 1996; Modified BS EN ISO 11885:2009: SOILS by Modified USEP 6010B, Rev.2, Dec.1996; Modified EPA Method 3050B, Rev.2, Dec.1996	PM14	Preparation of waters and leachates for metals by ICP OES/ICP MS. Samples are filtered for Dissolved metals, and remain unfiltered for Total metals then acidified	Yes		AR	Yes
TM36	Modified US EPA method 8015B v2:1996. Determination of Gasoline Range Organics (GRO) in the carbon chain range of C4-12 by headspace GC-FID. MTBE by GCFID co-elutes with 3-methylpentane if present and therefore can give a false positive. Positive MTBE results will be re-run using GC-MS to double check, when requested.	PM69	One part soil is mixed with 10 parts water in a vial leaving no headspace. The mixture is shaken and then left to leach for 24 hours before VOC analysis.			AR	Yes
TM38	Soluble Ion analysis using Discrete Analyser. Modified US EPA methods: Chloride 325.2 (1978), Sulphate 375.4 (Rev.2 1993), o-Phosphate 365.2 (Rev.2 1993), TON 353.1 (Rev.2 1993), Nitrite 354.1 (1971), Hex Cr 7196A (1992), NH4+ 350.1 (Rev.2 1993) – All anions comparable to BS ISO 15923-1: 2013I	PM0	No preparation is required.	Yes		AR	Yes
TM60	TC/TOC analysis of Waters by High Temperature Combustion followed by NDIR detection. Based on the following modified standard methods: USEPA 9060A (2002), APHA SMEWW 5310B:1999 22nd Edition, ASTM D 7573, and USEPA 415.1.	PM0	No preparation is required.			AR	Yes
TM73	Modified US EPA methods 150.1 (1982) and 9045D Rev. 4 - 2004) and BS1377-3:1990. Determination of pH by Metrohm automated probe analyser.	PM0	No preparation is required.			AR	Yes

EMT Job No: 22/8276

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/SANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
TM75	Modified US EPA method 310.1 (1978). Determination of Alkalinity by Metrohm automated titration analyser.	PM0	No preparation is required.			AR	Yes
TM89	Modified USEPA method OIA-1667 (1999). Determination of cyanide by Flow Injection Analyser. Where WAD cyanides are required a Ligand displacement step is carried out before analysis.	PM0	No preparation is required.	Yes		AR	Yes
NONE	No Method Code	PM17	Modified method BS EN12457-2:2002 As received solid samples are leached with water in a 10:1 water to soil ratio for 24 hours, the moisture content of the sample is included in the ratio.				
NONE	No Method Code	PM4	Gravimetric measurement of Natural Moisture Content and % Moisture Content at either 35°C or 105°C. Calculation based on ISO 11465:1993(E) and BS1377-2:1990.			AR	

Element Materials Technology
Unit 3 Deeside Point
Zone 3
Deeside Industrial Park
Deeside
CH5 2UA

P: +44 (0) 1244 833780
F: +44 (0) 1244 833781
W: www.element.com

Tetra Tech
5th Floor, Longcross Court
47 Newport Rd
Cardiff
Cardiff
UK
CF24 OAD

Attention :	Nicholas Bool
Date :	7th June, 2022
Your reference :	784-B035256
Our reference :	Test Report 22/8651 Batch 1
Location :	Blaeudlais
Date samples received :	26th May, 2022
Status :	Final Report
Issue :	1

Six samples were received for analysis on 26th May, 2022 of which two were scheduled for analysis. Please find attached our Test Report which should be read with notes at the end of the report and should include all sections if reproduced. Interpretations and opinions are outside the scope of any accreditation, and all results relate only to samples supplied.
All analysis is carried out on as received samples and reported on a dry weight basis unless stated otherwise. Results are not surrogate corrected.

Authorised By:

Bruce Leslie
Project Manager

Please include all sections of this report if it is reproduced

Element Materials Technology

Client Name: Tetra Tech
Reference: 784-B035256
Location: Blaeudlais
Contact: Nicholas Bool
EMT Job No: 22/8651

