

**Geotechnical &
Geo-environmental Report:**
Proposed Temporary Accommodation Structures,
Glasier Road, Merthyr Tydfil

Prepared for:
Smart Associates

February 2018

Job No: 14545

REPORT TITLE **Geotechnical and Geo-environmental Report:**
Proposed Temporary Accommodation Structures,
Glasier Road, Merthyr Tydfil

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Executive Summary

Site Location and Proposed Development	The site is located to the northern side of Glasier Road in Merthyr Tydfil and is located at an approximate National Grid Reference of 305560,205500. The site is rectangular in shape and occupies an approximate plan area of 0.06 hectares Merthyr Valley Homes Limited are proposing two temporary accommodation caravans on the site of a row of garages / lockups on Glaisher Road, Merthyr Tydfil.		
Site History	The site lay within a railway cutting from the earliest map obtained dated 1876. By 1957 the cutting had been filled. By 1969 the garages / lockups had been built.		
Geology	The site is underlain by the South Wales Lower Coal Measures Formation consisting grey, coal-bearing mudstones/siltstones, with seatearths and minor sandstones. The Gellideg Coal Seam outcrops some 250m east of the site and does not underlie the site. Glacial Till superficial deposits are shown to overlie the solid geology. Glacial Till typically comprises sandy, silty clay but can contain gravel-rich, or laminated sand layers. A significant and variable thickness of made ground may be encountered beneath the site associated with filling of the railway cutting and the development of the site and surrounding area		
Landfills	There are no current or historical landfills located within 250m of the site boundary. However, the site itself appears to lie above a large area of tipped colliery spoil.		
Site Investigation	A geotechnical and geo-environmental site investigation was carried out on 18th of January 2017 comprising 5 window sample boreholes.		
Summary of Ground Conditions	Depth (m)	Thickness (m)	Stratum
	0.00 to 0.10 / 0.15	0.10 / 0.15	MADE GROUND: CONCRETE slab (No reinforcement observed)
	0.1 / 0.15 to 1.40 / 3.00+	1.30 / 2.88+	MADE GROUND: Loose black red dark brown silty sandy GRAVEL. Gravel is fine to coarse and angular and includes fragments of ash, coal, brick, slag and porcelain.
	1.40 / 2.00 to 2.00+ / 3.00+	0.6+ / 1.00+	Firm brown sandy gravelly CLAY (Proven at WS3, WS4 and WS5)
Groundwater was not encountered up to 3mbgl.			
Summary of Contamination Testing	Chemical testing has identified Chrysotile asbestos within four of five samples; and Lead within one sample which exceeded the adopted guidelines. Both contaminants are considered non volatile and no further contaminants of concern were identified.		
Site Preparation	The local authority may wish to agree the details of the demolition and proposals to restore the site afterwards. All deleterious materials should be removed from site to an appropriate landfill facility. It is proposed to keep the existing concrete slab. Contingencies should be made for the protection/diversion of any necessary temporary/permanent support of structures and underground services on or adjacent to the site brought about as a result of the proposed works. Given the presence of contamination within the made ground on site and potential combustibility of the fill materials remedial measures are required to protect future site users. Service runs should also be encased in clean non-combustible material.		
Foundation Recommendations	The Caravans are proposed to lie upon pads directly above the existing concrete slabs. The additional load is considered likely to be within the region of ~40kN/m². A structural engineer may be able to confirm the suitability of the existing 0.1m thick concrete slab for this purpose.		
Soakaway Considerations	Shallow soakaways are considered unsuitable as contamination has been identified within the existing made ground / tipped material and the underlying clay is considered to have low permeability. The existing concrete slabs are proposed to be retained on site. It is therefore proposed to continue to use the existing site drainage.		

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SECTION 1 Introduction and Proposed Development

Merthyr Valley Homes Limited are proposing temporary accommodation caravans on the site of a row of garages / lockups on Glaiser Road, Merthyr Tydfil. The caravans are converted steel shipping containers, demountable and elevated on columns.

Terra Firma (Wales) Limited has been commissioned to undertake a geo-environmental assessment and geotechnical investigation of the site.

Smart Associates are the Civil and Structural Engineers for the project.

The main objectives of the geo-environmental assessment programme were to:

- Identify the potential environmental liabilities at the site associated with any soil contamination from past site uses.
- Provide a summary of the environmental conditions at the site, together with any necessary remediation works to render the site fit for its intended use.

The main objectives of the geotechnical site investigation were to:

- Determine the type, strength and bearing characteristics of the shallow superficial deposits and underlying solid geology.
- Provide recommendations for a suitable and economic foundation/floor slab solution for the development.
- Provide recommendations with regard to any other geotechnical aspects pertaining to the development.

In order to achieve the above objectives, Terra Firma (Wales) Limited carried out an assessment programme including a review of existing data, followed by a field investigation to determine the prevailing ground conditions and also to collect and analyse soil samples from selected locations around the site.

1.1 Limitations and Exceptions of Investigation

The geo-environmental and geotechnical investigation was conducted and this report has been prepared for the sole internal reliance of Merthyr Valley Homes Limited and their design and construction team. This report shall not be relied upon or transferred to any other parties without the express written authorisation of Terra Firma (Wales) Limited. If an unauthorised third party comes into possession of this report they rely on it at their peril and the authors owe them no duty of care and skill.

The report represents the findings and opinions of experienced geo-environmental and geo-technical consultants. Terra Firma (Wales) Limited does not provide legal advice and the advice of lawyers may also be required.

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

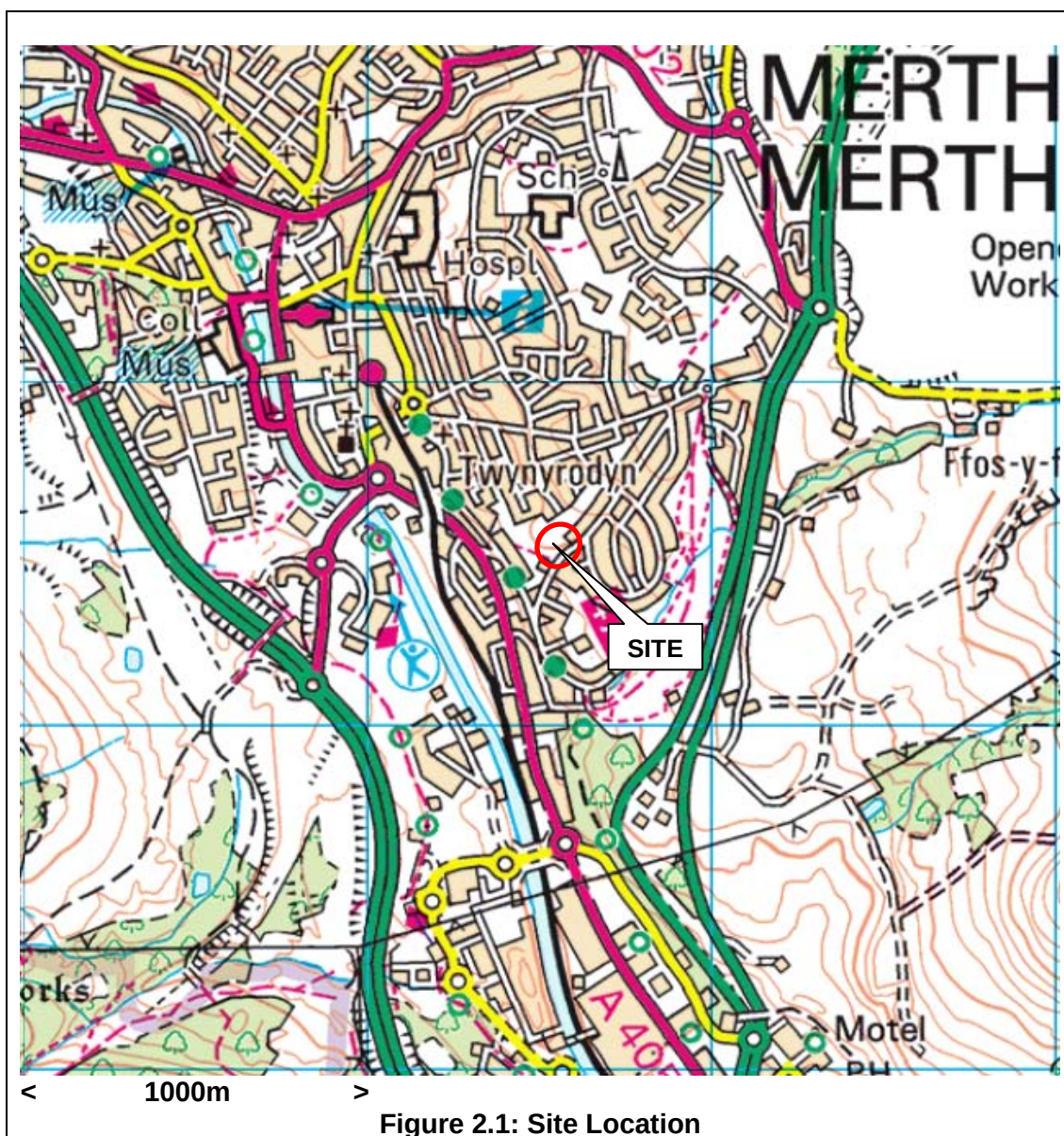
The site investigation was limited by the presence of the existing buildings and services on site.

It was beyond the scope of Terra Firma (Wales) Limited's brief to undertake an intrusive coal mining risk assessment of the site.

SECTION 2 Review of Existing Data

2.1 Physical Setting, Current Use and Site Conditions

The site is located to the northern side of Glasier Road in Merthyr Tydfil and is located at an approximate National Grid Reference of 305560 205500. The site is rectangular in shape and occupies an approximate plan area of 0.06 hectares. The location of the site is presented below in **Figure 2.1**.

