Toyoda Gosei UK Limited

Toyoda Gosei Factory Extension, Gorseinon

Site Investigation Report

11266/JJ/13/SI

Intégral
Géotechnique

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PROJECT:	**Toyoda Gosei Factory Extension, Gorseinon**
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1.0 INTRODUCTION

1.1 GENERAL

Toyoda Gosei UK Limited is proposing to extend their car parts factory site in Gorseinon, Swansea for industrial end use. Interserve are the principle contractor for the scheme Bingham Hall Partnership are the civil and structural engineer for the scheme.

Intégral Géotechnique (Wales) Limited have been appointed as the geotechnical engineers to undertake a site investigation to enable a geotechnical and geoenvironmental appraisal of the site and provide a basis for design.

This report presents the findings of the site investigation and gives recommendations for the design of foundations, floor slabs and other geotechnical and geoenvironmental aspects of the project.

1.2 PROPOSED DEVELOPMENT

The proposed development comprises an extension to the north-western corner of the existing factory building. The structure will likely house a new 'exterior coating' production line, comprising machinery including ovens and spray painting units, and a number of deep inspection pits. The likely layout of the proposed development is shown on 'B+M drawing. New exterior coating line for TGWales'.

1.3 SCOPE OF WORKS

The work instructed included a desk study of available information, site reconnaissance and an intrusive investigation. This was followed by laboratory testing and geotechnical and geo-environmental reporting.

The desk study comprised a review of:

- Historical Ordnance Survey maps covering the site;
- A Coal Authority Mining Report obtained for the site;
- Geological maps of the area and the online database provided by the British Geological Survey (BGS)
- The Environment Agency groundwater vulnerability map and aquifer database for the area.

1.3 SCOPE OF WORKS (CONTINUED)

The desk study information was used to make an initial assessment of the site and to design an investigation to be carried out by Intégral Géotechnique. The site investigation was designed in accordance with BS5930:1999, the Code of Practice for Site Investigations, BS10175:2011, the Code Of Practice For Investigation Of Potentially Contaminated Sites, and 'Development of Land Affected by Contamination: A Guide for Developers' prepared by Welsh Local Government Association (WLGA)/Environment Agency Wales (EAW) Land Contamination Working Group, 2012.

The site investigation included:

- An intrusive investigation carried out between 29th November and 4th December 2013 comprising seven machine excavated trial pits and three shell and auger boreholes.
- Sampling of soil/made ground for laboratory testing, and
- Soil infiltration testing carried out within two trial pits.

1.4 LIMITATIONS

This document is intended to be a working document for further development in discussion with all concerned including the Local Planning Authority and Natural Resources for Wales.

"Contamination" is taken throughout the report to mean the "presence of one or more potentially harmful substances as a result of human activity". The use of the term in this way does not imply that harm is being or might be caused by the contamination. It should be noted that "contamination" can have different meanings under different regulatory regimes, for example, planning, building control and Part IIA of the Environmental Protection Act 1990. Naturally elevated concentrations of potentially harmful substances may also be of concern and the significance of any that may be found is also evaluated in this report.

This report has been prepared for the use of Tyoda Gosei UK Limited and should not be passed to others without the express consent of Intégral Géotechnique (Wales) Limited.

2.0 THE SITE

2.1 SITE LOCATION AND DESCRIPTION

The proposed development area forms part of the larger surrounding Toyoda Gosei factory site located approximately 1km northwest of Gorseinon, Swansea at a National Grid Reference of 259435 199763, see Figure 1. The site area is situated within open space immediately adjacent to the north-western corner of the existing factory building.

The surrounding Toyoda Gosei factory site is situated on top of a level development plateau. There is an embankment to the southeast of the factory site and a cut slope to the northwest. The surrounding topography generally slopes towards the east. It appears that the plateau was formed partly by the reprofiling of a historical colliery waste tip and partly by some cut and fill earthworks to the northwest of the site.

The site of the proposed extension occupies an area of approximately 0.8 Ha of generally level ground at an approximate elevation of 31m AOD.

The boundaries of the proposed development area are defined by green fields to the west, scrubland to the north and the existing factory building to the south and east.

The majority of the proposed development area is covered in grass that was observed to be slightly waterlogged. There is a small access road running through the west and north of the site that leads to the back of the existing factory building.

Access to the larger surrounding factory site is gained via a security barrier off 'Heol y Mynydd'. The proposed development area is located to the back of the existing factory building and is accessed via a road running to the west from the security hut.

2.2 SITE OPERATIONS

The proposed development area comprises an undeveloped area of grass land, immediately adjacent to the north-western corner of the existing factory building. The factory itself is used to produce car parts and is currently operational.

2.3 SURROUNDING LAND USE

The site is located approximately 1km northeast of Gorseinon and approximately 1km southeast of Grovesend, within a predominantly residential and agricultural land use area. The proposed development area forms part of a larger surrounding car parts factory site.

2.3 SURROUNDING LAND USE (CONTINUED)

The factory is immediately surrounded by undeveloped grassland to the north, south, east and west.

There are residential dwellings situated approximately 350m west of the site, and approximately 500m south of the site.

The Afon Lliw runs north-south approximately 360m to the east of the site, and 'Coal Brook' runs west-east approximately 100m to the north of the site.

2.4 AVAILABLE SITE INVESTIGATION DATA

No previous site investigation data has been made available to Intégral Géotechnique (Wales) Limited.

3.0 SITE HISTORY

The recent history of the site has been traced with the use of historical Ordnance Survey (OS) maps. A selection of the maps used in the historical review is presented in Appendix A.

The oldest map in our possession is a 1:2,500 scale OS map dating back to 1877. This map showed the site was previously occupied by undeveloped fields. The 'Swansea Section' of the 'London and North Western Railway' is shown to have run approximately north-south to the east of the site. A development comprising a number of buildings was labelled as 'Cefn-arda' is shown to the southwest of the site.

The 1898 map showed a 'Coal Pit' present to the south of the site. The site and the surrounding area had remained largely unchanged.

The previously mentioned coal pit was not shown on the1916 map. It had been replaced with a small collection of buildings, an 'Air Shaft' and what appears to be a growing heap of colliery spoil. These features are believed to represent expanding coal mining operations to the south of the site.

By 1935 the colliery spoil heaps had expanded massively, and were shown to extend north to beneath the current footprint of the existing factory.

By 1958 it appears that the colliery spoil had extended to beneath the site area. However, by this time the spoil heaps were shown have been covered in rough grassland.

The 1972 map showed the site and much of the surrounding area had been labelled as a disused Tip. The Cefn-arda development to the southwest of the site was no longer present. The collection of buildings and the shaft to the south of the site had been relabelled as a disused mine by this time.

By 1988, the colliery tip underlying the site had undergone a large degree of reprofiling/earthworks with the construction of a large level plateau. A linear drain feature, trending northeast to southwest was shown crossing the plateau with steep embankments to the north and east. A disused shaft was also shown to the south of the site.

The existing factory site was constructed on top of the plateau in 1992 and was occupied by car parts manufacture 'Valeo' until 2001.

3.0 SITE HISTORY (CONTINUED)

The site and the surrounding area have remained largely unchanged since.

The factory remained unoccupied until Toyoda Gosei took over in 2011.

4.0 SITE ENVIRONMENTAL SETTING

4.1 PHYSICAL SETTING

The site is located on the outskirts of Gorseinon, approximately 1km northeast of the town centre at an approximate elevation of 31m AOD. The development area comprises undeveloped grassland and forms part of a larger surrounding factory site.

The Afon Lliw runs north-south approximately 360m to the east of the site, and 'Coal Brook' runs west-east approximately 100m to the north of the site.

4.2 GEOLOGY

The 1:50,000 scale geological map (BGS sheet 247) shows the site to be underlain by bedrock of the Carboniferous age Grovesend Beds of the South Wales Upper Coal Measures. These sedimentary rocks are predominantly argillaceous in nature, comprising mudstones and siltstones with well developed coals.

There are a number of north-south trending normal faults in the region. No faults appear to underlie the site area.

The presumed outcrops of the Upper and Lower Grovesend coal seams are shown trending on an north-south orientation approximately 500m to the west of the site.

The geological map also shows that superficial glacial till deposits of Devensian age overlie the bedrock on site. Till deposits typically comprise variable clays, sands, gravels and cobbles.

Some made or reworked ground together with some colliery spoil is likely to be present overlying the superficial deposits beneath the site.

A summary of the anticipated site geology is outlined in Table 1.

4.2 GEOLOGY (CONTINUED)

Table 1 : Summary of Anticipated Site Geology		
Geological Period	**Horizon**	**Description**
Recent	Made Ground / Reworked Ground/ Colliery Spoil	Heterogeneous deposits of variable thickness associated with past construction activities AND/OR Colliery spoil
Devensian	Glacial Till	Diamicton. Poorly sorted clay, sands, gravels and cobbles
Carboniferous	Grovesend Beds of the Upper Coal Measures	Predominantly argillaceous, comprising mudstones and siltstones, with well-developed coals; minor lithic ("Pennant") sandstones; locally developed red mudstones in the type area.

4.3 RADON

A radon report covering the site indicates that the site is not in a radon affected area and that no radon protective measures are required in the construction of new developments or extensions.

4.4 MINING

A Mining Report for the site has been obtained from the Coal Authority, a copy of which is presented in Appendix B. The report states the following:

- The site is within the zone of likely physical influence on the surface from past underground workings in four seams of coal at 240m and 500m depth last worked in 1969. However, any ground movement from these workings should have stopped by now.
- The site does not lie within the zone of influence of any current underground workings.
- There are no known coal mine entries on site or within 20m of the site boundary.
- No claim has been made to the Coal Authority relating to subsidence on the site or any site within 50m, since 31 October 1994.
- In the past the Coal Authority has undertaken gas emission investigations on site.

The depths of the worked coal seems that are likely underlying the site together with the date that they were last worked suggest that the risk to the proposed development from subsidence due to these mine workings is low and no special precautions are required.

4.5 HYDROLOGY, HYDROGEOLOGY AND FLOOD RISK

The closest surface water feature to site is the Coal Brook flowing west to east approximately 100m north of the site. The Afon Lliw flows north to south approximately 360m to the east of the site.

The Environment Agency groundwater vulnerability map and aquifer database classifies the superficial deposits and the bedrock beneath the site both as Secondary 'A' Aquifers. Secondary 'A' Aquifers are permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases form an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers.

The site is not recorded within a source protection zone as designated by the Environment Agency.

The soils underlying the site have been classified as having a high leaching potential. These are soils with little ability to attenuate diffuse source pollutants and in which liquid discharges have the potential to move rapidly to the underlying strata. It should be noted that soil information for urban areas is based on fewer observations than elsewhere.

The Environment Agency hydrological flood maps covering the site indicate that the site is not at risk of flooding from rivers or seas.

Tables 2 and 3 present a summary of the hydrological features and key hydrogeological nature of the site.

Table 2: Summary of Site Hydrology

Feature	Distance from site	Flow	Classification	Abstraction Consents (within 500m)	Discharge Location
Coal Brook	Approximately 100m to the north	West-East	Unknown	No	Afon Lliw
Afon Lliw	Approximately 360m to the east	North-South	Unknown	No	River Loughor

4.5 HYDROLOGY, HYDROGEOLOGY AND FLOOD RISK (CONTINUED)

Table 3: Summary of Site Hydrogeology

Geological Unit	Aquifer Classification	Aquifer Characteristics	Source Protection Zone	Groundwater Abstractions (within 500m)
Made ground	Not classified	Suspected heterogeneous deposits. Likely to be in hydraulic continuity with underlying natural soils/rocks	No	None
Glacial Till	Not classified	Diamicton. Likely to be in hydraulic continuity with underlying bedrock	No	None
Grovesend Beds	Secondary A	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.	No	None

4.6 LANDFILL SITES

The Environment Agency landfill maps indicate that there are currently no registered active or historical landfill sites on or within 1km of the site.

The closest historical landfill is located approximately 1.5km east of the site at Llys Nini Farm. Deposited waste included inert waste.

4.7 POTENTIAL CONTAMINATION

The main potential sources of contamination are associated with the colliery waste tip that historically covered the site. There is also the potential for made ground of unknown origin and/or colliery spoil associated with the construction of the development plateau and the car parts factory.

Reference to the Department of the Environment Industry Profiles has been made and a summary of the various activities and their associated potential contaminants that may be present on site are detailed in Table 4 and 5.

4.7 POTENTIAL CONTAMINATION (CONTINUED)

Previous Uses

Review of the historical site information has shown that prior to the formation of a level development plateau between 1972 and 1988, and the subsequent construction of the 'Valeo' car parts factory in 1992, there was a large colliery waste tip covering the site and much of the surrounding area.

There is the potential for ground and water resource contamination associated with both the suspected colliery waste underlying the site and any other potential made ground associated with raising levels beneath the site area during the construction of the surrounding factory.

Existing Uses

The site area comprises an undeveloped piece of land that forms part of the existing factory site. The site is predominantly covered in grass and hasn't been developed previously. There are no known existing uses which may be resulting in contamination apart from the anticipated presence of colliery spoil and/or made ground that may contain material contaminated with metals, non-metals, hydrocarbons, PAH's and asbestos.

Table 4: Potential Contaminants

Land Use: Greenfield site until between 1916 and 1935		
Material/Process	**Contamination/Hazard**	**Evidence**
Possible agricultural land	No potential contaminants	Historical Maps
Land Use: Colliery waste tip prior to 1935 to between 1972 and 1988		
Material/Process	**Contamination/Hazard**	**Evidence**
Colliery spoil	Metals and semi metals	Historical Maps
Land Use: Car parts factory (1992 to present)		
Material/Process	**Contamination/Hazard**	**Evidence**
Colliery spoil/Made ground associated with the construction of the development plateau and the existing adjacent factory.	Metals, semi metals, non-metals, PAHs, petroleum hydrocarbons, VOCs and SVOCs, asbestos.	Historical Maps

4.7 POTENTIAL CONTAMINATION (CONTINUED)

Adjacent Site Uses

The site forms part of the larger surrounding Toyoda Gosei car parts factory site. The whole factory has been constructed on a level plateau created by the reprofiling of a large colliery waste tip that historically covered the area.

There is the potential for contamination to have migrated onto site associated with the activities of the car parts factory immediately adjacent to the southern and eastern site boundaries.

Table 5: Potential Contaminants (adjacent site uses)

Potential Contamination Source	Adjacent Boundary	Process/Contaminants
Car parts factory including above ground storage tank	Eastern and southern boundaries	Metals, semi metals, non-metals, PAHs, petroleum hydrocarbons, VOCs and SVOCs, asbestos
Scrubland underlain by colliery spoil	Northern Boundary	Metals and semi metals
Greenfields	Western Boundary	No potential contaminants

5.0 PRELIMINARY CONCEPTUAL SITE MODEL

5.1 RISK ASSESSMENT FRAMEWORK

In order to be consistent with current UK government policies and legislation, it is necessary to identify, make decisions on, and take appropriate action to deal with land contamination, in accordance with the procedures specified in the Environment Agency document 'Model Procedures for the Management of Land Contamination CLR-11' (Environment Agency 2004).

The risk assessment process is designed to provide a reasoned, structured and pragmatic mechanism for the identification of any potential human health and controlled waters risks associated with land contamination and where necessary to develop a robust remediation strategy to ensure protection of the sensitive receptors (human health of future site occupiers, controlled waters etc).

In accordance with the CLR-11 framework, risk is defined as:

'a combination of the probability, or frequency, of occurrence of a defined hazard and the magnitude of the consequence of the occurrence'.

The three essential elements to any risk are defined by CLR-11 as follows:

- A contaminant, or hazard, which is in, on, or under the land and has the potential to cause harm (Source)
- A means by which a receptor can be exposed to, or affected by a contaminant or hazard (Pathway)
- A receptor, i.e. something which could be adversely affected by a contaminant or hazard, such as human health or groundwater (Receptor).

In order for there to be a potential risk, all three of the above elements must be present. If there is a source of contamination and a receptor (for example a resident or site user), then there is only a potential risk if there is a pathway linking the two. Such an active pathway is known as a relevant pollutant linkage. It is possible for the same contaminant to be linked to a receptor via a number of pathways, and hence it is important that all relevant pollutant linkages, to both human health and controlled waters, are separately identified on a site in order that a comprehensive conceptual model can be formed and ultimately a robust remediation strategy designed.

5.2 CLEA FRAMEWORK

The DEFRA/Environment Agency CLEA Model 2002, including the technical background, generic conceptual models and model parameters, and the Soil Guideline Values derived from this model, were withdrawn in August 2008. The model parameters and generic conceptual models were reviewed and the technical background updated to incorporate the results of additional research. The withdrawn reports were replaced by the following documents:

- Human Health Toxicological Assessment of Contaminants in Soil (Science Report Final SC050021/SR2)
- Updated Technical Background to the CLEA Model (Science Report Final SC050021/SR3)

5.3 CONCEPTUAL MODEL FRAMEWORK

The preliminary stage of the risk assessment process is to develop and define a conceptual site model, based on the desk study and any existing site investigation data. This is used to establish any potential contaminant sources, identify existing and future receptors and assess if there are any potentially active pathways by which a potential risk may be present.

The preliminary conceptual site model will be developed and refined as site specific data is gathered, such as actual ground conditions and chemical data, resulting in a more robust conceptual understanding of the site.

5.4 CRITICAL SENSITIVE RECEPTOR – HUMAN HEALTH

The proposed use following the re-development of the site is for a commercial/industrial end use. Therefore, the critical sensitive receptor from a human health perspective is an on-site commercial/industrial receptor.

In accordance with CLEA guidance for a standard CLEA commercial/industrial scenario, the critical sensitive receptor for a commercial/industrial end use risk assessment is a female adult, with exposure from 16 to 65 years

The standard commercial/industrial end use conceptual model defined by CLEA is assumed to be suitable for the purposes of this assessment.

5.5 CRITICAL SENSITIVE RECEPTOR – CONTROLLED WATERS

Based on the proposed redevelopment of the site for an industrial end use, and the findings of the desk study, the critical sensitive receptor from a controlled waters perspective is groundwater within the Secondary 'A' Aquifer of the underlying solid strata.

By considering groundwater as the critical sensitive receptor for controlled waters, the groundwater/hydrogeological risk assessment will also be protective of Coal Brook running west-east approximately 100m to the north of the site, and the Afon Lliw running north-south approximately 360m to the east of the site.

5.6 POTENTIAL CONTAMINANT SOURCES

As identified in the desk study, there was previously a colliery waste tip underlying the site. The disused tip underwent reprofiling works in order to create a level development plateau for the construction of the existing factory site.

The anticipated presence of wide spread colliery spoil and potential made ground of unknown origin is a potential source of contamination.

The main potential contaminants associated with the made ground are metals, semi metals, other inorganics, polycyclic aromatic hydrocarbons (PAH), petroleum hydrocarbons VOCs/SVOCs and asbestos.

5.7 POTENTIAL EXPOSURE PATHWAYS

Potential exposure pathways for the critical receptors (both human health and controlled waters) are listed below:

- Dermal contact with soil and/or soil derived dust
- Ingestion of soil
- Inhalation of vapours (indoor/outdoor air)
- Inhalation of soil derived dust
- Leaching of contaminants from localised made ground to groundwater
- Transportation of contaminants within groundwater

5.7 POTENTIAL EXPOSURE PATHWAYS (CONTINUED)

In addition, the following exposure pathways have also been considered:

- Building materials durability
- Ground gas risk

5.8 SUMMARY OF CONCEPTUAL EXPOSURE MODEL

A preliminary conceptual exposure model has been developed for the site. This is based on the findings of the desk study and historical review and includes all potential sources, pathways and receptors that may be present on site. Those that have been identified as being potentially active require further investigation in the form of sampling and testing of soils and groundwater, followed by appropriate risk assessment.

The preliminary conceptual exposure model will be reviewed and refined following the completion of the site works and laboratory testing.

5.8 SUMMARY OF CONCEPTUAL EXPOSURE MODEL (CONTINUED)

The preliminary conceptual exposure model is presented in Table 7.

Table 7: Preliminary Conceptual Exposure Model

Source		Receptor	Pathway	Potentially Active Pathway?
Origin	Contaminant			
Colliery spoil and/or potential made ground of unknown origin and historical land use	Metals, semi-metals, non-metals, PAHs, petroleum hydrocarbons VOCs/SVOCs and asbestos	Commercial/industrial onsite receptor – human health	Dermal Contact with made ground/dust	✓
			Ingestion of soil	✓
			Inhalation of dust	✓
			Inhalation of vapours – indoor/outdoor	✓
	Metals, semi-metals, inorganics, PAH.	Groundwater quality	Leaching from made ground	✓
	Metals, semi-metals, inorganics, PAH.	Surface water quality	Transportation within groundwater	✓
Colliery spoil and/or potential made ground of unknown origin/ Superficial deposits	pH, Sulphates	Building Materials Durability	Direct contact	✓
Colliery spoil and/or potential made ground of unknown origin/ Ground Gas – organic, gas producing materials	Methane, carbon dioxide	Human health	Accumulation of gases in confined spaces, and/or migration off site, leading to asphyxiation, or risk of explosion	✓

6.0 THE SITE INVESTIGATION

6.1 FIELDWORKS

A site investigation was designed in accordance with BS5930:1999, the Code of Practice for Site Investigations, BS10175:2011, the Code of Practice for Investigation of Potentially Contaminated Sites, and 'Development of Land Affected by Contamination: A Guide for Developers' prepared by Welsh Local Government Association (WLGA)/Environment Agency Wales (EAW) Land Contamination Working Group, 2012.

