

Bike Park Wales

Gethin Woods, Abercanaid, Merthyr Tydfil

Site Investigation Report

12329/LW/19/SI

CLIENT: **Bike Park Wales**

PROJECT: **Gethin Woods, Abercanaid, Merthyr Tydfil**

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1.0 INTRODUCTION

1.1 GENERAL

Bike Park Wales are proposing to expand their existing premises in Abercanaid for continued commercial use.

Bingham Hall Partnership Limited are the appointed Consulting Civil and Structural Engineers for the scheme.

Intégral Géotechnique (Wales) Limited have been appointed as the Geotechnical Engineers to undertake an intrusive 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 intrusive site investigation and gives recommendations for the design of foundations, floor slabs and other geotechnical and geoenvironmental aspects of the project.

A desk study and a coal mining risk assessment has previously been completed by Intégral Géotechnique and reference should be made to Desk Study Report Ref. 12329/LP/18/DS and the Coal Mining Risk Assessment Report Ref 12329/LP/18/CMRA.

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1.2 PROPOSED DEVELOPMENT

The initial phase of the proposed development will comprise the expansion of the existing bike park to include a new bike hire centre adjacent to the existing café building, an external catering unit opposite and a shower block in the existing car park.

1.2 PROPOSED DEVELOPMENT (CONTINUED)

The second phase of the proposed development also includes new on-site accommodation comprising a number of camping pods, shepherds' huts and lodges, along with car parking areas and play area. The proposed accommodation, car parking areas and play area is not included within this site investigation works. However, a soakaway test was undertaken as part of the site investigation in association within the proposed accommodation.

1.3 SCOPE OF WORKS

The work instructed included an intrusive investigation, followed by laboratory testing and geotechnical and geoenvironmental reporting.

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+A2:2010, 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)/Natural Resources Wales (NRW) Land Contamination Working Group, 2017.

The site investigation included:

- An intrusive investigation carried out in January 2019 comprising the drilling of four rotary open borehole and the machine excavation of four trial pits;
- Sampling of soil/fill for laboratory chemical and geotechnical testing;
- Indicative soakaway test within one trial pit.

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, Natural Resources Wales, and the Coal Authority as appropriate.

1.4 LIMITATIONS (CONTINUED)

“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 have been found is also evaluated in this report.

It is important to recognise that there may be areas of contamination that have not been found, or that contaminants are 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 changes in ground conditions may be present between exploratory hole locations.

Access for the intrusive site investigation was partially limited at the time due to buried services, dense vegetation/trees and steep sloping ground.

2.0 THE SITE

2.1 SITE LOCATION AND DESCRIPTION

The site is located in Gethin Woods approximately 0.5km west of Abercanaid, at a National Grid Reference of 305160, 203410, see Figure 1.

The site is irregular in shape and occupies an area of approximately 5 hectares. The boundaries of the site are defined by existing undeveloped and wooded areas to the north, east and west and an extensive network of bike trails and tracks utilised by the bike park to the south and southwest. A site plan is presented in Figure 2.

The site is situated on sloping ground, towards the base of the valley, and falls in a north easterly direction towards the River Taff from an approximate maximum elevation of 260m AOD to an approximately minimum elevation of 220m AOD. Offsite the ground rises more sharply to the southwest to reach a maximum elevation of 471m AOD.

Within the areas of proposed development around the existing building and car park areas the ground level has been reprofiled to form a series of plateaus.

The car parking areas generally has a covering of either hardstanding or gravel. Areas of hardstanding, paving and gravel surface surround the existing main building. Vegetated/soft landscaped areas also surround the building and car parking areas.

The surrounding areas consist of woodland areas associated with the Bike Park Wales.

2.2 SITE OPERATIONS

The site is currently part of the Bike Park Wales mountain bike park. The site is largely undeveloped but with some areas utilised for car parking and an existing café within the western area. Some existing tracks and trails also cross the area.

2.3 SURROUNDING LAND USE

The surrounding areas are largely undeveloped but with a network of mountain bike trails all around the site, particularly to the south.

2.4 AVAILABLE SITE INVESTIGATION DATA

A desk study and coal mining risk assessment has been undertaken at the site and reference below:

- Gethin Woods, Abercanaid, Merthyr Tydfil, Desk Study Report, Report No. 12329/LP/18/DS dated November 2018.
- Gethin Woods, Abercanaid, Merthyr Tydfil, Coal Mining Risk Assessment, Report No. 12329/LP/18/CMRA dated November 2018.

2.5 CONSULTATIONS WITH REGULATORS

The Local Authority have not been contacted at this stage.

3.0 PRELIMINARY CONCEPTUAL SITE MODEL

3.1 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 residents, 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.

3.1 RISK ASSESSMENT FRAMEWORK (CONTINUED)

Current practice during Generic Quantitative Risk Assessment of land affected by contamination is to use generic soil screening values based on the appropriate proposed end use. These usually comprise risk based Soil Guideline Values (SGVs) or Generic Assessment Criteria (GACs) derived by the Environment Agency's Contaminated Land Exposure Assessment Model (CLEA). The SGVs and the supporting technical guidance were developed in order to assist in the assessment of long term risk to human health from the exposure to contaminated soils.

Revised Statutory Guidance, published in 2012, to support Part 2A of the Environmental Protection Act 1990, introduced a new four category system for classifying land under Part 2A. Category 1 includes land where the level of risk is clearly unacceptable and Category 4 includes land where the level of risk posed is considered to be acceptably low. Under Part 2A, land would be determined as contaminated if it falls within Categories 1 or 2.

The revised Part 2A Statutory Guidance was accompanied by an Impact Assessment that identified a role for new 'Category 4 Screening Levels' (C4SLs) that would provide a simple test for determining when land is suitable for use and definitely not contaminated land. A Policy Companion Document including the C4SLs was published in March 2014 (England) and May 2014 (Wales).

The C4SLs have been based on the CLEA methodology and derived using the CLEA model, with modified toxicological and exposure parameters. To date, C4SLs have been released for six substances (arsenic, cadmium, chromium (VI), lead, benzo(a)pyrene and benzene).

The C4SLs have been derived on the assumption that where they exist, they will be used as generic screening criteria within generic quantitative risk assessment.

Following publication of the C4SLs, Land Quality Management (LQM), in conjunction with the Chartered Institute for Environmental Health (CIEH) released Suitable 4 Use Levels (S4ULs) in January 2015.

The S4ULs have been derived in accordance with UK legislation, and using a modified version of the Environment Agency's CLEA software. As such, the S4ULs are based on the concept of minimal or tolerable risk as described in Human Health Toxicological Assessment of Contaminants in Soil (Science Report SR2, Environment Agency 2009a).

S4ULs have been derived for a wider number of substances.

3.1 RISK ASSESSMENT FRAMEWORK (CONTINUED)

In addition to the existing SGVs, C4SLs and S4ULs, Atkins ATRISK^{soil} also provide a set of Soil Screening Values. These are currently intended to be used in conjunction with SGVs, although they intend to update these values in line with the C4SLs in due course.

We have reviewed all sets of values and intend to use the most appropriate assessment criteria as Tier 1 screening values in the first instance. Where a published C4SL is available, and considered appropriate, this will be used in the first instance.

3.2 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.

3.3 CRITICAL SENSITIVE RECEPTOR – HUMAN HEALTH

The proposed redevelopment of the site is an expansion of a current Bike Park to include a hire centre, shower block and external catering unit. The Bike Park end use is deemed to a non-standard land use and it is therefore considered that the Public Open Space (Public Park) end use is deemed appropriate for the site.

The Public Open Space (Public Park) is described in Defra 2014a as an area of open space, usually owned by the Local Authority, provided for recreational uses including family visits and picnics, children's play area, informal sporting activities and dog walking. It is assumed that tracking back of soils into the place of residence will be negligible. Therefore, the critical sensitive receptor from a human health perspective is an onsite Public Open Space (Public Park) receptor.

In accordance with S4UL/C4SL and CLEA guidance for a standard Public Open Space (Public Park), the critical sensitive receptor for a Public Open Space (Public Park) end use risk assessment is a female child, with exposure from 0 to 6 years.

3.3 CRITICAL SENSITIVE RECEPTOR – HUMAN HEALTH (CONTINUED)

The Public Open Space (Public Park) end use conceptual model defined by S4UL/C4SL and CLEA is assumed to be suitable for the purposes of this assessment.

3.4 CRITICAL SENSITIVE RECEPTOR – CONTROLLED WATERS

Based on the proposed redevelopment of the site for a Public Open Space (Public Park) end use, and the findings of the desk study, the critical sensitive receptor from a controlled water perspective is groundwater within the Secondary 'A' Aquifer of the South Wales Middle Coal Measures Formation.

By considering groundwater as the critical sensitive receptor for controlled waters, the groundwater/hydrogeological risk assessment will also be protective of the surface water feature that crosses the site.

3.5 POTENTIAL CONTAMINANT SOURCES

As identified in the desk study, the site has remained largely undeveloped over the years. The main changes were the construction of tracks and paths and with a café and car parking areas constructed as Bike Park Wales became more established. Made Ground would not be anticipated to be widespread across the site but localised areas should be expected.

The potential types of contaminants of concern are listed below:

- Metals, semi-metals, and inorganics within the shallow made ground;
- Polycyclic aromatic hydrocarbons (PAH) within the shallow made ground;
- Asbestos within the shallow made ground.

3.6 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 and/or soil attached to home-grown produce
- Ingestion of home-grown produce
- Inhalation of soil derived dust
- Inhalation of vapours – indoor and outdoor air
- Leaching of contaminants from made ground to groundwater
- Transportation of contaminants within groundwater.

3.6 POTENTIAL EXPOSURE PATHWAYS (CONTINUED)

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

- Ground gas generation and migration
- Building materials durability.

3.7 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, historical review and site walk over 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.

The preliminary conceptual exposure model is presented below in Table 1.

Table 1: Preliminary Conceptual Exposure Model				
Source		Receptor	Pathway	Potentially Active Pathway?
Origin	Contaminant			
Made Ground of unknown origin and historical land uses	Metals, semi-metals, non-metals, PAH, asbestos	Site User – human health	Dermal Contact with made ground/dust	✓
			Ingestion of soil and/or soil attached to home-grown produce	✓
			Ingestion of home-grown produce	✓
			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	✓
Made Ground of unknown origin and natural ground	pH and water soluble sulphate	Building Materials Durability	Direct contact	✓
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	✓

4.0 THE SITE INVESTIGATION

4.1 FIELDWORKS

An intrusive site investigation was designed in accordance with BS5930:2015, 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)/Natural Resources Wales (NRW) Land Contamination Working Group, 2017.

The intrusive site investigation was also designed to provide information to support and refine the preliminary conceptual site model/conceptual exposure model.

An intrusive investigation comprising the machine excavation of four trial pits and four rotary open boreholes, was carried out during January 2019.

The rotary open boreholes were drilled down to a maximum depth of 32.0m below existing ground level. The purpose of the rotary open boreholes was to investigate the deeper ground conditions including the presence or otherwise of any shallow coal seams or unrecorded mineworkings and to allow an assessment of the most appropriate foundation type for the proposed development.

The trial pits were excavated to a maximum depth of 2.3m below existing ground level. The purpose of the trial pits was to investigate the shallow ground conditions and to allow an assessment of the most appropriate foundation types for the proposed development.