Report : **Solid**

Solids: V=60g VOC jar, J=250g glass jar, T=plastic tub

EMT Sample No.	10-12	16-18									LOD/LOR	Units	Method No.
Sample ID	WS08	WS04											
Depth	1.90	1.60											
COC No / misc													
Containers	V J T	V J T											
Sample Date	19/05/2022	19/05/2022											
Sample Type	Soil	Soil											
Batch Number	1	1											
Date of Receipt	26/05/2022	26/05/2022											
Arsenic #	5.6	4.2									<0.5	mg/kg	TM30/PM15
Beryllium	2.4	1.7									<0.5	mg/kg	TM30/PM15
Cadmium #	<0.1	<0.1									<0.1	mg/kg	TM30/PM15
Chromium #	33.4	42.7									<0.5	mg/kg	TM30/PM15
Copper #	49	26									<1	mg/kg	TM30/PM15
Lead #	20	20									<5	mg/kg	TM30/PM15
Mercury #	<0.1	<0.1									<0.1	mg/kg	TM30/PM15
Nickel #	55.7	24.6									<0.7	mg/kg	TM30/PM15
Selenium #	2	2									<1	mg/kg	TM30/PM15
Vanadium	31	24									<1	mg/kg	TM30/PM15
Water Soluble Boron #	0.2	0.2									<0.1	mg/kg	TM74/PM32
Zinc #	116	72									<5	mg/kg	TM30/PM15
PAH MS													
Naphthalene #	<0.04	<0.04									<0.04	mg/kg	TM4/PM8
Acenaphthylene	<0.03	<0.03									<0.03	mg/kg	TM4/PM8
Acenaphthene #	<0.05	<0.05									<0.05	mg/kg	TM4/PM8
Fluorene #	<0.04	<0.04									<0.04	mg/kg	TM4/PM8
Phenanthrene #	<0.03	<0.03									<0.03	mg/kg	TM4/PM8
Anthracene #	<0.04	<0.04									<0.04	mg/kg	TM4/PM8
Fluoranthene #	<0.03	<0.03									<0.03	mg/kg	TM4/PM8
Pyrene #	<0.03	<0.03									<0.03	mg/kg	TM4/PM8
Benzo(a)anthracene #	<0.06	<0.06									<0.06	mg/kg	TM4/PM8
Chrysene #	<0.02	<0.02									<0.02	mg/kg	TM4/PM8
Benzo(bk)fluoranthene #	<0.07	<0.07									<0.07	mg/kg	TM4/PM8
Benzo(a)pyrene #	<0.04	<0.04									<0.04	mg/kg	TM4/PM8
Indeno(123cd)pyrene #	<0.04	<0.04									<0.04	mg/kg	TM4/PM8
Dibenzo(ah)anthracene #	<0.04	<0.04									<0.04	mg/kg	TM4/PM8
Benzo(ghi)perylene #	<0.04	<0.04									<0.04	mg/kg	TM4/PM8
PAH 16 Total	<0.6	<0.6									<0.6	mg/kg	TM4/PM8
Benzo(b)fluoranthene	<0.05	<0.05									<0.05	mg/kg	TM4/PM8
Benzo(k)fluoranthene	<0.02	<0.02									<0.02	mg/kg	TM4/PM8
PAH Surrogate % Recovery	82	84									<0	%	TM4/PM8

Please see attached notes for all abbreviations and acronyms

Client Name: Tetra Tech
Reference: 784-B035256
Location: Blaeudlais
Contact: Nicholas Bool
EMT Job No: 22/8651