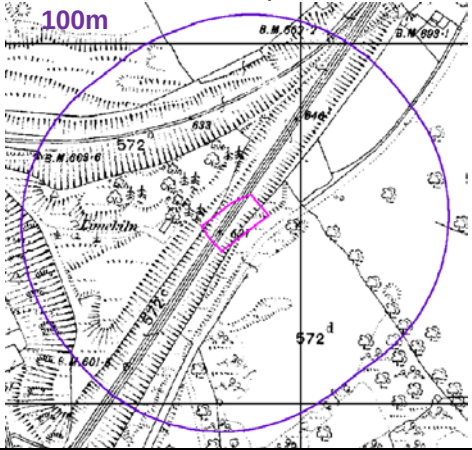
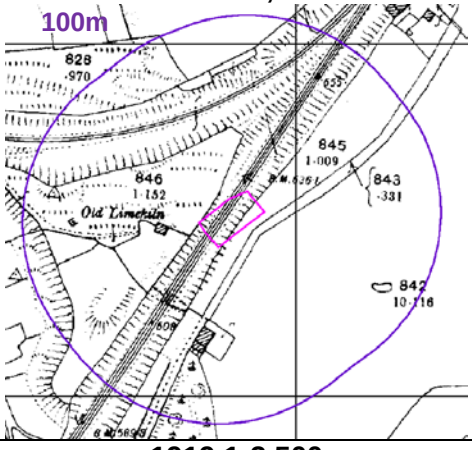
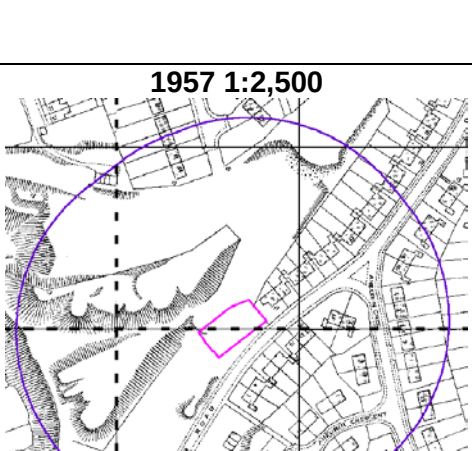


The site is currently occupied by two rows of residential garages. The garages/lockups are currently unoccupied and awaiting demolition. Consequently, the site investigation was restricted by the presence of structures and buried services.

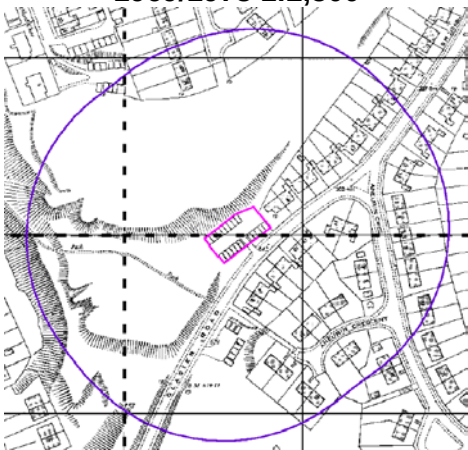
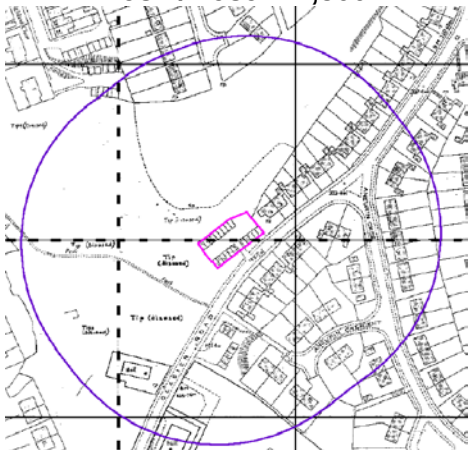
The existing concrete slabs generally appear to be in good condition although some have 'snapped'.

2.2 Site History

The history of the site has been traced using historical Ordnance Survey maps obtained from Landmark Information Group. The maps are presented in **Annex A**. A summary of the sites history is presented below:

Table 2.1 Historical Development from Map Information		
Map Edition and Scale	Key Features on Site	Key Features off Site
1876 1:2,500 	The site lies within a railway cutting.	The railway cutting runs across the site from the northeast to southwest. A limekiln is shown some 70m west of the site. Agricultural fields lie to the east of the site off a road later known as Glasier Road. Potential mine addits are shown to the southeast of the site.
1900 1:2,500 	No change since 1876.	The limekiln is labelled "old". Field boundaries east of Glasier road are no longer shown.
1919 1:2,500 	No change since 1876.	A new field boundary southeast of Glasier road is shown.
1957 1:2,500 	By 1957 the railway cutting had been filled.	The railway cuttings had been infilled. Glasier Road is labelled to the east. The fields to the east had been residentially developed. A residential property establishes the north-eastern site boundary.

2.2 Site History (Continued)**Table 2.1 Historical Development from Map Information (Continued)**

Map Edition and Scale	Key Features on Site	Key Features off Site
1969/1973 1:2,500 	By 1969 the garages / lockups had been built on site. The site layout resembles the current site layout.	Additional fill appears to have been placed to the northwest and west of the site. A footpath is shown some 30m southwest of the site. Additional garages/lockups appear to have been built some 50m south of the site.
1981 / 1989 1:2,500 	No change since 1969.	Community Halls appear to have been built on either side of Glasier Road some 80-100m southwest of the site. The filled area to the west and northwest of the site is labelled a disused tip.
2000 Aerial Photograph 	No change since 1969.	No significant change within the immediate surrounding area change since 1981/1989.
2006 1:2,500	No change since 1969.	No significant change within the immediate surrounding area change since 1981/1989.
2017 1:2,500	No change since 1969.	

2.3 Geological

2.3.1 Geology

The BGS 1:50,000 scale and 1:10,560 geological maps record the site to be underlain by the South Wales Lower Coal Measures Formation of Carboniferous Age which comprise grey, coal-bearing mudstones/siltstones, with seatearths and minor sandstones. The Gellideg Coal Seam outcrops some 250m east of the site and does not underlie the site.

There is potential for thin coal seams and ironstone seams to underlie the site at shallow depth.

Glacial Till superficial deposits are shown to overlie the solid geology. Glacial Till typically comprises sandy, silty clay but can contain gravel-rich, or laminated sand layers.

A significant and variable thickness of made ground may be encountered beneath the site associated with filling of the railway cutting and the development of the site and surrounding area.

2.3.2 Mining

The Coal Authority have no record of underground mining beneath the site, however the Coal Authority state that the property is in an area where there is coal at or close to the surface that may have been worked at some time in the past. The Coal Authority also has no record of coal mine entries within, or within 20m of, the site boundary.

A copy of the Coal Authorities Non-Residential Mining Report is presented within **Annex B**.

Thin coal seams are anticipated beneath the site at shallow depth and ironstone is also known to have been worked locally. A mine addit is recorded by the coal authority close to the site but not within 20m of the site boundary.

There is therefore a potential risk to the development from past unrecorded shallow workings.

2.3.3 Radon

The site lies within a lower probability radon area as less than 1% of homes are estimated to be at or above the action level. As such, **no** radon protective measures are necessary in the construction of new dwellings or extensions. A copy of the source data from the British Geological Survey's National Geoscience Information Service is included within the Envirocheck Report in **Annex A**.

2.4 Environmental Setting

2.4.1 Hydrogeology and Hydrology

The Envirocheck Report records that the bedrock beneath the site is classified as a Secondary A Aquifer. Secondary A Aquifers 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 are recorded as unproductive strata. These are layers with low permeability that have negligible significance for water supply or river base flow.

2.4.1 Hydrogeology and Hydrology (Continued)

The nearest surface water feature detailed in the Envirocheck Report is minor water course located 210m south of the site.

2.4.2 Flooding

The Flood Map records that the site lies within a Flood Zone 1 area. The site has a less than 1 in 1,000 annual probability of river or sea flooding.

2.4.3 Waste

There are no current or historical landfills located within, or within 250m of the site boundary.

However, the site itself appears to lie above a large area of tipped colliery spoil.

2.4.4 Sensitive Land Use

The following sensitive land uses are not located within, or within 1km of the site boundary;

- Ancient Woodland – 660m East, 750m Southeast and 920m East
- Sites of Special Scientific Interest – 810m Southwest – Cwm Glo A Glyndryys (grassland fungi)

The proposed development is not considered likely to impact these sensitive receptors.

The following sensitive land uses are not located within, or within 1km of the site boundary;

Areas of Adopted Green Belt
Areas of Unadopted Green Belt
Areas of Outstanding Natural Beauty
Environmentally Sensitive Areas
Forest Parks
Local Nature Reserves
Marine Nature Reserves
National Nature Reserves

National Parks
Nitrate Sensitive Areas
Nitrate Vulnerable Zones
Ramsar Sites
Special Areas of Conservation
Special Protection Areas
World Heritage Sites

2.4.5 Recorded Pollution Incidents

There are no recorded pollution incidents to water recorded within, or within 250m of the site.

2.5 Previous Site Investigation Data

There is no known previous site investigation available for the site.

SECTION 3 Preliminary Risk Assessment

The following sub-sections detail a preliminary risk assessment that is based on the desk study information.

3.1 General

The contaminated land regime is set out in Part IIA of the Environmental Protection Act (EPA) 1990 and was introduced on the 1st April 2000 in England and 1st July 2001 in Wales.

Part IIA was introduced to achieve two aims:

- (1) The identification of contaminated land
- (2) The remediation of contaminated land that poses an unacceptable risk to human health and/or the environment

Under Part IIA the statutory definition of 'contaminated land' is:

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

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

For land to be classified as 'Contaminated Land' there must be a **'pollutant linkage'**. A pollutant linkage requires three essential elements:

- (1) A **CONTAMINANT** (hazard) - a substance that is in, on or under the land and has the potential to cause harm or to cause pollution of **controlled waters**
- (2) A **RECEPTOR** (target) - something which could be adversely affected by a contaminant
- (3) A **PATHWAY** – a route or means which either allows the contaminant to cause significant harm to that receptor, or that there is a significant possibility of such harm being caused to the receptor, or that pollution of controlled waters is being or likely to be caused.

The term 'Risk' is widely used in different contexts and situations, but a prescriptive definition is given by the Guidelines for Environmental Risk Assessment and Management (DEFRA *et al*, 2000):

'Risk is a combination of the probability, or frequency, of occurrence of a defined hazard and the magnitude of the consequences of the occurrence'.

A 'Hazard' is defined as *'a property or situation that in particular circumstances could lead to harm'.*

The classification of consequences and probability and determining the risk category are defined in the following sections.