The site investigation was designed to gain an understanding the ground conditions at shallow/medium depths and to support and refine the preliminary conceptual site model/conceptual exposure model.

An investigation comprising seven machine excavated trial pits and three shell and auger boreholes was carried out between 29th November and 4th December 2013.

A summary of the locations and depth of the trial pits and boreholes is summarised in Table 8.

Table 8: Trial Pits and Boreholes Summary

ID	Depth (m)	Location
TP1	2.9	Outside footprint of proposed building at location of potential drainage system
TP2	2.3	Adjacent to existing factory building to potentially investigate existing foundations
TP3	2.7	Outside footprint of proposed building at location of potential drainage system
TP4	2.2	Outside footprint of proposed building at location of potential stockpiles
TP5	3.6	Beneath footprint of proposed building
TP6	3.4	
TP7	4.3	
BH1	9.3	
BH2	6.45	
BH3	6.0	

6.1 FIELDWORKS (CONTINUED)

The trial pits (TP1 to TP7) were located within grassy areas across the site area with emphasis placed on investigating the ground beneath the footprint of the proposed extension. The maximum depth of excavation was 4.3m below existing ground level in TP7.

Soakaway testing was carried out in two of the excavated trial pits (TP1 and TP3) which were situated within open areas outside the footprint of the proposed building at potential locations of proposed infiltration systems.

The boreholes (BH1to BH3) were located beneath the footprint of the proposed extension and drilled down to a maximum depth of 9.30m below existing ground level by cable percussive methods. The purpose of the boreholes was to prove the deeper ground conditions and allow for an assessment of the most appropriate foundation type for the proposed development. In-situ strength testing (SPT/CPTs) was carried out within each borehole. Combined groundwater and ground gas monitoring standpipes were installed within two of the boreholes (BH1 and BH2).

A programme of ground gas monitoring was commenced on 10th December 2013.

Representative soil samples were taken for laboratory chemical and physical testing and placed in the appropriate sample containers deemed suitable for the analysis required. Strict protocols were adopted during this process to limit the cross contamination of samples.

The fieldworks were supervised by a qualified Geotechnical Engineer from Intégral Géotechnique (Wales) Limited who also logged the trial pits and boreholes and prepared their detailed engineering logs in accordance with the requirements of BS5930: 1999.

The approximate locations of the trial pits and the shell and auger boreholes are shown in Figure 2. The engineering logs are presented in Appendix D and E respectively. The results of the soakaway testing are presented in Appendix F.

6.2 FIELD OBSERVATIONS

Although colliery spoil/made ground was encountered in each of the trial pits and boreholes, no visual or olfactory evidence of contamination was identified.

6.3 LABORATORY CHEMICAL TESTING

As part of the initial ground investigation, representative soil samples were taken from the trial pits across the site, stored at the appropriate temperature and dispatched to the UKAS accredited laboratories of i2 for laboratory chemical testing within 24 hours.

The samples were tested for a range of contaminants that reflects the historical use of the site, the findings of the desk study and the preliminary conceptual site model/conceptual exposure model. A list of the soil testing carried out is given below:

Beryllium	Cadmium
Total Chromium	Hexavalent Chromium (VI)
Copper	Lead
Mercury	Nickel
Vanadium	Zinc
Arsenic	Boron
Selenium	Elemental Sulphur
Total Cyanide	Total Sulphate
Sulphide	Water Soluble Sulphate
pH	Monohydric Phenol
Polyaromatic Hydrocarbons (PAH)	Asbestos

The results of the laboratory chemical testing are presented in Appendix G. A summary is presented in Appendix J.

6.4 LABORATORY GEOTECHNICAL TESTING

Representative soil samples of the shallow in-situ natural deposits were also sent to the laboratories of Geo Site Testing Services Limited (GSTL) and tested for Atterberg Limits, in order to assess potential shrinkability of the soils, moisture content, and pH and sulphates.

The laboratory geotechnical testing results are presented in Appendix H.

6.5 IN-SITU GAS MONITORING

Gas monitoring standpipes were installed in two of the shell and auger boreholes (BH1 and BH2) and a gas monitoring programme was commenced on 10th December 2013.

The results of the gas monitoring programme completed to date are presented in Appendix I and summarised in Table 9.

6.5 IN-SITU GAS MONITORING (CONTINUED)

The concentration levels of methane, carbon dioxide and oxygen were measured in the standpipes using a GA5000 Landfill Gas Analyser. In addition, gas flow rate and the atmospheric pressure at the time of the field measurements were also recorded.

Gas monitoring has been carried out over a range of atmospheric pressures to include at least one reading in low and/or falling pressure, in accordance with the recommendations made in CIRIA Report C665.

7.0 GROUND CONDITIONS

A summary of the ground conditions encountered across the site is presented below in Table 9.

TABLE 9 : SUMMARY OF GROUND CONDITIONS

Depth (m) From	Depth (m) To	Stratum
0.0	0.2	Grass onto Topsoil: Soft brown slightly silty to silty CLAY.
0.2	0.7/2.9	Colliery Spoil/Made Ground: Loose to medium dense black silty GRAVEL with occasional cobbles and boulders of angular shale. AND Medium dense dark red brown sandy GRAVEL of angular brink and clinker.
0.7/>2.9	4.5/7.1	Superficial Deposits: Firm and firm to stiff orange brown mottled grey slightly silty CLAY with increasing gravel and cobble content with depth. AND Loose slightly clayey SAND.
4.5/7.1	6.0/9.0	Highly Weathered Mudstone Bedrock: Stiff slightly gravelly CLAY. OR Medium dense slightly clayey GRAVEL of tabular mudstone.
6.0/9.0	>6.0/>9.0	Weak MUDSTONE Bedrock.

7.1 TOPSOIL

At each trial pit and borehole location, the ground surface was covered in grass and immediately underlain by a layer of slightly silty clay topsoil extending down to a depth of approximately 0.2m below existing ground level.

7.0 GROUND CONDITIONS (CONTINUED)

7.2 COLLIERY SPOIL/MADE GROUND

Within each trial pit and borehole, the topsoil encountered on site was found to be underlain by a layer of colliery spoil typically comprising loose to medium dense black silty gravel with occasional cobbles and boulders of angular shale extending down to a greatest depth of 2.8m in TP1 and a shallowest depth of 0.7m in TP6.

The strength of this material was found to vary with depth. The N values at 1.0m depth were recorded to range between N=9 and N=13 in BH1 to BH3, while at 2.0m depth an N value of 20 was recorded in BH1.

The greatest thicknesses of colliery spoil were generally encountered towards the east of the site, while the smallest thicknesses were generally encountered towards the west of the site. This suggests that the material was placed as a wedge on during the formation of a level development plateau on top of gently sloping ground. The shallowest thicknesses encountered in the west of the site are consistent with the presence of a cut slope along the western site boundary.

A representative soil sample of the colliery spoil was taken from BH1 and tested for Atterberg Limits in order to assess any potential shrinkability. The results indicate that the material is non plastic.

A thin layer of dark red brown sandy gravel of angular brick and clinker, typically between 0.2 and 0.3m thick, was encountered immediately below the colliery spoil across much of the site.

7.3 SUPERFICIAL DEPOSITS

The made ground deposits were observed to be underlain by superficial glacial deposits comprising firm and firm to stiff orange brown mottled grey slightly silty clay with increasing gravel and cobble content with depth. The clay material was observed to extend down to a maximum unproven depth of 4.3m in TP7. N values for this material ranged from 14 to 32. Within TP6 and BH3 these superficial clay deposits were found to be underlain by a layer of loose slightly clayey sand. This loose material was encountered at a depth of approximately 2.3m in TP6 and its thickness was unproven due to water seepage and collapse of the trial pit. In BH3 this loose material was encountered at a depth of approximately 3.3m, has an N value of 8, and was observed to extend down to an approximate depth of 4.5m below existing ground level.

7.3 SUPERFICIAL DEPOSITS (CONTINUED)

Representative soil samples of the natural cohesive deposits were taken from across the site and tested for Atterberg Limits in order to assess the potential shrinkability of the soils. The results indicate that all four samples tested are of intermediate plasticity with plasticity indices ranging from 17% to 28%. The modified plasticity indices vary from 16% to 28%, indicating that the soils are of low to intermediate volume change potential.

7.4 MUDSTONE BEDROCK

Highly weathered mudstone bedrock was observed to underlie the glacial deposits beneath the site. This material typically comprises stiff slightly gravelly clay or medium dense slightly clayey gravel of tabular mudstone, before grading into less weathered mudstone bedrock at depths of between approximately 6.0/9.0m below existing ground level.

7.5 GROUNDWATER

Groundwater seepages were encountered in TP3 and TP6 at 0.6m and 2.3m below existing ground level respectively. Groundwater was also observed in TP3, however, this is considered to represent seepage of perched groundwater.

Groundwater strikes of 5.1m and 4.5m were recorded in BH2 and BH3 respectively. These levels rose 4.0m below existing ground level within each borehole after twenty minutes standing time.

No water strike was recorded within BH1 during the drilling works, however, subsequent monitoring indicates a groundwater level of 2.3m below existing ground level in BH1 and 4.0m below existing ground level in BH2.

It should be noted that groundwater levels are likely to fluctuate seasonally.

7.6 SOAKAWAY TESTS

Soakaway testing was carried out in two trial pits (TP1 and TP3). It should be noted that the testing was carried out within the made ground deposits due their thickness and vertical extent.

Negligible infiltration was observed over a two hour testing period within TP3. Consequently, it was not possible to calculate a soil infiltration rate at this location.

7.6 SOAKAWAY TESTS (CONTINUED)

A soil infiltration rate of $2.2x10^{-5}$ m/s was calculated for TP1.

It should be noted that this initial testing should only be regarded as indicative and careful planning needs to be implemented when considering soakaways within made ground due to the heterogeneous chemical and physical properties of such deposits. If it should be proposed to use soakaways for this site, then more extensive location follow-up tests may be required, in order to confirm the suitability of the site and to satisfy the Local Authority.

8.0 CONTAMINATION

8.1 AVERAGING AREAS

In order to assess the laboratory test results reliably and in context, the data have been grouped into an averaging area. An averaging area (or area of interest) is that area of soil to which a receptor is exposed or which otherwise contributes to the creation of hazardous conditions. This may be an area of historical industrial usage, a soil type, or a specific proposed end use.

In the case of this analysis, the averaging areas have been determined according to the proposed commercial end use.

8.2 SOIL CONTAMINATION

The published Soil Guideline Values for arsenic, cadmium, mercury, nickel, selenium, phenol and BTEX compounds have been adopted as critical concentrations against which soil contaminant concentrations can be compared. In the absence of additional published SGVs, the Soil Screening Values (SSVs) derived by Atkins ATRISK^{soil} for a commercial end use and the Generic Assessment Criteria (GAC's) derived by Land Quality Management (LQM)/Chartered Institute of Environmental Health (CIEH) have been adopted.

Since the results of the testing indicate total organic carbon content (TOC) in the range of 1.2% to 1.7%, the results have been compared to the respective guidelines, where applicable, for 1% soil organic matter content.

The chemical testing results for the colliery spoil/made ground have been summarised and are presented in Appendix G.

8.2.1 Made Ground

Six samples of the colliery spoil/made ground were sent for laboratory chemical testing. The samples were obtained from 2.0m depth in TP1, 0.8m depth in TP3, 1.0m depth in TP5, 0.6m depth in TP6, 0.9m depth in TP7 and 1.3m depth in TP7.

The results of the laboratory testing indicate that all of the analysed chemical elements or compounds, apart from total chromium, are present at concentrations below their appropriate thresholds.

8.2 SOIL CONTAMINATION (CONTINUED)

Total chromium has been identified at an elevated concentration of 190mg/kg in the soil sample obtained from 1.3m depth in TP7. However, it should be noted that total chromium has been conservatively screened against the LQM screening criteria value for the more toxic form of chromium, chromium (VI), of 35mg/kg. No elevated concentrations of chromium (VI) were detected. When compared to the LQM screening criteria value for the less toxic form of chromium, chromium (III), of 3000mg/kg, no elevated total chromium concentrations were identified. Total chromium is therefore not considered to be of concern.

Asbestos was not detected within any of the samples.

No further exceedences were detected within the samples of made ground.

8.3 GROUND GASES

The results of the gas monitoring programme completed to date (three visits) are presented in Appendix I. A summary of the results is given in Table 10 below.

Table 10: Summary of Ground Gas Results

Borehole	Maximum Methane Concentration (%)	Maximum Carbon Dioxide Concentration (%)	Minimum Oxygen Concentration (%)	Gas Flow Rate (l/hr)
BH1	<0.5	<0.5	21.10	<0.3
BH2	<0.5	1.4	5.2	<0.3

The results show a maximum methane concentration of <0.5% and a maximum carbon dioxide concentration of 4.4%. The maximum gas flow rate recorded was <0.3l/hr.

A lowest minimum oxygen concentration of 5.2% was recorded in BH2.

9.0 REVISED CONCEPTUAL EXPOSURE MODEL

The preliminary conceptual exposure model has been reviewed and revised to reflect the findings of the site investigation and the results of the laboratory testing of soils. Pathways identified as a relevant pollutant linkage require appropriate risk assessment or mitigation measures (see Section 10).

Table 11: Revised Conceptual Exposure Model

Source		Receptor	Pathway	Preliminary Active Pathway? (see Sect. 5.8)	Relevant Pollutant Linkage	Justification/ Mitigation
Origin	Contaminant					
Colliery Spoil/Made Ground of unknown origin and historical/existing land uses	Metals, semi-metals, non-metals, PAH, petroleum hydrocarbons, Asbestos	Commercial/ industrial end user – human health	Dermal Contact with made ground/dust	✓	X	No elevated concentrations identified
			Ingestion of soil	✓	X	
			Inhalation of dust	✓	X	
			Inhalation of vapours – indoor/outdoor	✓	X	
	Metals, semi-metals, inorganics, PAH, petroleum hydrocarbons	Groundwater quality	Leaching from made ground	✓	X	No elevated soil concentrations identified
		Surface water quality	Transportation within groundwater	✓	X	
Potential point sources – e.g., Underground Storage Tanks	Petroleum hydrocarbons	Commercial /industrial end user – human health	Inhalation of Vapours – indoor/outdoor	✓	X	No point sources identified
	Petroleum hydrocarbons	Groundwater quality	Localised spillage	✓	X	
	Petroleum hydrocarbons	Surface water quality	Transportation within groundwater	✓	X	
Colliery Spoil/Made Ground of unknown origin and natural ground	Sulphates and pH	Building Materials Durability	Direct contact	✓	✓	Building materials will be in contact with made ground – risk assess

9.0 REVISED CONCEPTUAL EXPOSURE MODEL (CONTINUED)

Table 11: Revised Conceptual Exposure Model

Source		Receptor	Pathway	Preliminary Active Pathway? (see Sect. 5.8)	Relevant Pollutant Linkage	Justification/ Mitigation
Origin	Contaminant					
Ground Gas – organic, gas producing materials	Methane, carbon dioxide	Human health	Accumulation of gases in confined spaces, and/or migration off site, leading to asphyxiation, or risk of explosion	✓	✓	Potential gas producing materials present within the thick sequence of made ground – risk assess

10.0 RISK ASSESSMENT

10.1 METHODOLOGY

The risk of pollution, health effects or environmental harm occurring as a result of ground contamination is dependent upon three principal factors:

- The scale of the contamination sources;
- The presence of sensitive "receptors", eg Humans: health of the general public, site occupiers, redevelopment workers. Environment: flora, fauna, etc;
- The existence of migration pathways by which contaminants can reach the sensitive receptors.

This section assesses each of these factors in order to evaluate the overall level of risk and potential harm to receptors. The receptor may be human, a water resource, an eco-system or construction materials. Pathways connecting a perceived hazard to a receptor are referred to as exposure pathways.

The sources of contamination and the links connecting the hazards to the sensitive receptors will represent the basis for the risk assessment.

10.2 SOURCE-PATHWAY-RECEPTOR MODEL

The preliminary conceptual site model was based on the findings of the desk study. This was later reviewed and refined according to the findings of the site investigation, allowing for the ground conditions encountered and the results of laboratory testing of soil and groundwater. Any pathways considered to be inactive were removed from the model and all remaining potentially active pathways require risk assessment.

The pathways shown as potentially active in the Revised Conceptual Site Model in Section 9.0 above have been assessed below.

10.3 HUMAN HEALTH RISK ASSESSMENT

10.3.1 Site in its Present Condition

The site area is currently level and predominantly covered in grass. The site does not pose any significant risks to casual visitors or trespassers.

10.3 HUMAN HEALTH RISK ASSESSMENT (CONTINUED)

10.3.2 Future Site Users

A thick layer of colliery spoil/made ground containing large quantities of shale was encountered within all of the trial pits.

The laboratory chemical test results identified no contaminants present at concentrations above the appropriate thresholds for a commercial/industrial end use. Based on the contamination testing undertaken to date it is considered that the site poses negligible potential risk to future end users and no special precautions are necessary.

If any currently unidentified contamination should be encountered during future works, then these should be examined, sampled and chemically analysed with the results assessed by a geoenvironmental consultant. A strategy for dealing with any unforeseen contamination should be established prior to determining any required treatment/remedial measures.

All excavations should be regularly checked for safe atmospheres.

Normal good hygiene practices should be adequate to protect the health and safety of redevelopment workers, and should include:

- Minimum handling of materials;
- Washing of hands prior to all meal breaks, which should be taken in a designated clean area;
- The use of standard protective clothing such as boots and overalls and gloves, where considered relevant.

In dry weather, inhalation of dust and gases should be avoided preferably by the use of dust suppression techniques to minimize fugitive emissions and minimization of exposed materials at any particular time.

Additionally, a system should be established by which any 'unusual' materials that may be encountered are reported rapidly to the site management, so that the appropriate action may be taken, following specialist advice if necessary. An unusual material may be identified on site by colour, odour or physical nature.

Reference should be made to the Health and Safety Executive document "Protection of Workers and the General Public during the development of contaminated land" for detailed guidance on these matters.

10.4 GROUNDWATER RISK ASSESSMENT

Based on the historical use of the site, the ground conditions encountered, visual observations and the results of the laboratory testing of samples of made ground, the potential risk to groundwater quality is considered to be low.

The proposed building and areas hardstanding covering large areas of the site will reduce surface water infiltration and minimise any possibility of leachate generation. Hence it is considered that no significant threat to controlled waters exists.

Given the possibility of the proposed development utilising soil infiltration drainage systems, this assessment may be subject to future review and consequently leachability testing and/or groundwater sampling may be required.

10.5 GROUND GAS RISK ASSESSMENT

The results of the gas monitoring programme indicate a maximum methane concentration of <0.5%, a maximum carbon dioxide concentration of 1.4% and a depleted oxygen concentration of 5.2%. No gas flow above the detection limit of <0.3 l/hr was detected from the boreholes to date.

In accordance with CIRIA Report C665 a Gas Screening Value (GSV) of <0.004 l/hr has been calculated for carbon dioxide and a GSV of <0.002 l/hr has been calculated for methane. For structures other than low rise residential buildings, the site falls within Characteristic Situation 1, with no requirement for any gas protective measures.

Given the depleted oxygen level recorded in BH2, during site works it would be prudent to check all excavations for safe atmospheres.

No radon protective measures are required for the site.

10.6 RISKS TO BUILDINGS AND MATERIALS DURABILITY

10.6.1 Concrete Classification

A summary of the laboratory chemical test results for the chemicals monohydric phenol, sulphur, total sulphate, water soluble sulphate, sulphide and pH, which may adversely affect the durability of building materials is presented in Appendix G.

10.6 RISKS TO BUILDINGS AND MATERIALS DURABILITY (CONTINUED)

In accordance with BRE Digest SD1:2005 and adopting the assessment procedure specified therein for brownfield sites, the laboratory chemical test results indicate a characteristic value (taking the mean of the two highest results) for water soluble sulphate of 2050mg/l within the colliery spoil/made ground and 55mg/l within the underlying natural ground.

Using Table C2 of BRE Digest SD1:2005, these characteristic values correspond to a Design Sulphate Class DS-3 for the colliery spoil/made ground and DS-1 for the natural ground.

The groundwater regime of the site has been assessed as 'mobile' and a characteristic pH value of 6.6 has been determined (adopting the lowest test result). The Design Sulphate Class has been modified to give a site ACEC class of AC-3 for the colliery spoil/made ground and AC-1 for the natural ground.

10.6.2 Water Services

Water supply pipes will need to be protected from any contamination present within the ground. In particular, the presence of organic contaminants (such as PAHs) should be addressed when selecting pipe materials. Measures to protect the pipes will include clean backfill to trenches and possibly alternative material selection. Reference should be made to UKWIR Guidance for the Selection of Water Supply Pipes to be used in Brownfield Sites, document No. 10/WM/03/21. The final design and selection of the pipe and associated backfill should be agreed with the appropriate Regulator prior to installation.

10.7 SPOIL DISPOSAL

Under the Landfill Regulations (2002) all spoil materials should be classified if they require disposal to a landfill facility. To determine the appropriate type of landfill site, there will need to be waste acceptance criteria testing carried out and a characterisation of the materials in relation to the Waste regulations.

The existing made ground is tentatively classified as stable non-reactive hazardous waste but specialised testing will be required once earthworks design and volumes are known.

It is recommended that a sustainable development strategy is adopted which reduces to a practicable minimum the need for export of waste to a licensed tip.