Indicative soakaway tests were carried out in one trial pit in order to assess/monitor the likely permeability of the natural ground.

Representative soil samples were taken from the trial pits for laboratory chemical and geotechnical 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 prepared their detailed engineering logs in accordance with the requirements of BS5930+A2: 2010. The engineering logs provide descriptions of the materials encountered in accordance with BSEN ISO 14688-1 (2002) and 14689-1 (2003) for soils and rocks respectively.

4.1 FIELDWORKS (CONTINUED)

The rotary open boreholes logs are based on the driller's logs.

The approximate locations of the trial pits and rotary open boreholes are shown on Figure 2, while their logs are presented in Appendices A and B. The results of the indicative soakaway test is presented in Appendix C.

4.2 FIELD OBSERVATIONS

No visual or olfactory evidence of any contamination was observed during the drilling of the rotary open boreholes and excavation of the trial pits.

4.3 LABORATORY CHEMICAL TESTING

Representative soil samples were taken from the trial pits across the site, stored at the appropriate temperature and dispatched to the laboratories of i2 Analytical 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
Polycyclic Aromatic Hydrocarbons (PAH)	Asbestos

The results of all the soil testing are presented in Appendix D.

4.4 LABORATORY GEOTECHNICAL TESTING

Representative soil samples of the natural ground were also taken and dispatched to the laboratories of i2 Analytical for laboratory geotechnical testing including pH, water soluble sulphate and Atterberg Limits.

The results of the geotechnical testing are presented in Appendix E.

5.0 GROUND CONDITIONS

5.1 SHALLOW GROUND CONDITIONS

Information regarding the shallow ground conditions was predominantly derived from the trial pits excavated within the site.

5.1.1 Topsoil

A veneer of topsoil was encountered within trial pit TP1 at a thickness of 0.2m. The topsoil comprised of dark brown slightly gravelly silt/clay with rootlets.

5.1.2 Made Ground/Reworked Natural Ground

Made ground consisting of gravel aggregate was encountered at trial pits TP2 to TP4 and was encountered to depths of between 0.2m and 0.4m below existing ground level.

At trial pits TP2 and TP4, the made ground was further underlain by reworked natural ground consisting of soft red brown slightly gravelly sandy silt/clay and/or soft, soft to firm, firm brown to mottled yellow grey brown slightly sandy gravelly clay.

The reworked natural ground was encountered to depths of 1.0m and 1.4m below existing ground level in trial pits TP2 and TP4, respectively.

Tree trunk and branches remains were encountered within the reworked natural ground at TP4.

A groundwater seepage was encountered in TP2 at 0.6m below existing ground level.

5.1.3 Glacial Till

The topsoil, made ground or reworked natural ground was further underlain by superficial deposits consisting of glacial till deposits.

The glacial till comprised of a vertically and laterally variable sequence of medium dense brown to brown grey silty clayey sandy gravel and firm silty sandy gravelly clay. The gravel consisted of siltstone, mudstone and sandstone with cobbles and boulders encountered.

The glacial till was encountered at depths of between 0.2m and 1.4m below existing ground level.

5.1 SHALLOW GROUND CONDITIONS (CONTINUED)

The results of the Atterberg Limits testing on two samples of the glacial till deposits indicate that the materials have plasticity indices of 16% and 18% and a modified plasticity index of 15.5%. Therefore, in accordance with NHBC standards, the modified plasticity index indicates that the glacial till is of low volume change potential.

Each trial pit terminated due to slow progress on suspected boulders or bedrock.

5.1.4 Soakaways

An indicative soakaway test was undertaken in one trial pit, TP1.

No groundwater infiltration was recorded within TP1 and no infiltration rate could therefore be calculated at this location.

It should be noted that this initial testing should only be regarded as indicative. If it should be proposed to use soakaways for the site, then more extensive proposed location and depth specific follow-up tests will be required and should fully comply with BRE 365, in order to confirm the suitability of the site and to satisfy the local authority.

5.2 DEEPER GROUND CONDITIONS

Four rotary open boreholes were drilled on the site to depths of between 13.5m and 32.0m below existing ground level.

Borehole BH1 was located in the area of the proposed shower block, BH2 was located in the area of the proposed external catering units and boreholes BH3 and BH4 were located in the area of the proposed bike hire centre.

The deeper rotary open boreholes were principally drilled on site to profile the depth to rock head and identify the presence and nature of any shallow coal seams and associated mining voids. When using an openhole rotary drilling technique it is difficult to distinguish between made ground, reworked ground and superficial materials.

The boreholes generally encountered the top of the bedrock at depths of between 0.5m and 5.0m below existing ground level.

Coal seams were encountered within each borehole drilled. Within BH1, a 0.6m thick coal seam was encountered at a depth of 2.6m and a 1.1m thick banded coal seam was encountered at a depth of 30.1m below existing ground level. These seams are interpreted to be an unnamed thin coal seam.

5.2 DEEPER GROUND CONDITIONS (CONTINUED)

Within borehole BH2, a 0.5m thick coal seam was encountered at 6.0m below existing ground level. Within boreholes BH3 and BH4, a 0.6m thick coal seam was encountered at depths of 6.4m and 6.3m below ground level respectively. The coal seams in boreholes BH2 to BH4 are interpreted to be that of the Hafod Seam.

All coal seams were noted to be intact.

5.3 GROUNDWATER

A groundwater seepage was encountered in TP2 at a depth of 0.6m below existing ground level.

Within the boreholes, shallow groundwater was encountered at depths of between 5m and 8m and deeper groundwater was encountered at depths of between 17m and 22m below existing ground level.

The groundwater conditions are based on observations made at the time of the fieldwork. It should be noted that groundwater levels may vary due to seasonal and other effects.

6.0 CONTAMINATION

6.1 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 area has been determined according to the proposed Public Open Space (Public Park) end use.

6.2 SOIL CONTAMINATION

The Suitable 4 Use Levels (S4ULs) derived by LQM have been adopted as critical concentrations against which soil contaminant concentrations can be compared. In the absence of additional published S4ULs for lead and cyanide, Category 4 Screening Level (C4SL) published by DEFRA and Soil Screening Values (SSVs) derived by Atkins ATRISK^{soil} for a Public Open Space (Public Park) end use have been adopted, respectively

Since the results of the testing indicate total organic carbon content (TOC) in the range of 0.5% to 3.5%, the results have been compared to the respective guidelines, where applicable, for 1% soil organic matter content.

The soil test results for made ground have been summarised and are shown in Appendix F.

6.2.1 Topsoil

The results of the laboratory testing indicate that the analysed chemical elements or compounds are present at concentration below the appropriate threshold for a Public Open Space (Public Park) end use.

Asbestos was not detected within the screened samples.

6.2 SOIL CONTAMINATION (CONTINUED)

6.2.2 *Made Ground/Reworked Natural Ground*

The results of the laboratory testing indicate that the analysed chemical elements or compounds are present at concentrations below the appropriate threshold for a Public Open Space (Public Park) end use.

Asbestos was not detected within the screened sample.

6.2.3 *In-situ Natural Ground*

No visual or olfactory evidence of contamination of the in-situ natural ground was identified during the excavation of the trial pits and drilling of the boreholes. At the time of writing this report no samples of natural ground had been tested. It is considered likely that concentrations of determinands within the natural ground are likely to be naturally occurring and as such, the natural ground poses no significant threat to human health or the environment.

7.0 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, soil leachate, groundwater and gas monitoring. Pathways identified as a relevant pollutant linkage require appropriate risk assessment or mitigation measures (see Section 2).

Table 2: Revised Conceptual Exposure Model						
Source		Receptor	Pathway	Preliminary Active Pathway? (see Sect. 5.8)	Relevant Pollutant Linkage	Justification/ Mitigation
Origin	Contaminant					
Topsoil, Made Ground of unknown origin historical land uses and Reworked Natural Ground.	Metals, semi-metals, non-metals, PAH, asbestos	Site User – human health	Dermal Contact with made ground/dust	✓	X	No elevated concentration of contaminants identified within the topsoil, made ground, reworked natural ground.
			Ingestion of soil and/or soil attached to home-grown produce	✓	X	
			Ingestion of home-grown produce	✓	X	
			Inhalation of dust	✓	X	
			Inhalation of vapours – indoor/outdoor	✓	X	No sufficiently volatile contaminants identified.
	Metals, semi-metals, inorganics, PAH	Groundwater quality	Leaching from made ground	✓	X	
	Metals, semi-metals, inorganics, PAH	Surface water quality	Transportation within groundwater	✓	X	No significantly elevated soil concentrations identified.

7.0 REVISED CONCEPTUAL EXPOSURE MODEL (CONTINUED)

Source		Receptor	Pathway	Preliminary Active Pathway?	Relevant Pollutant Linkage	Justification/ Mitigation
Origin	Contaminant					
Made Ground of unknown origin, reworked natural ground and natural ground	pH and water soluble sulphate	Building Materials Durability	Direct contact	✓	✓	Building materials will be in contact with made ground – risk assess
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 not identified. No current or historical landfills identified within 250m of the site.

8.0 RISK ASSESSMENT

8.1 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.

8.2 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.

8.3 HUMAN HEALTH RISK ASSESSMENT

8.3.1 *Site in its Present Condition*

The site does not pose any risks to casual visitors or trespassers.

8.3 HUMAN HEALTH RISK ASSESSMENT (CONTINUED)

8.3.2 Future Site Users

The contamination test results and investigation observations for the topsoil, made ground and reworked natural ground indicate that the analysed chemical elements or compounds are present at concentrations below the appropriate threshold. It is therefore considered that a low risk to human health exists and will not pose a significant risk to end users. Therefore, no remedial measures are required on site with regards to site sourced contamination.

8.3.3 Construction Workers

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 minimise fugitive emissions and minimisation 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.

8.4 RISKS TO VEGETATION

Elevated concentrations of phytotoxic contaminants were not detected within the soil samples. It is therefore considered that there is a low risk to vegetation.

To ensure viable landscaped areas, a suitable growth medium is required in areas of soft landscaping, typically comprising a 150mm thick layer of topsoil.

8.5 GROUNDWATER RISK ASSESSMENT

The findings of the site investigation have not indicated any shallow contaminative sources. Perched groundwater was encountered at one location and consisted of a seepage within the reworked natural ground at a depth of 0.6m.

Within the boreholes, shallow groundwater was encountered at depths of between 5m and 8m and deeper groundwater was encountered at depths of between 17m and 22m below existing ground level.

Given, the above, the risk to controlled water is considered to be low.

8.6 GROUND GAS RISK ASSESSMENT

There was no evidence of any significant organic materials that could give rise to potential ground gas. It is therefore considered that no methane/carbon dioxide ground gas protective measures are required at the site.

The Desk Study Report indicated that there are no current or historical landfills located within 250m of the site.

The potential risk from ground gas at the site is considered to be low,

Basic radon protective measures are required.

8.7 RISKS TO BUILDINGS AND MATERIALS DURABILITY

8.7.1 Concrete Classification

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

8.7 RISKS TO BUILDINGS AND MATERIALS DURABILITY (CONTINUED)

Evidence to date does not indicate any specifically aggressive conditions, but it would be reasonable to expect a degree of sulphate and acidic aggressiveness from the made ground.

