Tylorstown Landslide

Environmental Impact Assessment

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Appendix 11.1

WFD Assessment

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Tylorstown Landslip Phase 4

Water Framework Directive Compliance Assessment

August 2021

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Quality Management

Job No	GC/003613		
Project	Tylorstown Landslip Phase 4		
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Date	13/08/2021		
Prepared by	Nicolas Holmberg	Signature (for file)	
Checked by	Robin Chase	Signature (for file)	
Authorised by	Rachel Taylor	Signature (for file)	

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1. Introduction

1.1 Purpose of this report

1.1.1 On Sunday 16th February 2020, Storm Dennis caused the Llanwonno Upper Tip to fail above the village of Tylorstown. Approximately 60,000m^3 of slipped material filled the valley bottom from the toe of the slope outwards in an extremely low angled and widely distributed debris envelope, filling the Afon Rhondda Fach's channel and diverting its course to the western side of the valley bottom. The slipped material also covered an essential water main and disused trainline which is used as a footpath. Emergency works (referred to as Phases 1, 2 and 3 of the Tylorstown Landslip scheme) were required to remove the slipped material from the river and valley bottom and transported to nearby receptor sites. These Phases are currently underway and do not form part of the Proposed Scheme.

1.1.2 The Proposed Scheme is for Phase 4 of the Tylorstown Tip project which consists of undertaking essential stabilisation and remediation works, as recommended by geotechnical studies, to ensure the remaining material within the Llanwonno Upper tip is safe, as well as offering enhancements for the local area.

1.1.3 The main objective for the Proposed Scheme is to prevent any future slips of material such as that that occurred following Storm Dennis by moving colliery material from the Llanwonno Upper Tip (RH01) to a new Receptor Site adjacent to Old Smokey (RH02). Further detail on the Proposed Scheme can be found in Chapter 3.

1.1.4 This Water Framework Directive Assessment report has been written to support the planning application and seeks to address the following:

- The elements of the proposed works which have the potential to negatively impact the surrounding water environment;
- The methodology and mitigation measures for the proposed works which have been developed to minimise these impacts; and
- how the proposed scheme complies with the EU Water Framework Directive.

1.2 Background to the Water Framework Directive

1.2.1 The Water Framework Directive (WFD) established a framework across the European Union for the protection of water bodies (including terrestrial ecosystems and wetlands directly dependent upon them), which aims to prevent further deterioration, enhance their status, promote sustainable water use, reduce pollution and mitigate the effects of floods and droughts. Water bodies include surface waters (rivers, large lakes, canals, transitional and coastal waters) and groundwater bodies (superficial and bedrock aquifers).

1.2.2 The baseline condition of all water bodies was presented in the River Basin Management Plans (RBMPs) in 2009, with England and Wales being split into its major river basin catchments. Updates to water body status is presented to the European Commission (EC) every six years. The 2015 RBMPs provided Cycle 2 updates and there are a further two cycles to be repeated in 2021 and 2027, by which point all water bodies should be achieving good ecological status or good ecological potential for artificial or heavily modified water bodies (AWB or HMWB).

1.2.3 For AWBs and HMWBs the classification system is slightly different in recognition of the impact that human activity can have on the water environment. For such water bodies the classification is based predominantly on the presence or absence of mitigation measures within the water body as a whole. These mitigation measures are defined for each water body within the RBMPs as set by the Natural Resource Wales (NRW) and the Environment Agency (EA).

1.2.4 As part of the Proposed Scheme, it is important for the client and NRW (as the relevant regulator) to consider any permanent changes the Proposed Scheme will create against the legal environmental obligations and apply best practice in terms of the environment and WFD. Any changes to physical river features, water flows, and / or chemical and ecological changes the Proposed Scheme may cause for the long term must be adequately considered as well as impacts on locally designated sites – all of which form part of the WFD assessment criteria.

1.2.5 In line with the WFD, EA Guidelines[1] or equivalent NRW guidelines, to ensure physical works or modifications in rivers meet WFD and wider environmental duties, the proposed scheme should ensure that:

- The works will not lead to a deterioration in the quality of a water body; and
- The works will not prevent the future improvement of a water body.

1.2.6 Consideration for the wider environmental effects of the scheme should also ensure that:

- The works will not impact a protected nature conservation area or priority habitat;
- The works will not impact a protected or priority species;
- Heritage, landscape and fisheries interests and the need for an Environmental Impact Assessment (EIA) have been considered; and

[1] *Flood & Coastal Risk Management – an introduction to delivering the Water Framework Directive (OI 871_11); Protecting and improving the water environment – Water Framework Directive compliance of physical works in rivers (Position 488_10); Internal Environmental Assessment and the Water Framework Directive: assessing new modifications (Operational Instruction 301_10); Internal Environmental Assessment and the Water Framework Directive: Supplementary Info (Operational Instruction 302_10).*

- Opportunities have been sought to improve the water environment.