10.7 SPOIL DISPOSAL (CONTINUED)

In order to minimise the potential for off-site disposal, the materials generated during the earthworks should be segregated and examined, with appropriate chemical testing as necessary, to enable the materials to be sorted or treated, with the resultant benefit of potentially generating re-use rather than disposal.

Excavated materials generated by the development may be considered as waste and subject to waste controls. Any re-use of excavated materials on-site should be undertaken in accordance with current waste and environmental legislation (e.g. Waste Framework Directive) and which may require the production of an approved Materials Management Plan (MMP) prepared in accordance with the CL:AIRE Code of Practice.

Although none is currently anticipated, any asbestos containing materials are likely to be classified as hazardous waste.

10.8 UNCERTAINTIES

It is important to recognise that there may be areas of contamination within the site area that have not been found or that contaminants may be present at concentrations above those that have been found. It is also important to recognise that contamination may be localised and that no investigation, however comprehensive, is capable of finding such occurrences, other than by chance.

It should also be noted that vertical and lateral variations in ground conditions could be present between trial pit and exploratory hole locations.

The near-surface drainage patterns have not been fully established.

11.0 ENGINEERING CONSIDERATIONS AND RECOMMENDATIONS

11.1 DETAILS OF PROPOSED DEVELOPMENT

The proposed development comprises an extension to the north-western corner of the existing factory building. The structure will contain a new 'exterior coating' production line, with machinery including ovens and spray painting units, and a number of deep inspection pits. The likely layout of the proposed development is shown on 'B+M drawing. New exterior coating line for TGWales'.

11.2 SITE PREPARATION

Prior to works commencing on site, any services within the site area should be identified and either diverted or protected. Any diversionary works should be carried out under the supervision of, and to the specification of, the appropriate statutory authorities. The resulting excavations should be backfilled with suitable acceptable granular fill material.

The topsoil on site (typically 0.2m thick), should be stripped off from beneath the proposed building. The excavated material will be unsuitable for structural fill and should be stockpiled in agreed locations or removed from site. Additionally, chemical analysis may be required to confirm the materials are fit for re-use/export to other sites.

Following site strip, the underlying colliery spoil/made ground and the in-situ superficial deposits should be examined and checked and tested if necessary. Any soft spots/areas should be removed and replaced with well compacted clean granular material.

Reduced levels should be brought up to the required levels with well compacted imported granular materials. Department of Transport (DTp) Type 1 sub base, or similar approved, could be used, and should be compacted in layers, in accordance with the current DTp Specification for Highway Works.

A materials management plan will be required to control an appropriate material use strategy to ensure the maximum benefit from available materials whilst managing and controlling final mitigation measures. A final verification report will be required.

A key consideration in the material use strategy will be the selective excavation of made ground and natural strata to ensure effective control. All made ground materials should be reusable as bulk fill or engineered fill in structural areas, subject to chemical and physical checks.

11.3 FOUNDATIONS AND FLOOR SLABS

11.3.1 General

We understand that the proposed development will comprise a portal frame structure with a series of deep inspection pits, the dimensions of which have yet to be finalised.

Given the ground conditions encountered during the site investigation, the main constraints on a foundation solution for the site are considered to be:

- The potential for adverse total and/or differential settlement due to the presence of variable thicknesses of colliery spoil/made ground across the site, and varying depths to rock head over short lateral distances across the site;
- The presence of localised soft spots/loose material below formation level.

11.3.2 Pad Foundations

It is considered that column loads from the proposed structure could be founded on reinforced concrete pad foundations, either constructed within the deeper more competent colliery spoil, typically encountered below 1m depth, or within the firm to stiff silty clay material, typically encountered below 0.7/2.6m depth.

For preliminary design purposes, an allowable bearing capacity of 150kN/m² could be achievable for pad foundations constructed within the deeper colliery spoil or the superficial clay deposits. This assessment is based on a two metre square pad constructed at a minimum depth of two metres below existing ground level. At this intensity of loading, the total settlements should not exceed 25mm, and any angular distortions caused by differential movements should be less than 1:750.

All pad foundations should be at a minimum depth of 900mm below finished levels in order to protect against the effects of frost heave and/or thermal shrinkage.

It is recommended that careful inspection is made of each foundation formation. Any encountered soft/loose materials, such as the loose sandy material encountered at depths of 2.3m and 3.3m in TP6 and BH2 respectively, or any softened clay materials, should be excavated and replaced with well compacted granular material or lean mix concrete.

11.3.3 Strip Foundations

It is considered that wall loads of the proposed structure could be founded on wide reinforced concrete strip foundations, either constructed within the deeper more competent colliery spoil, typically encountered below 1m depth, or within the firm to stiff silty clay material, typically encountered below 0.7/2.6m.

11.3 FOUNDATIONS AND FLOOR SLABS (CONTINUED)

For preliminary design purposes, an allowable bearing capacity of 100kN/m² could be achievable for wide reinforced strip foundations constructed within the deeper colliery spoil or the superficial clay deposits. This assessment is based on a 1m metre wide strip footing constructed at a minimum depth of one metre below existing ground level. At this intensity of loading, the total settlements should not exceed 25mm, and any angular distortions caused by differential movements should be less than 1:750.

All strip foundations should be at a minimum depth of 900mm below finished levels in order to protect against the effects of frost heave and/or thermal shrinkage.

It is recommended that careful inspection is made of each foundation formation. Any encountered soft/loose materials, such as the loose sandy material encountered at depths of 2.3m and 3.3m in TP6 and BH2 respectively, or any soften clay materials, should be excavated and replaced with well compacted granular material or lean mix concrete.

11.3.4 Floor Slabs

It is considered that ground bearing floor slabs could be adopted for the proposed structure. For preliminary design purposes, based on a design stress of 30kN/m² the total settlements should not exceed 25mm, and any angular distortions caused by differential movements should be less than 1:750.

No radon protective measures are required for the site.

Formations should be thoroughly proof rolled and in situ testing undertaken to verify the consistency and uniformity of the prepared formation.

11.4 EXCAVATIONS AND FORMATIONS

Generally, excavations formed within the existing made ground and superficial deposits across the majority of the site should be feasible with normal soil excavating machinery.

Excavations to typically 1.5m depth are unlikely to encounter significant groundwater inflows. Due to the level of the water table beneath the site, groundwater seepages should be anticipated within excavations below 2.0m depth. It should be noted that groundwater conditions can change dependant on seasonal and other factors. Perched pockets of groundwater within the colliery spoil/made ground should be anticipated.

The sides of excavations deeper than 1.2m should be fully supported by planking and strutting, or temporarily battered at gradients of typically 30°.

11.4 EXCAVATIONS AND FORMATIONS (CONTINUED)

Exposed formations are extremely susceptible to softening and deterioration by rainfall and site trafficking. Therefore, exposing of formations should be phased to minimise the potential for damaging, and/or immediately protected by backfilling with a 300mm thick layer of hardcore or blinding concrete.

Any 'soft spots/areas' encountered in the formations, including areas of loose sandy material, should be removed and replaced with well compacted imported granular materials.

11.5 DRAINAGE

Soakaway testing was carried out in two trial pits (TP1 and TP3) where possible infiltration systems are being proposed. It should be noted that the testing was carried out within the made ground deposits due to their thickness and vertical extent.

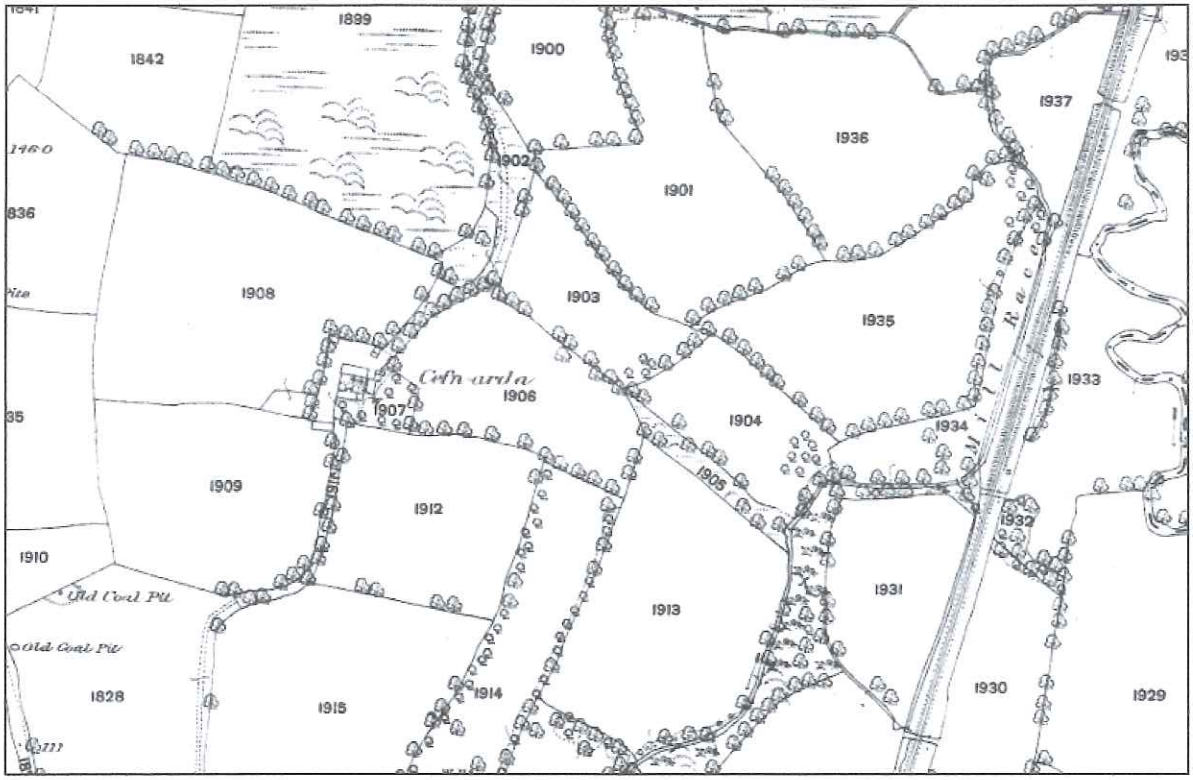
Negligible infiltration was observed over a two hour testing period within TP3. Consequently, it was not possible to calculate a soil infiltration rate at this location.

A soil infiltration rate of 2.2×10^{-5} m/s was calculated for TP1.

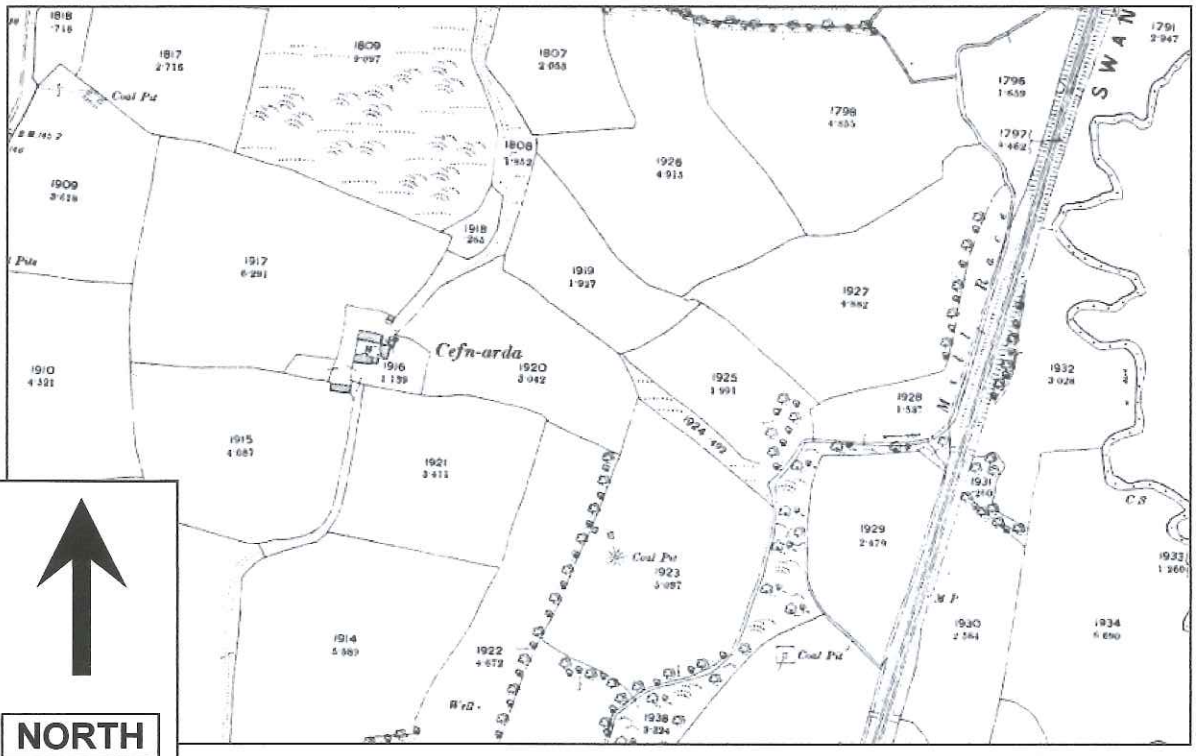
It should be noted that this initial testing should only be regarded as indicative and careful planning needs to be implemented when considering soakaways within made ground due to the heterogeneous chemical and physical properties of such deposits. If it should be proposed to use soakaways for this site, then more extensive location follow-up tests will be required, in order to confirm the suitability of the site and to satisfy the local authority. Additionally it should be noted that groundwater levels are likely to fluctuate seasonally.

APPENDIX A

HISTORICAL MAPS



1877



NORTH

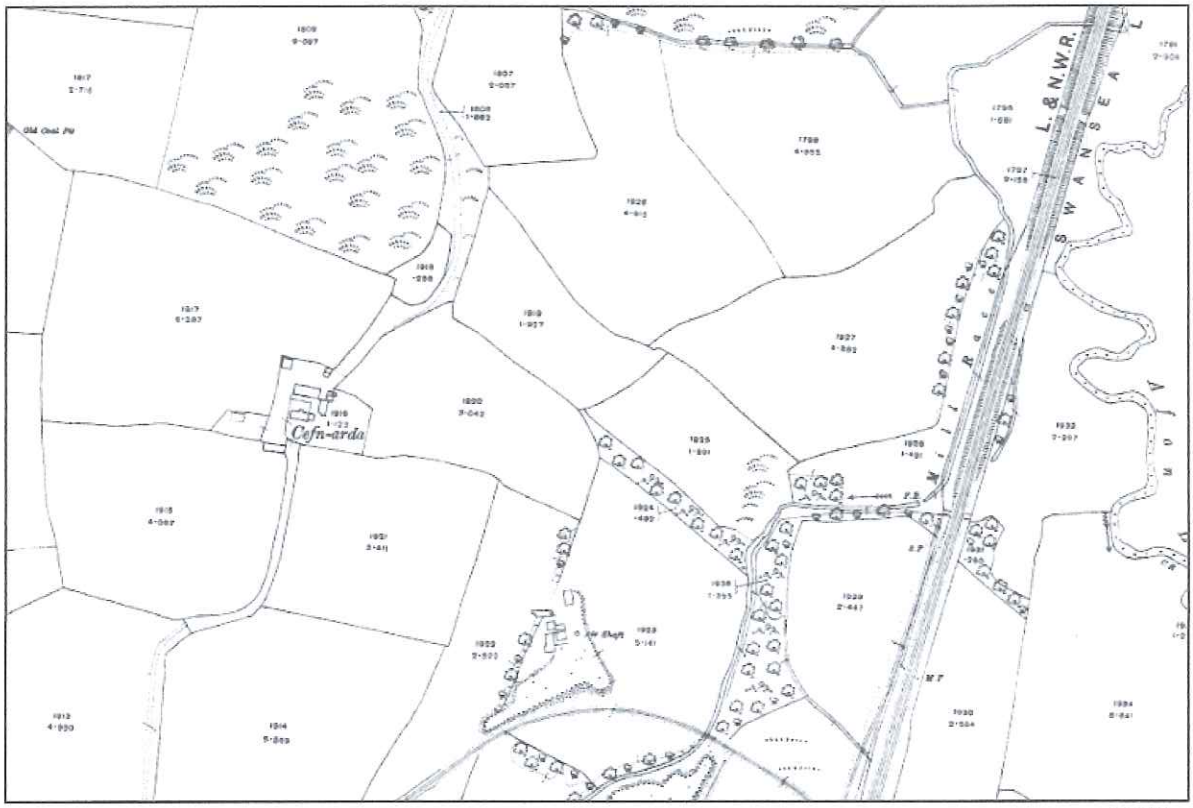
1898

Toyoda Gosei: 1877 (top) to 1898 (bottom)

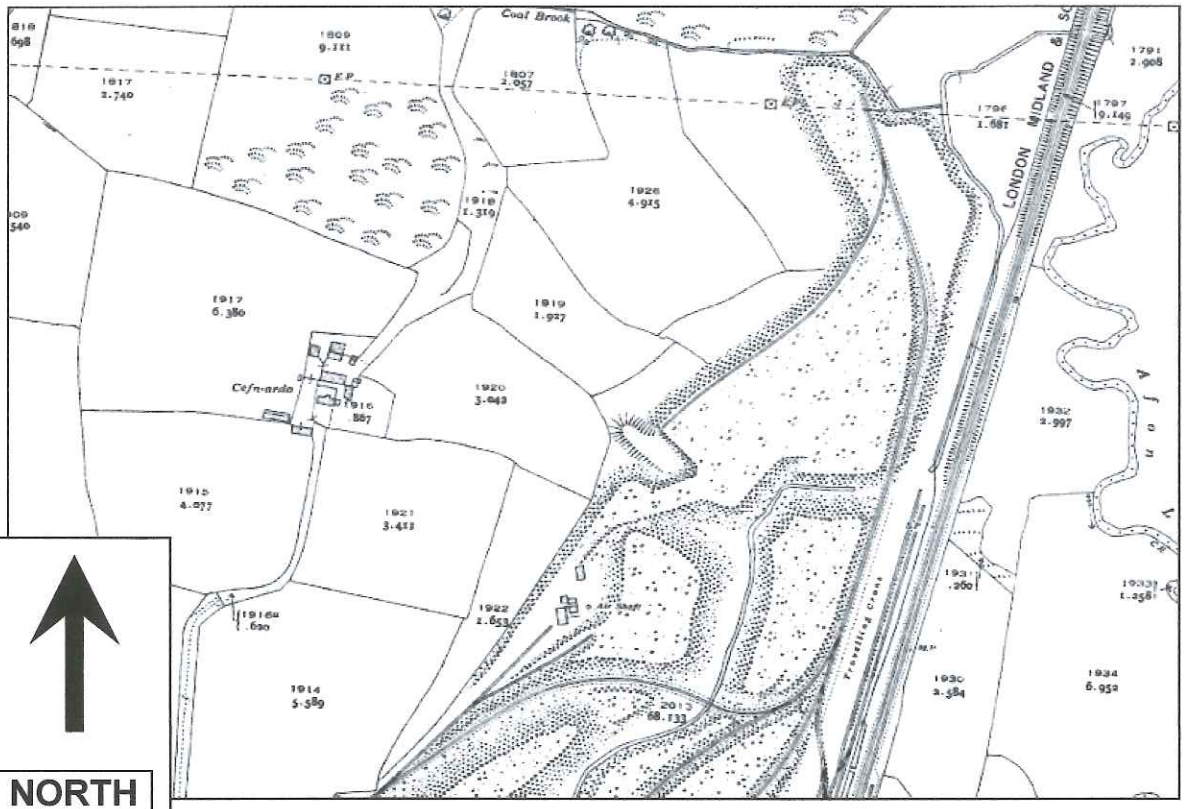
Not to scale

Intégral Géotechnique

Integral House
7 Beddau Way
Castlegate Business Park
Caerphilly
CF83 2AX
Tel: 029 2080 7991
Fax: 029 2086 2176



1916



1935

Toyoda Gosei: 1916 (top) to 1935 (bottom)