Made Ground/Reworked Natural Ground

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 highest of the test results) for water soluble sulphate within the made ground of 1600mg/l.

However, the made ground where a water soluble sulphate value of 1600mg/l was noted is recommended to be removed from below the proposed building. Therefore, the next highest test result of 77mk/g is deemed more appropriate.

Using Table C2 of BRE Digest SD1:2005, this characteristic value corresponds to Design Sulphate Class DS-1.

The groundwater regime of the site has been assessed as 'mobile' and a characteristic pH value within the made ground of 9.1 has been determined (adopting the lowest of the test results). The Design Sulphate Class has been modified to give a site ACEC class of AC-1 for concrete structures constructed within the made ground.

Natural Ground

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 highest of the test results) for water soluble sulphate within the natural ground of 110mg/l.

Using Table C2 of BRE Digest SD1:2005, this characteristic value corresponds to Design Sulphate Class DS-1.

The groundwater regime of the site has been assessed as 'mobile' and a characteristic pH value within the natural ground of 7.7 has been determined (adopting the lowest of the test results). The Design Sulphate Class has been modified to give a site ACEC class of AC-1 for concrete structures constructed within the natural ground.

8.7 RISKS TO BUILDINGS AND MATERIALS DURABILITY (CONTINUED)

8.7.2 Water Services

Based on the chemical analysis and observations undertaken to date, water supply pipes will not require any special protection measures from contaminants at the site. However, this should be agreed with the source provider and 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.

In order to comply with the UKWIR guidance, specific sampling and testing along the actual line of the proposed water supply route may need to be carried out once this has been established.

8.8 WASTE 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 and which may require the production of an approved Materials Management Plan (MMP) prepared in accordance with the CL:AIRE Code of Practice.

It is recommended that a sustainable development strategy is adopted which reduces to a practicable minimum the generation of waste materials and the need for disposal to a licensed tip. Emphasis should be on recovery and re-use rather than disposal.

However, any waste or surplus materials that are generated will need to be classified in accordance with current EC regulations and Environment Agency guidance prior to disposal. It is the responsibility of the waste producer to classify the waste.

Based on the data obtained from the site investigation works, any waste materials comprising of the existing made ground are likely to be classified as non-hazardous. The existing natural ground are likely to be classified as inert.

Any asbestos containing materials (ACMs) will be classified as hazardous waste.

This classification is provisional and indicative of the likely waste classification based on the data obtained to date (including chemical composition, moisture content, etc.). It also assumes that the materials tested will be representative of future generated waste.

8.8 WASTE DISPOSAL (CONTINUED)

In order to minimise disposal, the materials generated should be segregated and examined, with appropriate testing as necessary, to enable the materials to be sorted or treated into lower classifications, with the resultant benefit of potentially generating re-use rather than disposal.

Once final waste sources and volumes are known, the waste stockpile to be disposed off-site will need to be classified in accordance with Environment Agency/Natural Resources Wales Waste Classification – Guidance on the Classification and Assessment of Waste Technical Guidance WM3 (2015). This is likely to require additional sampling and testing of the generated waste materials to provide an up to date current basis for classification.

Depending on the waste classification, waste acceptance criteria (WAC) testing may be required, in order to determine which class of landfill site the waste can be sent to.

It is recommended that the results of the waste classification and any WAC test results are sent to the intended licensed waste operator prior to disposal in order to confirm their classification and acceptance.

8.9 UNCERTAINTIES

It is important to recognise that there may be areas of contamination within the site 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.

9.0 MINING RISK ASSESSMENT

SHALLOW MINE WORKINGS

A Coal Mining Risk Assessment was previously undertaken by Intégral Géotechnique and referenced 12329/LP/18/CMRA dated November 2018.

The Coal Authority Report included within the Coal Mining Risk Assessment states the site is in a surface area that could be affected by underground mining in 7 seams of coal at 100m to 270m depth, and last worked in 1955. However, the property is in an area where the Coal Authority believe there is coal at or close to the surface. This coal may have been worked at some time in the past and the presence of unrecorded workings cannot be ruled out. The potential presence of coal workings at or close to the surface should be considered, particularly prior to any site works or future development activity.

This site investigation report covers the area of the proposed bike hire centre and the minor structures consisting of the external catering unit and the shower block. The proposed structures are located in the western area of the Bike Park Wales site.

The conjectural outcrop of the Hafod seam, as indicated on Figure 2, is indicated to pass beneath the site, running approximately parallel to the south western edge and therefore this seam could be shallow beneath the western part of the site.

The Coal Mining Risk Assessment considered that there was a risk of ground subsidence occurring as a result of past shallow mine workings.

Accordingly, four rotary open boreholes were drilled in the proposed locations of the bike park hire centre and the minor structures consisting of the external catering unit and shower block, to investigate if there were any traces of the Hafod coal seam or any associated underground shallow mine workings.

Borehole BH1, drilled within the footprint of the proposed shower block, encountered a thin coal seam (0.6m thick) underlined by a banded coal seam at a depth of 26.5m. The coal seams were encountered as intact. The borehole proved that there is at least 21.5m of rock cover above the encountered deeper unnamed thin coal.

9.0 MINING RISK ASSESSMENT (CONTINUED)

Boreholes BH2, drilled within the footprint of the proposed external catering unit, encountered an intact thin coal seam (0.5m thick) at a depth of 6.0m. Boreholes BH3 and BH4, drilled within the footprint of the proposed bike hire centre, encountered a thin coal seam (0.6m thick) at a depth of 6.4m and 6.3m respectively. The coal seams again were encountered intact and are interpreted to be the Hafod coal seam. The boreholes proved that there is at least 4.5m to 5.8m of rock cover above the encountered 0.5m to 0.6m thick intact Hafod coal seam.

In addition to the above, the boreholes have proven there is a least 13.0/27.0m of rock cover above any underlying coal seams/associated workings that might be present beneath 13.5/30.0m depth of the boreholes. Based on the commonly accepted 10:1 required rock cover to void ratio, this rock cover should be sufficient to prevent any void migration up to the rock head, should any coal seam/associated workings be present beneath the depths of the boreholes.

Due to the observed intact nature of the thin coal seams and the proven rock cover, it is therefore considered that there is little risk of shallow coal workings beneath the proposed bike hire building, shower block and small external catering unit causing mine related ground subsidence at the site surface.

MINE ENTRIES

No mine entries are recorded within, or within 20m, of the site. However, although it is thought to be very unlikely, the possibility that unrecorded mine entries might be present, cannot be completely ruled out.

Should any unrecorded mine entries be encountered, they should be suitably investigated and assessed in order to determine what associated treatment/building exclusion zones are required.

10.0 ENGINEERING CONSIDERATIONS AND RECOMMENDATIONS

10.1 DETAILS OF PROPOSED DEVELOPMENT

The proposed development will comprise the expansion of the existing bike park to include a new bike hire centre adjacent to the existing café building, an external small scale (3m x 5m on plan) catering unit opposite and a shower/toilet block within the existing car park.

10.2 SITE PREPARATION

Prior to works commencing on site, any services within the proposed development areas should be identified and either diverted or protected. Any diversion works should be carried out under the supervision of, and to the specification of appropriate Statutory Authority. The resulting excavations should be backfilled with suitable granular fill material laid and compacted to Department of Transport (DTp) Specification for Earthworks.

Existing vegetation should be stripped. Any existing topsoil should be removed from beneath the proposed building and access roads. These excavated materials will be unacceptable as structural fill. Any topsoil, should be stockpiled and tested for potential re-use.

A system should be established for identification and dealing with any, unforeseen contamination encountered during site works (including identification of any potential asbestos containing materials). Any contamination, or suspected contamination, should be reported to the site manager, so that appropriate action may be taken, following specialist advice if necessary.

Any buried structures/services should be removed and crushed to acceptable size for re-use. Any deep service chambers, if present should be excavated and obstructions removed.

The resultant voids should be brought back up to the required level with well compacted suitable granular materials, laid and compacted in layers and benched into the surrounding soils. Department of Transport (DTp) Type 1 sub-base or similar approved, could be used and should be compacted in layers, in accordance with DTp Specification for Highway Works.

10.2 SITE PREPARATION (CONTINUED)

Allowances should be made for the protection and/or diversion of any active underground services present beneath the site. In addition, any surface drains that cross the site should be protected from either detrimental effect (including pollution and ground settlements during construction works).

Where mature trees/hedges are within influencing distance of the proposed buildings, allowances should be made for the removal of any associated roots that may become exposed in any proposed nearby earthworks and foundations excavations. Any such works should be conducted in accordance with current codes of practice. Exposed formations should be protected from site traffic and inclement weather in order to preserve their integrity. Any soft spots/areas should be removed and replaced with well compacted site won or imported granular fill material.

A series of slopes are present on site. If any fill is to be placed onto an existing sloping area then the original ground should be adequately benched, in order to prevent the possibility of slippage at the interface between the new fill and the original ground.

Any cut and/or fill slopes should be no steeper than 1v in 2h. Cut off drains should be provided at the top and French drains at the bottom of any cut and/or fill slopes. In areas of cut and/or fill, the slopes should be topsoiled and seeded with grass, in order to minimise any future maintenance problems caused by surface water run-offs.

10.3 FOUNDATIONS AND FLOOR SLABS

Based on the site investigation works undertaken to date, it is considered that due to the intact nature of the relatively thin coal seams and the proven rock cover, it is considered that there is little risk of shallow coal workings beneath the proposed buildings causing ground subsidence at the site surface. It is therefore considered that no mining mitigation measures are required.

Based on the site investigation works, the proposed structures can be founded upon either strip/trench fill or pad foundations within either the glacial till or bedrock.

It is recommended that the bike hire centre is founded within the bedrock encountered at 0.5m below existing ground level. An allowable bearing pressure of 150kN/m² could be used to design foundations in these materials.

10.3 FOUNDATIONS AND FLOOR SLABS (CONTINUED)

It is recommended that the external catering unit and shower block is founded within the glacial till deposits encountered at depths of between 1.0m and 1.4m. An allowable bearing pressure of 100kN/m² could be used to design foundations in these materials.

Foundations should be designed that no further load is imposed on the existing foundations to the existing building.

It should be noted that within trial pit TP4, undertaken in the vicinity of the proposed external catering unit, remains of trees, branches and general plant remains were encountered. It is recommended that these materials are removed from below the proposed structure. The reduced formation should be brought back up to the required level with well compacted suitable granular materials, laid and compacted in layers and benched into the surrounding soils. Department of Transport (DTp) Type 1 sub-base or similar approved, could be used and should be compacted in layers, in accordance with DTp Specification for Highway Works.

For all structures the intensities of loadings, and in the competent materials the total settlement should not exceed 25mm and any angular distortions caused by differential movements should be less than 1:750.

Any soft spots encountered in foundation trenches should be excavated out and the foundations over deepened until more competent soils are encountered. No foundations should be cast within topsoil, made ground, reworked natural ground or locally soft or loose natural soils.

Foundations should be embedded into the natural soils by a minimum of 200mm. Within influencing distance of trees, the foundations should be deepened.

To protect against the effects of frost heave and thermal shrinkage, foundations formations should be taken down a minimum of 900mm below finished ground levels.