3.2 Classification of Consequence

Table 3.1 Classification of Consequence	
Classification	Definition
Severe	• Short term (acute) risk to human health likely to result in significant harm • Short term risk to controlled waters • Catastrophic damage to buildings/structures • Short term risk to an ecosystem or organism within the particular ecosystem
Medium	• Chronic damage to human health (long term risk) • Pollution of a sensitive water resource • A significant change in an ecosystem or organism within the ecosystem
Mild	• Pollution of non-sensitive water resources • Significant damage to buildings/structures
Negligible	• Harm (not necessarily significant) which may result in financial loss • Non permanent health effects to humans (easily prevented by PPE for example) • Easily repairable effects of structural (building) damage

3.3 Classification of Probability

Table 3.2 Classification of Probability	
Classification	Definition
High	• There is a complete pollution linkage and an event appears very likely to occur in the short term and is inevitable in the long term. • Evidence of harm to the receptor
Medium	• There is a complete pollution linkage which means that it is probable that an event will occur • The event is not inevitable but possible in short term and likely in the long term
Low	• There is a complete pollution linkage and circumstances are possible under which an event could occur • It is not certain that an event will occur in the long term, and it is less likely to occur in the short term
Negligible	• There is a complete pollution linkage but circumstances are such that it is improbable that an event would occur even in the long term

3.4 Risk Assessment Matrix

By comparing the consequences of a risk and the probability of the risk of a pollution linkage, the likely risk category can be determined as shown in **Table 3.3** below.

Table 3.3 Risk Assessment Matrix					
Increasing acceptability ↘		Consequence			
		Severe	Medium	Mild	Negligible
Probability	High	High	High	Medium / Low	Near zero
	Medium	High	Medium	Low	Near zero
	Low	High / medium	Medium / Low	Low	Near zero
	Negligible	High / medium / Low	Medium / Low	Low	Near zero

High Risk: There is a high probability that severe harm could risk a receptor, or there is evidence that a receptor is being harmed. The risk if realised is likely to result in liability, and urgent investigation or remediation will be required.

Medium Risk: It is probable that harm will arise to a receptor. However it is relatively unlikely that such harm would be severe, or if harm does occur the harm is likely to be relatively mild. Investigation will be required to determine the liability, and some remedial works may be required in the long term.

Low Risk: It is possible that harm may arise to a receptor, but it is likely that the harm would be mild.

Near Zero Risk: There is a very low risk of harm to the receptor. In the event of harm being realised the harm is not likely to be severe.

The following sub-sections detail a preliminary risk assessment, based upon the desk study information.

3.5 Preliminary Site Conceptual Model

The preceding sections enable a preliminary conceptual model of the site to be drawn up, to illustrate the likely ground conditions beneath the site together with a preliminary assessment of the nature of any underlying aquifer and groundwater movement. The preliminary site conceptual model is used as a model for the design and implementation of the site investigation, whereby areas of potential contamination can be targeted as well as investigating the site as a whole.

3.5.1 Potential Sources of Contamination

The potential contamination beneath the site, whether in the matrix of soil or any groundwater will be related to site past use and the history of the surrounding area.

A historical map review has revealed that the site lies above a filled railway cutting and more recently been used for private garages / lockups.

It is considered that there could be a risk of contaminants within imported fill materials which may demolition wastes and potential leaks and spills.

We would expect there to be a **medium** risk of contamination relating to past use. The risk of contamination would be determined by testing for a general suite of contaminants including asbestos and petroleum hydrocarbons.

3.5.2 Potential Receptors, Pathways and Risks

There are both human and hydrological receptors to any contamination that may be present on site.

Construction workers will be excavating in soils and will be exposed via dermal contact with soils and dust, ingestion of soil dust and inhalation of soil dust.

Inhalation of asbestos fibres is also a possible risk, if present, as is inhalation of vapours.

A residential end use is proposed. Once developed, future site users will potentially be at risk from the same pathways.

Neighbouring site users and passers-by may potentially be exposed to soil dust, asbestos fibres and vapours.

If any contamination is identified this may be leachable, enabling it to mobilise through perched groundwater within site soils.

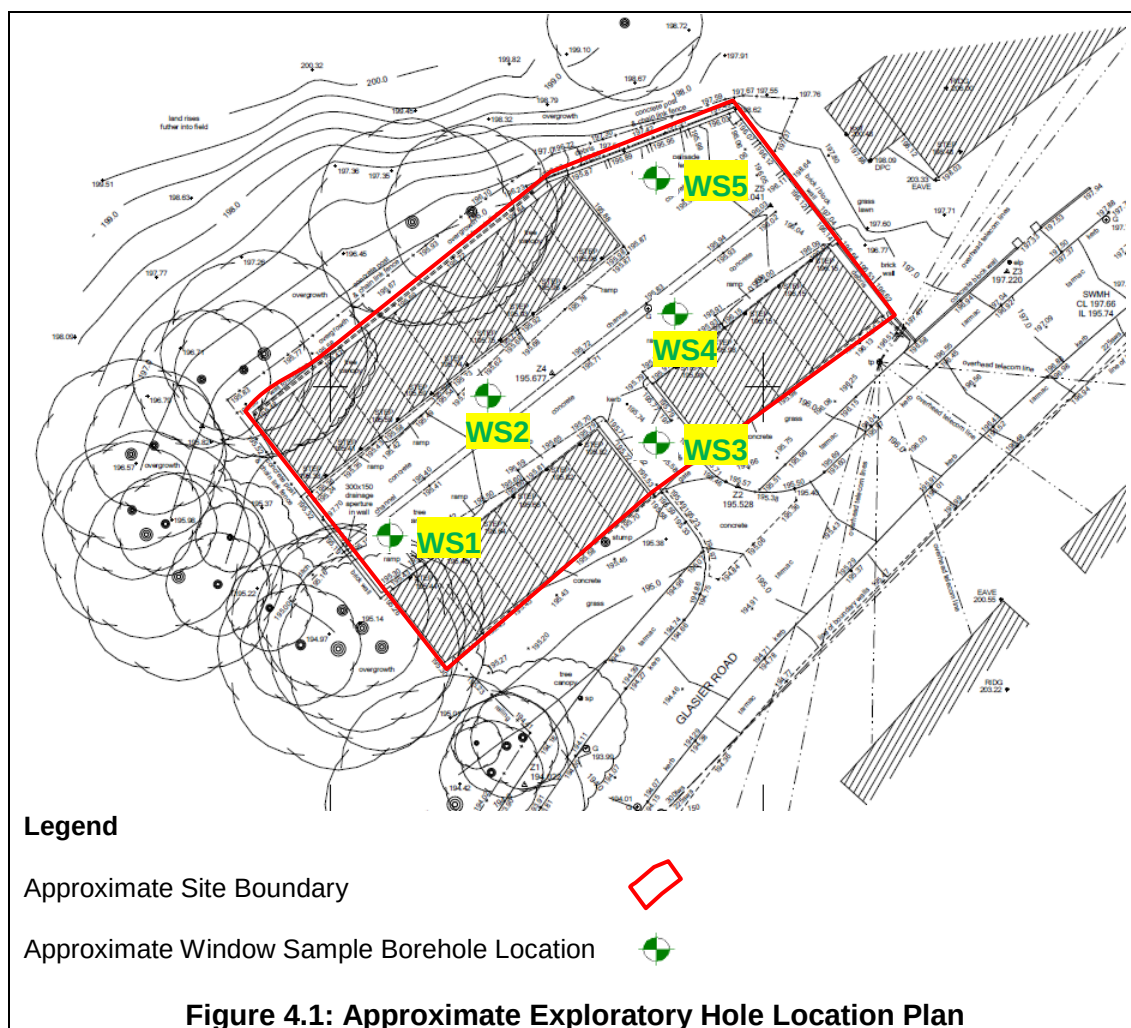
SECTION 4 Field Investigation

4.1 Site Works

A geotechnical and geo-environmental site investigation was carried out on 18th of January 2017 comprising 5 window sample boreholes.

The fieldworks were supervised by Terra Firma (Wales) Limited. The boreholes were logged to the requirements of BS5930:1999/EC7. The logs are presented in Annex C.

The window sample locations are presented in **Figure 4.1**.



4.2 Ground Conditions

A summary of the ground conditions identified in the boreholes is given in **Table 4.1** below.

Table 4.1 Summary of Ground Conditions		
Depth (m)	Thickness (m)	Stratum
0.00 - 0.10 / 0.15	0.10 / 0.15	MADE GROUND: CONCRETE slab (No reinforcement observed)
0.10 / 0.15 - 1.40 / >3.00	1.30 / >2.88	MADE GROUND: Loose black red dark brown silty sandy GRAVEL . Gravel is fine to coarse and angular and includes fragments of ash, coal, brick, slag and porcelain.
1.40 / 2.00 - >3.00	-	Firm brown sandy gravelly CLAY (Proven at WS3, WS4 and WS5)

No visual or olfactory evidence of contamination was identified within the exploratory holes.

Boreholes were prone to collapse with depth within the loose tip materials.

Continuous SPT(C) tests were undertaken following collapse. Refusal depth (N Values of 50 or greater) varied from 5.25mbgl at WS1 to 3.1mbgl in WS4.

4.3 Groundwater

Groundwater was not encountered up to 3mbgl.

4.4 Laboratory Chemical Testing

During the intrusive investigation, small disturbed soil samples were collected.

The sample locations and depths are listed in the following table.

Table 4.2 Sample Locations and Depths		
Sample	Depth (m)	Description
WS1	0.5	MADE GROUND: Black slightly clayey, gravelly SAND with brick, slag
WS2	0.3	MADE GROUND: Black slightly clayey, gravelly SAND with brick, slag, coal
WS3	0.5	MADE GROUND: Dark brown slightly clayey, gravelly SAND
WS4	0.5	MADE GROUND: Black slightly clayey, gravelly SAND with brick, slag,
WS5	0.5	MADE GROUND: Black, slightly clayey, gravelly SAND with brick, slag, ceramic)

4.4 Laboratory Chemical Testing (Continued)

The soil samples taken were despatched to the laboratories of Derwentside Environmental Testing Services (DETS), Consett.