1.2.7 Where a scheme is found to cause a potential deterioration in WFD status of a water body or prevent it achieving good status then the project must be subject to a more detailed assessment under Article 4.7 to defend the breach of WFD objectives. Strict environmental and sustainability criteria must be met to enable the work to proceed.

1.3 WFD Elements

1.3.1 The WFD classification for a defined water body is produced by the assessment of a wide variety of different 'elements' measured against specific standards and targets developed by the WFD UK Technical advisory Group (UKTAG) and the European Union that relate to a particular type and natural status of a water body.

Ecological Status

1.3.2 Ecological status classification is based upon the following groups of elements:

- Biological elements such as fish, invertebrates, macrophytes, phytobenthos (which include aquatic and riparian plants, macro-algae, phytoplankton and diatoms);
- Supporting elements that include chemical measurements such as ammonia, dissolved oxygen, pH, phosphate, copper, zinc and temperature (often referred to as 'physchem' attributes) and includes specific pollutants;
- Hydromorphology (supporting conditions) that assess the physical attributes of the water body such as 'quantity and dynamics of flow', 'river continuity', 'structure of riparian zone' and 'morphology'; and
- Assessments given for each element are also accompanied by a measure of certainty in the result (i.e. Probable, Suspected, and Certain).

1.3.3 The ecological status classification is based upon the poorest measurement found for any of the relevant elements being assessed for the identified water body. 'Good ecological status' is a classification that applies to near-natural water bodies and has been described for assessment purposes to represent those that demonstrate only a slight variation from undisturbed, natural conditions.

1.3.4 Primary elements assessed are the biological elements, supported by standard water quality parameters (physchem). The assessment also includes a review of whether or not the water body supports good conditions or features with respect to the quantity and dynamics of flow and the geomorphological condition (hydromorphology). Biotic indicator condition (high, good, moderate, poor, bad) takes precedent over physchem standards for the classification, with physchem only contributing as high, good or moderate (even if poor or bad water quality elements are recorded).

Chemical Status

1.3.5 Chemical status is recorded as good or fail and is assessed by compliance with environmental standards for chemicals that are listed in the Environmental Quality Standards (EQS) Directive 2008/105/EC1 4 (and amendments of 2013). These chemicals include priority substances and priority hazardous substances.

1.3.6 The chemical status classification for a water body is determined by the worst scoring chemical, along with a measure of results certainty. This is only assessed for water bodies where such pollutants are known to be discharged in significant quantities and is not assessed for watercourses that do not receive such substances (labelled as 'does not require assessment').

Groundwater Status

1.3.7 Groundwater status is based on a series of conditions defined in the WFD (2000/60/EC) and Groundwater Directive (2006/118/EC) and a series of tests have been designed to define good groundwater status in respect of five chemical and four quantitative parameters. The results for these are combined and the worst-case classification for the chemical status and the worst case for the quantitative elements are presented independently and the overall groundwater status is taken from the worst of these two results. Groundwaters are either classed as good or poor status.

Overall Status

1.3.8 Overall status classification is based on the poorest result for ecological and / or chemical status and is based on a 'one out, all out' principle. The classification methodology is being continuously developed as more data is collected and monitoring methods improve.

1.3.9 For heavily modified and artificial water bodies, the assessment is based more on chemical supporting elements than on the biological elements or supporting conditions. This is because good status would otherwise be impossible to achieve. Meeting the requirements of areas that are protected under other European legislation (e.g. Bathing Waters, Birds, Drinking Water, Freshwater Fish, Shellfish, Habitats, Nitrates and Urban Wastewater Treatment Directives) can also be applied to and strengthen WFD assessments.

1.3.10 The 2015 status classification provides a baseline condition against which targets of 'no deterioration' can be measured and provides a basis against which any future improvements can be measured. Reasons for a given classification are complex and may not necessarily be fully understood, particularly if there is a failure of an element of an overall status. Further investigations and improved monitoring may be required.

1.4 WFD Assessment Process

1.4.1 In order to perform the WFD assessment the following methodology has been adopted:

- Step 1 – Baseline data collection;
- Step 2 – Screening: exclude activities assessed not to have an impact on water bodies or WFD elements;
- Step 3 – Scoping: identify water bodies and specific WFD elements to be assessed; and
- Step 4 – WFD Compliance Assessment: consider impacts and mitigation and conclude the effects of the activity.