All strip/trench fill or pad foundations for individual buildings should be constructed within uniform strata in order to minimise the potential for differential settlement. There should be no spanning of foundations between soils of different strengths. If there are significant changes in the bearing strata beneath foundations, then footings should include suitably designed mesh reinforcement, both top and bottom, to mitigate risks of relative deflection.

10.3 FOUNDATIONS AND FLOOR SLABS (CONTINUED)

Laboratory Atterberg Limits have been determined for samples of the glacial till deposits. The results show that the weathered strata is of low volume change potential. Footings should be deepened in accordance with NHBC guidance for low shrinkage for foundations adjacent to mature trees and hedgerows. The bedrock is regarded to be non-shrinkable.

Deeper foundation depths may be required where the founding horizon may need to be taken down below any root system or in areas of the placement of fill material.

The floor slabs can be designed and constructed as ground bearing, provided the thickness of the underlying fill is less than 600mm. In areas where made ground and/or reworked materials exceed 600mm, suspended floor slabs will be required. Suspended floor slabs may also be required in close proximity to any existing mature trees and hedge lines and in areas with obvious sign of desiccation.

10.4 EXCAVATIONS AND FORMATIONS

Most excavations should be possible with normal excavating machinery. However, allowances should be made for the use of pneumatic breaker attachments, or similar tools, if any excavations deeper than the trial pits are planned.

Allowances should also be made for encountering and having to deal with bedrock within the proposed depth of excavations. More powerful excavating machinery and/or breaking equipment may be required to excavate into the bedrock.

A groundwater seepage was noted in TP2 at a depth of 0.6m below existing ground level.

Within the boreholes, shallow groundwater was encountered at depths of between 5m and 8m and deeper groundwater was encountered at depths of between 17m and 22m below existing ground level.

It is considered that any groundwater inflows together with rainfall infiltrations within excavations could be controlled by the use of conventional pumping techniques to sumps.

The ground conditions are based on observations made at the time of the fieldworks. It should be noted that groundwater levels may vary due to seasonal and other effects.

The sides of the excavations deeper than 1.0m should be supported by trench boxes or temporarily battered at gradients of typically 30°.

10.4 EXCAVATIONS AND FORMATIONS (CONTINUED)

The exposed formation within the in-situ materials will be susceptible to damage, softening and deterioration by wet weather and site traffic.

Any soft spots/areas should be removed and replaced with compacted imported granular material.

10.5 ACCESS ROADS AND CAR PARKING AREAS

Following site strip there are likely to be variations in the strength of the materials at the formation levels. Subject to confirmatory in situ testing, we recommend that for design purposes California Bearing Ration (CBR) values of 1 – 2% could be assumed for the existing made ground and reworked natural ground and 2 – 3% for the in situ natural deposits.

Any 'soft spots/areas' should be removed and replaced 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 current DTp Specification for Highway Works.

It should be noted that the Highway Authority may insist that field CBR tests should be carried out to confirm the above assumptions. Depending on the outcome of such field tests, the above recommendations may be revised, if necessary, amended.

10.6 DRAINAGE

An indicative soakaway test was undertaken within one trial pit, TP1.

No groundwater infiltration was recorded during the soil infiltration test, and no infiltration rate could therefore be calculated at the location.

It should be noted that this initial testing should only be regarded as indicative. If it should be proposed to use soakaways for this site, then more extensive proposed location and depth specific follow-up tests will be required and should fully comply with BRE 365, in order to confirm the suitability of the site and to satisfy the local authority.

APPENDIX A

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: Bike Park Wales			Project No.: 12329		Trial Pit No.: TP1 Sheet 1 of 1	
Location: Abercanaid			Client: Bike Park Wales			Logged By: LW		Scale 1:25	
Equipment: JCB 3CX			Coordinates:			Dimensions 2.70m			
Date Excavated: 16/01/2019			Level:			Depth : 1.70m 0.70m			
Samples & In-situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description			
Depth (m)	Type	Results							
0.10	ES		0.20			Topsoil: Grass/vegetation onto dark brown slightly gravelly silt/clay with rootlets.			
						Soft to firm yellow grey brown slightly sandy gravelly CLAY. Gravel is fine to coarse angular to subrounded of mudstone and siltstone.			
						0.80	Medium dense/firm mottled brown grey sandy gravelly CLAY to sandy clayey GRAVEL. Gravel is fine to coarse angular to subrounded of siltstone, mudstone and sandstone, with frequent cobbles and some boulders		
1.70	End of Trialpit at 1.70 m								
	Remarks:			Groundwater:			Key:		
1. Trial pit terminated at 1.7m bgl due to slow progress on suspected boulders. 2. Soakaway test undertaken.			Groundwater not encountered			D - Small disturbed sample B - Bulk disturbed sample ES - Environmental soil sample W - Water sample			
			Stability: Stable						

Intégral Géotechnique Intégral House, 7 Beddau Way Castlegate Business Park Caerphilly CF83 2AX Tel. 029 20807991 Fax. 029 20862176 mail@integralgeotec.com			Project Name: Bike Park Wales			Project No.: 12329		Trial Pit No.: TP2 Sheet 1 of 1	
Location: Abercanaid			Client: Bike Park Wales			Logged By: LW		Scale 1:25	
Equipment: JCB 3CX			Coordinates:			Dimensions 2.70m			
Date Excavated: 16/01/2019			Level:			Depth : 1.60m 0.70m			
Samples & In-situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description			
Depth (m)	Type	Results							
0.30	ES		0.20			Made Ground: Gravel aggregate above a geotextile layer.			
						Suspected Reworked Natural Ground: Soft red brown slightly gravelly slightly sandy silt/clay with rootlets.			
						Suspected Reworked Natural Ground: Soft to firm mottled yellow red brown grey gravelly sandy clay. Gravel is fine to coarse angular to subangular of siltstone, mudstone and sandstone.			
1.20	D		1.00			Medium dense/firm mottled brown grey sandy gravelly CLAY to sandy clayey GRAVEL. Gravel is fine to coarse angular to subrounded of siltstone, mudstone and sandstone, with frequent cobbles and some boulders			
			1.60			End of Trialpit at 1.60 m			
Remarks:			Groundwater: Seepage at 0.6m			Key:			
1. Trial pit terminated at 1.6m bgl due to slow progress on suspected boulders.			Stability: Stable			D - Small disturbed sample B - Bulk disturbed sample ES - Environmental soil sample W - Water sample			

			Intégral House, 7 Beddau Way Castlegate Business Park Caerphilly CF83 2AX Tel. 029 20807991 Fax. 029 20862176 mail@integralgeotec.com			Project Name: Bike Park Wales			Project No.: 12329		Trial Pit No.: TP3 Sheet 1 of 1	
Location: Abercanaid						Client: Bike Park Wales			Logged By: LW		Scale 1:25	
Equipment: JCB 3CX						Coordinates:			Dimensions 3.00m			
Date Excavated: 16/01/2019						Level:			Depth : 0.60m 0.90m			
Samples & In-situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description						
Depth (m)	Type	Results										
0.10	ES					Made Ground: Brown grey slightly sandy gravel of aggregate.						
			0.40			Medium dense brown grey slightly silty slightly clayey GRAVEL. Gravel is fine to coarse angular of mudstone, siltstone and sandstone with frequent cobbles and boulders.						
			0.60			End of Trialpit at 0.60 m						
								1				
								2				
								3				
								4				
								5				
Remarks: 1. Trial pit terminated at 0.6m bgl due to terminated on suspected bedrock.						Groundwater: Groundwater not encountered		Key: D - Small disturbed sample B - Bulk disturbed sample ES - Environmental soil sample W - Water sample				
						Stability: Stable						

Intégral Géotechnique Intégral House, 7 Beddau Way Castlegate Business Park Caerphilly CF83 2AX Tel. 029 20807991 Fax. 029 20862176 mail@integralgeotec.com			Project Name: Bike Park Wales			Project No.: 12329		Trial Pit No.: TP4 Sheet 1 of 1	
Location: Abercanaid			Client: Bike Park Wales			Logged By: LW		Scale 1:25	
Equipment: JCB 3CX			Coordinates:			Dimensions 2.80m			
Date Excavated: 16/01/2019			Level:			Depth : 2.30m 0.70m			
Samples & In-situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description			
Depth (m)	Type	Results							
0.30	ES		0.20			Made Ground: Aggregate gravel layer			
			0.40			Made Ground: Brown grey slightly sandy gravel of aggregate.			
1.50	D		1.40			Reworked Natural Ground: Soft, soft to firm brown slightly silty slightly sandy slightly gravelly clay. Gravel is fine to coarse angular to subangular of siltstone, mudstone and sandstone. With tree remains between 1.2 and 1.4.			
			2.30			Medium dense brown grey silty clayey sandy GRAVEL. Gravel is fine to coarse angular to subangular of sandstone and mudstone with frequent cobbles and boulders.			
			End of Trialpit at 2.30 m						
Remarks:			Groundwater:			Key:			
1. Trial pit terminated at 2.3m bgl due to slow progress on suspected boulders or bedrock.			Stability: Stable			D - Small disturbed sample B - Bulk disturbed sample ES - Environmental soil sample W - Water sample			

APPENDIX B

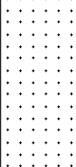
ROTARY BOREHOLES LOGS

		Integral House, 7 Beddau Way Castlegate Business Park Caerphilly CF83 2AX Tel. 029 20807991 Fax. 029 20862176 mail@integralgeotec.com		Project Name: Bike Park Wales				Project No.: 12329		Borehole No.: BH1 Sheet 1 of 1	
Location: Abercanaid				Client: Bike Park Wales				Coordinates:		Hole Type: RO	
Equipment: T44				Diameter of Casing:				Level:		Scale 1:200	
Diameter of Boring:				Depth of Casing:				Dates 17/01/2019 -		Logged By: Apex	

Well	Water Strikes	Rotary Coring					Depth (m)	Level (m AOD)	N Value	Legend	Stratum Description		
		Depth (m)	TCR	SCR	RQD	FI							
	5.00 						2.80				Made Ground/Boulder Clay (Driller's Description)	1	
													2
												Till (Driller's Description)	3
													4
												Sandstone with mudstone bands (Driller's Description)	5
													6
													7
													8
													9
													10
													11
													12
													13
													14
													15
											16		
											17		
											18		
											19		
											20		
											21		
											22		
											23		
											24		
											25		
											26		
							26.50				Coal (Driller's Description)	27	
							27.10				Sandstone/Mudstone	28	
												29	
							29.00				Coal Banded (Driller's Description)	30	
							30.10				Mudstone (Driller's Description)	31	
												32	
							32.00				End of Borehole at 32.00 m	33	
												34	
												35	
												36	
												37	
												38	
												39	
												40	

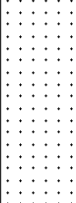
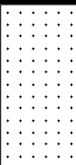
Remarks: 1. Rotary open borehole to 32m bgl.				Key: D - Small disturbed sample B - Bulk disturbed sample ES - Environmental soil sample SPT - Standard Penetration Test (split spoon) CPT - Standard Penetration Test (solid cone)				W - Water sample U - Undisturbed sample TCR - Total Core Recovery SCR - Solid Core Recovery RQD - Rock Quality Designation					
--	--	--	--	---	--	--	--	--	--	--	--	---	--