The following chemical tests were undertaken:

Metals and Metalloids

Lead
Arsenic
Mercury
Chromium
Copper
Nickel
Zinc

In-Organics

Cyanide
Sulphate

Others

pH (acidity)
Organic Matter
Asbestos

Organic Chemicals

Phenol
Polycyclic Aromatic Hydrocarbons (PAHs)
Petroleum Hydrocarbons

The laboratory soil chemical test results are presented in **Annex D**.

4.5 Laboratory Geotechnical Testing

During the intrusive investigation, small disturbed soil samples were collected. Three samples of clayey soils were submitted for Atterberg testing.

The sample locations, depths and results are summarised listed in the following table. The results are presented in **Annex E**.

Table 4.3 Summary of Geotechnical Testing				
Sample	Plasticity Index (%)	% Passing 0.425mm	Modified Plasticity Index (%)	Volume Change Potential
WS1 0.8mbgl	15	68	10.2	Low
WS4 2.0mbgl	23	82	18.86	Low
WS5 2.0mbgl	26	79	20.54	Medium
Volume Change Potential: (less than 20% = Low) (20 to less than 40% = Medium) (40% or over = High)				

SECTION 5 Soil Analytical Results

5.1 Soil Assessment Methodology

Comparison of the analytical results has been made with Soil Guideline Values (SGVs) for a commercial end use, sourced from The Environment Agency Contaminated Land Exposure Assessment (CLEA).

Where SGV values are not available reference has been made to the 2015 residential (including plant uptake) Sutable 4 Use Levels (S4ULs) provided by Land Quality Management (LQM) and the Chartered Institute of Environmental Health (CIEH) or DEFRA's Category 4 Screening Levels (C4SLs).

5.2 Chemical Test Results

Table 5.1 Summary of Soil Chemical Test Results Standard Suite					
Substance	Residential SGV/GAC/S4UL (mg/kg)	Source	Measured Concentrations of Tested Substances (mg/kg)		Number of Exceedences
			Minimum	Maximum	
Arsenic	32	SGV	1.1	24	0/5
Cadmium	10	SGV	<0.1	0.3	0/5
Chromium	-	-	20	30	-
Chromium III	910	S4UL	20	30	0/5
Chromium VI	6	S4UL	<1.0	<1.0	0/5
Copper	2,400	S4UL	18	110	0/5
Lead	200	P.C4SL	11	310	1/5
Mercury	170	SGV	<0.05	0.36	0/5
Nickel	180	S4UL	6.6	51	0/5
Selenium	350	SGV	<0.5	3.1	0/5
Zinc	3,700	S4UL	56	520	0/5
Cyanide	8	SGV	<0.1	0.4	0/5
Organic matter %	-	-	1.9%	>25%	-
Loss on Ignition	-	-	-	36	2 tested
Sulphate (SO ₄) %	-	-	0.09%	0.14%	-
pH	-	-	7.1	9.3	-
Phenol	420	SGV	<0.3	<0.3	0/5
Total PAH	-	-	<0.1	4.9	-
Asbestos	-	-	None Detected	Detected	4/5

Notes:

- A total of 5 samples were tested.
- SGV - CLEA "Soil Guideline Values"
- S4UL - Land Quality Management Chartered Institute of Environmental Health's "Sutable 4 Use Levels"
- P.C4SL - DEFRA's "Provisional Category 4 Screening Level"
- < - Below Laboratory Detection Limit

5.2 Soil Test Results (Continued)

A summary of the speciated PAH results are given in **Table 5.2** below.

Table 5.2 Summary of Soil Chemical Test Results Speciated PAH					
Substance	Residential SGV/GAC/S4UL (mg/kg)	Source	Measured Concentrations of Tested Substances (mg/kg)		Number of Exceedences
			Minimum	Maximum	
Naphthalene	2.3	S4UL	< 0.03	< 0.03	0/5
Acenaphthylene	170	S4UL	< 0.03	< 0.03	0/5
Acenaphthene	210	S4UL	< 0.03	< 0.03	0/5
Fluorene	170	S4UL	< 0.03	< 0.03	0/5
Phenanthrene	95	S4UL	< 0.03	0.19	0/5
Anthracene	2400	S4UL	< 0.03	0.07	0/5
Fluoranthene	280	S4UL	< 0.03	0.71	0/5
Pyrene	620	S4UL	< 0.03	0.71	0/5
Benzo(a)anthracene	7.2	S4UL	< 0.03	0.34	0/5
Chrysene	15	S4UL	< 0.03	0.57	0/5
Benzo(b)fluoranthene	2.6	S4UL	< 0.03	0.78	0/5
Benzo(k)fluoranthene	77	S4UL	< 0.03	0.33	0/5
Benzo(a)pyrene	2.2	S4UL	< 0.03	0.5	0/5
Indeno(123cd)pyrene	27	S4UL	< 0.03	0.28	0/5
Dibenzo(ah)anthracene	0.24	S4UL	< 0.03	0.07	0/5
Benzo(ghi)perylene	320	S4UL	< 0.03	<0.31	0/5

Notes:

- A total of 5 samples were tested.
- < - Below Laboratory Detection Limit
- S4UL - Land Quality Management Chartered Institute of Environmental Health's "Suitable 4 Use Levels" based on 1% soil organic matter.

5.2 Soil Test Results (Continued)

A summary of the speciated petroleum hydrocarbons results are given in **Table 5.3** below.

Table 5.3 Summary of Soil Chemical Test Results Petroleum Hydrocarbons					
Substance	SGV/ GAC (mg/kg)	Source	Measured Concentrations of Tested Substances (mg/kg)		Number of Exceedences
			Minimum	Maximum	
<u>PH- Aliphatic</u>					
>C5-C6	42	CIEH	<0.01	<0.01	0/5
>C6-C8	100	CIEH	<0.01	<0.01	0/5
>C8-C10	27	CIEH	<0.01	<0.01	0/5
>C10-C12	130	CIEH	<1.5	<1.5	0/5
>C12-C16	1100	CIEH	<1.2	<1.2	0/5
>C16-C21*	65000	CIEH	<1.5	<1.5	0/5
>C21-C35*	65000	CIEH	<3.4	<3.4	0/5
>C35-C44*	65000	CIEH	<3.4	<3.4	0/5
<u>PH- Aromatic</u>					
>C6-C7	70	CIEH	<0.01	<0.01	0/5
>C7-C8	130	CIEH	<0.01	<0.01	0/5
>C8-C10	34	CIEH	<0.01	<0.01	0/5
>C10-C12	74	CIEH	<0.9	<0.9	0/5
>C12-C16	140	CIEH	<0.5	<0.5	0/5
>C16-C21	260	CIEH	<0.6	1.6	0/5
>C21-C35	1100	CIEH	<1.4	5.6	0/5
>C35-C44**	1100	CIEH	<1.4	<1.4	0/5

Notes:

- A total of 5 samples were tested.
- < - Below Laboratory Detection Limit
- S4UL - Land Quality Management Chartered Institute of Environmental Health's "Suitable 4 Use Levels" based on 1% soil organic matter.
- Threshold for aliphatic fraction >C16-C35 used.
- ** Threshold for aromatic fraction >C21-C35 used.

A summary of the asbestos identification results are given in **Table 5.4** below.

Table 5.4 Summary of Soil Chemical Test Results Asbestos Identification		
Sample Location	Depth	Analyst Comment
WS1	0.5mbgl	Bundles of Chrysotile fibres present
WS2	0.3mbgl	Small bundles of Chrysotile fibres present
WS3	0.5mbgl	Bundles of Chrysotile fibres present
WS4	0.5mbgl	No Asbestos Identified
WS5	0.5mbgl	Bundles of Chrysotile fibres present

SECTION 6 Quantitative Risk Assessment

6.1 Potential Contaminants

Chemical testing for a broad suite of contaminants has identified the following contaminants above residential guidelines;

- Chrysotile (white) asbestos within four of five samples; and
- Lead within one sample

Lead was detected at one sample at WS1 (0.5mbgl) at 310mg/kg which exceeded the adopted guideline of 200mg/kg.

Both contaminants are considered non volatile.

No further contaminants of concern were identified.

6.2 Potential Human Health Exposure Pathways

Exposure Pathways

1. Ingestion of soil/soil dust
2. Ingestion of vegetables/attached soil
3. Dermal contact / eye contact with soil/dust
4. Inhalation of soil dust
5. Inhalation of vapours
6. Ingestion of water
7. Dermal contact of water

Chemical testing for a broad suite of contaminants has revealed that concentrations of lead and asbestos identified within the made ground are above the generic human health guidelines for residential development.

However, since the site is to remain capped by the existing concrete slab, it is considered that there is no viable hazard receptor pathway to between contaminants and site occupiers.

Following development site end users are unlikely to be exposed to groundwater. If ground workers are exposed to groundwater appropriate PPE should be employed.

6.3 Potential Receptors

During Construction

- Construction workers
- Neighbouring site users
- Passers-by
- The Aquatic environment - Surface waters and groundwater.

Following Construction

- Site End Users - Future site visitors and workers
- Site End Users - Maintenance contractors
- The Aquatic environment - Surface waters and groundwater.
- Building Materials - Sulphates in the ground can damage building materials.

6.3.1 Construction Workers

During ground works the ground workers will be in more intimate contact with the soils than site end users however the risks should be controlled with good site management, COSHH, good standards of hygiene and appropriate health & safety, dust suppression and use of personal protection equipment (PPE). Additional measures may also be required to deal with the asbestos contamination.

6.3.2 Neighbouring Site Users and Passers-by

Passersby and neighbouring site users will be at risk from the inhalation of dust and asbestos during construction activities. These risks can be mitigated through appropriate dust suppression measures, good site management, and site screening to prevent unauthorised access. Additional measures may also be required to deal with the asbestos contamination.

6.3.3 Future Site Users

The existing concrete slab acts as a capping layer and prevents exposure to the identified non volatile contaminants below. Future site users will not require additional protection.

With regards to protection of the potable water supply, all pipes must be designed to appropriate UK Water Industry Research guidance; Guidance for the Selection of Water Supply Pipes to be used in Brownfield Sites, UKWIR Report Ref: 10/WM/03/21. If these guidelines are exceeded along the route of the proposed pipe, specialist pipe materials should be employed. The local Water Authority should be consulted at this stage.