Not to scale

Intégral Géotechnique

Integral House
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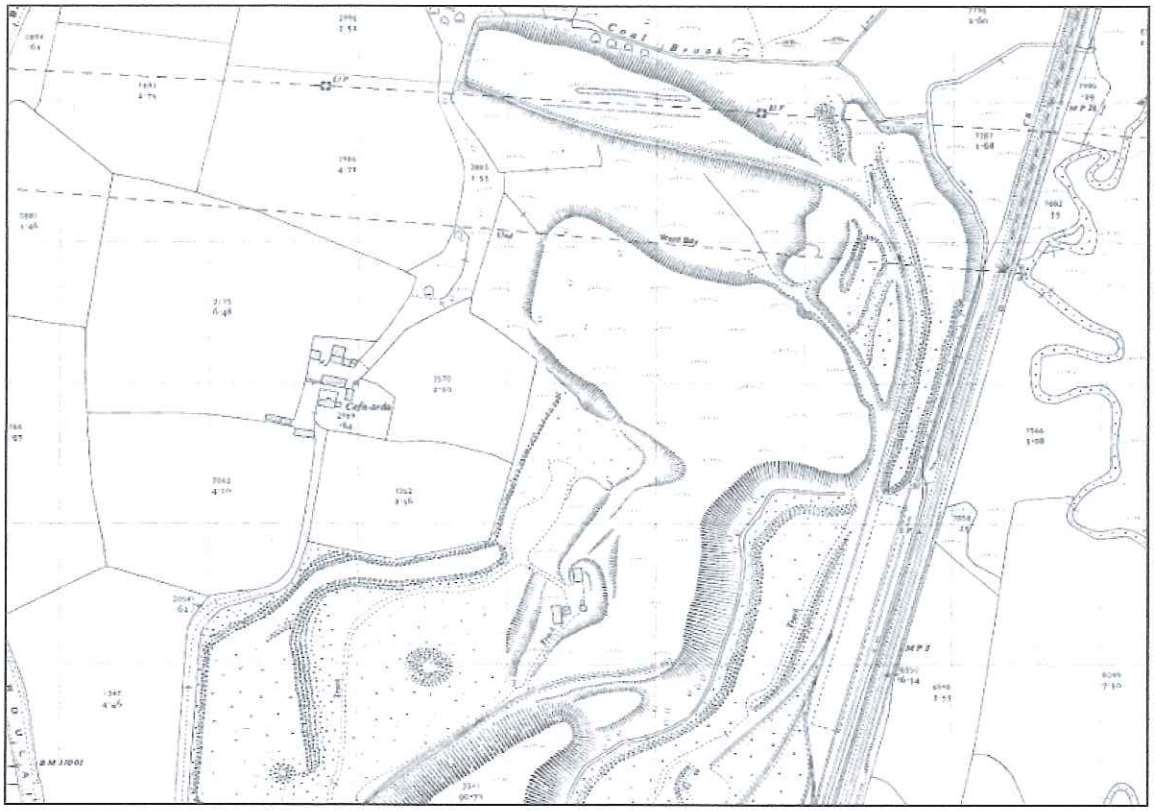
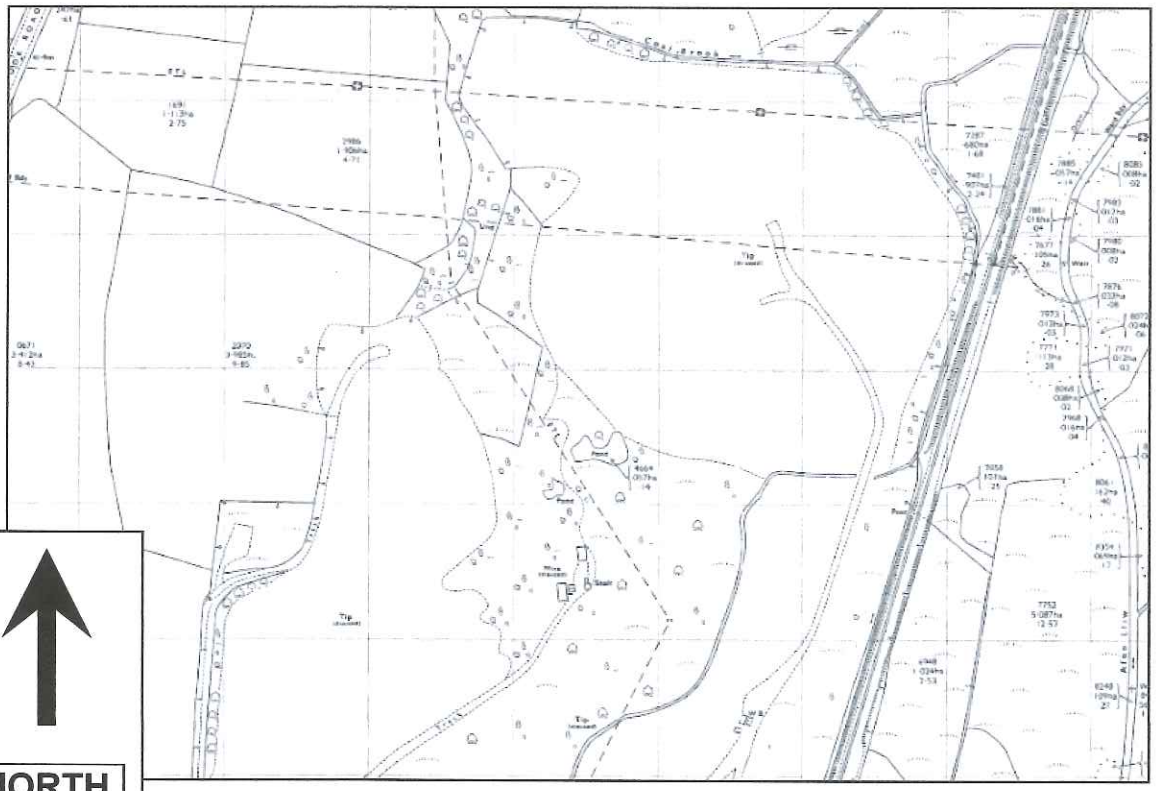


1958



NORTH

1972

Toyoda Gosei: 1958 (top) to 1972 (bottom)

Not to scale

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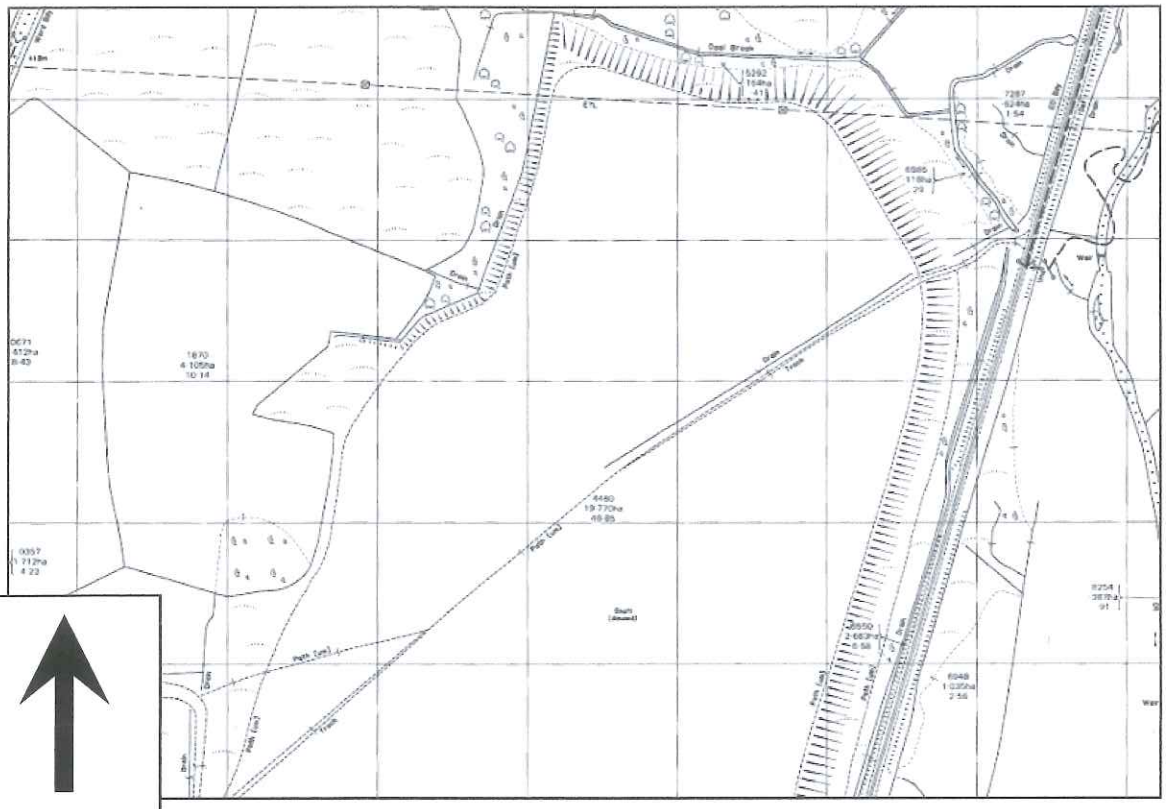

NORTH

1988

Toyoda Gosei: 1958 (top) to 1972 (bottom)

Not to scale

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APPENDIX B

COAL AUTHORITY REPORT

The Coal Authority

Issued by:
The Coal Authority, Property Search Services, 200 Lichfield Lane, Berry Hill, Mansfield, Nottinghamshire, NG18 4RG
Website: www.groundstability.com Phone: 0845 762 6848 DX 716176 MANSFIELD 5

INTEGRAL GEOTECHNIQUE (WALES) LTD.
INTEGRAL HOUSE
7 BEDDAU WAY
CAERPHILLY
MID GLAMORGAN
CF83 2AX

Our reference:	**51000419826001**
Your reference:	**11266/JJ**
Date of your enquiry:	**02 December 2013**
Date we received your enquiry:	**02 December 2013**
Date of issue:	**03 December 2013**

This report is for the property described in the address below and the attached plan.

Non-Residential Coal Authority Mining Report

T G PARK, HEOL Y MYNYDD, GORSEINON, SWANSEA, SA4 4NY

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.

Coal mining	See comments below
Brine Compensation District	No

Information from the Coal Authority

Underground coal mining

Past

The property is in the likely zone of influence from workings in 4 seams of coal at 240m to 500m depth, and last worked in 1969.

Any ground movement from these coal workings should have stopped by now.

Present

The property is not in the likely zone of influence of any present underground coal workings.

Future

The property is not in an area for which the Coal Authority is determining whether to grant a licence to remove coal using underground methods.

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

The property is not in an area that is likely to be affected at the surface from any planned future workings.

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

No notice of the risk of the land being affected by subsidence has been given under section 46 of the Coal Mining Subsidence Act 1991.

Mine entries

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

Coal mining geology

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

Opencast coal mining

Past

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

Present

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

Future

The property is not within 800 metres of the boundary of an opencast site for which the Coal Authority is determining whether to grant a licence to remove coal by opencast methods.

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.

Coal mining subsidence

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

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

The 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.

Mine gas

In the past the Coal Authority has undertaken gas emission investigations within the subject property within this report. If you require further information on this matter, you should contact the Coal Authoritys Surface Hazards Management Department at the above address.

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.

Withdrawal of support

The property is not in an area for which a notice of entitlement to withdraw support has been published.

The property is not in an area for which a notice has been given under section 41 of the Coal Industry Act 1994, revoking the entitlement to withdraw support.

Working facilities orders

The property is not in an area for which 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.

Payments to owners of former copyhold land

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

Information from the Cheshire Brine Subsidence Compensation Board

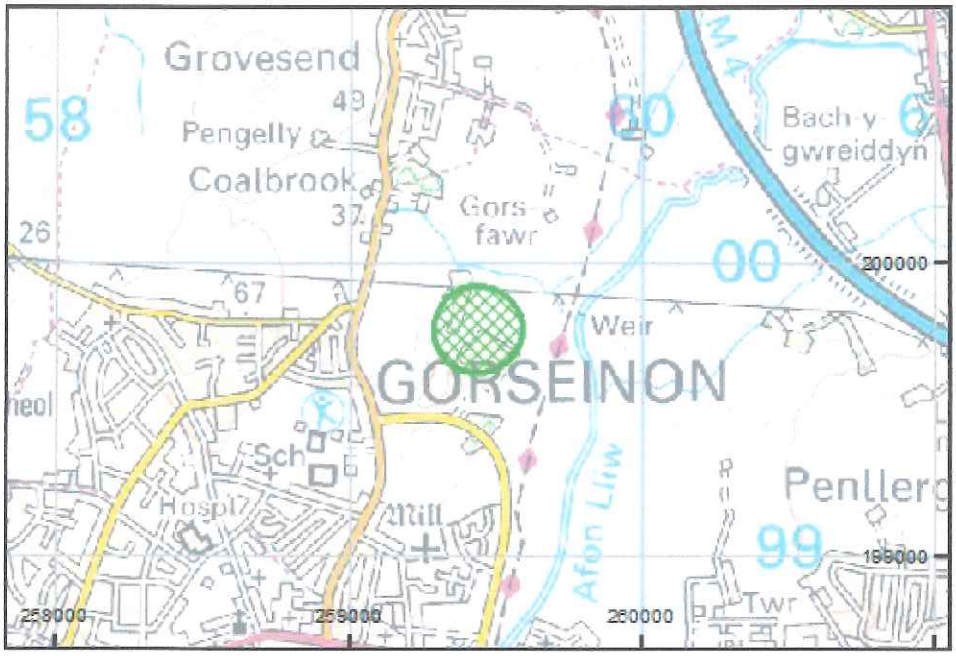
The property lies outside the Cheshire Brine Compensation District.

`dditional Remarks

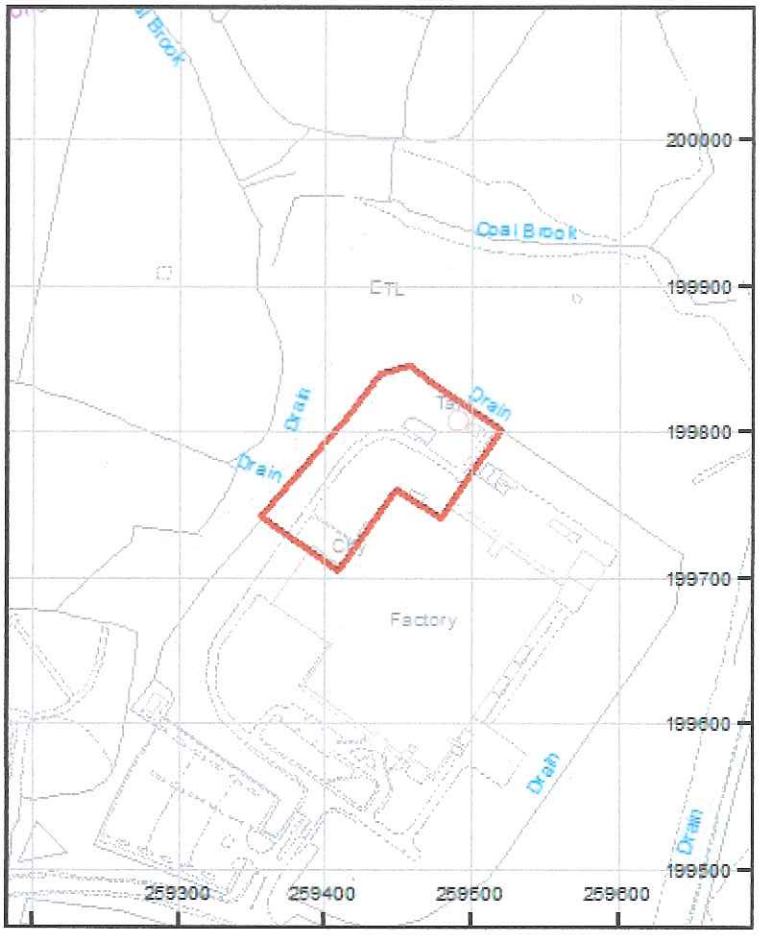
This report is prepared in accordance with the Law Society's Guidance Notes 2006, the User Guide 2006 and the Coal Authority and Cheshire Brine Board's Terms and Conditions 2006.

Location map

Approximate position of property



Enquiry boundary



Key

Approximate position of enquiry boundary shown

Mapping sourced from Ordnance Survey

APPENDIX C

RADON REPORT

UKradon - Radon Risk Reports

British Geological Survey

Public Health England

Radon Risk Report for addresses in England and Wales

Issued by Public Health England and the British Geological Survey using Address-Point®. Fee paid £3.00 + VAT. Email receipt issued by Secure Trading Ltd.

Address searched: Toyoda Gosei, T G Park, Heol Y Mynydd, Gorseinon, Swansea, SA4 4NY

Numerical grid reference for this address:

259468 East

199663 North

Date of report: 9 December 2013

Guidance for existing properties

Is this property in a radon Affected Area? - NO

The answer to the standard enquiry on house purchase known as CON29 Standard Enquiry of Local Authority; 3.13 Radon Gas: Location of the Property in a Radon Affected Area is:

No, this property is not in a Radon Affected Area as defined by Public Health England.

The estimated probability of the property being above the Action Level for radon is:0-1%

The result may not be valid for buildings larger than 25 metres.

This report informs you of the estimated probability that this particular property is above the Action Level for radon. This does not necessarily mean there is a radon problem in the property; the only way to find out whether it is above or below the Action Level is to carry out a radon measurement in an existing property.

Radon Affected Areas are designated by the Public Health England. PHE advises that radon gas should be measured in all properties within Radon Affected Areas.

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

Further information is available from PHE or www.ukradon.org.

Guidance for new buildings and extensions to existing properties

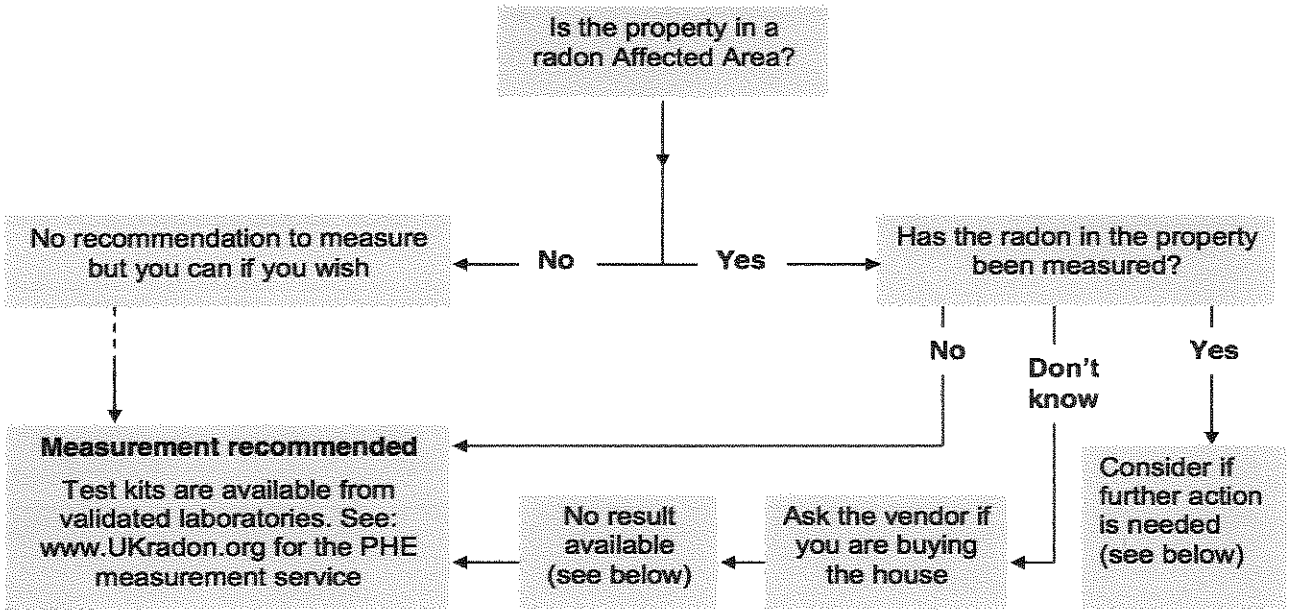
What is the requirement under Building Regulations for radon protection in new buildings and extensions at the property location? - None

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

See the Radon and Building Regulations for more details.

Report design 27 July 2011. V 2013.11

PHE guidance for occupiers and prospective purchases



Existing radon test results: There is no public record of individual radon measurements. Results of previous tests can only be obtained from the seller. Radon levels can be significantly affected by changes to the building or its use, particularly by alterations to the heating and ventilation which can also be affected by changes in occupier. If in doubt, test again for reassurance.

Radon Bond: This is simply a retained fund, the terms of which are negotiated between the purchaser and the vendor. It allows the conveyance of the property to proceed without undue delay. The purchaser is protected against the possible cost of radon reduction work and the seller does not lose sale proceeds if the result is low. Make sure the agreement allows enough time to complete the test, get the result and arrange the work if needed.

High Results: Exposure to high levels of radon increases the risk of developing lung cancer. If a test in a home gives a result at or above the Action Level of 200 Becquerels per cubic metre of air (Bq/m3), formal advice will be given to lower the level. Radon reduction will also be recommended if the occupants include smokers or ex-smokers when the radon level is at or above the Target Level of 100 Bq/m3; these groups have a higher risk. Information on health risks and radon reduction work is available from PHE. Guidance about radon reduction work is also available from some Local Authorities, the Building Research Establishment and specialist contractors.