		Integral House, 7 Beddau Way Castlegate Business Park Caerphilly CF83 2AX Tel. 029 20807991 Fax. 029 20862176 mail@integralgeotec.com		Project Name: Bike Park Wales				Project No.: 12329		Borehole No.: BH2 Sheet 1 of 1	
Location: Abercanaid				Client: Bike Park Wales				Coordinates:		Hole Type: RO	
Equipment: T44				Diameter of Casing:				Level:		Scale 1:200	
Diameter of Boring:				Depth of Casing:				Dates 17/01/2019 -		Logged By: Apex	

Well	Water Strikes	Rotary Coring					Depth (m)	Level (m AOD)	N Value	Legend	Stratum Description	
		Depth (m)	TCR	SCR	RQD	FI						
							1.50				Made Ground/Boulder Clay (Driller's Description)	1
											Sandstone (Driller's Description)	2
												3
												4
												5
							6.00				Coal (Driller's Description)	6
							6.50				Sandstone (Driller's Description)	7
												8
												9
												10
												11
												12
							13.00				Sandstone with mudstone bands (Driller's Description)	13
												14
												15
												16
												17
												18
												19
												20
												21
												22
												23
												24
												25
												26
												27
												28
												29
								30.00			End of Borehole at 30.00 m	
												31
												32
												33
												34
												35
												36
												37
												38
												39
												40

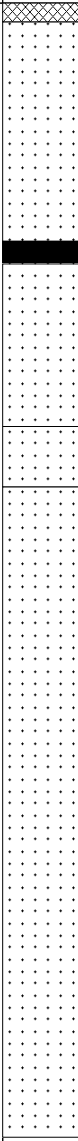
Remarks: 1. Rotary open borehole to 30m bgl.		Key: D - Small disturbed sample B - Bulk disturbed sample ES - Environmental soil sample SPT - Standard Penetration Test (split spoon) CPT - Standard Penetration Test (solid cone)		W - Water sample U - Undisturbed sample TCR - Total Core Recovery SCR - Solid Core Recovery RQD - Rock Quality Designation		
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		Intégral House, 7 Beddau Way Castlegate Business Park Caerphilly CF83 2AX Tel. 029 20807991 Fax. 029 20862176 mail@integralgeotec.com		Project Name: Bike Park Wales				Project No.: 12329		Borehole No.: BH3 Sheet 1 of 1	
Location: Abercanaid				Client: Bike Park Wales				Coordinates:		Hole Type: RO	
Equipment: T44				Diameter of Casing:				Level:		Scale 1:200	
Diameter of Boring:				Depth of Casing:				Dates 18/01/2019 -		Logged By: Apex	

Well	Water Strikes	Rotary Coring					Depth (m)	Level (m AOD)	N Value	Legend	Stratum Description		
		Depth (m)	TCR	SCR	RQD	FI							
	8.00 						0.50				 Made Ground (Driller's Description)	1	
											 Sandstone (Driller's Description)	2	
												3	
												4	
												5	
												6	
								6.40				 Coal (Driller's Description)	7
								7.00				 Sandstone (Driller's Description)	8
													9
													10
								11.50				 Highly fractured sandstone (Driller's Description)	11
								12.50				 Sandstone (Driller's Description)	12
								13.50				End of Borehole at 13.50 m	13
											14		
											15		
											16		
											17		
											18		
											19		
											20		
											21		
											22		
											23		
											24		
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											31		
											32		
											33		
											34		
											35		
											36		
											37		
											38		
											39		
											40		

Remarks: 1. Rotary open borehole to 13.5m bgl.		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		
--	--	---	--	--	--	---

		Integral House, 7 Beddau Way Castlegate Business Park Caerphilly CF83 2AX Tel. 029 20807991 Fax. 029 20862176 mail@integralgeotec.com		Project Name: Bike Park Wales				Project No.: 12329		Borehole No.: BH4 Sheet 1 of 1	
Location: Abercanaid				Client: Bike Park Wales				Coordinates:		Hole Type: RO	
Equipment: T44				Diameter of Casing:				Level:		Scale 1:200	
Diameter of Boring:				Depth of Casing:				Dates 18/01/2019 -		Logged By: Apex	

Well	Water Strikes	Rotary Coring					Depth (m)	Level (m AOD)	N Value	Legend	Stratum Description		
		Depth (m)	TCR	SCR	RQD	FI							
							0.50				Made Ground (Driller's Description)	1	
											Sandstone (Driller's Description)	2	
													3
													4
													5
													6
								6.30				Coal (Driller's Description)	7
								6.90				Sandstone (Driller's Description)	8
													9
													10
													11
								11.20				Fractured sandstone (Driller's Description)	12
													13
													14
													15
													16
													17
													18
													19
													20
										21			
										22			
										23			
										24			
										25			
										26			
										27			
										28			
										29			
						30.00				End of Borehole at 30.00 m	30		
											31		
											32		
											33		
											34		
											35		
											36		
											37		
											38		
											39		
											40		

Remarks: 1 Rotary open borehole to 30m bgl.		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		
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APPENDIX C

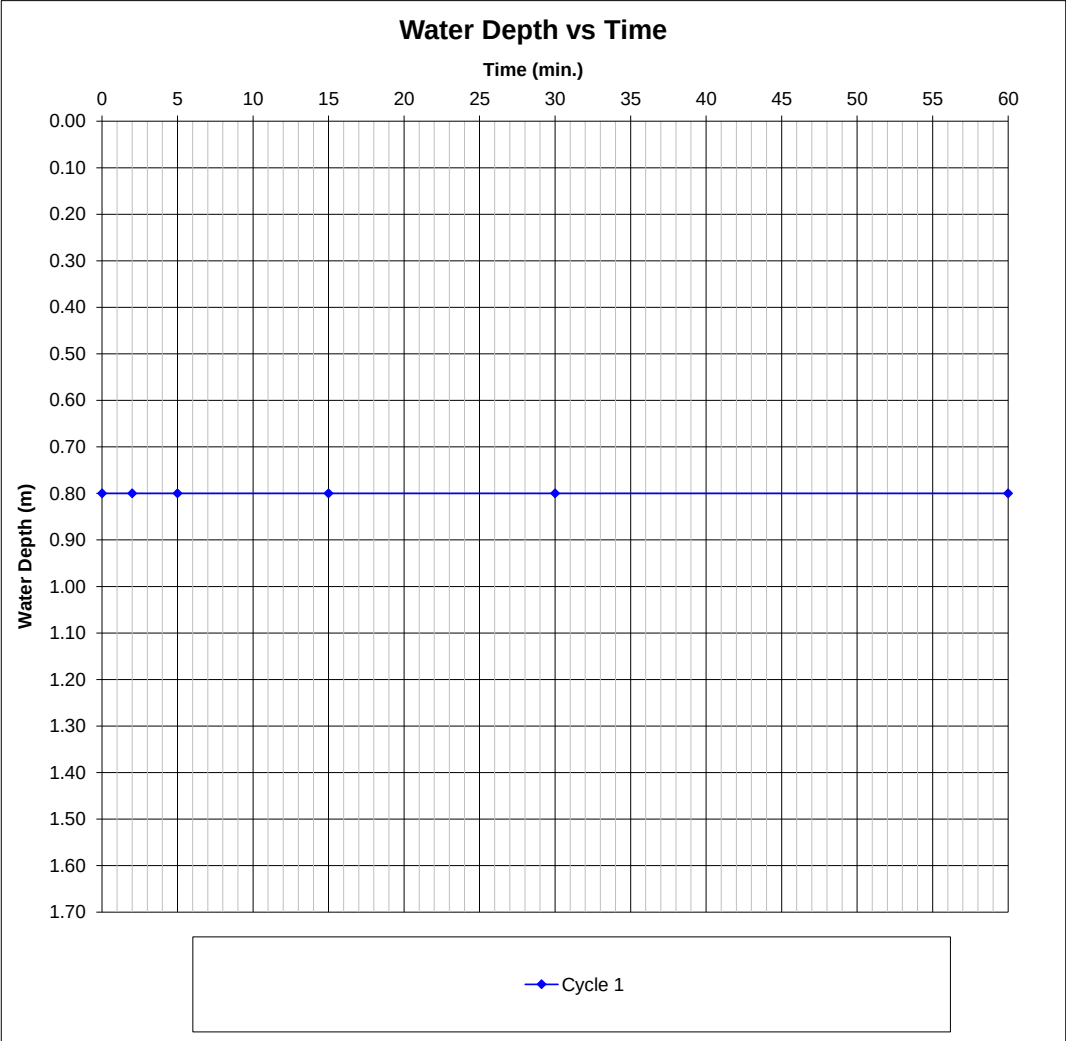
SOAKAWAY TEST RESULTS

BRE365 SOIL INFILTRATION RATE TEST - TP1

12329 Bike Park Wales

Trial Pit Information	
Length (m)	2.70
Width (m)	0.70
Depth (m)	1.70
Groundwater	Dry
Weather Conditions	Raining
Date	16-Jan-19

Remarks
Infiltration not observed

[illegible]

APPENDIX D

LABORATORY CHEMICAL TEST RESULTS

**Lowri Williams**

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Analytical Report Number : 19-25711

Project / Site name: Bike Park Wales

Samples received on: 21/01/2019

Your job number: 12329

Samples instructed on: 21/01/2019

Your order number:

Analysis completed by: 30/01/2019

Report Issue Number: 1

Report issued on: 30/01/2019

Samples Analysed: 4 soil samples

Signed:

Jordan Hill
Reporting Manager
For & on behalf of i2 Analytical Ltd.

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

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

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

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

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Analytical Report Number: 19-25711

Project / Site name: Bike Park Wales

Lab Sample Number				1136573	1136574	1136575	1136576	1136577
Sample Reference				TP4	TP2	TP3	TP4	TP2
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				1.20	1.20	0.10	0.30	0.30
Date Sampled				16/01/2019	16/01/2019	16/01/2019	16/01/2019	16/01/2019
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
Moisture Content	%	N/A	NONE	-	-	5.7	13	23
Total mass of sample received	kg	0.001	NONE	-	-	0.49	0.47	0.46

Asbestos in Soil	Type	N/A	ISO 17025	-	-	Not-detected	Not-detected	Not-detected
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General Inorganics

pH - Automated	pH Units	N/A	MCERTS	-	-	8.0	9.1	8.2
Total Cyanide	mg/kg	1	MCERTS	-	-	< 1	< 1	< 1
Total Sulphate as SO ₄	mg/kg	50	MCERTS	-	-	1700	8200	870
Water Soluble SO ₄ 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	-	-	0.077	1.6	0.032
Sulphide	mg/kg	1	MCERTS	-	-	61	780	< 1.0
Total Sulphur	mg/kg	50	MCERTS	-	-	1100	4200	480
Total Organic Carbon (TOC)	%	0.1	MCERTS	-	-	0.5	0.9	2.5
Loss on Ignition @ 450°C	%	0.2	MCERTS	-	-	1.4	3.0	6.3

Total Phenols

Total Phenols (monohydric)	mg/kg	1	MCERTS	-	-	< 1.0	< 1.0	< 1.0
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Speciated PAHs