6.4 Summary of Human Health Risks

Asbestos and lead are identified contaminants of concern on site. A quantitative human health risk assessment on the potential human health effects is detailed below:

Table 6.1 Human Health Risk Assessment				
Source	Pathway	Receptors	Risk Assessment	Mitigation Measures
Soil	Dermal contact with soil/dust. Inhalation and ingestion of soil/soil dust	Construction workers.	Medium Risk	COSHH assessment and good level of PPE/ hygiene by site workers/ staff; dust suppression measures if required
Soil	Inhalation and ingestion of soil dust, dermal contact with dust	Neighbouring site users, Passers-by	Medium Risk	Dust suppression where necessary
Soil	Dermal contact with soil/dust. Inhalation and ingestion of soil/soil dust	Future site users	Low Risk	None (existing concrete slab breaks pathways to receptors)
Soil	Inhalation of landfill gas Risk of explosion	Future site users	Low Risk	(Caravan structure means no direct pathway and no confined spaces)
Soil	Inhalation of ground gas Risk of explosion	Future site users	Low Risk	
Soil	Inhalation of vapours	Future site users	Low Risk	
Soil	Permeation of water pipes	Future site users	Low Risk (with mitigation measures)	UK Water Industry Research publication 'Guidance for the Selection of Water Supply Pipes to be Used in Brownfield Sites (Report 10/WM/03/21)' should be consulted.

6.4 Summary of Human Health Risks (Continued)

During the ground works, the contractor should comply with all current Health and Safety regulations.

If during the development materials are encountered that are significantly different to those encountered in the investigation, the occurrence should be reported to the Engineer and appropriate action taken prior to continuing with the works.

In accordance with EC Regulation 1272/2008 and Environment Agency Guidance WM2 (v.3/2013) soils and other materials destined for off-site disposal should be classified on the basis of their hazard phrases prior to disposal. Soils are classified as a mirror entry waste and should be classified on the basis of their specific chemical properties. Terra Firma Wales Ltd offer this service if required.

6.5 Summary of Risks to the Aquatic Environment

A Qualitative Risk Assessment on the potential effects to the aquatic environment is detailed in **Table 6.2**.

Table 6.2 Risks to the Aquatic Environment				
Source	Pathway	Target	Risk Assessment	Mitigation Measures
Soil	Surface water run-off	Perched Groundwater Neighbouring sites	Low Risk	Measures to avoid accidental spillage of materials, and to control surface run off.
Soil	Leaching	Perched Groundwater	Low Risk	Contamination testing has identified no significantly elevated levels of contaminants. No significant risk of leachate is considered likely.
Soil	Downward migration of perched groundwater	Aquifer		
Soil	Groundwater migration	Watercourses		

6.6 Mining Risk Assessment

The Gellideg Coal Seam outcrops some 250m east of the site but does not underlie the site. The site lies below the Gellideg Coal Seam meaning that there is potential for thin coal seams and ironstone seams to underlie the site at shallow depth. The Coal Authority records a coal outcrop at or near the surface.

The Coal Authority have no record of underground mining beneath the site, however the Coal Authority state that the property is in an area where there is coal at or close to the surface that may have been worked at some time in the past. A mine addit (Coal Authority Reference 305205-043) is recorded by the coal authority to the southeast of Glasier Road but not within 20m of the site boundary

The site lies within a Development High Risk Area as defined by the Coal Authority. These area areas where coal mining risks are present at a shallow depth and could affect new developments.

The caravans are considered to count as non-permanent structures with no ground works. In accordance with the Coal Authorities "Exemptions List" for the Risk Based Approach to development Management the proposed nature of the development may be exempt. The Local Planning Authority may therefore consider the temporary accommodation to be exempt from Coal Authority Consultation due to the nature of Development.

There is no known previous site investigation available for the site and it is not known if the site has previously been investigated or treated. It was beyond the scope of Terra Firma (Wales) Limited's brief to undertake an intrusive coal mining risk assessment of the site and there is therefore a potential risk to the development from past unrecorded shallow workings.

SECTION 7 Engineering Recommendations

7.1 Preparation of Site

It is recommended that prior to site works Refurbishment and Demolition Surveys should be undertaken including an appropriate asbestos survey. Where demolition is proposed, the local authority may wish to agree the details of the demolition and proposals to restore the site afterwards. All deleterious materials should be removed from site to an appropriate landfill facility.

It is proposed to keep the existing concrete slab on site.

Contingencies should be made for the protection/diversion of any underground services present beneath the site brought about as a result of the proposed works.

Contingencies should also be made for the protection and any necessary temporary/permanent support of structures on or adjacent to the site.

All materials to be removed from site should be taken to an appropriately licensed landfill facility. In accordance with EC Regulation 1272/2008 and Environment Agency Guidance WM3 (v. 1/2015) soils and other materials destined for off-site disposal should be classified on the basis of their hazard phrases prior to disposal.

Given the presence of contamination within the made ground on site and potential combustibility of the fill materials remedial measures are required to protect future site users. Service runs should also be encased in clean non-combustible material.

7.2 Foundations

The following foundation recommendations are given on the assumption that no shallow workings with significant voids are present beneath the site.

The Caravans are proposed to lie upon pads directly above the existing concrete slabs.

The additional load is considered likely to be no greater than 40kN/m².

A structural engineer may be able to confirm the suitability of the existing 0.1m thick concrete slab for this purpose.

Gas protection measures are not required as the underside of the caravans are open to external air.

7.3 Excavations and Formations

Following demolition excavations should be possible using normal excavating plant. Buried obstructions are unlikely but provision should be made for the use of a breaker to deal with concrete slabs and foundations.

The sides of any excavations deeper than 1.0m should be supported by planking and strutting or other proprietary means.

Any groundwater inflows together with rainwater infiltration should be dealt with by conventional pumping techniques. However it should be noted that during times of heavy rainfall a higher water table will be encountered.

7.3 Excavations and Formations (Continued)

The sub-formations/formations will be susceptible to loosening, softening and deterioration by exposure to weather (rain, frost and drying conditions), the action of water (flood water or removal of groundwater) and site traffic.

7.4 Sustainable Urban Drainage

Shallow soakaways are considered unsuitable as contamination has been identified within the existing made ground / tipped material and the underlying clay is considered to have low permeability.

The existing concrete slabs are proposed to be retained on site. It is therefore proposed to continue to use the existing site drainage.

7.5 Protection of Buried Concrete

Sulphate was recorded between 0.09% and 0.14% and pH of between 7.1 and 9.3. With reference to Table C2 of BRE Special Digest 1:2005, these soils fall into Design Sulphate Class DS1 AC-1.

ANNEX A
Envirocheck Report

ANNEX B
Coal Authority
Mining Report



The Coal
Authority

Resolving the **impacts** of mining

CON29M Non-Residential Mining Report

GLASIER ROAD
MERTHYR TYDFIL

Date of enquiry: 12 January 2018
Date enquiry received: 12 January 2018
Issue date: 12 January 2018

Our reference: 51001755233001
Your reference: 152693506_2 |



CON29M Non-Residential Mining Report

This report is based on, and limited to, the records held by the Coal Authority and the Cheshire Brine Subsidence Compensation Board's records, at the time we answer the search.

Client name

LANDMARK INFORMATION GROUP LIMITED

Enquiry address

GLASIER ROAD, MERTHYR TYDFIL

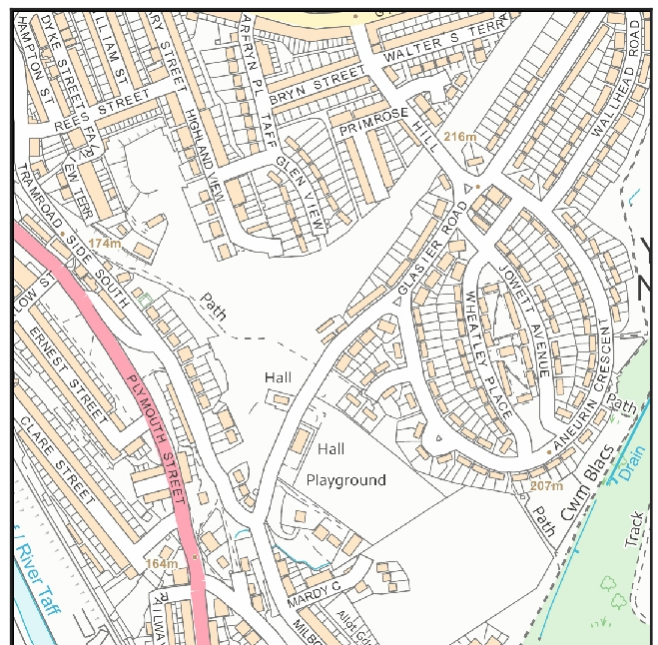
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Approximate position of property



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Summary

Has the search report highlighted evidence or potential of		
1	Past underground coal mining	Yes
2	Present underground coal mining	No
3	Future underground coal mining	Yes
4	Mine entries	Yes
5	Coal mining geology	No
6	Past opencast coal mining	No
7	Present opencast coal mining	No
8	Future opencast coal mining	No
9	Coal mining subsidence	No
10	Mine gas	No
11	Hazards related to coal mining	No
12	Withdrawal of support	No
13	Working facilities order	No
14	Payments to owners of former copyhold land	No
15	Information from the Cheshire Brine Subsidence Compensation Board	No

For detailed findings, please go to page 4.

Detailed findings

1. Past underground coal mining

The property is not within a surface area that could be affected by past underground mining.

However the property is in an area where the Coal Authority believe there is coal at or close to the surface. This coal may have been worked at some time in the past. The potential presence of coal workings at or close to the surface should be considered prior to any site works or future development activity. Your attention is drawn to the Comments on the Coal Authority information section of the report.

2. Present underground coal mining

The property is not within a surface area that could be affected by present underground mining.

3. Future underground coal mining

The property is not in an area where the Coal Authority has plans to grant a licence to remove coal using underground methods.

The property is not in an area where a licence has been granted to remove or otherwise work coal using underground methods.

The property is not in an area likely to be affected from any planned future underground coal mining.

However, reserves of coal exist in the local area which could be worked at some time in the future.

No notices have been given, under section 46 of the Coal Mining Subsidence Act 1991, stating that the land is at risk of subsidence.