Report : Solid

Solids: V=60g VOC jar, J=250g glass jar, T=plastic tub

EMT Sample No.	10-12	16-18									LOD/LOR	Units	Method No.
Sample ID	WS08	WS04											
Depth	1.90	1.60											
COC No / misc													
Containers	V J T	V J T											
Sample Date	19/05/2022	19/05/2022											
Sample Type	Soil	Soil											
Batch Number	1	1											
Date of Receipt	26/05/2022	26/05/2022											
TPH CWG													
Aliphatics													
>C5-C6 (HS_1D_AL)#	<0.1	<0.1									<0.1	mg/kg	TM36/PM12
>C6-C8 (HS_1D_AL)#	<0.1	<0.1									<0.1	mg/kg	TM36/PM12
>C8-C10 (HS_1D_AL)	<0.1	<0.1									<0.1	mg/kg	TM36/PM12
>C10-C12 (EH_CU_1D_AL)#	<0.2	<0.2									<0.2	mg/kg	TM5/PM8/PM16
>C12-C16 (EH_CU_1D_AL)#	<4	<4									<4	mg/kg	TM5/PM8/PM16
>C16-C21 (EH_CU_1D_AL)#	<7	<7									<7	mg/kg	TM5/PM8/PM16
>C21-C35 (EH_CU_1D_AL)#	<7	<7									<7	mg/kg	TM5/PM8/PM16
>C35-C44 (EH_1D_AL)	<7	<7									<7	mg/kg	TM5/PM8/PM16
Total aliphatics C5-44 (EH+HS_1D_AL)	<26	<26									<26	mg/kg	TM5/TM36/PM8/PM12/PM16
Aromatics													
>C5-EC7 (HS_1D_AR)#	<0.1	<0.1									<0.1	mg/kg	TM36/PM12
>EC7-EC8 (HS_1D_AR)#	<0.1	<0.1									<0.1	mg/kg	TM36/PM12
>EC8-EC10 (HS_1D_AR)#	<0.1	<0.1									<0.1	mg/kg	TM36/PM12
>EC10-EC12 (EH_CU_1D_AR)#	<0.2	<0.2									<0.2	mg/kg	TM5/PM8/PM16
>EC12-EC16 (EH_CU_1D_AR)#	<4	<4									<4	mg/kg	TM5/PM8/PM16
>EC16-EC21 (EH_CU_1D_AR)#	<7	<7									<7	mg/kg	TM5/PM8/PM16
>EC21-EC35 (EH_CU_1D_AR)#	<7	<7									<7	mg/kg	TM5/PM8/PM16
>EC35-EC44 (EH_1D_AR)	<7	<7									<7	mg/kg	TM5/PM8/PM16
Total aromatics C5-44 (EH+HS_1D_AR)	<26	<26									<26	mg/kg	TM5/TM36/PM8/PM12/PM16
Total aliphatics and aromatics(C5-44) (EH+HS_CU_1D_Total)	<52	<52									<52	mg/kg	TM5/TM36/PM8/PM12/PM16
MTBE#	<5	<5									<5	ug/kg	TM36/PM12
Benzene#	<5	<5									<5	ug/kg	TM36/PM12
Toluene#	<5	<5									<5	ug/kg	TM36/PM12
Ethylbenzene#	<5	<5									<5	ug/kg	TM36/PM12
m/p-Xylene#	<5	<5									<5	ug/kg	TM36/PM12
o-Xylene#	<5	<5									<5	ug/kg	TM36/PM12
Total Phenols HPLC	<0.15	<0.15									<0.15	mg/kg	TM26/PM21B
Natural Moisture Content	12.3	14.3									<0.1	%	PM4/PM0
Hexavalent Chromium#	<0.3	<0.3									<0.3	mg/kg	TM38/PM20
Sulphate as SO4 (2:1 Ext)#	0.0482	0.0626									<0.0015	g/l	TM38/PM20
Chromium III	33.4	42.7									<0.5	mg/kg	NONE/NONE
Free Cyanide	<0.5	<0.5									<0.5	mg/kg	TM89/PM45
Fraction Organic Carbon	0.009	0.015									<0.001	None	TM21/PM24
pH#	6.27	5.59									<0.01	pH units	TM73/PM11

Please see attached notes for all abbreviations and acronyms

Client Name: Tetra Tech
Reference: 784-B035256
Location: Blaeudlais
Contact: Nicholas Bool

Note:

Asbestos Screen analysis is carried out in accordance with our documented in-house methods PM042 and TM065 and HSG 248 by Stereo and Polarised Light Microscopy using Dispersion Staining Techniques and is covered by our UKAS accreditation. Detailed Gravimetric Quantification and PCOM Fibre Analysis is carried out in accordance with our documented in-house methods PM042 and TM131 and HSG 248 using Stereo and Polarised Light Microscopy and Phase Contrast Optical Microscopy (PCOM). Asbestos sub-samples are retained for not less than 6 months from the date of analysis unless specifically requested.

The LOQ of the Asbestos Quantification is 0.001% dry fibre of dry mass of sample.

Where the sample is not taken by a Element Materials Technology consultant, Element Materials Technology cannot be responsible for inaccurate or unrepresentative sampling.

EMT Job No.	Batch	Sample ID	Depth	EMT Sample No.	Analyst Name	Date Of Analysis	Analysis	Result
22/8651	1	WS08	1.90	12	Catherine Coles	07/06/2022	**General Description (Bulk Analysis)**	sand
					Catherine Coles	07/06/2022	**Asbestos Fibres**	NAD
					Catherine Coles	07/06/2022	**Asbestos ACM**	NAD
					Catherine Coles	07/06/2022	**Asbestos Type**	NAD
22/8651	1	WS04	1.60	18	Catherine Coles	07/06/2022	**General Description (Bulk Analysis)**	sand, soil
					Catherine Coles	07/06/2022	**Asbestos Fibres**	NAD
					Catherine Coles	07/06/2022	**Asbestos ACM**	NAD
					Catherine Coles	07/06/2022	**Asbestos Type**	NAD

Client Name: Tetra Tech
Reference: 784-B035256
Location: Blaeudlais
Contact: Nicholas Bool

EMT Job No.	Batch	Sample ID	Depth	EMT Sample No.	Analysis	Reason
No deviating sample report results for job 22/8651						

Please note that only samples that are deviating are mentioned in this report. If no samples are listed it is because none were deviating.
Only analyses which are accredited are recorded as deviating if set criteria are not met.

NOTES TO ACCOMPANY ALL SCHEDULES AND REPORTS

EMT Job No.: 22/8651

SOILS and ASH

Please note we are only MCERTS accredited (UK soils only) for sand, loam and clay and any other matrix is outside our scope of accreditation.

Where an MCERTS report has been requested, you will be notified within 48 hours of any samples that have been identified as being outside our MCERTS scope. As validation has been performed on clay, sand and loam, only samples that are predominantly these matrices, or combinations of them will be within our MCERTS scope. If samples are not one of a combination of the above matrices they will not be marked as MCERTS accredited.