PHE designated radon website: http://www.ukradon.org
Building Research Establishment: http://www.bre.co.uk/radon/reduce.html

APPENDIX D

TRIAL PIT LOGS

Intégral Géotechnique
Intégral House, 7 Beddau Way
Castlegate Business Park
Caerphilly CF83 2AX
Tel. 029 20807991
Fax. 029 20862176
mail@integralgeotec.com

Project Name :	Project No.:	Trial Pit No.:
Toyoda Gosei Factory Extension	**11266**	**TP1** Sheet 1 of 1
Location : Gorseinon	Client : Toyoda Gosei	Logged By : JJ / Scale : 1:25
Equipment : JCB 3CX	Coordinates : -	Dimensions: 2.30m / Depth : 2.90m / 0.70m
Date Excavated : 29/11/2013	Level : -	

Samples & In-situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description
Depth (m)	Type	Results				
			0.20			Grass onto soft dark brown slightly silty CLAY with occasional gravel and many fine roots (Topsoil)
						Loose becoming medium dense black silty sandy GRAVEL with occasional cobbles and rare boulders (0.2 x 0.2m) of angular shale and coal. Gravel is fine, medium and coarse angular shale and coal (Made Ground)
2.00	ES					
			2.80			Loose to medium dense dark red brown slightly sandy GRAVEL. Gravel is fine, medium and coarse angular brick and subangular sandstone (Made Ground) Possible buried topsoil surface at 2.8m
			2.90			Trial Pit Complete at 2.90 m

0 1 2 3 4 5

Remarks:
Excavation terminated at 2.9m to undertake soakaway test

Groundwater : Pit dry

Stability : Sides stable in short term

Key :
D - Small disturbed sample
B - Bulk disturbed sample
ES - Environmental soil sample
W - Water sample

AGS

HoleBASE 3.1 (Bld 426.58) Standard Trialpit Log v2 dated 27th Nov 03

Intégral Géotechnique
Intégral House, 7 Beddau Way
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Caerphilly CF83 2AX
Tel. 029 20807991
Fax. 029 20862176
mail@integralgeotec.com

Project Name :	Project No.:	Trial Pit No.:
Toyoda Gosei Factory Extension	**11266**	**TP2** Sheet 1 of 1
Location : Gorseinon	Client : Toyoda Gosei	Logged By : JJ / Scale : 1:25
Equipment : JCB 3CX	Coordinates : -	Dimensions 2.00m
Date Excavated : 29/11/2013	Level : -	Depth : 2.30m / 1.40m

Samples & In-situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description
Depth (m)	Type	Results				
						Grass onto soft brown slightly silty CLAY with many fine roots (Topsoil)
			0.30			Medium dense black silty sandy GRAVEL with frequent cobbles and rare boulders (0.3 x 0.2m) of black sometimes burnt orange angular shale (Made Ground) concrete possibly associated with existing pad foundation exposed at 0.3m depth.
			1.90			Medium dense dark red brown sandy GRAVEL. Gravel is fine, medium and coarse angular brick and clinker (Made Ground)
2.00	ES					
2.10	D		2.10			Firm to stiff orange brown and grey slightly silty CLAY with occasional cobbles of subangular mudstone and subrounded sandstone
			2.30			Trial Pit Complete at 2.30 m

0 1 2 3 4 5

Remarks:

Groundwater : Pit dry

Stability : Sides stable in short term

Key :
D - Small disturbed sample
B - Bulk disturbed sample
ES - Environmental soil sample
W - Water sample

AGS

HoleBASE 3.1 (Bld 428.59) Standard Trialpit Log v2 dated 27th Nov 03

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Project Name :	Project No.:	Trial Pit No.:
Toyoda Gosei Factory Extension	**11266**	**TP3** Sheet 1 of 1
Location : Gorseinon	Client : Toyoda Gosei	Logged By : JJ / Scale : 1:25
Equipment : JCB 3CX	Coordinates : -	Dimensions 2.10m
Date Excavated : 29/11/2013	Level : -	Depth : 2.70m / 0.70m

Samples & In-situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description
Depth (m)	Type	Results				
						Grass onto soft brown slightly silty CLAY with rare gravel and many fine roots (Topsoil)
			0.20			Loose to medium dense silty GRAVEL with occasional cobbles and boulders (0.3 x 0.3m) of angular shale (Made Ground)
0.80	ES					
						rare brick and clinker at 2.1m
			2.20			Firm orange brown mottled grey slightly silty CLAY with occasional gravel and cobbles of subrounded sandstone and angular mudstone
2.50	D					
			2.70			Trial Pit Complete at 2.70 m

Remarks:
Excavation terminated at 2.7m to undertake soakaway test

Groundwater : Water seepage at 0.6m depth (perched groundwater)

Stability : Minor collapse during soakaway test

Key :
D - Small disturbed sample
B - Bulk disturbed sample
ES - Environmental soil sample
W - Water sample

AGS

HoleBASE 3.1 (Bld 426.58) Standard Trialpit Log V2 dated 27th Nov 03

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Fax. 029 20862176
mail@integralgeotec.com

Project Name :	Project No.:	Trial Pit No.:
Toyoda Gosei Factory Extension	**11266**	**TP4** Sheet 1 of 1

Location :	Client :	Logged By :	Scale :
Gorseinon	Toyoda Gosei	JJ	1:25

Equipment :	Coordinates :	Dimensions
JCB 3CX	-	2.00m
Date Excavated :	Level :	Depth : 2.20m / 0.70m
29/11/2013	-	

Samples & In-situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description
Depth (m)	Type	Results				
						Grass onto soft brown slightly silty CLAY with rare gravel and many fine roots (Topsoil)
			0.30			Loose to medium dense silty GRAVEL with occasional cobbles and boulders (0.2 x 0.3m) of angular shale (Made Ground)
1.60	ES					
			2.10			Firm orange brown mottled grey slightly silty CLAY with occasional gravel and cobbles of subrounded sandstone and angular mudstone
			2.20			Trial Pit Complete at 2.20 m

0 1 2 3 4 5

Remarks:

Groundwater : Pit dry

Stability : Sides stable in short term

Key :
D - Small disturbed sample
B - Bulk disturbed sample
ES - Environmental soil sample
W - Water sample

AGS

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Project Name :	Project No.:	Trial Pit No.:
Toyoda Gosei Factory Extension	**11266**	**TP5** Sheet 1 of 1

Location :	Client :	Logged By :	Scale :
Gorseinon	Toyoda Gosei	JJ	1:25

Equipment :	Coordinates :	Dimensions
JCB 3CX	-	Depth : 3.60m; 2.10m; 0.70m
Date Excavated :	Level :	
29/11/2012	-	

Samples & In-situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description
Depth (m)	Type	Results				
						Grass onto soft brown slightly silty CLAY with many fine roots (Topsoil)
			0.20			
						Medium dense black silty GRAVEL with occasional cobbles and boulders (0.2 x 0.3m) of angular shale. Gravel is fine, medium and coarse black and burnt orange angular shale (Made Ground)
1.00	ES					
			1.20			
						Firm to stiff orange brown mottled grey slightly silty CLAY with occasional gravel and cobbles of angular mudstone and rounded quartz.. Gravel is fine, medium and coarse angular mudstone and subrounded sandstone
2.70	D					
			3.60			Trial Pit Complete at 3.60 m

0 1 2 3 4 5

Remarks:

Groundwater : Pit dry

Stability : Sides stable in short term

Key :
D - Small disturbed sample
B - Bulk disturbed sample
ES - Environmental soil sample
W - Water sample

AGS

HoleBASE 3.1 (Bld 425.56) Standard Trialpit Log v2 dated 27th Nov 03

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Project Name :	Project No.:	Trial Pit No.:
Toyoda Gosei Factory Extension	**11266**	**TP6** Sheet 1 of 1
Location : Gorseinon	Client : Toyoda Gosei	Logged By : JJ / Scale : 1:25
Equipment : JCB 3CX	Coordinates : -	Dimensions: 2.20m / Depth : 3.40m / 0.70m
Date Excavated : 29/11/2013	Level : -	

Samples & In-situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description
Depth (m)	Type	Results				
			0.00			Grass onto soft brown slightly silty CLAY with many fine roots (Topsoil)
			0.30			Medium dense dark red brown silty sandy GRAVEL with occasional cobbles of brick. shale, coal and clinker (Made Ground)
0.60	ES		0.70			Firm to stiff grey mottled orange becoming orange mottled grey slightly silty CLAY with occasional gravel and cobbles of subrounded sandstone and angular mudstone
			2.30			Loose grey brown clayey SAND with occasional gravel of angular mudstone
2.80	ES		3.40			Trial Pit Complete at 3.40 m

Remarks:

Groundwater : Groundwater seepage at 2.3m depth

Stability : Collapse below 2.3m with water seepage

Key :
D - Small disturbed sample
B - Bulk disturbed sample
ES - Environmental soil sample
W - Water sample

AGS

HoleBASE 3.1 (Bld 428.58) Standard Trialpit Log v2 dated 27th Nov 03

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Project Name :	Project No.:	Trial Pit No.:
Toyoda Gosei Factory Extension	**11266**	**TP7** Sheet 1 of 1
Location : Gorseinon	Client : Toyoda Gosei	Logged By : JJ / Scale : 1:25
Equipment : JCB 3CX	Coordinates : -	Dimensions: 2.40m (Depth : 4.30m, 0.70m)
Date Excavated : 29/11/2013	Level : -	

Samples & In-situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description
Depth (m)	Type	Results				
						Grass onto soft brown slightly silty CLAY with occasional gravel and many fine roots (Topsoil)
			0.20			Medium dense black silty GRAVEL with occasional cobbles of angular shale. Gravel is fine, medium and coarse angular shale (Made Ground)
0.90	ES					
			1.20			Medium dense dark red brown slightly silty sandy GRAVEL with occasional cobbles of brick, slag and clinker (Made Ground)
1.30	ES					
			1.50			Firm to stiff orange brown mottled grey slightly silty CLAY with occasional gravel of subrounded quartz and tabular mudstone
2.00	D					
			2.40			Firm to stiff dark orange brown mottled grey slightly silty very gravelly CLAY with occasional cobbles and boulders of subrounded sandstone and subangular and angular mudstone. Gravel is fine, medium and coarse angular shale and mudstone and subrounded sandstone and quartz
			4.30			Trial Pit Complete at 4.30 m

0 1 2 3 4 5

Remarks:

Groundwater : Pit dry

Stability : Sides stable in short term

Key :
D - Small disturbed sample
B - Bulk disturbed sample
ES - Environmental soil sample
W - Water sample

AGS

HoleBASE 3.1 (Bld 428.59) Standard Trialpit Log v2 dated 27th Nov 03

APPENDIX E

SHELL AND AUGER BOREHOLE LOGS

Intégral Géotechnique
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mail@integralgeotec.com

Project Name :	Project No.:	Borehole No.:
Toyoda Gosei Factory Extension	**11266**	**BH1** Sheet 1 of 1

Location : Gorseinon	Client: Toyoda Gosei	Coordinates : - -	Hole Type : Cable
Equipment : Dando 2000	Diameter of Casing : 200 mm	Level : -	Scale : 1:50
Diameter of Boring : 200mm	Depth of Casing : 9.00 mBGL	Dates 29/11/2013 - 02/12/2013	Logged By : JJ

Well	Water Strikes	Samples & In-situ Testing Depth (m)	Type	Results	Depth (m)	Level (m AOD)	Legend	Stratum Description
					0.20			Grass onto soft brown silty CLAY with many fine roots (Topsoil)
		1.00	CPT	N=9 (2,2,2,2,2,3)				Loose to medium dense becoming medium dense black silty sandy GRAVEL with occasional cobbles of angular shale and rare coal (Colliery Spoil/Made Ground)
		1.00	ES					
		2.00	CPT	N=20 (3,15,7,6,4,3)				
					2.60			Firm to stiff orange brown mottled grey slightly silty slightly sandy CLAY with occasional gravel and cobbles and rare boulders
		3.00	CPT	N=32 (4,4,5,6,8,13)				
	▽ 3.54 m							
		4.00	CPT	N=21 (3,5,5,5,5,6)				
		5.00	CPT	N=40 (2,4,5,6,8,21)				
		6.50	CPT	N=18 (3,2,4,4,4,6)				
					7.10			Stiff becoming very stiff grey slightly gravelly CLAY with mudstone lithorelicts (Weathered Mudstone Bedrock)
		8.00	CPT	N=43 (5,7,9,10,11,13)				
		9.30	CPT	50/75mm (23,34,50)	9.30			End of Borehole at 9.30 m
		Depth (m)	Type	Results				

Remarks :
Chiselling for 30mins from 5.3 to 5.6m depth.
Chiselling for 60mins from 9.0 to 9.3m depth

Key :

D - Small disturbed sample
B - Bulk disturbed sample
ES - Environmental soil sample
SPT - Standard Penetration Test (split spoon)
CPT - Standard Penetration Test (solid cone)
W - Water sample
U - Undisturbed sample
TCR - Total Core Recovery
SCR - Solid Core Recovery
RQD - Rock Quality Designation

AGS

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Project Name :	Project No.:	Borehole No.:
Toyoda Gosei Factory Extension	**11266**	**BH2** Sheet 1 of 1

Location : Gorseinon	Client: Toyoda Gosei	Coordinates : - -	Hole Type : Cable
Equipment : Dando 2000	Diameter of Casing : 200 mm	Level : -	Scale : 1:50
Diameter of Boring : 200mm	Depth of Casing : 6.00 mBGL	Dates 02/12/2013 - 03/12/2013	Logged By : JJ

Well	Water Strikes	Samples & In-situ Testing: Depth (m)	Type	Results	Depth (m)	Level (m AOD)	Legend	Stratum Description
					0.20			Grass onto soft brown silty CLAY with many fine roots (Topsoil)
		1.00	CPT	N=10 (2,4,3,2,2,3)				Medium dense black silty sandy GRAVEL with occasional cobbles of angular shale (Colliery Spoil/Made Ground)
		1.00	ES					
					1.70			Firm to stiff becoming stiff orange brown mottled grey slightly silty slightly sandy CLAY with occasional gravel and cobbles and rare boulders
		2.00	CPT	N=14 (2,2,2,4,3,5)				
		3.00	CPT	N=36 (4,5,20,4,4,8)				
					3.30			Loose grey brown slightly clayey SAND with occasional gravel
	Rising to 4.00 m	4.00	CPT	N=8 (1,1,2,2,2,2)				
					4.50			Medium dense to dense brown slightly clayey GRAVEL of tabular mudstone (Weathered Mudstone Bedrock)
	5.10 m	5.00	CPT	N=36 (4,5,8,9,9,10)				
		6.00	CPT	103/225mm (21,24,22,31,50)	6.00			MUDSTONE (Bedrock)
					6.45			End of Borehole at 6.45 m
		Depth (m)	Type	Results				

Stratum Description scale: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

Remarks :

Chiselling for 30mins from 3.1 to 3.3m depth.
Chiselling for 60mins from 6.1 to 6.3m depth

Key :

D - Small disturbed sample
B - Bulk disturbed sample
ES - Environmental soil sample
SPT - Standard Penetration Test (split spoon)
CPT - Standard Penetration Test (solid cone)
W - Water sample
U - Undisturbed sample
TCR - Total Core Recovery
SCR - Solid Core Recovery
RQD - Rock Quality Designation

AGS

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Project Name :	Project No.:	Borehole No.:
Toyoda Gosei Factory Extension	**11266**	**BH3** Sheet 1 of 1

Location : Gorseinon	Client: Toyoda Gosei	Coordinates : - -	Hole Type : Cable
Equipment : Dando 2000	Diameter of Casing : 200 mm	Level : -	Scale : 1:50
Diameter of Boring : 200mm	Depth of Casing : 4.60 mBGL	Dates 02/12/2013 - 03/12/2013	Logged By : JJ

Well	Water Strikes	Samples & In-situ Testing Depth (m)	Type	Results	Depth (m)	Level (m AOD)	Legend	Stratum Description
					0.20			Grass onto soft brown silty CLAY with many fine roots (Topsoil)
		1.00	CPT	N=13 (1,6,6,3,2,2)				Loose to medium dense black silty sandy GRAVEL with occasional cobbles of angular shale (Colliery Spoil/Made Ground)
		1.00	ES		1.20			
		2.00	CPT	N=16 (2,3,3,4,5,4)				Firm to stiff orange brown mottled grey slightly silty slightly sandy CLAY with occasional gravel and cobbles and rare boulders
		3.00	CPT	N=20 (3,4,4,5,4,7)				
	Rising to 4.00 m	4.00	CPT	N=28 (2,3,4,8,10,6)				
	4.50 m							
		5.00	CPT	N=26 (2,3,6,5,7,8)	5.10			
					5.20			Medium dense brown SAND and GRAVEL
								Medium dense brown slightly clayey GRAVEL of tabular mudstone (Weathered Mudstone Bedrock)
					6.00			End of Borehole at 6.00 m
		Depth (m)	Type	Results				

0 1 2 3 4 5 6 7 8 9 10

Remarks :

Chiselling for 60mins from 4.6 to 4.8m depth.
Hole terminated at 5.4m depth as unable to advance casing past obstruction at 4.6m

Key :

D - Small disturbed sample
B - Bulk disturbed sample
ES - Environmental soil sample
SPT - Standard Penetration Test (split spoon)
CPT - Standard Penetration Test (solid cone)
W - Water sample
U - Undisturbed sample
TCR - Total Core Recovery
SCR - Solid Core Recovery
RQD - Rock Quality Designation

AGS

HoleBASE 3.1 (Bld 426.58) Standard Borehole Log v2 dated 27th Nov 03

APPENDIX F

SOAKAWAY TESTING RESULTS

Toyoda Gosei

SOAKAWAY **TP1 (2.9m)**

Date	29-Nov-13		
Engineer	JJ	**Job Number**	11266
Main Stratigraphic Unit	Made Ground: Medium dense black silty sandy GRAVEL		
Pit Stable ?	Sides Stable		
Weather Conditions	Dry		

Time (min.)	Depth (m)
0	2.07
1	2.08
3	2.09
7	2.13
26	2.22
52	2.32
80	2.45
120	2.59
170	2.74

Pit Dimensions

Length (m)	2.0
Width (m)	0.7
Depth (m)	2.9

Effective Storage

Water Depth at Start of Test (m)	2.07		
Water Depth at End of Test (m)	2.74		
Effective Depth (Measured) (m)	0.67		
% Effective Storage Depth	80.72%		
		Depth below GL	
Effective Storage Depth (100%) (m)	0.83		
Effective storage depth (75%) (m)	0.6225	2.69	0
Effective storage depth (50%) (m)	0.415		
Effective storage depth (25%) (m)	0.2075	2.2775	0

Time for Soakaway

Time for measured outflow	170	minutes
Time for 100% outflow (see graph or readings?)	215	minutes
Time for 75-25% outflow (see graph)	120	minutes

Volume of Infiltrated Water = length x width x effective storage depth

Volume outflowing between measured effective depth	0.938	m^3
Volume outflowing over 100% effective depth	1.162	m^3
Volume outflowing between 75% and 25% effective depth	0.581	m^3

Surface Area

(100% effective Storage)		(75-25% effective storage)		(over measured Depth)	
Length Area (m^2)	3.32	Length Area (m^2)	1.66	Length Area (m^2)	2.68
Width Area (m^2)	1.16	Width Area (m^2)	0.58	Width Area (m^2)	0.94
Base (m^2)	1.40	Base (m^2)	1.40	Base (m^2)	1.40

Mean Surface Area through which outflow occurs = (length area x 2) = (width area x 2) + base area

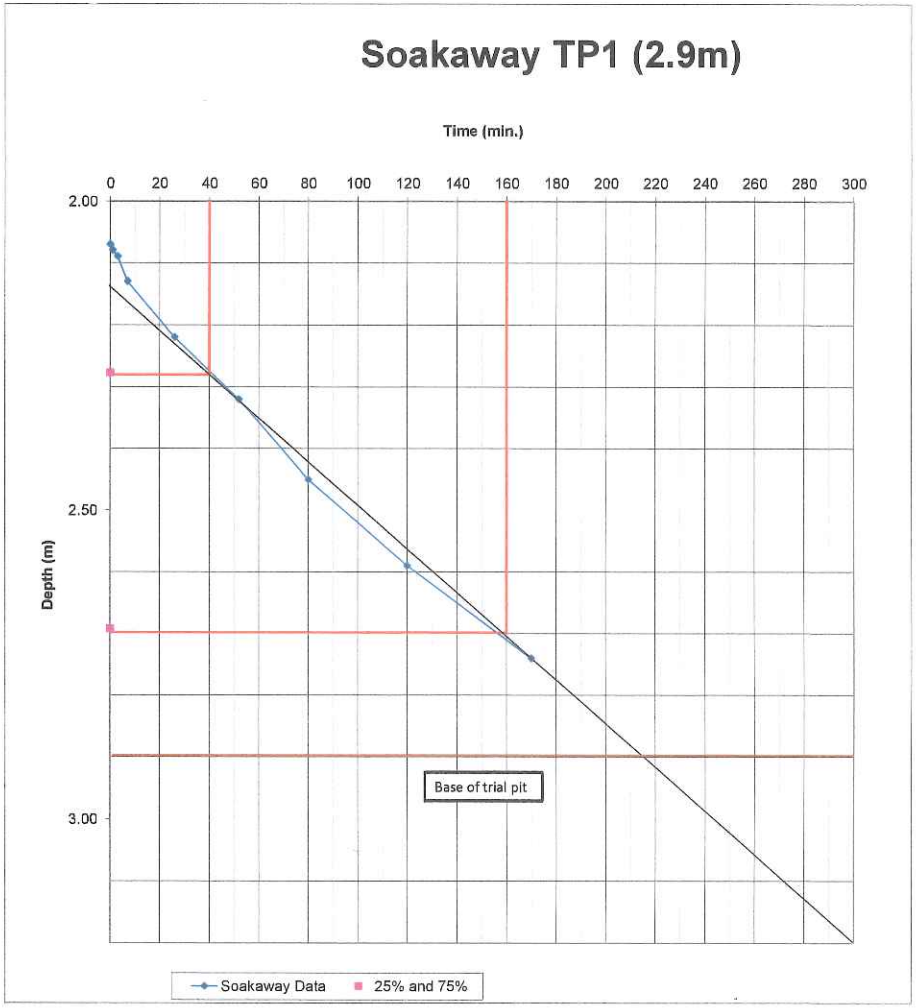
(100% effective storage)	5.88	m^2
(50% effective storage)	3.64	m^2
(Over Measured depth)	5.02	m^2

Soil Infiltration Rate = volume of infiltrated water / (surface area x infiltration time x 60)

Over 100% effective depth:	1.53E-05	m/s
Over measured Depth	1.83E-05	m/s
Over 75% - 25% effective depth:	2.22E-05	m/s

Comments

Soakaway test undertaken within made ground due to depth



Toyoda Gosei

SOAKAWAY **TP3 (2.7m)**

Date	29-Nov-13
Engineer	JJ
Job Number	11266
Main Stratigraphic Unit	Firm orange brown mottled grey slighily silty CLAY with occasional gravel and cobbles
Pit Stable ?	Minor collapse during soakaway test
Weather Conditions	Dry

Time (min.)	Depth (m)
0	1.77
1	1.77
2	1.77
5	1.77
10	1.77
40	1.77
90	1.77
130	1.77