Naphthalene	mg/kg	0.05	MCERTS	-	-	< 0.05	< 0.05	< 0.05
Acenaphthylene	mg/kg	0.05	MCERTS	-	-	< 0.05	< 0.05	< 0.05
Acenaphthene	mg/kg	0.05	MCERTS	-	-	< 0.05	< 0.05	< 0.05
Fluorene	mg/kg	0.05	MCERTS	-	-	< 0.05	< 0.05	< 0.05
Phenanthrene	mg/kg	0.05	MCERTS	-	-	< 0.05	< 0.05	< 0.05
Anthracene	mg/kg	0.05	MCERTS	-	-	< 0.05	< 0.05	< 0.05
Fluoranthene	mg/kg	0.05	MCERTS	-	-	< 0.05	< 0.05	< 0.05
Pyrene	mg/kg	0.05	MCERTS	-	-	< 0.05	< 0.05	< 0.05
Benzo(a)anthracene	mg/kg	0.05	MCERTS	-	-	< 0.05	< 0.05	< 0.05
Chrysene	mg/kg	0.05	MCERTS	-	-	< 0.05	< 0.05	< 0.05
Benzo(b)fluoranthene	mg/kg	0.05	MCERTS	-	-	< 0.05	< 0.05	< 0.05
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	-	-	< 0.05	< 0.05	< 0.05
Benzo(a)pyrene	mg/kg	0.05	MCERTS	-	-	< 0.05	< 0.05	< 0.05
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	-	-	< 0.05	< 0.05	< 0.05
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	-	-	< 0.05	< 0.05	< 0.05
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	-	-	< 0.05	< 0.05	< 0.05

Total PAH

Speciated Total EPA-16 PAHs	mg/kg	0.8	MCERTS	-	-	< 0.80	< 0.80	< 0.80
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Analytical Report Number: 19-25711

Project / Site name: Bike Park Wales

Lab Sample Number	1136573	1136574	1136575	1136576	1136577
Sample Reference	TP4	TP2	TP3	TP4	TP2
Sample Number	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)	1.20	1.20	0.10	0.30	0.30
Date Sampled	16/01/2019	16/01/2019	16/01/2019	16/01/2019	16/01/2019
Time Taken	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status		

Heavy Metals / Metalloids

Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	-	-	6.2	7.4	13
Beryllium (aqua regia extractable)	mg/kg	0.06	MCERTS	-	-	0.32	3.0	0.83
Boron (water soluble)	mg/kg	0.2	MCERTS	-	-	0.5	2.9	0.9
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	-	-	0.4	0.2	< 0.2
Chromium (hexavalent)	mg/kg	4	MCERTS	-	-	< 4.0	< 4.0	< 4.0
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	-	-	7.8	8.8	19
Copper (aqua regia extractable)	mg/kg	1	MCERTS	-	-	16	13	12
Lead (aqua regia extractable)	mg/kg	1	MCERTS	-	-	24	12	31
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	-	-	< 0.3	< 0.3	< 0.3
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	-	-	11	11	14
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	-	-	< 1.0	4.4	2.7
Vanadium (aqua regia extractable)	mg/kg	1	MCERTS	-	-	8.8	14	28
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	-	-	32	32	78

Analytical Report Number: 19-25711

Project / Site name: Bike Park Wales

Lab Sample Number				1136578				
Sample Reference				TP1				
Sample Number				None Supplied				
Depth (m)				0.10				
Date Sampled				16/01/2019				
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	31				
Total mass of sample received	kg	0.001	NONE	0.46				

Asbestos in Soil	Type	N/A	ISO 17025	Not-detected				
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General Inorganics

pH - Automated	pH Units	N/A	MCERTS	7.3				
Total Cyanide	mg/kg	1	MCERTS	< 1				
Total Sulphate as SO ₄	mg/kg	50	MCERTS	700				
Water Soluble SO ₄ 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	0.031				
Sulphide	mg/kg	1	MCERTS	< 1.0				
Total Sulphur	mg/kg	50	MCERTS	2900				
Total Organic Carbon (TOC)	%	0.1	MCERTS	3.3				
Loss on Ignition @ 450°C	%	0.2	MCERTS	8.0				

Total Phenols

Total Phenols (monohydric)	mg/kg	1	MCERTS	< 1.0				
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Speciated PAHs

Naphthalene	mg/kg	0.05	MCERTS	< 0.05				
Acenaphthylene	mg/kg	0.05	MCERTS	< 0.05				
Acenaphthene	mg/kg	0.05	MCERTS	< 0.05				
Fluorene	mg/kg	0.05	MCERTS	< 0.05				
Phenanthrene	mg/kg	0.05	MCERTS	< 0.05				
Anthracene	mg/kg	0.05	MCERTS	< 0.05				
Fluoranthene	mg/kg	0.05	MCERTS	< 0.05				
Pyrene	mg/kg	0.05	MCERTS	< 0.05				
Benzo(a)anthracene	mg/kg	0.05	MCERTS	< 0.05				
Chrysene	mg/kg	0.05	MCERTS	< 0.05				
Benzo(b)fluoranthene	mg/kg	0.05	MCERTS	< 0.05				
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	< 0.05				
Benzo(a)pyrene	mg/kg	0.05	MCERTS	< 0.05				
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	< 0.05				
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	< 0.05				
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	< 0.05				

Total PAH

Speciated Total EPA-16 PAHs	mg/kg	0.8	MCERTS	< 0.80				
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Analytical Report Number: 19-25711

Project / Site name: Bike Park Wales

Lab Sample Number				1136578				
Sample Reference				TP1				
Sample Number				None Supplied				
Depth (m)				0.10				
Date Sampled				16/01/2019				
Time Taken				None Supplied				
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status					
Heavy Metals / Metalloids								
Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	20				
Beryllium (aqua regia extractable)	mg/kg	0.06	MCERTS	0.51				
Boron (water soluble)	mg/kg	0.2	MCERTS	0.5				
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	< 0.2				
Chromium (hexavalent)	mg/kg	4	MCERTS	< 4.0				
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	14				
Copper (aqua regia extractable)	mg/kg	1	MCERTS	14				
Lead (aqua regia extractable)	mg/kg	1	MCERTS	28				
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3				
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	11				
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0				
Vanadium (aqua regia extractable)	mg/kg	1	MCERTS	20				
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	49				



Analytical Report Number : 19-25711

Project / Site name: Bike Park Wales

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

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

Lab Sample Number	Sample Reference	Sample Number	Depth (m)	Sample Description *
1136573	TP4	None Supplied	1.20	-
1136574	TP2	None Supplied	1.20	-
1136575	TP3	None Supplied	0.10	Brown clay and sand with gravel.
1136576	TP4	None Supplied	0.30	Brown clay and sand with rubble and vegetation.
1136577	TP2	None Supplied	0.30	Brown clay and sand with gravel.
1136578	TP1	None Supplied	0.10	Brown clay and loam with vegetation.

Analytical Report Number : 19-25711

Project / Site name: Bike Park Wales

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

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 diphenylcarbazine followed by colorimetry.	In-house method	L080-PL	W	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 2, 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 (automated)	Determination of pH in soil by addition of water followed by automated electrometric measurement.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L099-PL	D	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. Gravimetric determination of stone > 10 mm as % dry weight.	In-house method based on British Standard Methods and MCERTS requirements.	L019-UK/PL	D	NONE
Sulphate, water soluble, in soil (16hr extraction)	Determination of water soluble sulphate by ICP-OES. Results reported directly (leachate equivalent) and corrected for extraction ratio (soil equivalent).	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests, 2:1 water:soil extraction, analysis by ICP-OES.	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 (Automated) 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	L009-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	MCERTS
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	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.

Iss No 19-25711-1 Bike Park Wales 12329

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The results included within the report are representative of the samples submitted for analysis.

Page 7 of 7

APPENDIX E

LABORATORY GEOTECHNICAL TEST RESULTS

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Analytical Report Number : 19-25869

Project / Site name: Bike Park Wales

Samples received on: 21/01/2019

Your job number: 12329

Samples instructed on: 21/01/2019

Your order number:

Analysis completed by: 01/02/2019

Report Issue Number: 1

Report issued on: 01/02/2019

Samples Analysed: 2 soil samples

Signed:

Jordan Hill
Reporting Manager
For & on behalf of i2 Analytical Ltd.

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

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

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

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

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Analytical Report Number: 19-25869

Project / Site name: Bike Park Wales

Lab Sample Number				1137723	1137724			
Sample Reference				TP4	TP2			
Sample Number				None Supplied	None Supplied			
Depth (m)				1.20	1.20			
Date Sampled				16/01/2019	16/01/2019			
Time Taken				None Supplied	None Supplied			
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status					
Stone Content	%	0.1	NONE	< 0.1	< 0.1			
Moisture Content	%	N/A	NONE	15	14			
Total mass of sample received	kg	0.001	NONE	0.34	0.32			

General Inorganics

pH - Automated	pH Units	N/A	MCERTS	6.5	7.7			
Water Soluble SO ₄ 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	0.11	0.027			



Analytical Report Number : 19-25869

Project / Site name: Bike Park Wales

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

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

Lab Sample Number	Sample Reference	Sample Number	Depth (m)	Sample Description *
1137723	TP4	None Supplied	1.20	Brown clay and loam with gravel.
1137724	TP2	None Supplied	1.20	Brown clay and loam with gravel.

Analytical Report Number : 19-25869

Project / Site name: Bike Park Wales

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

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Moisture Content	Moisture content, determined gravimetrically.	In-house method based on BS1377 Part 2, 1990, Chemical and Electrochemical Tests	L019-UK/PL	W	NONE
pH in soil (automated)	Determination of pH in soil by addition of water followed by automated electrometric measurement.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L099-PL	D	MCERTS
Stones content of soil	Standard preparation for all samples unless otherwise detailed. Gravimetric determination of stone > 10 mm as % dry weight.	In-house method based on British Standard Methods and MCERTS requirements.	L019-UK/PL	D	NONE
Sulphate, water soluble, in soil (16hr extraction)	Determination of water soluble sulphate by ICP-OES. Results reported directly (leachate equivalent) and corrected for extraction ratio (soil equivalent).	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests, 2:1 water:soil extraction, analysis by ICP-OES.	L038-PL	D	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.