It is assumed that you have taken representative samples on site and require analysis on a representative subsample. Stones will generally be included unless we are requested to remove them.

All samples will be discarded one month after the date of reporting, unless we are instructed to the contrary. Asbestos samples are retained for 6 months.

If you have not already done so, please send us a purchase order if this is required by your company.

Where appropriate please make sure that our detection limits are suitable for your needs, if they are not, please notify us immediately.

All analysis is reported on a dry weight basis unless stated otherwise. Limits of detection for analyses carried out on as received samples are not moisture content corrected. Results are not surrogate corrected. Samples are dried at 35°C ±5°C unless otherwise stated. Moisture content for CEN Leachate tests are dried at 105°C ±5°C. Ash samples are dried at 37°C ±5°C.

Where Mineral Oil or Fats, Oils and Grease is quoted, this refers to Total Aliphatics C10-C40.

Where a CEN 10:1 ZERO Headspace VOC test has been carried out, a 10:1 ratio of water to wet (as received) soil has been used.

% Asbestos in Asbestos Containing Materials (ACMs) is determined by reference to HSG 264 The Survey Guide - Appendix 2 : ACMs in buildings listed in order of ease of fibre release.

Sufficient amount of sample must be received to carry out the testing specified. Where an insufficient amount of sample has been received the testing may not meet the requirements of our accredited methods, as such accreditation may be removed.

Negative Neutralization Potential (NP) values are obtained when the volume of NaOH (0.1N) titrated (pH 8.3) is greater than the volume of HCl (1N) to reduce the pH of the sample to 2.0 - 2.5. Any negative NP values are corrected to 0.

The calculation of Pyrite content assumes that all oxidisable sulphides present in the sample are pyrite. This may not be the case. The calculation may be an overesitimate when other sulphides such as Barite (Barium Sulphate) are present.

WATERS

Please note we are not a UK Drinking Water Inspectorate (DWI) Approved Laboratory .

ISO17025 accreditation applies to surface water and groundwater and usually one other matrix which is analysis specific, any other liquids are outside our scope of accreditation.

As surface waters require different sample preparation to groundwaters the laboratory must be informed of the water type when submitting samples.

Where Mineral Oil or Fats, Oils and Grease is quoted, this refers to Total Aliphatics C10-C40.

STACK EMISSIONS

Where an MCERTS report has been requested, you will be notified within 48 hours of any samples that have been identified as being outside our MCERTS scope. As validation for Dioxins and Furans and Dioxin like PCBs has been performed on XAD-2 Resin, only samples which use this resin will be within our MCERTS scope.

Where appropriate please make sure that our detection limits are suitable for your needs, if they are not, please notify us immediately.

DEVIATING SAMPLES

All samples should be submitted to the laboratory in suitable containers with sufficient ice packs to sustain an appropriate temperature for the requested analysis. The temperature of sample receipt is recorded on the confirmation schedules in order that the client can make an informed decision as to whether testing should still be undertaken.

SURROGATES

Surrogate compounds are added during the preparation process to monitor recovery of analytes. However low recovery in soils is often due to peat, clay or other organic rich matrices. For waters this can be due to oxidants, surfactants, organic rich sediments or remediation fluids. Acceptable limits for most organic methods are 70 - 130% and for VOCs are 50 - 150%. When surrogate recoveries are outside the performance criteria but the associated AQC passes this is assumed to be due to matrix effect. Results are not surrogate corrected.

DILUTIONS

A dilution suffix indicates a dilution has been performed and the reported result takes this into account. No further calculation is required.

BLANKS

Where analytes have been found in the blank, the sample will be treated in accordance with our laboratory procedure for dealing with contaminated blanks.

NOTE

Data is only reported if the laboratory is confident that the data is a true reflection of the samples analysed. Data is only reported as accredited when all the requirements of our Quality System have been met. In certain circumstances where all the requirements of the Quality System have not been met, for instance if the associated AQC has failed, the reason is fully investigated and documented. The sample data is then evaluated alongside the other quality control checks performed during analysis to determine its suitability. Following this evaluation, provided the sample results have not been effected, the data is reported but accreditation is removed. It is a UKAS requirement for data not reported as accredited to be considered indicative only, but this does not mean the data is not valid.
Where possible, and if requested, samples will be re-extracted and a revised report issued with accredited results. Please do not hesitate to contact the laboratory if further details are required of the circumstances which have led to the removal of accreditation.
Laboratory records are kept for a period of no less than 6 years.

REPORTS FROM THE SOUTH AFRICA LABORATORY

Any method number not prefixed with SA has been undertaken in our UK laboratory unless reported as subcontracted.