4. Mine entries

There are no known coal mine entries within, or within 20 metres of, the boundary of the property.

There may however be mine entries/additional mine entries in the local area which the Coal Authority has no knowledge of.

5. Coal mining geology

The Coal Authority is not aware of any damage due to geological faults or other lines of weakness that have been affected by coal mining.

6. Past opencast coal mining

The property is not within the boundary of an opencast site from which coal has been removed by opencast methods.

7. Present opencast coal mining

The property does not lie within 200 metres of the boundary of an opencast site from which coal is being removed by opencast methods.

8. Future opencast coal mining

There are no licence requests outstanding to remove coal by opencast methods within 800 metres of the boundary.

The property is not within 800 metres of the boundary of an opencast site for which a licence to remove coal by opencast methods has been granted.

9. Coal mining subsidence

The Coal Authority has not received a damage notice or claim for the subject property, or any property within 50 metres of the enquiry boundary, since 31st October 1994.

There is no current Stop Notice delaying the start of remedial works or repairs to the property.

The Coal Authority is not aware of any request having been made to carry out preventive works before coal is worked under section 33 of the Coal Mining Subsidence Act 1991.

10. Mine gas

The Coal Authority has no record of a mine gas emission requiring action.

11. Hazards related to coal mining

The property has not been subject to remedial works, by or on behalf of the Authority, under its Emergency Surface Hazard Call Out procedures.

12. Withdrawal of support

The property is not in an area where a notice to withdraw support has been given.

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.

13. Working facilities order

The property is not in an area where an order has been made, under the provisions of the Mines (Working Facilities and Support) Acts 1923 and 1966 or any statutory modification or amendment thereof.

14. Payments to owners of former copyhold land

The property is not in an area where a relevant notice has been published under the Coal Industry Act 1975/Coal Industry Act 1994.

15. Information from the Cheshire Brine Subsidence Compensation Board

The property lies outside the Cheshire Brine Compensation District.

Comments on the Coal Authority information

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In view of the mining circumstances a prudent developer would seek appropriate technical advice before any works are undertaken.

Therefore if development proposals are being considered, technical advice relating to both the investigation of coal and former coal mines and their treatment should be obtained before beginning work on site. All proposals should apply good engineering practice developed for mining areas. No development should be undertaken that intersects, disturbs or interferes with any coal or mines of coal without the permission of the Coal Authority. Developers should be aware that the investigation of coal seams/former mines of coal may have the potential to generate and/or displace underground gases and these risks both under and adjacent to the development should be fully considered in developing any proposals. The need for effective measures to prevent gases entering into public properties either during investigation or after development also needs to be assessed and properly addressed. This is necessary due to the public safety implications of any development in these circumstances.

Additional remarks

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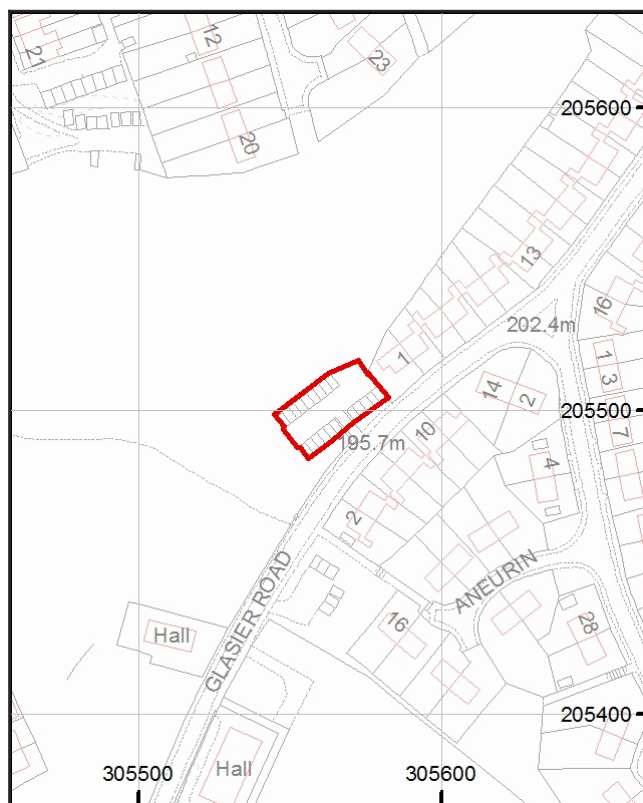
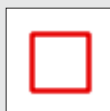
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Enquiry boundary

Key

Approximate position of enquiry boundary shown



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ANNEX C
Borehole Logs



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www.terrafirmawales.co.uk

Borehole No.

WS1

Sheet 1 of 1

Project Name:	Glasier Road	Project No:	14545	Co-ords:		Hole Type	WLS
Location:	Merthyr Tydfil	Level:		Scale	1:50	Logged By	TW
Client:	WK Plasterers	Dates:	18/01/2018 -				

Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Well	Legend	Stratum Description	
	Depth (m)	Type	Results						
				0.15				CONCRETE	
	0.50	ES						MADE GROUND: Loose black red dark brown silty sandy GRAVEL. Gravel is fine to coarse and angular and includes fragments of ash, coal brick, slag and porcelain.	
	0.80	D		0.70				MADE GROUND: Firm brown sandy gravelly CLAY	
	1.00	SPT	N=1 (1,1/1,0,0,0)	0.90				MADE GROUND: Loose black red dark brown silty sandy GRAVEL. Gravel is fine to coarse and angular and includes fragments of ash, coal, brick, slag and porcelain.	1
	2.00	SPT	N=4 (1,1/1,1,1,1)						2
	3.00	SPT	N=2 (1,1/1,0,0,1)	3.00				End of Borehole at 3.000m	3
	3.45	SPT	N=4 (0,1/0,1,2,1)						
	3.90	SPT	N=15 (1,1/2,2,3,8)						4
	4.35	SPT	N=27 (5,3/4,3,8,12)						
	4.80	SPT	N=50 (8,10/7,9,18,16)						5
									6
									7
									8
									9
									10

Remarks: Sampler remained dry



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Borehole No.

WS2

Sheet 1 of 1

Project Name:	Glasier Road	Project No:	14545	Co-ords:		Hole Type	WLS
Location:	Merthyr Tydfil	Level:		Scale	1:50	Logged By	TW
Client:	WK Plasterers	Dates:	18/01/2018 -				

Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Well	Legend	Stratum Description	
	Depth (m)	Type	Results						
				0.12				CONCRETE	
	0.30	ES						MADE GROUND: Loose dark brown locally orange and black silty sandy GRAVEL. Gravel is fine to coarse and angular and includes fragments of ash, brick, slag and porcelain.	
	1.00	SPT	N=1 (0,0/0,1,0,0)						1
	2.00	SPT	N=0 (0,0/0,0,0,0)						2
	3.00	SPT	N=4 (0,0/0,1,1,2)	3.00					3
	3.45	SPT	N=5 (1,0/1,2,1,1)						
	3.90	SPT	N=18 (2,2/3,4,5,6)						4
	4.35	SPT	50 (25 for 50mm/50 for 105mm)						5
									6
									7
									8
									9
									10

Remarks: Sampler remained dry



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Borehole No.

WS3

Sheet 1 of 1

Project Name:	Glasier Road	Project No:	14545	Co-ords:		Hole Type	WLS
Location:	Merthyr Tydfil	Level:		Scale	1:50	Logged By	TW
Client:	WK Plasterers	Dates:	18/01/2018 -				

Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Well	Legend	Stratum Description	
	Depth (m)	Type	Results						
				0.10				CONCRETE	
	0.50	ES						MADE GROUND: Loose black red dark brown silty sandy GRAVEL. Gravel is fine to coarse and angular and includes fragments of ash, coal, brick, slag and porcelain.	1
	1.00	SPT	N=6 (1,1/1,2,1,2)						
				1.40				Firm brown sandy gravelly CLAY	
	2.00	SPT	N=16 (1,1/2,5,7,2)	2.00					2
	2.45	SPT	N=15 (9,3/3,3,4,5)						
	2.90	SPT	50 (3,15/50 for 165mm)					End of Borehole at 2.000m	3
									4
									5
									6
									7
									8
									9
									10

Remarks: Sampler remained dry



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Borehole No.

WS4

Sheet 1 of 1

Project Name:	Glasier Road	Project No:	14545	Co-ords:		Hole Type	WLS
Location:	Merthyr Tydfil	Level:		Scale	1:50	Logged By	TW
Client:	WK Plasterers	Dates:	18/01/2018 -				

Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Well	Legend	Stratum Description	
	Depth (m)	Type	Results						
				0.10				CONCRETE	
	0.50	ES						MADE GROUND: Loose black red dark brown silty sandy GRAVEL. Gravel is fine to coarse and angular and includes fragments of ash, coal, brick, slag and porcelain.	1
	1.00	SPT	N=5 (0,1/1,0,1,3)						
				1.50				Firm brown sandy gravelly CLAY	
	2.00	D		2.00					2
	2.00	SPT	N=15 (2,4/4,2,4,5)					End of Borehole at 2.000m	
	2.45	SPT	N=32 (5,5/6,8,8,10)						
	2.90	SPT	50 (10,9/50 for 200mm)						3
									4
									5
									6
									7
									8
									9
									10

Remarks: Sampler remained dry



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CF23 7HA

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Borehole No.

WS5

Sheet 1 of 1

Project Name:	Glasier Road	Project No:	14545	Co-ords:		Hole Type	WLS
Location:	Merthyr Tydfil	Level:		Scale	1:50	Logged By	TW
Client:	WK Plasterers	Dates:	18/01/2018 -				

Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Well	Legend	Stratum Description	
	Depth (m)	Type	Results						
				0.10				CONCRETE	
	0.50	ES						MADE GROUND: Loose black red dark brown silty sandy GRAVEL. Gravel is fine to coarse and angular and includes fragments of ash, coal, brick, slag and porcelain.	1
	1.00	SPT	N=0 (0,0/0,0,0,0)						
	2.00	D		2.00					2
	2.00	SPT	N=44 (1,1/12,14,10,8)					Firm brown sandy gravelly CLAY	
	3.00	SPT	N=15 (2,2/6,2,2,5)	3.00					3
	3.45	SPT	N=19 (7,4/4,3,4,8)						
	3.90	SPT	N=50 (5,12/22,10,5,13)					End of Borehole at 3.000m	4
									5
									6
									7
									8
									9
									10

Remarks: Sampler remained dry

ANNEX D
Soil Chemical Test Results



Certificate of Analysis

Certificate Number 18-01523

26-Jan-18

Client Terra Firma (Wales) Ltd
5 Deryn Court
Wharfdale Road
Pentwyn
Cardiff
CF23 7HB

Our Reference 18-01523

Client Reference 14545/TW

Order No (not supplied)

Contract Title Glasier Road

Description 5 Soil samples.