TEST CERTIFICATE

Liquid and Plastic Limits

i2 Analytical Ltd
7 Woodshots Meadow
Croxley Green Business Park
Watford Herts WD18 8YS



Environmental Science

4041

Tested in Accordance with: BS 1377-2: 1990: Clause 4.3 and 5

Client: Integral Geotechnique
Client Address: Integral House, 7 Beddau Way,
Castlegate Business Park, CF83 2AX
Contact: Lowri Williams
Site Name: Bike Park Wales
Site Address: Not Given

Client Reference: 12329
Job Number: 19-25866
Date Sampled: 16/01/2019
Date Received: 21/01/2019
Date Tested: 25/01/2019
Sampled By: Not Given

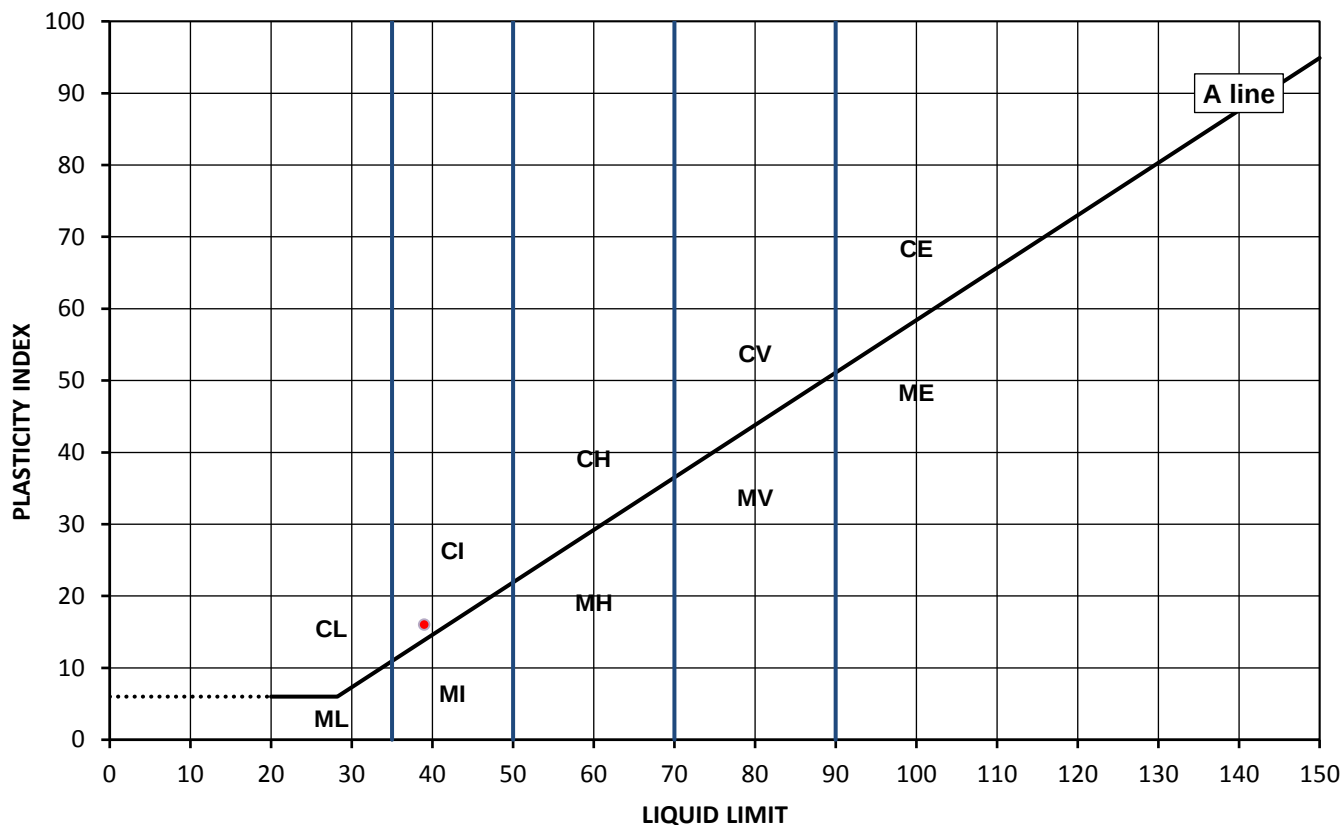
Test Results

Laboratory Reference: 1137691
Hole No.: TP4
Sample Reference: Not Given
Soil Description: Dark brown slightly gravelly sandy CLAY

Depth Top [m]: 1.20
Depth Base [m]: Not Given
Sample Type: D

Sample Preparation: Tested after >425um removed by hand

As Received Moisture Content [%]	Liquid Limit [%]	Plastic Limit [%]	Plasticity Index [%]	% Passing 425µm BS Test Sieve
24	39	23	16	97



Legend, based on BS 5930:2015 Code of practice for site investigations

C	Clay	Plasticity	Liquid Limit
M	Silt	L	Low
		I	Medium
		H	High
		V	Very high
		E	Extremely high
			below 35
			35 to 50
			50 to 70
			70 to 90
			exceeding 90
	Organic	O	append to classification for organic material (eg CHO)

Remarks:

Approved: Dariusz Piotrowski
PL Geotechnical Laboratory Manager
Date Reported: 01/02/2019

Signed: Darren Berrill
Geotechnical General Manager

GF 236.3

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The results included within the report are representative of the samples submitted for analysis.
The analysis was carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland.*



TEST CERTIFICATE

Liquid and Plastic Limits

i2 Analytical Ltd
7 Woodshots Meadow
Croxley Green Business Park
Watford Herts WD18 8YS



4041

Tested in Accordance with: BS 1377-2: 1990: Clause 4.3 and 5

Client: Integral Geotechnique
Client Address: Integral House, 7 Beddau Way,
Castlegate Business Park, CF83 2AX
Contact: Lowri Williams
Site Name: Bike Park Wales
Site Address: Not Given

Client Reference: 12329
Job Number: 19-25866
Date Sampled: 16/01/2019
Date Received: 21/01/2019
Date Tested: 25/01/2019
Sampled By: Not Given

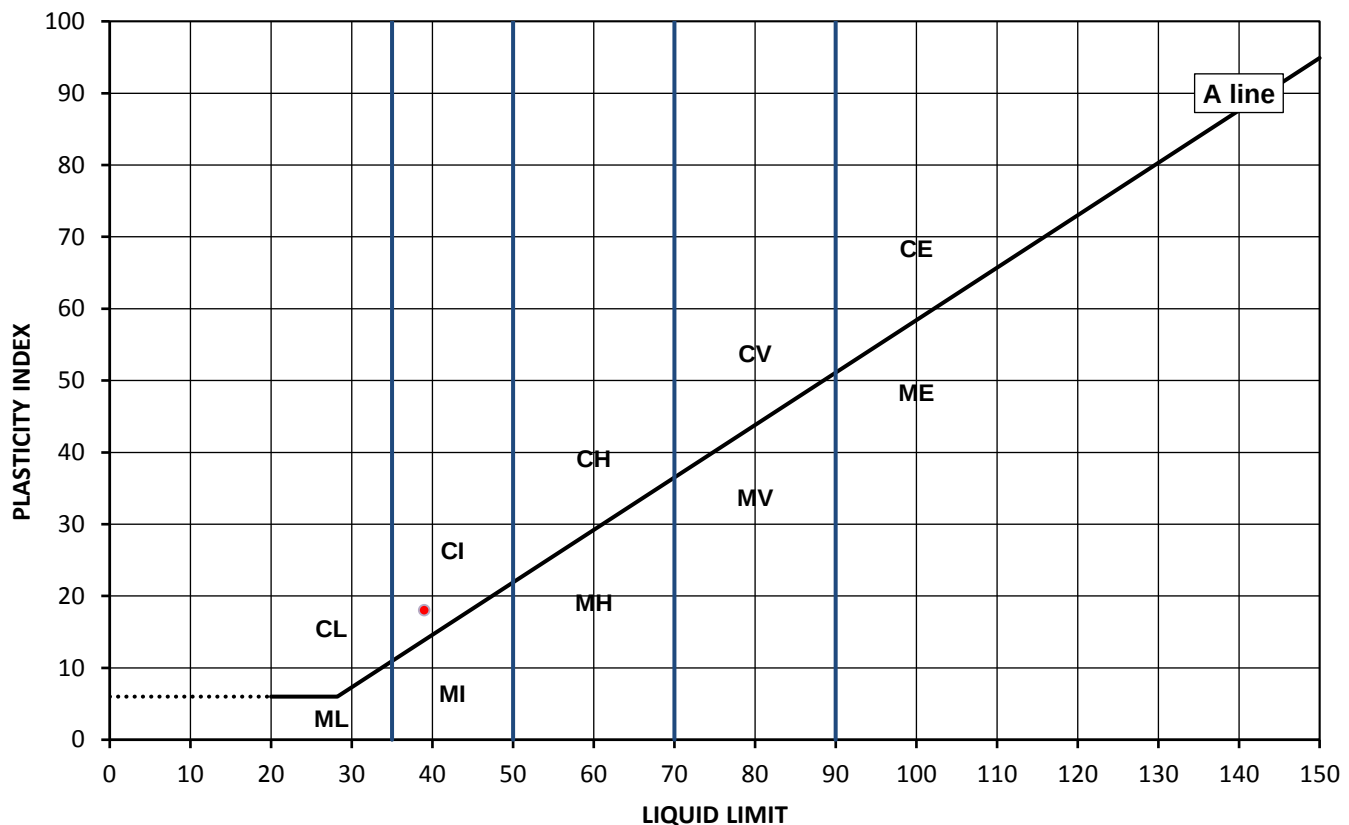
Test Results

Laboratory Reference: 1137692
Hole No.: TP2
Sample Reference: Not Given
Soil Description: Dark brown slightly gravelly sandy CLAY

Depth Top [m]: 1.20
Depth Base [m]: Not Given
Sample Type: D

Sample Preparation: Tested after washing to remove >425um

As Received Moisture Content [%]	Liquid Limit [%]	Plastic Limit [%]	Plasticity Index [%]	% Passing 425µm BS Test Sieve
20	39	21	18	86



Legend, based on BS 5930:2015 Code of practice for site investigations

C	Clay	Plasticity	Liquid Limit
M	Silt	L	Low
		I	Medium
		H	High
		V	Very high
		E	Extremely high
			below 35
			35 to 50
			50 to 70
			70 to 90
			exceeding 90
	Organic	O	append to classification for organic material (eg CHO)

Remarks:

Approved: Dariusz Piotrowski
PL Geotechnical Laboratory Manager
Date Reported: 01/02/2019

Signed: Darren Berrill
Geotechnical General Manager

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The analysis was carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland.*



4041

Client: Integral Geotechnique
 Client Address: Integral House, 7 Beddau Way,
 Castlegate Business Park, CF83 2AX
 Contact: Lowri Williams
 Site Name: Bike Park Wales
 Site Address: Not Given

SUMMARY REPORT

Summary of Classification Test Results

Tested in Accordance with:

MC by BS 1377-2: 1990: Clause 3.2; Atterberg by BS 1377-2: 1990: Clause 4.3, Clause 4.4 and 5; PD by BS 1377-2: 1990: Clause 8.2

i2 Analytical Ltd
 7 Woodshots Meadow
 Croxley Green Business Park
 Watford Herts WD18 8YS



Client Reference: 12329
 Job Number: 19-25866
 Date Sampled: 16/01/2019
 Date Received: 21/01/2019
 Date Tested: 25/01/2019
 Sampled By: Not Given

Test results

Laboratory Reference	Hole No.	Sample				Description	Remarks	MC#	Atterberg#				Density		Total Porosity				
		Reference	Depth Top m	Depth Base m	Type				% Passing 425um	LL	PL	PI	bulk Mg/m3	PD Mg/m3					
1137692	TP2	Not Given	1.20	Not Given	D	Dark brown slightly gravelly sandy CLAY	Atterberg 4 Point	20	86	39	21	18							
1137691	TP4	Not Given	1.20	Not Given	D	Dark brown slightly gravelly sandy CLAY	Atterberg 4 Point	24	97	39	23	16							

Note: # UKAS accredited; NP - Non plastic

Comments:

Approved: Dariusz Piotrowski
 PL Geotechnical Laboratory Manager
 Date Reported: 01/02/2019

Signed: Darren Berrill
 Geotechnical General Manager

GF 238.5

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 The results included within the report are representative of the samples submitted for analysis.
 The analysis was carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland."