Measurement Uncertainty

Measurement uncertainty defines the range of values that could reasonably be attributed to the measured quantity. This range of values has not been included within the reported results. Uncertainty expressed as a percentage can be provided upon request.

Customer Provided Information

Sample ID and depth is information provided by the customer.

ABBREVIATIONS and ACRONYMS USED

#	ISO17025 (UKAS Ref No. 4225) accredited - UK.
SA	ISO17025 (SANAS Ref No.T0729) accredited - South Africa
B	Indicates analyte found in associated method blank.
DR	Dilution required.
M	MCERTS accredited.
NA	Not applicable
NAD	No Asbestos Detected.
ND	None Detected (usually refers to VOC and/SVOC TICs).
NDP	No Determination Possible
SS	Calibrated against a single substance
SV	Surrogate recovery outside performance criteria. This may be due to a matrix effect.
W	Results expressed on as received basis.
+	AQC failure, accreditation has been removed from this result, if appropriate, see 'Note' on previous page.
>>	Results above calibration range, the result should be considered the minimum value. The actual result could be significantly higher.
*	Analysis subcontracted to an Element Materials Technology approved laboratory.
AD	Samples are dried at 35°C ±5°C
CO	Suspected carry over
LOD/LOR	Limit of Detection (Limit of Reporting) in line with ISO 17025 and MCERTS
ME	Matrix Effect
NFD	No Fibres Detected
BS	AQC Sample
LB	Blank Sample
N	Client Sample
TB	Trip Blank Sample
OC	Outside Calibration Range

HWOL ACRONYMS AND OPERATORS USED

HS	Headspace Analysis.
EH	Extractable Hydrocarbons - i.e. everything extracted by the solvent.
CU	Clean-up - e.g. by florisil, silica gel.
1D	GC - Single coil gas chromatography.
Total	Aliphatics & Aromatics.
AL	Aliphatics only.
AR	Aromatics only.
2D	GC-GC - Double coil gas chromatography.
#1	EH_Total but with humics mathematically subtracted
#2	EU_Total but with fatty acids mathematically subtracted
_	Operator - underscore to separate acronyms (exception for +).
+	Operator to indicate cumulative e.g. EH+HS_Total or EH_CU+HS_Total
MS	Mass Spectrometry.

EMT Job No: 22/8651

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/SANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
PM4	Gravimetric measurement of Natural Moisture Content and % Moisture Content at either 35°C or 105°C. Calculation based on ISO 11465:1993(E) and BS1377-2:1990.	PM0	No preparation is required.			AR	
TM4	Modified USEPA 8270D v5:2014 method for the solvent extraction and determination of PAHs by GC-MS.	PM8	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required.			AR	Yes
TM4	Modified USEPA 8270D v5:2014 method for the solvent extraction and determination of PAHs by GC-MS.	PM8	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required.	Yes		AR	Yes
TM5	Modified 8015B v2:1996 method for the determination of solvent Extractable Petroleum Hydrocarbons (EPH) within the range C8-C40 by GCFID. For waters the solvent extracts dissolved phase plus a sheen if present.	PM8/PM16	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required/Fractionation into aliphatic and aromatic fractions using a Rapid Trace SPE.			AR	Yes
TM5	Modified 8015B v2:1996 method for the determination of solvent Extractable Petroleum Hydrocarbons (EPH) within the range C8-C40 by GCFID. For waters the solvent extracts dissolved phase plus a sheen if present.	PM8/PM16	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required/Fractionation into aliphatic and aromatic fractions using a Rapid Trace SPE.	Yes		AR	Yes
TM5/TM36	please refer to TM5 and TM36 for method details	PM8/PM12/PM16	please refer to PM8/PM16 and PM12 for method details			AR	Yes
TM21	Modified BS 7755-3:1995, ISO10694:1995 Determination of Total Organic Carbon or Total Carbon by combustion in an Eltra TOC furnace/analyser in the presence of oxygen. The CO2 generated is quantified using infra-red detection. Organic Matter (SOM) calculated as per EA MCERTS Chemical Testing of Soil, March 2012 v4.	PM24	Dried and ground solid samples are washed with hydrochloric acid, then rinsed with deionised water to remove the mineral carbon before TOC analysis.			AD	Yes
TM26	Determination of phenols by Reversed Phased High Performance Liquid Chromatography and Electro-Chemical Detection.	PM21B	As Received samples are extracted in Methanol: Water (60:40) by reciprocal shaker.			AR	Yes
TM30	Determination of Trace Metals by ICP-OES (Inductively Coupled Plasma – Optical Emission Spectrometry): WATERS by Modified USEPA Method 200.7, Rev. 4.4, 1994; Modified EPA Method 6010B, Rev.2, Dec 1996; Modified BS EN ISO 11885:2009: SOILS by Modified USEP 6010B, Rev.2, Dec.1996; Modified EPA Method 3050B, Rev.2, Dec.1996	PM15	Acid digestion of dried and ground solid samples using Aqua Regia refluxed at 112.5 °C. Samples containing asbestos are not dried and ground.			AD	Yes
TM30	Determination of Trace Metals by ICP-OES (Inductively Coupled Plasma – Optical Emission Spectrometry): WATERS by Modified USEPA Method 200.7, Rev. 4.4, 1994; Modified EPA Method 6010B, Rev.2, Dec 1996; Modified BS EN ISO 11885:2009: SOILS by Modified USEP 6010B, Rev.2, Dec.1996; Modified EPA Method 3050B, Rev.2, Dec.1996	PM15	Acid digestion of dried and ground solid samples using Aqua Regia refluxed at 112.5 °C. Samples containing asbestos are not dried and ground.	Yes		AD	Yes