Date Received 20-Jan-18

Date Started 20-Jan-18

Date Completed 26-Jan-18

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

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

Approved By

A handwritten signature in blue ink, appearing to read "A Fenwick", is written over a light blue horizontal line.

Adam Fenwick
Contracts Manager



Summary of Chemical Analysis

Matrix Descriptions

Our Ref 18-01523

Client Ref 14545/TW

Contract Title Glasier Road

Sample ID	Depth	Lab No	Completed	Matrix Description
WS1	0.5	1286916	26/01/2018	Black slightly clayey, gravelly SAND (Made ground - brick, slag)
WS2	0.3	1286917	26/01/2018	Black slightly clayey, gravelly SAND (Possible made ground - brick, slag, coal)
WS3	0.5	1286918	26/01/2018	Dark brown slightly clayey, gravelly SAND
WS4	0.5	1286919	26/01/2018	Black slightly clayey, gravelly SAND (Possible made ground - brick, slag,)
WS5	0.5	1286920	26/01/2018	Black, slightly clayey, gravelly SAND (Made ground - brick, slag, ceramic)

Summary of Chemical Analysis

Soil Samples

Our Ref 18-01523

Client Ref 14545/TW

Contract Title Glasier Road

Lab No	1286916	1286917	1286918	1286919	1286920
Sample ID	WS1	WS2	WS3	WS4	WS5
Depth	0.50	0.30	0.50	0.50	0.50
Other ID					
Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL
Sampling Date	18/01/18	18/01/18	18/01/18	18/01/18	18/01/18
Sampling Time	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units					
Preparation								
Moisture Content	DETS 1004	0.1	%	19	18	13	25	32
Metals								
Antimony	DETS 2301*	1	mg/kg	1.8	2.1	1.1	3.6	2.8
Arsenic	DETS 2301#	0.2	mg/kg	13	23	4.8	24	23
Beryllium	DETS 2301#	0.2	mg/kg	1.8	0.9	2.6	1.9	3.1
Boron, Water Soluble	DETS 2123#	0.2	mg/kg	1.3	0.7	0.9	1.2	1.3
Cadmium	DETS 2301#	0.1	mg/kg	0.3	0.3	< 0.1	0.1	0.3
Chromium	DETS 2301#	0.15	mg/kg	29	21	30	21	20
Chromium III	DETS 2301*	0.15	mg/kg	29	21	30	21	20
Chromium, Hexavalent	DETS 2204*	1	mg/kg	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Copper	DETS 2301#	0.2	mg/kg	65	77	18	98	110
Lead	DETS 2301#	0.3	mg/kg	310	160	11	97	100
Manganese	DETS 2301#	20	mg/kg	1400	7500	2900	490	1200
Mercury	DETS 2325#	0.05	mg/kg	0.14	0.36	< 0.05	0.07	< 0.05
Molybdenum	DETS 2301#	0.4	mg/kg	2.7	3.5	0.6	6.5	7.0
Nickel	DETS 2301#	1	mg/kg	21	23	6.6	48	51
Selenium	DETS 2301#	0.5	mg/kg	< 0.5	3.1	1.7	1.4	1.0
Zinc	DETS 2301#	1	mg/kg	90	75	24	100	520
Inorganics								
Loss on Ignition at 440oC	DETS 2003#	0.01	%				34	36
pH	DETS 2008#			9.2	7.5	9.3	7.1	7.1
Cyanide, Total	DETS 2130#	0.1	mg/kg	0.2	0.2	< 0.1	0.2	0.4
Cyanide, Complex	DETS 2130*	0.2	mg/kg	< 0.2	< 0.2	< 0.2	< 0.2	0.3
Organic matter	DETS 2002#	0.1	%	12	21	1.9	> 25	> 25
Sulphate as SO4, Total	DETS 2321#	0.01	%	0.12	0.13	0.11	0.09	0.14
Petroleum Hydrocarbons								
Aliphatic C5-C6	DETS 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aliphatic C6-C8	DETS 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aliphatic C8-C10	DETS 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aliphatic C10-C12	DETS 3072#	1.5	mg/kg	< 1.5	< 1.5	< 1.5	< 1.5	< 1.5
Aliphatic C12-C16	DETS 3072#	1.2	mg/kg	< 1.2	< 1.2	< 1.2	< 1.2	< 1.2
Aliphatic C16-C21	DETS 3072#	1.5	mg/kg	< 1.5	< 1.5	< 1.5	< 1.5	< 1.5
Aliphatic C21-C35	DETS 3072#	3.4	mg/kg	< 3.4	< 3.4	< 3.4	< 3.4	< 3.4
Aliphatic C35-C44	DETS 3072*	3.4	mg/kg	< 3.4	< 3.4	< 3.4	< 3.4	< 3.4
Aliphatic C5-C35	DETS 3072*	10	mg/kg	< 10	< 10	< 10	< 10	< 10
Aromatic C5-C7	DETS 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aromatic C7-C8	DETS 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aromatic C8-C10	DETS 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aromatic C10-C12	DETS 3072#	0.9	mg/kg	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9
Aromatic C12-C16	DETS 3072#	0.5	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Aromatic C16-C21	DETS 3072#	0.6	mg/kg	1.6	< 0.6	< 0.6	< 0.6	< 0.6

Summary of Chemical Analysis

Soil Samples

Our Ref 18-01523

Client Ref 14545/TW

Contract Title Glasier Road

Lab No	1286916	1286917	1286918	1286919	1286920
Sample ID	WS1	WS2	WS3	WS4	WS5
Depth	0.50	0.30	0.50	0.50	0.50
Other ID					
Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL
Sampling Date	18/01/18	18/01/18	18/01/18	18/01/18	18/01/18
Sampling Time	n/s	n/s	n/s	n/s	n/s

Test	Method	LOD	Units					
Aromatic C21-C35	DETSC 3072#	1.4	mg/kg	5.6	< 1.4	< 1.4	< 1.4	< 1.4
Aromatic C35-C44	DETSC 3072*	1.4	mg/kg	< 1.4	< 1.4	< 1.4	< 1.4	< 1.4
Aromatic C5-C35	DETSC 3072*	10	mg/kg	< 10	< 10	< 10	< 10	< 10
TPH Ali/Aro Total	DETSC 3072*	10	mg/kg	< 10	< 10	< 10	< 10	< 10
PAHs								
Naphthalene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Acenaphthylene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Acenaphthene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Fluorene	DETSC 3303	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Phenanthrene	DETSC 3303#	0.03	mg/kg	0.19	0.06	0.08	0.08	< 0.03
Anthracene	DETSC 3303	0.03	mg/kg	0.05	< 0.03	0.07	< 0.03	< 0.03
Fluoranthene	DETSC 3303#	0.03	mg/kg	0.60	0.11	0.71	0.15	< 0.03
Pyrene	DETSC 3303#	0.03	mg/kg	0.47	0.09	0.71	0.10	< 0.03
Benzo(a)anthracene	DETSC 3303#	0.03	mg/kg	0.34	0.09	0.54	0.05	< 0.03
Chrysene	DETSC 3303	0.03	mg/kg	0.44	0.14	0.57	0.07	< 0.03
Benzo(b)fluoranthene	DETSC 3303#	0.03	mg/kg	0.57	0.14	0.78	0.08	< 0.03
Benzo(k)fluoranthene	DETSC 3303#	0.03	mg/kg	0.21	0.05	0.33	< 0.03	< 0.03
Benzo(a)pyrene	DETSC 3303#	0.03	mg/kg	0.25	0.06	0.50	0.04	< 0.03
Indeno(1,2,3-c,d)pyrene	DETSC 3303#	0.03	mg/kg	0.17	0.05	0.28	< 0.03	< 0.03
Dibenzo(a,h)anthracene	DETSC 3303#	0.03	mg/kg	0.05	< 0.03	0.07	< 0.03	< 0.03
Benzo(g,h,i)perylene	DETSC 3303#	0.03	mg/kg	0.18	0.05	0.31	< 0.03	< 0.03
PAH - USEPA 16, Total	DETSC 3303	0.1	mg/kg	3.5	0.84	4.9	0.57	< 0.10
Phenols								
Phenol - Monohydric	DETSC 2130#	0.3	mg/kg	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3

Summary of Asbestos Analysis

Soil Samples

Our Ref 18-01523

Client Ref 14545/TW

Contract Title Glasier Road

Lab No	Sample ID	Material Type	Result	Comment*	Analyst
1286916	WS1 0.50	SOIL	Chrysotile	Bundles of Chrysotile fibres present	Andrew Little
1286917	WS2 0.30	SOIL	Chrysotile	Small bundles of Chrysotile present	Andrew Little
1286918	WS3 0.50	SOIL	Chrysotile	Bundles of Chrysotile fibres present	Andrew Little
1286919	WS4 0.50	SOIL	NAD	none	Andrew Little
1286920	WS5 0.50	SOIL	Chrysotile	Bundles of Chrysotile fibres present	Andrew Little

Crocidolite = Blue Asbestos, Amosite = Brown Asbestos, Chrysotile = White Asbestos. Anthophyllite, Actinolite and Tremolite are other forms of Asbestos. Samples are analysed by DETSC 1101 using polarised light microscopy in accordance with HSG248 and documented in-house methods. NAD = No Asbestos Detected. Where a sample is NAD, the result is based on analysis of at least 2 sub-samples and should be taken to mean 'no asbestos detected in sample'. Key: * -not included in laboratory scope of accreditation.