Pit Dimensions

Length (m)	2.0
Width (m)	0.7
Depth (m)	2.7

Effective Storage

Water Depth at Start of Test (m)	1.77	
Water Depth at End of Test (m)	1.77	
Effective Depth (Measured) (m)	0	
% Effective Storage Depth	0.00%	
		Depth below GL
Effective Storage Depth (100%) (m)	0.93	
Effective storage depth (75%) (m)	0.6975	2.47
Effective storage depth (50%) (m)	0.465	
Effective storage depth (25%) (m)	0.2325	2.0025

0

0

Time for Soakaway

Time for measured outflow	130	minutes
Time for 100% outflow (see graph or readings?)		minutes
Time for 75-25% outflow (see graph)		minutes

Volume of Infiltrated Water = length x width x effective storage depth

Volume outflowing between measured effective depth	0.000 m^3
Volume outflowing over 100% effective depth	1.302 m^3
Volume outflowing between 75% and 25% effective depth	0.651 m^3

Surface Area

(100% effective Storage)		(75-25% effective storage)		(over measured Depth)	
Length Area (m^2)	3.72	Length Area (m^2)	1.86	Length Area (m^2)	0.00
Width Area (m^2)	1.30	Width Area (m^2)	0.65	Width Area (m^2)	0.00
Base (m^2)	1.40	Base (m^2)	1.40	Base (m^2)	1.40

Mean Surface Area through which outflow occurs = (length area x 2) = (width area x 2) + base area

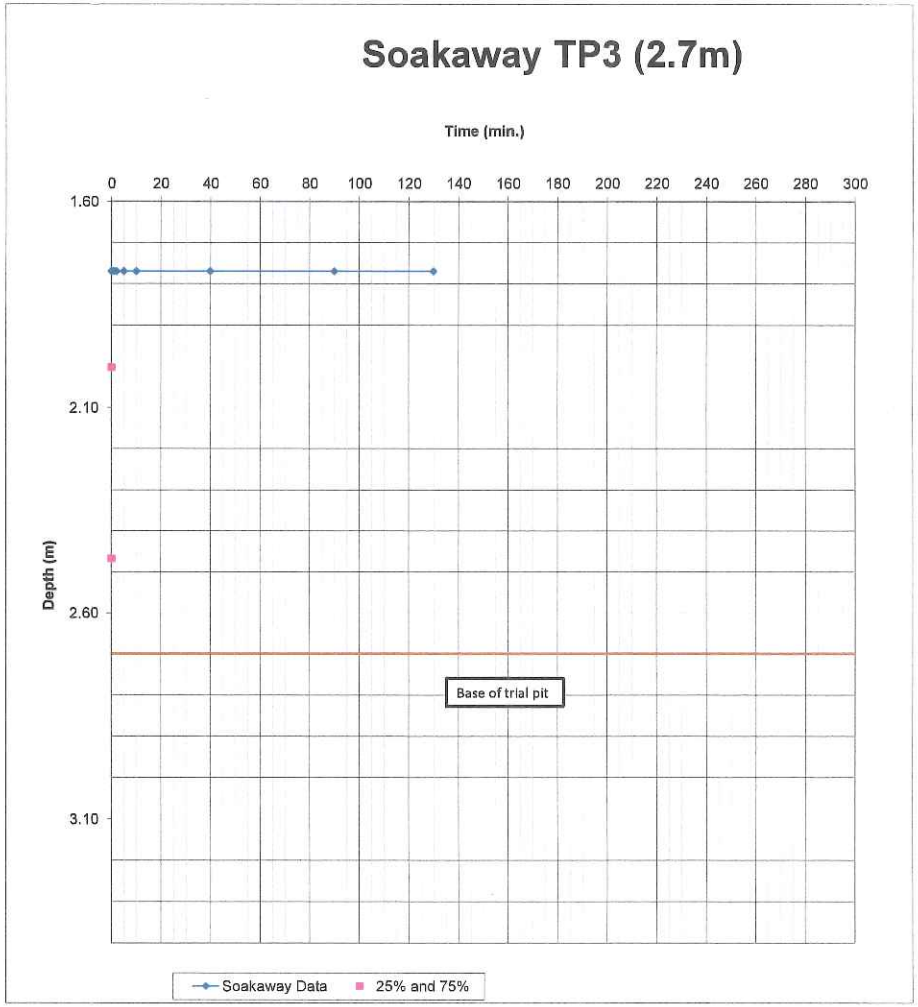
(100% effective storage)	6.42 m^2
(50% effective storage)	3.91 m^2
(Over Measured depth)	1.40 m^2

Soil Infiltration Rate = volume of infiltrated water / (surface area x infiltration time x 60)

Over 100% effective depth:	N/A	m/s
Over measured Depth	N/A	m/s
Over 75% - 25% effective depth:	N/A	m/s

Comments

Negligible infiltration observed over testing period



APPENDIX G

LABORATORY CHEMICAL TESTING RESULTS (COLLIERY SPOIL/MADE GROUND)

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Analytical Report Number : 13-48791

Project / Site name:	Toyoda Gosei, Gorseinon	**Samples received on:**	03/12/2013
Your job number:	11266	**Samples instructed on:**	03/12/2013
Your order number:		**Analysis completed by:**	11/12/2013
Report Issue Number:	1	**Report issued on:**	11/12/2013
Samples Analysed:	6 soil samples		

Signed:

Thurstan Plummer
Organics Technical Manager
For & on behalf of i2 Analytical Ltd.

Signed:

Rexona Rahman
Customer Services Manager
For & on behalf of i2 Analytical Ltd.

Other office located at: ul. Pionierów 39, 41 -711 Ruda Śląska, Poland

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

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

Excel copies of reports are only valid when accompanied by this PDF certificate.

Analytical Report Number: 13-48791

Project / Site name: Toyoda Gosei, Gorseinon

Lab Sample Number				301874	301875	301876	301877	301878
Sample Reference				TP1	TP3	TP5	TP6	TP7
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				2.00	0.80	1.00	0.60	0.90
Date Sampled				29/11/2013	29/11/2013	29/11/2013	29/11/2013	29/11/2013
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
Stone Content	%	0.1	NONE	< 0.1	< 0.1	< 0.1	-	< 0.1
Moisture Content	%	N/A	NONE	4.8	8.1	6.6	-	5.2
Total mass of sample received	kg	0.001	NONE	0.41	0.42	0.39	-	0.39
Asbestos in Soil	Type	N/A	ISO 17025	Not-detected	Not-detected	Not-detected	Not-detected	Not-detected
General Inorganics								
pH	pH Units	N/A	MCERTS	6.7	6.9	6.6	-	6.9
Total Cyanide	mg/kg	1	MCERTS	< 1	< 1	< 1	-	< 1
Total Sulphate as SO_4	mg/kg	100	ISO 17025	4700	510	3700	-	1400
Water Soluble Sulphate (Soil Equivalent)	g/l	0.0025	MCERTS	4.4	0.36	3.7	-	1.5
Water Soluble Sulphate as SO_4 (2:1)	mg/kg	2.5	MCERTS	4400	360	3700	-	1500
Water Soluble Sulphate (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	2.2	0.18	1.9	-	0.77
Sulphide	mg/kg	1	MCERTS	22	12	130	-	66
Total Sulphur	mg/kg	100	NONE	6100	2900	6700	-	6300
Total Organic Carbon (TOC)	%	0.1	MCERTS	1.2	1.6	1.8	-	1.7
Loss on Ignition @ 450°C	%	0.2	MCERTS	35	26	35	-	27
Total Phenols								
Total Phenols (monohydric)	mg/kg	2	MCERTS	< 2.0	< 2.0	< 2.0	-	< 2.0
Speciated PAHs								
Naphthalene	mg/kg	0.05	MCERTS	0.68	0.63	0.87	-	0.68
Acenaphthylene	mg/kg	0.2	MCERTS	< 0.20	< 0.20	< 0.20	-	< 0.20
Acenaphthene	mg/kg	0.1	MCERTS	< 0.10	< 0.10	< 0.10	-	< 0.10
Fluorene	mg/kg	0.2	MCERTS	< 0.20	< 0.20	0.26	-	< 0.20
Phenanthrene	mg/kg	0.2	MCERTS	1.3	1.2	1.3	-	1.2
Anthracene	mg/kg	0.1	MCERTS	< 0.10	< 0.10	< 0.10	-	< 0.10
Fluoranthene	mg/kg	0.2	MCERTS	< 0.20	0.41	< 0.20	-	0.33
Pyrene	mg/kg	0.2	MCERTS	< 0.20	0.35	< 0.20	-	0.32
Benzo(a)anthracene	mg/kg	0.2	MCERTS	< 0.20	0.27	< 0.20	-	0.22
Chrysene	mg/kg	0.05	MCERTS	0.64	0.79	0.63	-	0.72
Benzo(b)fluoranthene	mg/kg	0.1	MCERTS	< 0.10	0.56	0.44	-	0.54
Benzo(k)fluoranthene	mg/kg	0.2	MCERTS	< 0.20	0.27	0.23	-	0.22
Benzo(a)pyrene	mg/kg	0.1	MCERTS	< 0.10	0.21	< 0.10	-	0.21
Indeno(1,2,3-cd)pyrene	mg/kg	0.2	MCERTS	< 0.20	< 0.20	< 0.20	-	< 0.20
Dibenz(a,h)anthracene	mg/kg	0.2	MCERTS	< 0.20	< 0.20	< 0.20	-	< 0.20
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	-	< 0.05
Total PAH								
Speciated Total EPA-16 PAHs	mg/kg	1.6	MCERTS	2.6	4.8	3.8	-	4.6
Heavy Metals / Metalloids								
Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	18	18	17	-	18
Beryllium (aqua regia extractable)	mg/kg	0.06	MCERTS	1.0	1.0	1.0	-	0.9
Boron (water soluble)	mg/kg	0.2	MCERTS	< 0.2	< 0.2	< 0.2	-	< 0.2
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	0.3	0.3	0.3	-	0.5
Chromium (hexavalent)	mg/kg	4	MCERTS	< 4.0	< 4.0	< 4.0	-	< 4.0
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	8.8	11	9.8	-	13
Copper (aqua regia extractable)	mg/kg	1	MCERTS	63	65	68	-	67
Lead (aqua regia extractable)	mg/kg	2	MCERTS	34	32	36	-	41
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3	< 0.3	< 0.3	-	< 0.3
Nickel (aqua regia extractable)	mg/kg	2	MCERTS	40	36	33	-	31
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	-	< 1.0
Vanadium (aqua regia extractable)	mg/kg	1	MCERTS	15	15	14	-	17
Zinc (aqua regia extractable)	mg/kg	2	MCERTS	86	87	82	-	110

Analytical Report Number: 13-48791
Project / Site name: Toyoda Gosei, Gorseinon

Lab Sample Number				301874	301875	301876	301877	301878
Sample Reference				TP1	TP3	TP5	TP6	TP7
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				2.00	0.80	1.00	0.60	0.90
Date Sampled				29/11/2013	29/11/2013	29/11/2013	29/11/2013	29/11/2013
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
Petroleum Hydrocarbons								
TPH-CWG - Aliphatic >EC5 - EC6	mg/kg	0.1	MCERTS	< 0.1	-	< 0.1	-	-
TPH-CWG - Aliphatic >EC6 - EC8	mg/kg	0.1	MCERTS	< 0.1	-	< 0.1	-	-
TPH-CWG - Aliphatic >EC8 - EC10	mg/kg	0.1	MCERTS	< 0.1	-	< 0.1	-	-
TPH-CWG - Aliphatic >EC10 - EC12	mg/kg	1	MCERTS	< 1.0	-	< 1.0	-	-
TPH-CWG - Aliphatic >EC12 - EC16	mg/kg	2	MCERTS	< 2.0	-	2.9	-	-
TPH-CWG - Aliphatic >EC16 - EC21	mg/kg	8	MCERTS	< 8.0	-	10	-	-
TPH-CWG - Aliphatic >EC21 - EC35	mg/kg	8	MCERTS	< 8.0	-	51	-	-
TPH-CWG - Aliphatic >EC16 - EC35	mg/kg	10	NONE	< 10	-	61	-	-
TPH-CWG - Aliphatic > EC35 - EC44	mg/kg	8.4	NONE	< 8.4	-	< 8.4	-	-
TPH-CWG - Aliphatic (EC5 - EC35)	mg/kg	10	MCERTS	< 10	-	64	-	-
TPH-CWG - Aliphatic (EC5 - EC44)	mg/kg	10	NONE	< 10	-	64	-	-
TPH-CWG - Aromatic >EC5 - EC7	mg/kg	0.1	MCERTS	< 0.1	-	< 0.1	-	-
TPH-CWG - Aromatic >EC7 - EC8	mg/kg	0.1	MCERTS	< 0.1	-	< 0.1	-	-
TPH-CWG - Aromatic >EC8 - EC10	mg/kg	0.1	MCERTS	< 0.1	-	< 0.1	-	-
TPH-CWG - Aromatic >EC10 - EC12	mg/kg	1	MCERTS	< 1.0	-	< 1.0	-	-
TPH-CWG - Aromatic >EC12 - EC16	mg/kg	2	MCERTS	< 2.0	-	< 2.0	-	-
TPH-CWG - Aromatic >EC16 - EC21	mg/kg	10	MCERTS	< 10	-	< 10	-	-
TPH-CWG - Aromatic >EC21 - EC35	mg/kg	10	MCERTS	< 10	-	< 10	-	-
TPH-CWG - Aromatic > EC35 - EC44	mg/kg	8.4	NONE	< 8.4	-	< 8.4	-	-
TPH-CWG - Aromatic (EC5 - EC35)	mg/kg	10	MCERTS	< 10	-	< 10	-	-
TPH-CWG - Aromatic (EC5 - EC44)	mg/kg	10	NONE	< 10	-	< 10	-	-
TPH Total C5 - C44	mg/kg	10	NONE	< 10	-	64	-	-

Analytical Report Number: 13-48791

Project / Site name: Toyoda Gosei, Gorseinon

Lab Sample Number				301879				
Sample Reference				TP7				
Sample Number				None Supplied				
Depth (m)				1.30				
Date Sampled				29/11/2013				
Time Taken				None Supplied				
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
Stone Content	%	0.1	NONE	< 0.1				
Moisture Content	%	N/A	NONE	12				
Total mass of sample received	kg	0.001	NONE	0.40				
Asbestos in Soil	Type	N/A	ISO 17025	Not-detected				
General Inorganics								
pH	pH Units	N/A	MCERTS	7.1				
Total Cyanide	mg/kg	1	MCERTS	< 1				
Total Sulphate as SO_4	mg/kg	100	ISO 17025	1300				
Water Soluble Sulphate (Soil Equivalent)	g/l	0.0025	MCERTS	0.54				
Water Soluble Sulphate as SO_4 (2:1)	mg/kg	2.5	MCERTS	540				
Water Soluble Sulphate (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	0.27				
Sulphide	mg/kg	1	MCERTS	42				
Total Sulphur	mg/kg	100	NONE	1500				
Total Organic Carbon (TOC)	%	0.1	MCERTS	1.5				
Loss on Ignition @ 450°C	%	0.2	MCERTS	8.2				
Total Phenols								
Total Phenols (monohydric)	mg/kg	2	MCERTS	< 2.0				
Speciated PAHs								
Naphthalene	mg/kg	0.05	MCERTS	< 0.05				
Acenaphthylene	mg/kg	0.2	MCERTS	< 0.20				
Acenaphthene	mg/kg	0.1	MCERTS	< 0.10				
Fluorene	mg/kg	0.2	MCERTS	< 0.20				
Phenanthrene	mg/kg	0.2	MCERTS	< 0.20				
Anthracene	mg/kg	0.1	MCERTS	< 0.10				
Fluoranthene	mg/kg	0.2	MCERTS	< 0.20				
Pyrene	mg/kg	0.2	MCERTS	< 0.20				
Benzo(a)anthracene	mg/kg	0.2	MCERTS	< 0.20				
Chrysene	mg/kg	0.05	MCERTS	< 0.05				
Benzo(b)fluoranthene	mg/kg	0.1	MCERTS	< 0.10				
Benzo(k)fluoranthene	mg/kg	0.2	MCERTS	< 0.20				
Benzo(a)pyrene	mg/kg	0.1	MCERTS	< 0.10				
Indeno(1,2,3-cd)pyrene	mg/kg	0.2	MCERTS	< 0.20				
Dibenz(a,h)anthracene	mg/kg	0.2	MCERTS	< 0.20				
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	< 0.05				
Total PAH								
Speciated Total EPA-16 PAHs	mg/kg	1.6	MCERTS	< 1.6				
Heavy Metals / Metalloids								
Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	35				
Beryllium (aqua regia extractable)	mg/kg	0.06	MCERTS	1.8				
Boron (water soluble)	mg/kg	0.2	MCERTS	2.7				
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	11				
Chromium (hexavalent)	mg/kg	4	MCERTS	< 4.0				
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	190				
Copper (aqua regia extractable)	mg/kg	1	MCERTS	410				
Lead (aqua regia extractable)	mg/kg	2	MCERTS	620				
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3				
Nickel (aqua regia extractable)	mg/kg	2	MCERTS	65				
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0				
Vanadium (aqua regia extractable)	mg/kg	1	MCERTS	200				
Zinc (aqua regia extractable)	mg/kg	2	MCERTS	1500				

Analytical Report Number: 13-48791
Project / Site name: Toyoda Gosei, Gorseinon

Lab Sample Number				301879				
Sample Reference				TP7				
Sample Number				None Supplied				
Depth (m)				1.30				
Date Sampled				29/11/2013				
Time Taken				None Supplied				
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
Petroleum Hydrocarbons								
TPH-CWG - Aliphatic >EC5 - EC6	mg/kg	0.1	MCERTS	-				
TPH-CWG - Aliphatic >EC6 - EC8	mg/kg	0.1	MCERTS	-				
TPH-CWG - Aliphatic >EC8 - EC10	mg/kg	0.1	MCERTS	-				
TPH-CWG - Aliphatic >EC10 - EC12	mg/kg	1	MCERTS	-				
TPH-CWG - Aliphatic >EC12 - EC16	mg/kg	2	MCERTS	-				
TPH-CWG - Aliphatic >EC16 - EC21	mg/kg	8	MCERTS	-				
TPH-CWG - Aliphatic >EC21 - EC35	mg/kg	8	MCERTS	-				
TPH-CWG - Aliphatic >EC16 - EC35	mg/kg	10	NONE	-				
TPH-CWG - Aliphatic > EC35 - EC44	mg/kg	8.4	NONE	-				
TPH-CWG - Aliphatic (EC5 - EC35)	mg/kg	10	MCERTS	-				
TPH-CWG - Aliphatic (EC5 - EC44)	mg/kg	10	NONE	-				
TPH-CWG - Aromatic >EC5 - EC7	mg/kg	0.1	MCERTS	-				
TPH-CWG - Aromatic >EC7 - EC8	mg/kg	0.1	MCERTS	-				
TPH-CWG - Aromatic >EC8 - EC10	mg/kg	0.1	MCERTS	-				
TPH-CWG - Aromatic >EC10 - EC12	mg/kg	1	MCERTS	-				
TPH-CWG - Aromatic >EC12 - EC16	mg/kg	2	MCERTS	-				
TPH-CWG - Aromatic >EC16 - EC21	mg/kg	10	MCERTS	-				
TPH-CWG - Aromatic >EC21 - EC35	mg/kg	10	MCERTS	-				
TPH-CWG - Aromatic > EC35 - EC44	mg/kg	8.4	NONE	-				
TPH-CWG - Aromatic (EC5 - EC35)	mg/kg	10	MCERTS	-				
TPH-CWG - Aromatic (EC5 - EC44)	mg/kg	10	NONE	-				
TPH Total C5 - C44	mg/kg	10	NONE	-				

Analytical Report Number : 13-48791

Project / Site name: Toyoda Gosei, Gorseinon

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

Stone content of a sample is calculated as the % weight of the stones not passing a 2 mm sieve. Results are not corrected for stone content.

Lab Sample Number	Sample Reference	Sample Number	Depth (m)	Sample Description *
301874	TP1	None Supplied	2.00	Black gravelly topsoil with coal.
301875	TP3	None Supplied	0.80	Black gravelly topsoil with coal.
301876	TP5	None Supplied	1.00	Black gravelly topsoil with coal.
301877	TP6	None Supplied	0.60	-
301878	TP7	None Supplied	0.90	Black gravelly topsoil with coal.
301879	TP7	None Supplied	1.30	Brown topsoil and gravel with coal.