EMT Job No: 22/8651

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/SANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
TM36	Modified US EPA method 8015B v2:1996. Determination of Gasoline Range Organics (GRO) in the carbon chain range of C4-12 by headspace GC-FID. MTBE by GCFID co-elutes with 3-methylpentane if present and therefore can give a false positive. Positive MTBE results will be re-run using GC-MS to double check, when requested.	PM12	Modified US EPA method 5021A v2:2014. Preparation of solid and liquid samples for GC headspace analysis.			AR	Yes
TM36	Modified US EPA method 8015B v2:1996. Determination of Gasoline Range Organics (GRO) in the carbon chain range of C4-12 by headspace GC-FID. MTBE by GCFID co-elutes with 3-methylpentane if present and therefore can give a false positive. Positive MTBE results will be re-run using GC-MS to double check, when requested.	PM12	Modified US EPA method 5021A v2:2014. Preparation of solid and liquid samples for GC headspace analysis.	Yes		AR	Yes
TM38	Soluble Ion analysis using Discrete Analyser. Modified US EPA methods: Chloride 325.2 (1978), Sulphate 375.4 (Rev.2 1993), o-Phosphate 365.2 (Rev.2 1993), TON 353.1 (Rev.2 1993), Nitrite 354.1 (1971), Hex Cr 7196A (1992), NH4+ 350.1 (Rev.2 1993) – All anions comparable to BS ISO 15923-1: 2013I	PM20	Extraction of dried and ground or as received samples with deionised water in a 2:1 water to solid ratio using a reciprocal shaker for all analytes except hexavalent chromium. Extraction of as received sample using 10:1 ratio of 0.2M sodium hydroxide to soil for hexavalent chromium using a reciprocal shaker.	Yes		AD	Yes
TM38	Soluble Ion analysis using Discrete Analyser. Modified US EPA methods: Chloride 325.2 (1978), Sulphate 375.4 (Rev.2 1993), o-Phosphate 365.2 (Rev.2 1993), TON 353.1 (Rev.2 1993), Nitrite 354.1 (1971), Hex Cr 7196A (1992), NH4+ 350.1 (Rev.2 1993) – All anions comparable to BS ISO 15923-1: 2013I	PM20	Extraction of dried and ground or as received samples with deionised water in a 2:1 water to solid ratio using a reciprocal shaker for all analytes except hexavalent chromium. Extraction of as received sample using 10:1 ratio of 0.2M sodium hydroxide to soil for hexavalent chromium using a reciprocal shaker.	Yes		AR	Yes
TM65	Asbestos Bulk Identification method based on HSG 248 Second edition (2021)	PM42	Modified SCA Blue Book V.12 draft 2017 and WM3 1st Edition v1.1:2018. Solid samples undergo a thorough visual inspection for asbestos fibres prior to asbestos identification using TM065.	Yes		AR	
TM73	Modified US EPA methods 150.1 (1982) and 9045D Rev. 4 - 2004) and BS1377-3:1990. Determination of pH by Metrohm automated probe analyser.	PM11	Extraction of as received solid samples using one part solid to 2.5 parts deionised water.	Yes		AR	No
TM74	Analysis of water soluble boron (20:1 extract) by ICP-OES.	PM32	Hot water soluble boron is extracted from dried and ground samples using a 20:1 ratio.	Yes		AD	Yes
TM89	Modified USEPA method OIA-1667 (1999). Determination of cyanide by Flow Injection Analyser. Where WAD cyanides are required a Ligand displacement step is carried out before analysis.	PM45	As received solid samples are extracted with 1M NaOH by orbital shaker for Cyanide, Sulphide and Thiocyanate analysis.			AR	Yes
NONE	No Method Code	NONE	No Method Code			AD	Yes

APPENDIX G – GROUNDWATER AND GROUND GAS MONITORING DATA

Tetra Tech
LANDGAS AND GROUNDWATER MONITORING RESULTS

Site Name: Blaendulais
Job No.: B035256
Client: Neath Port Talbot Council

Date Monitored: 02/06/22
Monitoring Engineer: JTC
Weather: dry, warm

EQUIPMENT USED

Type	Make	Serial	Last Calibrated
Gas Analyser	**Landtec GA5000**	**G502044**	**Nov-21**
Interface Meter	**Solinst**	**122-004988-1**	**n/a**