Information in Support of the Analytical Results

Our Ref 18-01523
 Client Ref 14545/TW
 Contract Glasier Road

Containers Received & Deviating Samples

Lab No	Sample ID	Date Sampled	Containers Received	Holding time exceeded for tests	Inappropriate container for tests
1286916	WS1 0.50 SOIL	18/01/18	GJ 250ml, GJ 60ml, PT 1L		
1286917	WS2 0.30 SOIL	18/01/18	GJ 250ml, GJ 60ml, PT 1L		
1286918	WS3 0.50 SOIL	18/01/18	GJ 250ml, GJ 60ml, PT 1L		
1286919	WS4 0.50 SOIL	18/01/18	GJ 250ml, GJ 60ml, PT 1L		
1286920	WS5 0.50 SOIL	18/01/18	GJ 250ml, GJ 60ml, PT 1L		

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

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

Soil Analysis Notes

Inorganic soil analysis was carried out on a dried sample, crushed to pass a 425µm sieve, in accordance with BS1377.

Organic soil analysis was carried out on an 'as received' sample. Organics results are corrected for moisture and expressed on a dry weight basis.

The Loss on Drying, used to express organics analysis on an air dried basis, is carried out at a temperature of 28°C +/-2°C.

Disposal

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

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

Appendix A - Details of Analysis

Method	Parameter	Units	Limit of Detection	Sample Preparation	Sub-Contracted	UKAS	MCERTS
DETSC 2002	Organic matter	%	0.1	Air Dried	No	Yes	Yes
DETSC 2003	Loss on ignition	%	0.01	Air Dried	No	Yes	Yes
DETSC 2008	pH	pH Units	1	Air Dried	No	Yes	Yes
DETSC 2024	Sulphide	mg/kg	10	Air Dried	No	Yes	Yes
DETSC 2076	Sulphate Aqueous Extract as SO ₄	mg/l	10	Air Dried	No	Yes	Yes
DETSC 2084	Total Carbon	%	0.5	Air Dried	No	Yes	Yes
DETSC 2084	Total Organic Carbon	%	0.5	Air Dried	No	Yes	Yes
DETSC 2119	Ammoniacal Nitrogen as N	mg/kg	0.5	Air Dried	No	Yes	Yes
DETSC 2130	Cyanide free	mg/kg	0.1	Air Dried	No	Yes	Yes
DETSC 2130	Cyanide total	mg/kg	0.1	Air Dried	No	Yes	Yes
DETSC 2130	Phenol - Monohydric	mg/kg	0.3	Air Dried	No	Yes	Yes
DETSC 2130	Thiocyanate	mg/kg	0.6	Air Dried	No	Yes	Yes
DETSC 2321	Total Sulphate as SO ₄	%	0.01	Air Dried	No	Yes	Yes
DETSC 2325	Mercury	mg/kg	0.05	Air Dried	No	Yes	Yes
DETSC 3049	Sulphur (free)	mg/kg	0.75	Air Dried	No	Yes	Yes
DETSC2123	Boron (water soluble)	mg/kg	0.2	Air Dried	No	Yes	Yes
DETSC2301	Arsenic	mg/kg	0.2	Air Dried	No	Yes	Yes
DETSC2301	Barium	mg/kg	1.5	Air Dried	No	Yes	Yes
DETSC2301	Beryllium	mg/kg	0.2	Air Dried	No	Yes	Yes
DETSC2301	Cadmium Available	mg/kg	0.1	Air Dried	No	Yes	Yes
DETSC2301	Cadmium	mg/kg	0.1	Air Dried	No	Yes	Yes
DETSC2301	Cobalt	mg/kg	0.7	Air Dried	No	Yes	Yes
DETSC2301	Chromium	mg/kg	0.15	Air Dried	No	Yes	Yes
DETSC2301	Copper	mg/kg	0.2	Air Dried	No	Yes	Yes
DETSC2301	Manganese	mg/kg	20	Air Dried	No	Yes	Yes
DETSC2301	Molybdenum	mg/kg	0.4	Air Dried	No	Yes	Yes
DETSC2301	Nickel	mg/kg	1	Air Dried	No	Yes	Yes
DETSC2301	Lead	mg/kg	0.3	Air Dried	No	Yes	Yes
DETSC2301	Selenium	mg/kg	0.5	Air Dried	No	Yes	Yes
DETSC2301	Zinc	mg/kg	1	Air Dried	No	Yes	Yes
DETSC 3072	Ali/Aro C10-C35	mg/kg	10	As Received	No	Yes	Yes
DETSC 3072	Aliphatic C10-C12	mg/kg	1.5	As Received	No	Yes	Yes
DETSC 3072	Aliphatic C10-C12	mg/kg	10	As Received	No	Yes	Yes
DETSC 3072	Aliphatic C10-C35	mg/kg	10	As Received	No	Yes	Yes
DETSC 3072	Aliphatic C12-C16	mg/kg	1.2	As Received	No	Yes	Yes
DETSC 3072	Aliphatic C12-C16	mg/kg	10	As Received	No	Yes	Yes
DETSC 3072	Aliphatic C16-C21	mg/kg	1.5	As Received	No	Yes	Yes
DETSC 3072	Aliphatic C16-C21	mg/kg	10	As Received	No	Yes	Yes
DETSC 3072	Aliphatic C21-C35	mg/kg	3.4	As Received	No	Yes	Yes
DETSC 3072	Aliphatic C21-C35	mg/kg	3.4	As Received	No	Yes	Yes
DETSC 3072	Aromatic C10-C12	mg/kg	0.9	As Received	No	Yes	Yes
DETSC 3072	Aromatic C10-C12	mg/kg	10	As Received	No	Yes	Yes
DETSC 3072	Aromatic C10-C35	mg/kg	10	As Received	No	Yes	Yes
DETSC 3072	Aromatic C12-C16	mg/kg	0.5	As Received	No	Yes	Yes
DETSC 3072	Aromatic C12-C16	mg/kg	10	As Received	No	Yes	Yes
DETSC 3072	Aromatic C16-C21	mg/kg	0.6	As Received	No	Yes	Yes
DETSC 3072	Aromatic C16-C21	mg/kg	10	As Received	No	Yes	Yes
DETSC 3072	Aromatic C21-C35	mg/kg	1.4	As Received	No	Yes	Yes
DETSC 3072	Aromatic C21-C35	mg/kg	1.4	As Received	No	Yes	Yes
DETS 062	Benzene	mg/kg	0.01	As Received	No	Yes	Yes
DETS 062	Ethylbenzene	mg/kg	0.01	As Received	No	Yes	Yes
DETS 062	Toluene	mg/kg	0.01	As Received	No	Yes	Yes
DETS 062	Xylene	mg/kg	0.01	As Received	No	Yes	Yes
DETS 062	m+p Xylene	mg/kg	0.01	As Received	No	Yes	Yes
DETS 062	o Xylene	mg/kg	0.01	As Received	No	Yes	Yes
DETSC 3311	C10-C24 Diesel Range Organics (DRO)	mg/kg	10	As Received	No	Yes	Yes
DETSC 3311	C24-C40 Lube Oil Range Organics (LORO)	mg/kg	10	As Received	No	Yes	Yes
DETSC 3311	EPH (C10-C40)	mg/kg	10	As Received	No	Yes	Yes

Appendix A - Details of Analysis

Method	Parameter	Units	Limit of Detection	Sample Preparation	Sub-Contracted	UKAS	MCERTS
DETSC 3303	Acenaphthene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3303	Acenaphthylene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3303	Benzo(a)pyrene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3303	Benzo(a)anthracene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3303	Benzo(b)fluoranthene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3303	Benzo(k)fluoranthene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3303	Benzo(g,h,i)perylene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3303	Dibenzo(a,h)anthracene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3303	Fluoranthene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3303	Indeno(1,2,3-c,d)pyrene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3303	Naphthalene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3303	Phenanthrene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3303	Pyrene	mg/kg	0.03	As Received	No	Yes	Yes
DETSC 3401	PCB 28 + PCB 31	mg/kg	0.01	As Received	No	Yes	Yes
DETSC 3401	PCB 52	mg/kg	0.01	As Received	No	Yes	Yes
DETSC 3401	PCB 101	mg/kg	0.01	As Received	No	Yes	Yes
DETSC 3401	PCB 118	mg/kg	0.01	As Received	No	Yes	Yes
DETSC 3401	PCB 153	mg/kg	0.01	As Received	No	Yes	Yes
DETSC 3401	PCB 138	mg/kg	0.01	As Received	No	Yes	Yes
DETSC 3401	PCB 180	mg/kg	0.01	As Received	No	Yes	Yes
DETSC 3401	PCB Total	mg/kg	0.01	As Received	No	Yes	Yes

Method details are shown only for those determinands listed in Annex A of the MCERTS standard. Anything not included on this list falls outside the scope of MCERTS. No Recovery Factors are used in the determination of results. Results reported assume 100% recovery. Full method statements are available on request.

ANNEX D
Soil Geotechnical Test Results



Laboratory Report



Contract Number: 37957

Client Ref:

Report Date: **30-01-2018**

Client PO:

Client **Terrafirma Wales Ltd**
5 Deryn Court
Wharfedale Road
Pentwyn
Cardiff
CF23 7HB

Contract Title: **14545 - Glasier Road**
For the attention of: **Tom Walby**

Date Received: **22-01-2018**
Date Commenced: **22-01-2018**
Date Completed: **30-01-2018**

Test Description	Qty
Moisture Content BS 1377 : Part 2 : 3.2 - * UKAS	3
4 Point Liquid & Plastic Limit (LL/PL) BS 1377 Part 2 : 4.3 & 5.3 - * UKAS	3
Disposal of Samples on Project	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:

Alex Wynn (Associate Director) - Ben Sharp (Contracts Manager) - Emma Sharp (Office Manager)

Paul Evans (Quality/Technical Manager) - Richard John (Advanced Testing Manager) - Sean Penn (Administrative Assistant)

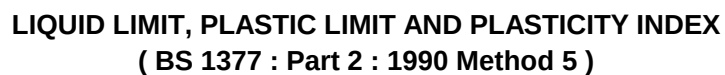
Vaughan Edwards (Managing Director) - Wayne Honey (Administrative/Quality Assistant)

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





Contract Number

37957

Site Name

14545 - Glasier Road

Symbols: NP : Non Plastic # : Liquid Limit and Plastic Limit Wet Sieved