Analytical Report Number : 13-48791

Project / Site name: Toyoda Gosei, Gorseinon

Water matrix abbreviations: Surface Water (SW) Potable Water (PW) Ground Water (GW)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Asbestos identification in soil	Asbestos Identification with the use of polarised light microscopy in conjunction with disperion staining techniques.	In house method based on HSG 248	A001-PL	D	ISO 17025
Boron, water soluble, in soil	Determination of water soluble boron in soil by hot water extract followed by ICP-OES.	In-house method based on Second Site Properties version 3	L038-PL	D	MCERTS
Hexavalent chromium in soil	Determination of hexavalent chromium in soil by extraction in water then by acidification, addition of 1,5 diphenylcarbazide followed by colorimetry.	In-house method	L080-PL	D	MCERTS
Loss on ignition of soil @ 450oC	Determination of loss on ignition in soil by gravimetrically with the sample being ignited in a muffle furnace.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L047-PL	D	MCERTS
Metals in soil by ICP-OES	Determination of metals in soil by aqua-regia digestion followed by ICP-OES.	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.	L038-PL	D	MCERTS
Moisture Content	Moisture content, determined gravimetrically.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L019-UK/PL	W	NONE
Monohydric phenols in soil	Determination of phenols in soil by extraction with sodium hydroxide followed by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (skalar)	L080-PL	W	MCERTS
pH in soil	Determination of pH in soil by addition of water followed by electrometric measurement.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L005-PL	W	MCERTS
Speciated EPA-16 PAHs in soil	Determination of PAH compounds in soil by extraction in dichloromethane and hexane followed by GC-MS with the use of surrogate and internal standards.	In-house method based on USEPA 8270	L064-PL	D	MCERTS
Stones content of soil	Standard preparation for all samples unless otherwise detailed. Stones not passing through a 10 mm sieve is determined gravimetrically and reported as a percentage of the dry weight. Sample	In-house method based on British Standard Methods and MCERTS requirements.	L019-UK/PL	D	NONE
Sulphate, water soluble, in soil	Determination of water soluble sulphate by extraction with water followed by ICP-OES. Results reported corrected for extraction ratio (soil equivalent) as g/l and mg/kg; and upon the 2:1	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L038-PL	D	MCERTS
Sulphide in soil	Determination of sulphide in soil by acidification and heating to liberate hydrogen sulphide, trapped in an alkaline solution then assayed by ion selective electrode.	In-house method	L010-PL	D	MCERTS
Total cyanide in soil	Determination of total cyanide by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (Skalar)	L080-PL	W	MCERTS
Total organic carbon in soil	Determination of organic matter in soil by oxidising with potassium dichromate followed by titration with iron (II) sulphate.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L023-PL	D	MCERTS
Total sulphate (as SO4 in soil)	Determination of total sulphate in soil by extraction with 10% HCl followed by ICP-OES.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L038-PL	D	ISO 17025
Total Sulphur in soil	Determination of total sulphur in soil by extraction with aqua-regia, potassium bromide/bromate followed by ICP-OES.	In-house method based on BS1377 Part 3, 1990, and MEWAM 2006 Methods for the Determination of Metals in Soil	L038-PL	D	NONE
TPH7 (Soil)	Determination of dichloromethane/hexane extractable hydrocarbons in soil by GC-MS.	In-house method	L064-UK	D	NONE

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Analytical Report Number : 13-48791

Project / Site name: Toyoda Gosei, Gorseinon

Water matrix abbreviations: Surface Water (SW) Potable Water (PW) Ground Water (GW)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
TPHCWG (Soil)	Determination of pentane extractable hydrocarbons in soil by GC-MS/GC-FID.	In-house method	L076-PL	W	MCERTS

For method numbers ending in 'UK' analysis have been carried out in our laboratory in the United Kingdom.
For method numbers ending in 'PL' analysis have been carried out in our laboratory in Poland.
Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received the results obtained are multiplied by a moisture correction factor that is determined gravimetrically using the moisture content which is carried out at a maximum of 30oC.

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7 Woodshots Meadow,
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e: reception@i2analytical.com

Analytical Report Number : 13-48895

Project / Site name:	Toyoda Gosei, Gorseinon	**Samples received on:**	06/12/2013
Your job number:	11266	**Samples instructed on:**	06/12/2013
Your order number:		**Analysis completed by:**	16/12/2013
Report Issue Number:	1	**Report issued on:**	16/12/2013
Samples Analysed:	1 soil sample		

Signed:

Dr Claire Stone
Quality Manager
For & on behalf of i2 Analytical Ltd.

Signed:

Rexona Rahman
Customer Services Manager
For & on behalf of i2 Analytical Ltd.

Other office located at: ul. Pionierów 39, 41 -711 Ruda Śląska, Poland

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

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

Excel copies of reports are only valid when accompanied by this PDF certificate.

Analytical Report Number: 13-48895

Project / Site name: Toyoda Gosei, Gorseinon

Lab Sample Number				302392				
Sample Reference				BH1				
Sample Number				None Supplied				
Depth (m)				1.00				
Date Sampled				29/11/2013				
Time Taken				1200				
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
Stone Content	%	0.1	NONE	< 0.1				
Moisture Content	%	N/A	NONE	7.7				
Total mass of sample received	kg	0.001	NONE	0.40				
Asbestos in Soil	Type	N/A	ISO 17025	Not-detected				
General Inorganics								
pH	pH Units	N/A	MCERTS	6.8				
Total Cyanide	mg/kg	1	MCERTS	< 1				
Total Sulphate as SO_4	mg/kg	100	ISO 17025	2100				
Water Soluble Sulphate (Soil Equivalent)	g/l	0.0025	MCERTS	1.2				
Water Soluble Sulphate as SO_4 (2:1)	mg/kg	2.5	MCERTS	1200				
Water Soluble Sulphate (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	0.58				
Sulphide	mg/kg	1	MCERTS	18				
Total Sulphur	mg/kg	100	NONE	4200				
Total Organic Carbon (TOC)	%	0.1	MCERTS	1.0				
Loss on Ignition @ 450°C	%	0.2	MCERTS	14				
Total Phenols								
Total Phenols (monohydric)	mg/kg	2	MCERTS	< 2.0				
Speciated PAHs								
Naphthalene	mg/kg	0.05	MCERTS	0.93				
Acenaphthylene	mg/kg	0.2	MCERTS	< 0.20				
Acenaphthene	mg/kg	0.1	MCERTS	< 0.10				
Fluorene	mg/kg	0.2	MCERTS	< 0.20				
Phenanthrene	mg/kg	0.2	MCERTS	1.1				
Anthracene	mg/kg	0.1	MCERTS	< 0.10				
Fluoranthene	mg/kg	0.2	MCERTS	0.20				
Pyrene	mg/kg	0.2	MCERTS	0.20				
Benzo(a)anthracene	mg/kg	0.2	MCERTS	0.26				
Chrysene	mg/kg	0.05	MCERTS	0.33				
Benzo(b)fluoranthene	mg/kg	0.1	MCERTS	< 0.10				
Benzo(k)fluoranthene	mg/kg	0.2	MCERTS	< 0.20				
Benzo(a)pyrene	mg/kg	0.1	MCERTS	< 0.10				
Indeno(1,2,3-cd)pyrene	mg/kg	0.2	MCERTS	< 0.20				
Dibenz(a,h)anthracene	mg/kg	0.2	MCERTS	< 0.20				
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	< 0.05				
Total PAH								
Speciated Total EPA-16 PAHs	mg/kg	1.6	MCERTS	3.0				
Heavy Metals / Metalloids								
Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	30				
Beryllium (aqua regia extractable)	mg/kg	0.06	MCERTS	1.1				
Boron (water soluble)	mg/kg	0.2	MCERTS	< 0.2				
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	0.3				
Chromium (hexavalent)	mg/kg	4	MCERTS	< 4.0				
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	13				
Copper (aqua regia extractable)	mg/kg	1	MCERTS	66				
Lead (aqua regia extractable)	mg/kg	2	MCERTS	36				
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3				
Nickel (aqua regia extractable)	mg/kg	2	MCERTS	36				
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0				
Vanadium (aqua regia extractable)	mg/kg	1	MCERTS	18				
Zinc (aqua regia extractable)	mg/kg	2	MCERTS	90				

4041

Analytical Report Number : 13-48895

Project / Site name: Toyoda Gosei, Gorseinon

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

Stone content of a sample is calculated as the % weight of the stones not passing a 2 mm sieve. Results are not corrected for stone content.

Lab Sample Number	Sample Reference	Sample Number	Depth (m)	Sample Description *
302392	BH1	None Supplied	1.00	Black clay and topsoil with coal and vegetation.

4041

Analytical Report Number : 13-48895

Project / Site name: Toyoda Gosei, Gorseinon

Water matrix abbreviations: Surface Water (SW) Potable Water (PW) Ground Water (GW)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Asbestos identification in soil	Asbestos Identification with the use of polarised light microscopy in conjunction with disperion staining techniques.	In house method based on HSG 248	A001-PL	D	ISO 17025
Boron, water soluble, in soil	Determination of water soluble boron in soil by hot water extract followed by ICP-OES.	In-house method based on Second Site Properties version 3	L038-PL	D	MCERTS
Hexavalent chromium in soil	Determination of hexavalent chromium in soil by extraction in water then by acidification, addition of 1,5 diphenylcarbazide followed by colorimetry.	In-house method	L080-PL	D	MCERTS
Loss on ignition of soil @ 450oC	Determination of loss on ignition in soil by gravimetrically with the sample being ignited in a muffle furnace.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L047-PL	D	MCERTS
Metals in soil by ICP-OES	Determination of metals in soil by aqua-regia digestion followed by ICP-OES.	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.	L038-PL	D	MCERTS
Moisture Content	Moisture content, determined gravimetrically.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L019-UK/PL	W	NONE
Monohydric phenols in soil	Determination of phenols in soil by extraction with sodium hydroxide followed by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (skalar)	L080-PL	W	MCERTS
pH in soil	Determination of pH in soil by addition of water followed by electrometric measurement.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L005-PL	W	MCERTS
Speciated EPA-16 PAHs in soil	Determination of PAH compounds in soil by extraction in dichloromethane and hexane followed by GC-MS with the use of surrogate and internal standards.	In-house method based on USEPA 8270	L064-PL	D	MCERTS
Stones content of soil	Standard preparation for all samples unless otherwise detailed. Stones not passing through a 10 mm sieve is determined gravimetrically and reported as a percentage of the dry weight. Sample	In-house method based on British Standard Methods and MCERTS requirements.	L019-UK/PL	D	NONE
Sulphate, water soluble, in soil	Determination of water soluble sulphate by extraction with water followed by ICP-OES. Results reported corrected for extraction ratio (soil equivalent) as g/l and mg/kg; and upon the 2:1	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L038-PL	D	MCERTS
Sulphide in soil	Determination of sulphide in soil by acidification and heating to liberate hydrogen sulphide, trapped in an alkaline solution then assayed by ion selective electrode.	In-house method	L010-PL	D	MCERTS
Total cyanide in soil	Determination of total cyanide by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (Skalar)	L080-PL	W	MCERTS
Total organic carbon in soil	Determination of organic matter in soil by oxidising with potassium dichromate followed by titration with iron (II) sulphate.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L023-PL	D	MCERTS
Total sulphate (as SO4 in soil)	Determination of total sulphate in soil by extraction with 10% HCl followed by ICP-OES.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L038-PL	D	ISO 17025
Total Sulphur in soil	Determination of total sulphur in soil by extraction with aqua-regia, potassium bromide/bromate followed by ICP-OES.	In-house method based on BS1377 Part 3, 1990, and MEWAM 2006 Methods for the Determination of Metals in Soil	L038-PL	D	NONE

For method numbers ending in 'UK' analysis have been carried out in our laboratory in the United Kingdom.
For method numbers ending in 'PL' analysis have been carried out in our laboratory in Poland.
Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received the results obtained are multiplied by a moisture correction factor that is determined gravimetrically using the moisture content which is carried out at a maximum of 30oC.

APPENDIX H

LABORATORY GEOTECHNICAL TESTING RESULTS

2788

Laboratory Report

GSTL
GEO Site & Testing Services Ltd

Contract Number: 21708

Client's Reference: **11266/JJ**

Report Date: **17-12-2013**

Client **Integral Geotechnique (Wales) Limited**
7 Beddau Way
Castlegate Business Park
Caerphilly
Cardiff
CF83 2AX

Contract Title: **Toyoda Gosei, Gorseinon**
For the attention of: **Jack**

Date Received: **04-12-2013**
Date Commenced: **04-12-2013**
Date Completed: **17-12-2013**

Test Description	Qty
Moisture Content 1377 : 1990 Part 2 : 3.2 - UKAS *	4.0
4 Point Liquid & Plastic Limit (LL/PL) 1377 : 1990 Part 2 : 4.3 & 5.3 - UKAS *	4.0
pH Value of Soil 1377 : 1990 Part 3 : 9	4.0
Water Soluble Sulphate 2:1 extract 1377 : 1990 Part 3 : 5	4.0

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

Approved Signatories:
Alex Wynn (Associate Director) - Benjamin Sharp (Contracts Manager) - Emma Williams (Office Manager)
Paul Evans (Quality/Technical Manager) - Vaughan Edwards (Managing Director)

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

Client ref: 11266/JJ

Location: Toyoda Gosei, Gorseinon

Contract Number: 21708

Hole Number	Sample Number	Type	Depth (m)	Description of Sample*
TP3	0	S	2.50	Brown silty CLAY.
TP5	0	S	2.70	Grey silty CLAY.
TP6	0	S	2.80	Brown sandy fine to medium gravelly silty CLAY.
TP7	0	S	2.00	Brown fine to medium gravelly silty CLAY.

Note: Results on this table are in summary format and may not meet the requirements of the relevant standards, additional information is held by the laboratory

GSTL
GEO Site & Testing Services Limited

Checked By

D P Evans
Approved By:

Date Approved: 17.12.13

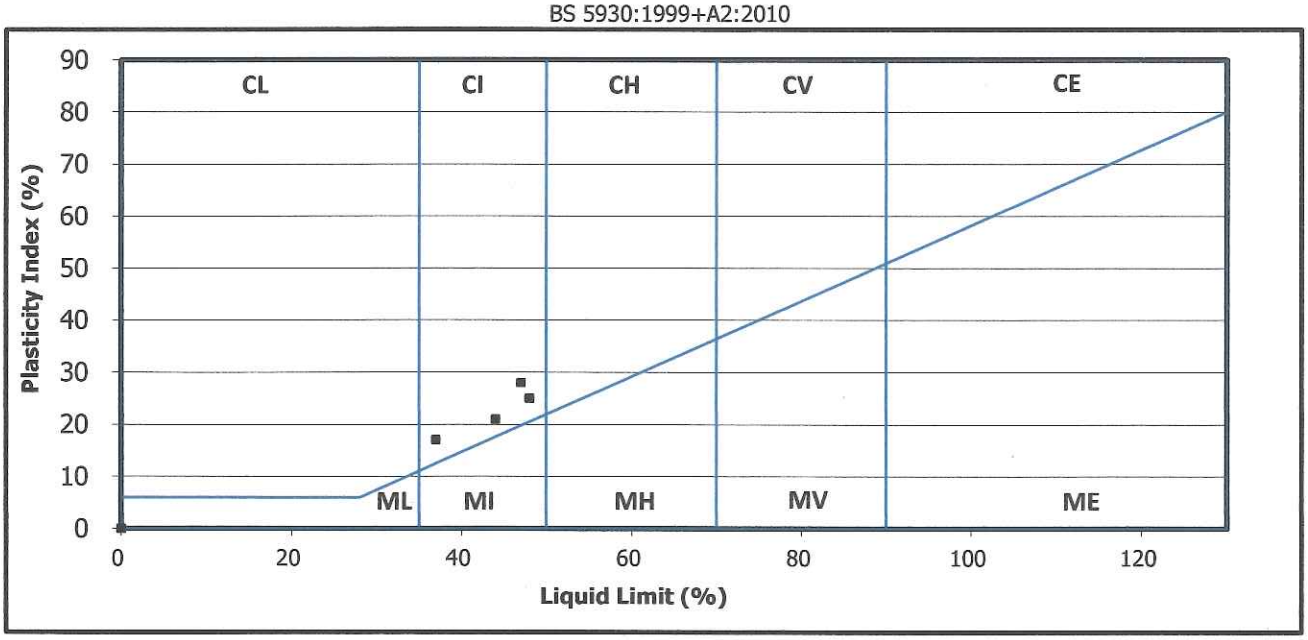
Test Report: **Method of the Determination of the plastic limit and plasticity index**
BS 1377 : Part 2 : 1990 Method 5

Client ref: **11266/JJ**
Location: **Toyoda Gosei, Gorseinon**
Contract Number: **21708**

Hole/ Sample Number	Sample Type	Depth m	Moisture Content % Cl. 3.2	Liquid Limit % Cl. 4.3/4.4	Plastic Limit % Cl. 5.	Plasticity Index % Cl. 6.	% Passing .425mm	Remarks
TP3	S	2.50	21.0	47	19	28	100	CI Intermediate Plasticity
TP5	S	2.70	23.9	44	23	21	100	CI Intermediate Plasticity
TP6	S	2.80	21.5	37	20	17	94	CI Intermediate Plasticity
TP7	S	2.00	26.2	48	23	25	96	CI Intermediate Plasticity

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

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



GSTL
GEO Site & Testing Services Limited

Checked By

Approved By:

Date Approved: 17.12.13

UKAS TESTING 2788

GSTL
GEO Site & Testing Services Limited

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e-mail: info@geo.uk.com

Certificate of Analysis

Date:	16/12/2013
Client:	Integral
Our Reference:	21708-041213
Client Reference:	11266
Contract Title:	Toyoda Gosei, Gorseinon
Description: (Total Samples)	4
Date Received:	04/12/2013
Date Started:	11/12/2013
Date Completed:	15/12/2013
Test Procedures:	(B.S. 1377 : PART 3 : 1990)

Notes:

Solid samples will be disposed 1 month and liquids 2 weeks

Approved By:

Authorised Signatories:	Vaughan Edwards	Dafydd Simon	Paul Evans
	Managing Director	Team Leader	Technical Manager

Contract No: 21708-041213
Client Ref: 11266
Location: Toyoda Gosei, Gorseinon
Date: 15/12/2013

GEO Site & Testing Services Limited

SUMMARY OF CHEMICAL ANALYSES

(B.S. 1377 : PART 3 : 1990)

Hole Number	Sample Number	Depth m	Sulphate Content SO3 (as SO_4)			Chloride Content		pH Value @ 25°C	Organic Matter Content %	Loss on Ignition %	Remarks
			Acid Soluble Sulphate as % SO_4	Aqueous Extract Sulphate as g/l SO_4	Ground-water g/l	Soluble Chloride as % equiv. NaCl	Ground-water g/l				
			Clause 5.5.	Clause 5.5.	Clause 5.4.	Clause 7.3	Clause 7.2	Clause 9.	Clause 3.	Clause 4.	
TP3		2.50		<.01 (<.01)				7.74			
TP5		2.70		0.01 (0.02)				7.51			
TP6		2.80		0.02 (0.02)				7.33			
TP7		2.00		<.01 (<.01)				7.11			

NCP - No Chloride present
G.L - Ground Level

Laboratory Report

2788

GSTL
GEO Site & Testing Services Ltd

Contract Number: 21723

Client's Reference: **11266/JJ**

Report Date: **18-12-2013**

Client **Integral Geotechnique (Wales) Limited**
7 Beddau Way
Castlegate Business Park
Caerphilly
Cardiff
CF83 2AX

Contract Title: **Toyoda Gosei, Gorseinon**
For the attention of: **Jack**

Date Received: **09-12-2013**
Date Commenced: **09-12-2013**
Date Completed: **18-12-2013**

Test Description	Qty
Moisture Content 1377 : 1990 Part 2 : 3.2 - UKAS *	2.0
4 Point Liquid & Plastic Limit (LL/PL) 1377 : 1990 Part 2 : 4.3 & 5.3 - UKAS *	2.0
pH Value of Soil 1377 : 1990 Part 3 : 9	2.0
Water Soluble Sulphate 2:1 extract 1377 : 1990 Part 3 : 5	2.0

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

Approved Signatories:
Alex Wynn (Associate Director) - Benjamin Sharp (Contracts Manager) - Emma Williams (Office Manager)
Paul Evans (Quality/Technical Manager) - Vaughan Edwards (Managing Director)

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

Client ref: 11266/JJ

Location: Toyoda Gosei, Gorseinon

Contract Number: 21723

Hole Number	Sample Number	Type	Depth (m)	Description of Sample*
BH1		S	1.00	Grey slightly clayey silty fine to coarse GRAVEL.
BH2		S	2.00	Brown fine to medium gravelly silty CLAY.