LANDGAS CONCENTRATIONS - INSTALLATION CONDITIONS

Exploratory Hole No	Peak		Steady									
	CH_4 (% vol)	CO_2 (% vol)	CH_4 (% vol)	CO_2 (% vol)	O_2 (% vol)	BAL (%)	PID (ppm)	H_2S (ppm)	HCN (ppm)	CO (ppm)	Time	Remarks
BH02	0.0	0.9	0.0	0.9	14.1	84.9	nt	0	nt	0	10:00	
BH01	0.0	0.8	0.0	0.9	14.3	84.8	nt	0	nt	0	10:30	
WS08	0.0	0.6	0.0	0.6	14.3	85	nt	0	nt	0	10:45	

LANDGAS - PHYSICAL PARAMETERS

Exploratory Hole No	Atmos Pressure (m bar)	Atmos Temp (°C)	BH Flow		BH Pressure		Remarks
			Peak (L/hr)	Steady (L/hr)	Peak (mbar)	Steady (mbar)	
BH02	995	14.0	0.1	0.1	0.14	0.14	
BH01	995	14.0	0.1	0.1	0.13	0.13	
WS08	995	14.0	0.1	0.1	0.10	0.10	

AMBIENT ATMOSPHERIC CONDITIONS

Parameter	Before Monitoring	After Monitoring
CH_4 (% vol)	0.0	0.0
CO_2 (% vol)	0.2	0.0
O_2 (% vol)	21.1	21.1
PID (ppm)	nt	nt
Atmos Press. (m bar)	1018	1018

ATMOSPHERIC PRESSURE CONDITIONS

3 days prior (m bar)	1019
2 days prior (m bar)	1019
1 day prior (m bar)	1018
during (m bar) am,midday,pm	1021, 1022, 1023
1 day post (m bar)	1024

GROUNDWATER / NAPL - PHYSIO-CHEMICAL PARAMETERS

Exploratory Hole No	Water Surface (mbgl)	Base Depth (mbgl)	LNAPL Surface (mbgl)	DNAPL Surface (mbgl)	Water Quality Indicators								Remarks
					ORP (mV)	SPC (µs/cm)	C (µs/cm)	Ph (value)	DO (mg/L)	Dissolved Solids (ppt)	Resistivity (Ω·cm)	Temp (°C)	
BH02	3.30	3.40	nd	nd	nt	nt	nt	nt	nt	nt	nt	nt	
BH01	3.40	6.00	nd	nd	nt	nt	nt	nt	nt	nt	nt	nt	
WS08	dry	1.00	nd	nd	nt	nt	nt	nt	nt	nt	nt	nt	

Notes nt = not tested
nd = not detected

Data Compiled by: JTC
Data Checked by: NEB

Tetra Tech
LANDGAS AND GROUNDWATER MONITORING RESULTS

Site Name: Blaendulais
Job No.: B035256
Client: Neath Port Talbot Council

Date Monitored: 09/06/22
Monitoring Engineer: JTC
Weather: overcast, warm

EQUIPMENT USED

Type	Make	Serial	Last Calibrated
Gas Analyser	**Landtec GA5000**	**G502044**	**Nov-21**
Interface Meter	**Solinst**	**122-004988-1**	**n/a**

LANDGAS CONCENTRATIONS - INSTALLATION CONDITIONS

Exploratory Hole No	Peak		Steady									
	CH_4 (% vol)	CO_2 (% vol)	CH_4 (% vol)	CO_2 (% vol)	O_2 (% vol)	BAL (%)	PID (ppm)	H_2S (ppm)	HCN (ppm)	CO (ppm)	Time	Remarks
BH02	0.1	0.2	0.1	0.2	20.8	78.9	nt	0	nt	0	11:30	
BH01	0.1	0.2	0.1	0.3	20.6	79.0	nt	0	nt	0	12:00	
WS08	0.1	0.5	0.1	0.5	20.4	79	nt	nt	nt	nt	13:00	

LANDGAS - PHYSICAL PARAMETERS

Exploratory Hole No	Atmos Pressure (m bar)	Atmos Temp (°C)	BH Flow		BH Pressure		Remarks
			Peak (L/hr)	Steady (L/hr)	Peak (mbar)	Steady (mbar)	
BH02	994	16.0	0.1	0.1	0.07	0.07	
BH01	994	16.0	0.1	0.1	0.09	0.09	
WS08	994	16.0	0.1	0.1	0.09	0.09	

AMBIENT ATMOSPHERIC CONDITIONS

Parameter	Before Monitoring	After Monitoring
CH_4 (% vol)	0.0	0.0
CO_2 (% vol)	0.0	0.0
O_2 (% vol)	21.4	21.5
PID (ppm)	nt	nt
Atmos Press. (m bar)	1017	1015