APPENDIX F

SUMMARY OF CHEMICAL TEST RESULTS

SUMMARY OF LABORATORY SOIL TEST RESULTS

METALS AND SEMI-METALS

Job No.: 12329
Site: Bike Park Wales
Soil Type: Topsoil, Made Ground/Reworked Natural 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	TP3	0.10	6.2	0.5	0.32	0.4	7.8	< 4.0	16	24	< 0.3	11	< 1.0	8.8	32
2	TP4	0.30	7.4	2.9	3.0	0.2	8.8	< 4.0	13	12	< 0.3	11	4.4	14	32
3	TP2	0.30	13	0.9	0.83	< 0.2	19	< 4.0	12	31	< 0.3	14	2.7	28	78
4	TP1	0.10	20	0.5	0.51	< 0.2	14	< 4.0	14	28	< 0.3	11	< 1.0	20	49
Screening Criteria Value			170.0	46000.0	63.0	532.0	-	220.0	44000.0	1300.0	30.0	3400.0	1800.0	5000.0	170000.0
Source of Screening Criteria Value			S4UL	S4UL	S4UL	S4UL	-	S4UL	S4UL	C4SL	S4UL	S4UL	S4UL	S4UL	S4UL

SUMMARY OF LABORATORY SOIL TEST RESULTS

INORGANIC CHEMICALS & OTHERS

Job No.: 12329
Site: Bike Park Wales
Soil Type: Topsoil, Made Ground/Reworked Natural Ground
Soil Organic Matter: 1%

No.	Location	Depth (m)	Cyanide (mg/kg)	Loss on ignition, dried solids (%)	Moisture content at 30 C (%)	Phenol (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 (%)	Equivalent SOM (%)	Asbestos in Soil	Asbestos Quantification (%)
1	TP3	0.10	< 1	1.4	5.7	< 1.0	8.0	0.077	1700	61	1100	0.5	0.86	Not-detected	#N/A
2	TP4	0.30	< 1	3.0	13	< 1.0	9.1	1.6	8200	780	4200	0.9	1.55	Not-detected	#N/A
3	TP2	0.30	< 1	6.3	23	< 1.0	8.2	0.032	870	< 1.0	480	2.5	4.30	Not-detected	#N/A
4	TP1	0.10	< 1	8.0	31	< 1.0	7.3	0.031	700	< 1.0	2900	3.3	5.68	Not-detected	#N/A
Screening Criteria Value			34.0	-	-	760.0	-	-	-	-	-	-	-	-	0.001
Source of Screening Criteria Value			ATRISK	-	-	S4UL	-	-	-	-	-	-	-	-	IOM

SUMMARY OF LABORATORY SOIL TEST RESULTS

POLYAROMATIC HYDROCARBONS (PAH)

Job No.: 12329
Site: Bike Park Wales
Soil Type: Topsoil, Made Ground/Reworked Natural 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	TP3	0.10	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
2	TP4	0.30	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
3	TP2	0.30	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
4	TP1	0.10	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Screening Criteria Value			29000.0	29000.0	150000.0	49.0	11.0	13.0	1400.0	370.0	93.0	1.1	6300.0	20000.0	150.0	1200.0	6200.0	15000.0
Source of Screening Criteria Value			S4UL	S4UL	S4UL	S4UL	S4UL	S4UL	S4UL	S4UL	S4UL	S4UL	S4UL	S4UL	S4UL	S4UL	S4UL	S4UL

FIGURES



NORTH

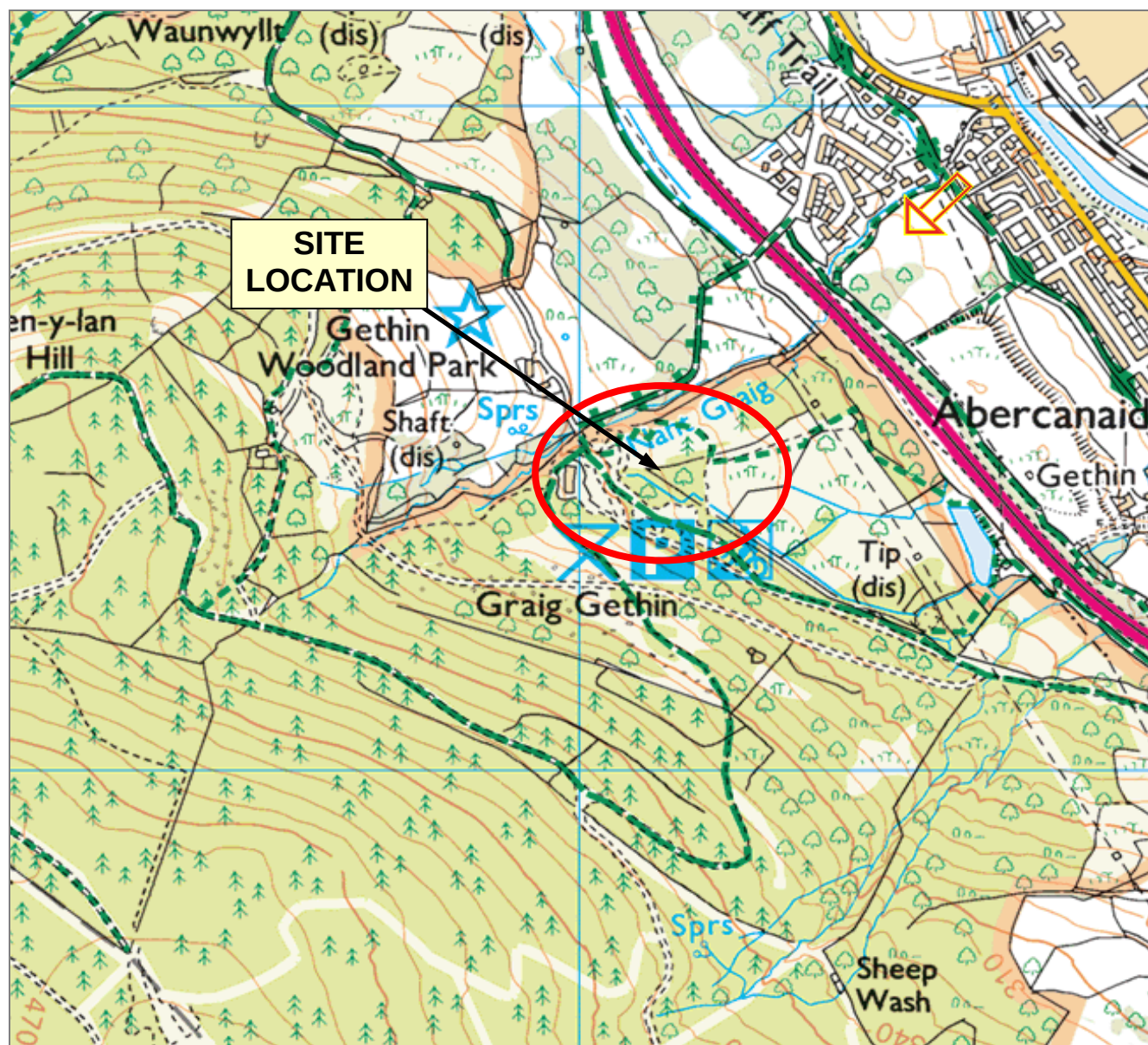


FIGURE 1: SITE LOCATION

Bike Park Wales, Abercanaid, Merthyr Tydfil

Intégral
Géotechnique

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

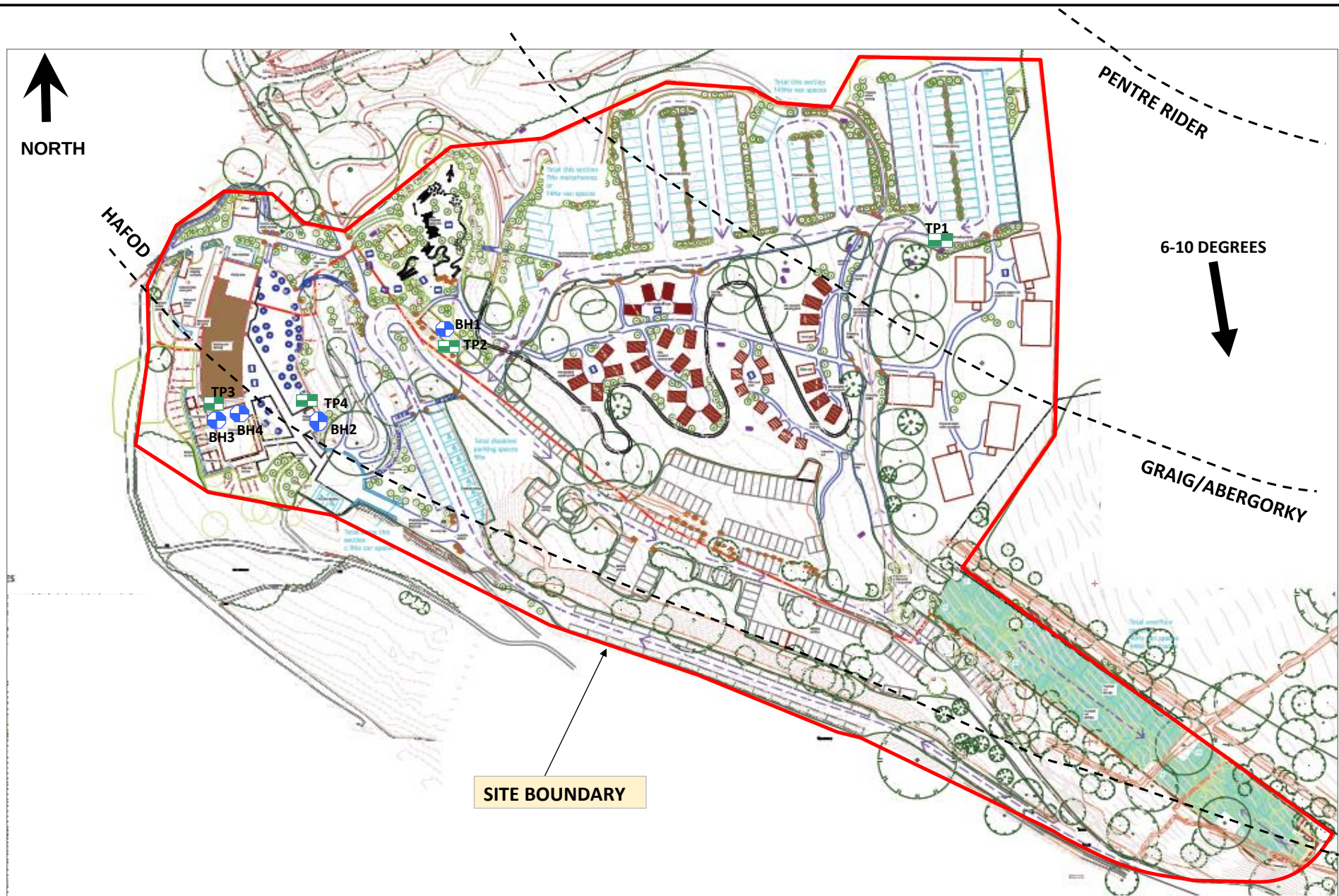


FIGURE 2: SITE PLAN

Bike Park Wales, Abercanaid, Merthyr Tydfil

Intégral
Géotechnique

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