Note: Results on this table are in summary format and may not meet the requirements of the relevant standards, additional information is held by the laboratory

GSTL
GEO Site & Testing Services Limited

Checked By

D P Evans
Approved By:

Date Approved: 18.12.13

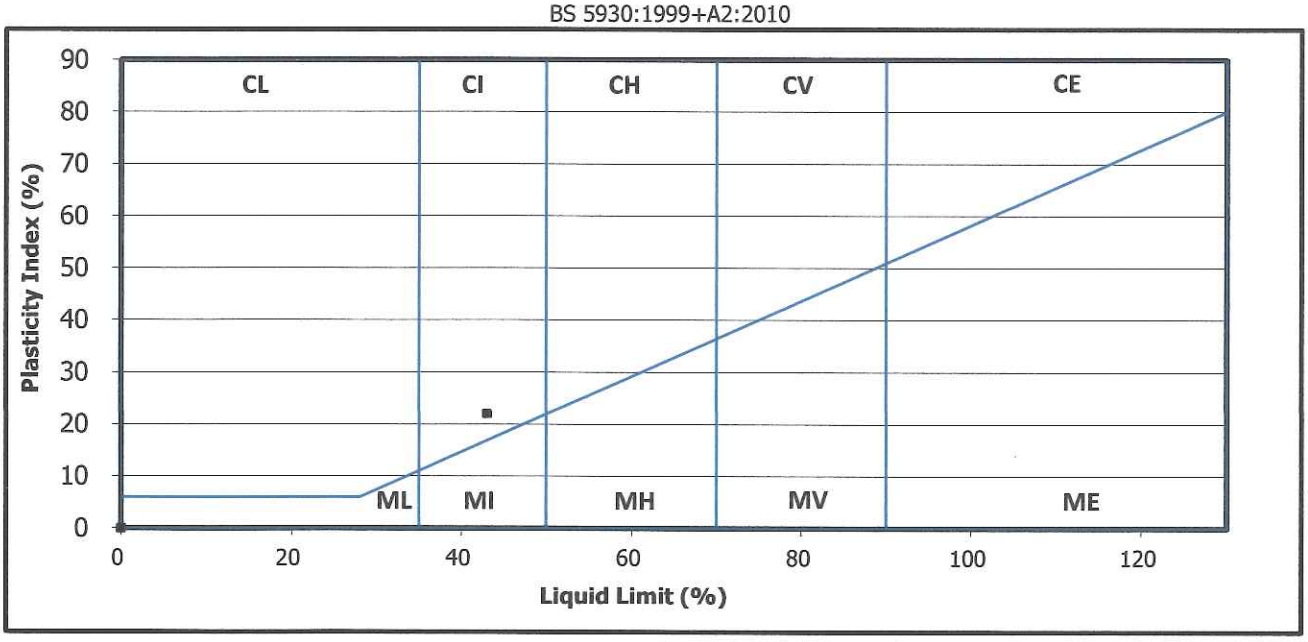
Test Report: **Method of the Determination of the plastic limit and plasticity index**
BS 1377 : Part 2 : 1990 Method 5

Client ref: 11266/JJ
Location: Toyoda Gosei, Gorseinon
Contract Number: 21723

Hole/ Sample Number	Sample Type	Depth m	Moisture Content % Cl. 3.2	Liquid Limit % Cl. 4.3/4.4	Plastic Limit % Cl. 5.	Plasticity Index % Cl. 6.	% Passing .425mm	Remarks
BH1	S	1.00	11.1		NP		20	
BH2	S	2.00	19.1	43	21	22	94	CI Intermediate Plasticity

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

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



GSTL
GEO Site & Testing Services Limited

Checked By

Approved By:

Date Approved: 18.12.13

UKAS TESTING 2788

GSTL
GEO Site & Testing Services Limited

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e-mail: info@geo.uk.com

Certificate of Analysis

Date:	16/12/2013
Client:	Integral
Our Reference:	21723-091213
Client Reference:	11266
Contract Title:	Toyoda Gosei, Gorseinon
Description: (Total Samples)	2
Date Received:	09/12/2013
Date Started:	11/12/2013
Date Completed:	15/12/2013
Test Procedures:	(B.S. 1377 : PART 3 : 1990)

Notes:

Solid samples will be disposed 1 month and liquids 2 weeks

Approved By:

Authorised Signatories:	Vaughan Edwards	Dafydd Simon	Paul Evans
	Managing Director	Team Leader	Technical Manager

Contract No: 21723-091213
Client Ref: 11266
Location: Toyoda Gosei, Gorseinon
Date: 15/12/2013

GSTL
GEO Site & Testing Services Limited

SUMMARY OF CHEMICAL ANALYSES

(B.S. 1377 : PART 3 : 1990)

Hole Number	Sample Number	Depth m	Sulphate Content SO3 (as SO_4)			Chloride Content		pH Value @ 25°C	Organic Matter Content %	Loss on Ignition %	Remarks
			Acid Soluble Sulphate as % SO_4	Aqueous Extract Sulphate as g/l SO_4	Ground-water g/l	Soluble Chloride as % equiv. NaCl	Ground-water g/l				
			Clause 5.5.	Clause 5.5.	Clause 5.4.	Clause 7.3	Clause 7.2	Clause 9.	Clause 3.	Clause 4.	
BH1		1.00		0.47 (0.57)				7.77			
BH2		2.00		0.09 (0.11)				7.70			

NCP - No Chloride present
G.L - Ground Level

APPENDIX I

IN-SITU GAS MONITORING RESULTS

FIELD GAS MONITORING RESULTS - SUMMARY

Job No.: 11266
Site: Toyoda Gorsei

Maximum Methane Concentration (%)	Maximum Carbon Dioxide Concentration (%)	Maximum Gas Concentration (%)	Maximum Gas Flow Rate (l/hr)	GSV (l/hr)
<0.5	1.40	1.40	<0.3	<0.0042

Methane							
Location	Round 1	Round 2	Round 3	Round 4	Round 5	Round 6	Maximum
BH 1	<0.5	<0.5	<0.5				<0.50
BH 2	<0.5	<0.5	<0.5				<0.50

Carbon Dioxide							
Location	Round 1	Round 2	Round 3	Round 4	Round 5	Round 6	Maximum
BH 1	<0.5	<0.5	<0.5				<0.50
BH 2	1.30	1.40	1.10				1.40

Oxygen							
Location	Round 1	Round 2	Round 3	Round 4	Round 5	Round 6	Minimum
BH 1	21.10	20.90	20.10				20.10
BH 2	7.70	6.30	5.20				5.20

Gas Flow Rate							
Location	Round 1	Round 2	Round 3	Round 4	Round 5	Round 6	Maximum
BH 1	<0.3	<0.3	<0.3				<0.30
BH 2	<0.3	<0.3	<0.3				<0.30

Intégral Géotechnique

FIELD GAS MONITORING RESULTS

Job No.:	11266
Site:	Toyoda Gorsei
Monitoring Date:	10.12.13
Monitoring Round:	1

Monitoring Conditions		Barometric Pressure (mb)	
Weather:	Cloudy	On Arrival:	1023
Ambient Temp:	11°C	During Monitoring	1023
Instrument:	GA5000	End of Monitoring	1023

Location	Well Base Level (mbgl)	Water Level (mbgl)	Methane (CH4)			Oxygen (O2) (%)	Carbon Dioxide (CO2) (%)	Carbon Monoxide (CO) (ppm)	Hydrogen Sulphide (H2S) (ppm)	Peak Gas Flow (l/hr)	VOC Vapours (ppm>background)
			LEL (%)	Average (%)	Peak (%)						
BH 1	3.3	2.3			<0.5	21.10	<0.5	<1	<1	<0.3	0.30
BH 2	4.8	4.0			<0.5	7.70	1.30	3.00	<1	<0.3	0.20

Typical Instrument Accuracy:

$\%CH_4$	0-70% +/- 0.5%	CO	0-500ppm +/- 2% FS
$\%CO_2$	0-60% +/- 0.5%	H_2S	0-5000ppm +/- 2.0% FS
$\%O_2$	0-25% +/- 1.0%	Flow from borehole	+/- 0.3l/h

LEL = Lower Explosive Limit
N/R = No Reading Taken
FS = Full Scale

Notes:

Intégral Géotechnique

FIELD GAS MONITORING RESULTS

Job No.:	11266
Site:	Toyoda Gorsei
Monitoring Date:	19.12.13
Monitoring Round:	2

Monitoring Conditions		Barometric Pressure (mb)	
Weather:	Rain/Lightning	On Arrival:	988
Ambient Temp:	7°C	During Monitoring	988
Instrument:	GA5000	End of Monitoring	988

Location	Well Base Level (mbgl)	Water Level (mbgl)	Methane (CH4)			Oxygen (O2) (%)	Carbon Dioxide (CO2) (%)	Carbon Monoxide (CO) (ppm)	Hydrogen Sulphide (H2S) (ppm)	Peak Gas Flow (l/hr)	VOC Vapours (ppm>background)
			LEL (%)	Average (%)	Peak (%)						
BH 1	3.3	2.15			<0.5	20.90	<0.5	<1	<1	<0.3	0.30
BH 2	4.8	3.96			<0.5	6.30	1.40	<1	<1	<0.3	0.10

Typical Instrument Accuracy:

$\%CH_4$	0-70% +/- 0.5%	CO	0-500ppm +/- 2% FS
$\%CO_2$	0-60% +/- 0.5%	H_2S	0-5000ppm +/- 2.0% FS
$\%O_2$	0-25% +/- 1.0%	Flow from borehole	+/- 0.3l/h

LEL = Lower Explosive Limit
N/R = No Reading Taken
FS = Full Scale

Notes:

Intégral Géotechnique

FIELD GAS MONITORING RESULTS

Job No.:	11266
Site:	Toyoda Gorsei
Monitoring Date:	09.01.14
Monitoring Round:	3

Monitoring Conditions		Barometric Pressure (mb)	
Weather:	Cloudy	On Arrival:	1004
Ambient Temp:	9°C	During Monitoring	1004
Instrument:	GA5000	End of Monitoring	1004

Location	Well Base Level (mbgl)	Water Level (mbgl)	Methane (CH4)			Oxygen (O2) (%)	Carbon Dioxide (CO2) (%)	Carbon Monoxide (CO) (ppm)	Hydrogen Sulphide (H2S) (ppm)	Peak Gas Flow (l/hr)	VOC Vapours (ppm>background)
			LEL (%)	Average (%)	Peak (%)						
BH 1	3.3	2.12			<0.5	20.10	<0.5	<1	<1	<0.3	0.10
BH 2	4.8	3.92			<0.5	5.20	1.10	<1	<1	<0.3	0.30

Typical Instrument Accuracy:

$\%CH_4$	0-70% +/- 0.5%	CO	0-500ppm +/- 2% FS
$\%CO_2$	0-60% +/- 0.5%	H_2S	0-5000ppm +/- 2.0% FS
$\%O_2$	0-25% +/- 1.0%	Flow from borehole	+/- 0.3l/h

LEL = Lower Explosive Limit
N/R = No Reading Taken
FS = Full Scale

Notes:

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APPENDIX J

SUMMARY OF LABORATORY CHEMICAL TESTING RESULTS (COLLIERY SPOIL/MADE GROUND)

SUMMARY OF LABORATORY SOIL TEST RESULTS

METALS AND SEMI-METALS

Job No.: 11266
Site: Toyoda Gosei
Soil Type: Colliery Spoil/Made Ground
Soil Organic Matter: 1%

No.	Location	Depth (m)	Arsenic (mg/kg)	Boron (mg/kg)	Beryllium (mg/kg)	Cadmium (mg/kg)	Chromium (mg/kg)	Chromium (VI) (mg/kg)	Copper (mg/kg)	Lead (mg/kg)	Mercury (Elemental) (mg/kg)	Nickel (mg/kg)	Selenium (mg/kg)	Vanadium (mg/kg)	Zinc (mg/kg)
1	TP1	2.00	18	< 0.2	1	0.3	8.8	< 4.0	63	34	< 0.3	40	< 1.0	15	86
2	TP3	0.80	18	< 0.2	1	0.3	11	< 4.0	65	32	< 0.3	36	< 1.0	15	87
3	TP5	1.00	17	< 0.2	1	0.3	9.8	< 4.0	68	36	< 0.3	33	< 1.0	14	82
4	TP6	0.60	-	-	-	-	-	-	-	-	-	-	-	-	-
5	TP7	0.90	18	< 0.2	0.9	0.5	13	< 4.0	67	41	< 0.3	31	< 1.0	17	110
6	TP7	1.30	35	2.7	1.8	11	190	< 4.0	410	620	< 0.3	65	< 1.0	200	1500
	Screening Criteria Value		640.0	192000.0	420.0	230.0	35.0	35.0	71700.0	750.0	26.0	1800.0	13000.0	3160.0	665000.0
	Source of Screening Criteria Value		SGV	LQM	LQM	SGV	LQM	LQM	LQM	SGV	SGV	SGV	SGV	LQM	LQM

SUMMARY OF LABORATORY SOIL TEST RESULTS

INORGANIC CHEMICALS & OTHERS

Job No.: 11266
Site: Toyoda Gosei
Soil Type: Colliery Spoil/Made Ground
Soil Organic Matter: 1%

No.	Location	Depth (m)	Cyanide (mg/kg)	Loss on ignition, dried solids (%)	Moisture content at 30 C (%)	Monohydric phenols (mg/kg)	pH (pH units)	Water Soluble Sulphate (g/l)	Sulphate Total as SO4 (mg/kg)	Sulphide (mg/kg)	Total Sulphur (mg/kg)	TOC by Ignition in O2 (%)
1	TP1	2.00	< 1	35	4.8	< 2.0	6.7	4.4	4700	22	6100	1.2
2	TP3	0.80	< 1	26	8.1	< 2.0	6.9	0.36	510	12	2900	1.6
3	TP5	1.00	< 1	35	6.6	< 2.0	6.6	3.7	3700	130	6700	1.8
4	TP6	0.60	-	-	-	-	-	-	-	-	-	-
5	TP7	0.90	< 1	27	5.2	< 2.0	6.9	1.5	1400	66	6300	1.7
	Screening Criteria Value		34.0	10.0	-	3200.0	5.0	-	-	-	-	6.0
	Source of Screening Criteria Value		ATRISK	WAC	-	SGV	-	-	-	-	-	WAC

Intégral Géotechnique

SUMMARY OF LABORATORY SOIL TEST RESULTS

POLYAROMATIC HYDROCARBONS (PAH)

Job No.: 11266
Site: Toyoda Gosei
Soil Type: Colliery Spoil/Made Ground
Soil Organic Matter: 1%

No.	Location	Depth (m)	Acenaphthene (mg/kg)	Acenaphthylene (mg/kg)	Anthracene (mg/kg)	Benzo(a)anthracene (mg/kg)	Benzo(a)pyrene (mg/kg)	Benzo(b)fluoranthene (mg/kg)	Benzo(ghi)perylene (mg/kg)	Benzo(k)fluoranthene (mg/kg)	Chrysene (mg/kg)	Dibenzo(ah)anthracene (mg/kg)	Fluoranthene (mg/kg)	Fluorene (mg/kg)	Indeno(123cd)pyrene (mg/kg)	Naphthalene (mg/kg)	Phenanthrene (mg/kg)	Pyrene (mg/kg)
1	TP1	2.00	< 0.10	< 0.20	< 0.10	< 0.20	< 0.10	< 0.10	< 0.05	< 0.20	0.64	< 0.20	< 0.20	< 0.20	< 0.20	0.68	1.3	< 0.20
2	TP3	0.80	< 0.10	< 0.20	< 0.10	0.27	0.21	0.56	< 0.05	0.27	0.79	< 0.20	0.41	< 0.20	< 0.20	0.63	1.2	0.35
3	TP5	1.00	< 0.10	< 0.20	< 0.10	< 0.20	< 0.10	0.44	< 0.05	0.23	0.63	< 0.20	< 0.20	0.26	< 0.20	0.87	1.3	< 0.20
4	TP6	0.60	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5	TP7	0.90	< 0.10	< 0.20	< 0.10	0.22	0.21	0.54	< 0.05	0.22	0.72	< 0.20	0.33	< 0.20	< 0.20	0.68	1.2	0.32
6	TP7	1.30	< 0.10	< 0.20	< 0.10	< 0.20	< 0.10	< 0.10	< 0.05	< 0.20	< 0.05	< 0.20	< 0.20	< 0.20	< 0.20	< 0.05	< 0.20	< 0.20
	Screening Criteria Value		85000.0	84000.0	53000.0	90.0	14.0	100.0	650.0	140.0	140.0	13.0	23000.0	64000.0	60.0	200.0	22000.0	54000.0
	Source of Screening Criteria Value		LQM	LQM	LQM	LQM	LQM	LQM	LQM	LQM	LQM	LQM	LQM	LQM	LQM	LQM	LQM	LQM

Intégral Géotechnique

SUMMARY OF LABORATORY SOIL TEST RESULTS

PETROLEUM HYDROCARBONS

Job No.: 11266
Site: Toyoda Gosei
Soil Type: Colliery Spoil/Made Ground
Soil Organic Matter: 1%

No.	Location	Depth (m)	Aliphatic C5-C6 (mg/kg)	Aliphatic C6-C8 (mg/kg)	Aliphatic C8-C10 (mg/kg)	Aliphatic C10-C12 EPH (mg/kg)	Aliphatic C12-C16 EPH (mg/kg)	Aliphatic C16-C35 EPH (mg/kg)	Aliphatic C35-C40 EPH (mg/kg)	Aromatic C5-C7 (mg/kg)	Aromatic C7-C8 (mg/kg)	Aromatic C8-C10 (mg/kg)	Aromatic C10-C12 EPH (mg/kg)	Aromatic C12-C16 EPH (mg/kg)	Aromatic C16-C21 EPH (mg/kg)	Aromatic C21-C35 EPH (mg/kg)	Aromatic C35-C40 EPH (mg/kg)
1	TP1	2.00	< 0.1	< 0.1	< 0.1	< 1.0	< 2.0	< 10	< 8.4	< 0.1	< 0.1	< 0.1	< 1.0	< 2.0	< 10	< 10	< 8.4
2	TP3	0.80	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3	TP5	1.00	< 0.1	< 0.1	< 0.1	< 1.0	2.9	61	< 8.4	< 0.1	< 0.1	< 0.1	< 1.0	< 2.0	< 10	< 10	< 8.4
4	TP6	0.60	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5	TP7	0.90	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6	TP7	1.30	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Screening Criteria Value		3400.0	8300.0	2100.0	10000.0	61000.0	1000000.0	1000000.0	95.0	4400.0	3700.0	17000.0	36000.0	28000.0	28000.0	28000.0
	Source of Screening Criteria Value		LQM	LQM	LQM	LQM	LQM	LQM	LQM	SGV	SGV	LQM	LQM	LQM	LQM	LQM	LQM

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SUMMARY OF LABORATORY SOIL TEST RESULTS

METALS AND SEMI-METALS

Job No.: 11266
Site: Toyoda Gosei
Soil Type: Colliery Spoil/Made Ground
Soil Organic Matter: 1%

No.	Location	Depth (m)	Arsenic (mg/kg)	Boron (mg/kg)	Beryllium (mg/kg)	Cadmium (mg/kg)	Chromium (mg/kg)	Chromium (VI) (mg/kg)	Copper (mg/kg)	Lead (mg/kg)	Mercury (Elemental) (mg/kg)	Nickel (mg/kg)	Selenium (mg/kg)	Vanadium (mg/kg)	Zinc (mg/kg)
1	BH1	1.00	30	< 0.2	1.1	0.3	13	< 4.0	66	36	< 0.3	36	< 1.0	18	90
	Screening Criteria Value		640.0	192000.0	420.0	230.0	35.0	35.0	71700.0	750.0	26.0	1800.0	13000.0	3160.0	655000.0
	Source of Screening Criteria Value		SGV	LQM	LQM	SGV	LQM	LQM	LQM	SGV	SGV	SGV	SGV	LQM	LQM

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SUMMARY OF LABORATORY SOIL TEST RESULTS

INORGANIC CHEMICALS & OTHERS

Job No.: 11266
Site: Toyoda Gosei
Soil Type: Colliery Spoil/Made Ground
Soil Organic Matter: 1%

No.	Location	Depth (m)	Cyanide (mg/kg)	Loss on ignition, dried solids (%)	Moisture content at 30 C (%)	Monohydric phenols (mg/kg)	pH (pH units)	Water Soluble Sulphate (g/l)	Sulphate Total as SO4 (mg/kg)	Sulphide (mg/kg)	Total Sulphur (mg/kg)	TOC by Ignition in O2 (%)
1	BH1	1.00	< 1	14	7.7	< 2.0	6.8	1.2	2100	18	4200	1
	Screening Criteria Value		34.0	10.0	-	3200.0	5.0	-	-	-	-	6.0
	Source of Screening Criteria Value		ATRISK	WAC	-	SGV	-	-	-	-	-	WAC

Intégral Géotechnique

SUMMARY OF LABORATORY SOIL TEST RESULTS

POLYAROMATIC HYDROCARBONS (PAH)

Job No.: 11266
Site: Toyoda Gosei
Soil Type: Colliery Spoil/Made Ground
Soil Organic Matter: 1%

No.	Location	Depth (m)	Acenaphthene (mg/kg)	Acenaphthylene (mg/kg)	Anthracene (mg/kg)	Benzo(a)anthracene (mg/kg)	Benzo(a)pyrene (mg/kg)	Benzo(b)fluoranthene (mg/kg)	Benzo(ghi)perylene (mg/kg)	Benzo(k)fluoranthene (mg/kg)	Chrysene (mg/kg)	Dibenzo(ah)anthracene (mg/kg)	Fluoranthene (mg/kg)	Fluorene (mg/kg)	Indeno(123cd)pyrene (mg/kg)	Naphthalene (mg/kg)	Phenanthrene (mg/kg)	Pyrene (mg/kg)
1	BH1	1.00	< 0.10	< 0.20	< 0.10	0.26	< 0.10	< 0.10	< 0.05	< 0.20	0.33	< 0.20	0.2	< 0.20	< 0.20	0.93	1.1	0.2
	Screening Criteria Value		85000.0	84000.0	53000.0	90.0	14.0	100.0	650.0	140.0	140.0	13.0	23000.0	64000.0	60.0	200.0	22000.0	54000.0
	Source of Screening Criteria Value		LQM	LQM	LQM	LQM	LQM	LQM	LQM	LQM	LQM	LQM	LQM	LQM	LQM	LQM	LQM	LQM

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FIGURES

Figure 1: Site Location

Project: Toyoda Gosei Factory Extension	Job no.: 11266	Intégral Géotechnique	Integral House, 7 Beddau Way, Castlegate Business Park, Caerphilly, CF83 2AX. Tel: 029 2080 7991
Client: Toyoda Gosei Limited	Scale: 1:25,000 at A4		

NORTH

Legend:

- Approximate trial pit location
- Approximate soakaway test location
- Approximate borehole location
- Approximate site boundary

Figure 2: Site Plan

Project: Toyoda Gosei Factory Extension	Job no.: 11266	Intégral Géotechnique	Integral House, 7 Beddau Way, Castlegate Business Park, Caerphilly, CF83 2AX. Tel: 029 2080 7991
Client: Toyoda Gosei Limited	Scale: 1:1000 at A4		