ATMOSPHERIC PRESSURE CONDITIONS

3 days prior (m bar)	1019
2 days prior (m bar)	1012
1 day prior (m bar)	1008
during (m bar) am,midday,pm	1017, 1017, 1015
1 day post (m bar)	1018

GROUNDWATER / NAPL - PHYSIO-CHEMICAL PARAMETERS

Exploratory Hole No	Water Surface (mbgl)	Base Depth (mbgl)	LNAPL Surface (mbgl)	DNAPL Surface (mbgl)	Water Quality Indicators								Remarks
					ORP (mV)	SPC (µs/cm)	C (µs/cm)	Ph (value)	DO (mg/L)	Dissolved Solids (ppt)	Resistivity (Ω·cm)	Temp (°C)	
BH02	3.30	3.40	nd	nd	nt	nt	nt	nt	nt	nt	nt	nt	
BH01	3.40	6.00	nd	nd	nt	nt	nt	nt	nt	nt	nt	nt	
WS08	dry	1.00	nd	nd	nt	nt	nt	nt	nt	nt	nt	nt	
			nd	nd	nt	nt	nt	nt	nt	nt	nt	nt	
			nd	nd	nt	nt	nt	nt	nt	nt	nt	nt	

Notes nt = not tested
nd = not detected

Data Compiled by: JTC
Data Checked by: NEB

Tetra Tech
LANDGAS AND GROUNDWATER MONITORING RESULTS

Site Name: Blaendulais
Job No.: B035256
Client: Neath Port Talbot Council

Date Monitored: 15/06/22
Monitoring Engineer: JM
Weather: clear, warm

EQUIPMENT USED

Type	Make	Serial	Last Calibrated
Gas Analyser	**Landtec GA5000**	**G502044**	**Nov-21**
Interface Meter	**Solinst**	**122-004988-1**	**n/a**

LANDGAS CONCENTRATIONS - INSTALLATION CONDITIONS

Exploratory Hole No	Peak		Steady									
	CH_4 (% vol)	CO_2 (% vol)	CH_4 (% vol)	CO_2 (% vol)	O_2 (% vol)	BAL (%)	PID (ppm)	H_2S (ppm)	HCN (ppm)	CO (ppm)	Time	Remarks
BH02	0.1	0.2	0.1	0.2	20.8	78.9	nt	0	nt	0	09:00	
BH01	0.1	0.4	0.1	0.4	16.9	82.9	nt	0	nt	0	09:30	
WS08	0.1	0.5	0.1	0.5	20.4	79	nt	0	nt	0	10:00	

LANDGAS - PHYSICAL PARAMETERS

Exploratory Hole No	Atmos Pressure (m bar)	Atmos Temp (°C)	BH Flow		BH Pressure		Remarks
			Peak (L/hr)	Steady (L/hr)	Peak (mbar)	Steady (mbar)	
BH02	998	16.0	0.1	0.1	-0.12	-0.05	
BH01	998	16.0	0.2	0.2	-0.17	-0.17	
WS08	998	16.0	0.2	0.2	0.12	0.12	

AMBIENT ATMOSPHERIC CONDITIONS

Parameter	Before Monitoring	After Monitoring
CH_4 (% vol)	0.1	0.1
CO_2 (% vol)	0.1	0.1
O_2 (% vol)	21.1	21.1
PID (ppm)	nt	nt
Atmos Press. (m bar)	998	998

ATMOSPHERIC PRESSURE CONDITIONS

3 days prior (m bar)	1026
2 days prior (m bar)	1028
1 day prior (m bar)	1023
during (m bar) am,midday,pm	1019, 1020, 1019
1 day post (m bar)	1018

GROUNDWATER / NAPL - PHYSIO-CHEMICAL PARAMETERS

Exploratory Hole No	Water Surface (mbgl)	Base Depth (mbgl)	LNAPL Surface (mbgl)	DNAPL Surface (mbgl)	Water Quality Indicators								Remarks
					ORP (mV)	SPC (µs/cm)	C (µs/cm)	Ph (value)	DO (mg/L)	Dissolved Solids (ppt)	Resistivity (Ω·cm)	Temp (°C)	
BH02	DRY	3.40	nd	nd	nt	nt	nt	nt	nt	nt	nt	nt	
BH01	4.12	6.00	nd	nd	nt	nt	nt	nt	nt	nt	nt	nt	
WS08	DRY	1.00	nd	nd	nt	nt	nt	nt	nt	nt	nt	nt	
			nd	nd	nt	nt	nt	nt	nt	nt	nt	nt	
			nd	nd	nt	nt	nt	nt	nt	nt	nt	nt	

Notes nt = not tested
nd = not detected

Data Compiled by: JM
Data Checked by: NEB