1.4.2 In order to ensure no deterioration in the WFD status of surface or ground water bodies, the following criteria must be demonstrated:

- WFD 1: The proposed works will not result in a deterioration of current ecological status or potential.
- WFD 2: The proposed works will not cause failure to meet Good Ecological Status / Good Ecological Potential (GES/GEP) by the target timeframe.
- WFD 3: The proposed works will not permanently prevent or compromise the relevant environmental objectives being met in other water bodies.

1.5 Consultation with NRW

1.5.1 NRW were initially consulted regarding this Scheme through the EIA scoping process and, in their scoping response, NRW confirmed that the planning application and ES were to be accompanied by a WFD assessment and supported by a drainage survey.

1.5.2 A meeting was subsequently held between NRW, RCT and Redstart on 28/04/2021 during which Redstart presented the Proposed Scheme as well as their approach to:

- The drainage strategy and design;
- Site investigations; and
- The WFD Assessment.

1.5.3 NRW were subsequently invited to provide their comments or raise questions about the points above. The following points were raised by NRW:

- NRW confirmed that they agreed with the assessor's decision to exclude the Nant Clydach from the WFD assessment;
- NRW requested that the assessment consider the fish spawning season and include appropriate mitigation measures in relation to this; and
- NRW queried whether the proposals create an easier pathway for leachate, due to looser compaction on the donor site. However, the Redstart design team

confirmed that material is expected to be more tightly compacted at Llanwonno Tip than it is currently.

1.5.4 The above comments were taken into consideration and integrated into the assessment, where relevant, during the finalisation of this report.

2. Design Description

2.1 Design elements

2.1.1 The Proposed Scheme involves ensuring the remaining material within the tip safe, as well as offering enhancements for the area. As such, it includes the remediation of the remaining material within RH01, on the hillside and consists of the following, as depicted in Figure 2.1.

Llanwonno Tip

2.1.2 Circa 195,000m^3 of material remaining within Llanwonno Upper Tip, on the hillside, will be removed and landscaping of the area following the removal will be implemented. The hillside will be graded to match the natural sloping gradient of the valley side, tying the area into the surrounding landscape. This will also create more stability on the valley side by removing the material overlying the natural sloping gradient of the valley The proposed excavation area is depicted in drawing GC3613-RED-75-XX-DR-C-0063 and associated cross sections in drawings GC3613-RED-75-XX-DR-C-0064 to 0069.

2.1.3 Appropriate surface water drainage will be provided at the reprofiled tip. This will consist of swales and herring bone drains to collect surface water flows, directing them towards a network of three drainage channels below the tip. These will, in turn, direct waters towards an existing channel and outfall to the Afon Rhondda Fach. Further details of the outline drainage design are available in the Tylorstown Slip Phase 4 drainage strategy (see Appendix 11.2 of the Tylorstown Slip Phase 4 Environmental Statement).

Slip Area

2.1.4 Up to 35,000m^3 of material will be used to infill such features as the slip scar, below Llanwonno Tip, to bring the ground to a homogenous level, similar to the natural sloping gradient of the valley side.

Widening of Tramway

2.1.5 Approximately 160,000m^3 of the material will need to be transported along a disused tramway to the adjacent Receptor Site (approximate centre at ST 02103 95732). Widening of the existing tram way is necessary to allow access for trucks and plant to RH01 and the Receptor Site.

Receptor Site

2.1.6 As mentioned above, approximately 160,000m^3 of the material excavated from Llanwonno Tip will be transported to the Receptor Site, to be deposited and landscaped into a new landform, adjacent to the existing Old Smokey. The purpose of this movement of colliery material is to prevent any future slips such as that that occurred in February 2020, by moving it to a more stable and secure location. The final landform at of the Receptor Site will be 540m long, with a width varying between 75m and 120m, a maximum height of 7.08m, a 2.5% cross fall and 1 in 3 side batters. The location of the Receptor Site is depicted in Figure 2.1 below. The outline drainage design proposals for the Receptor Site consist of swales surrounding the new landform and feeding into two attenuation ponds which discharge into the existing drainage network.

2.1.7 Further drawings and details of the Receptor Site are available in Volumes 1 and 2 of the Tylorstown landslip Phase 4 Environmental Statement. The exact layout and landscaping of the reprofiled material will be refined during the detailed design and informed by environmental surveys and the EIA process. Further details of the outline drainage design are available in the Tylorstown Slip Phase 4 drainage strategy.

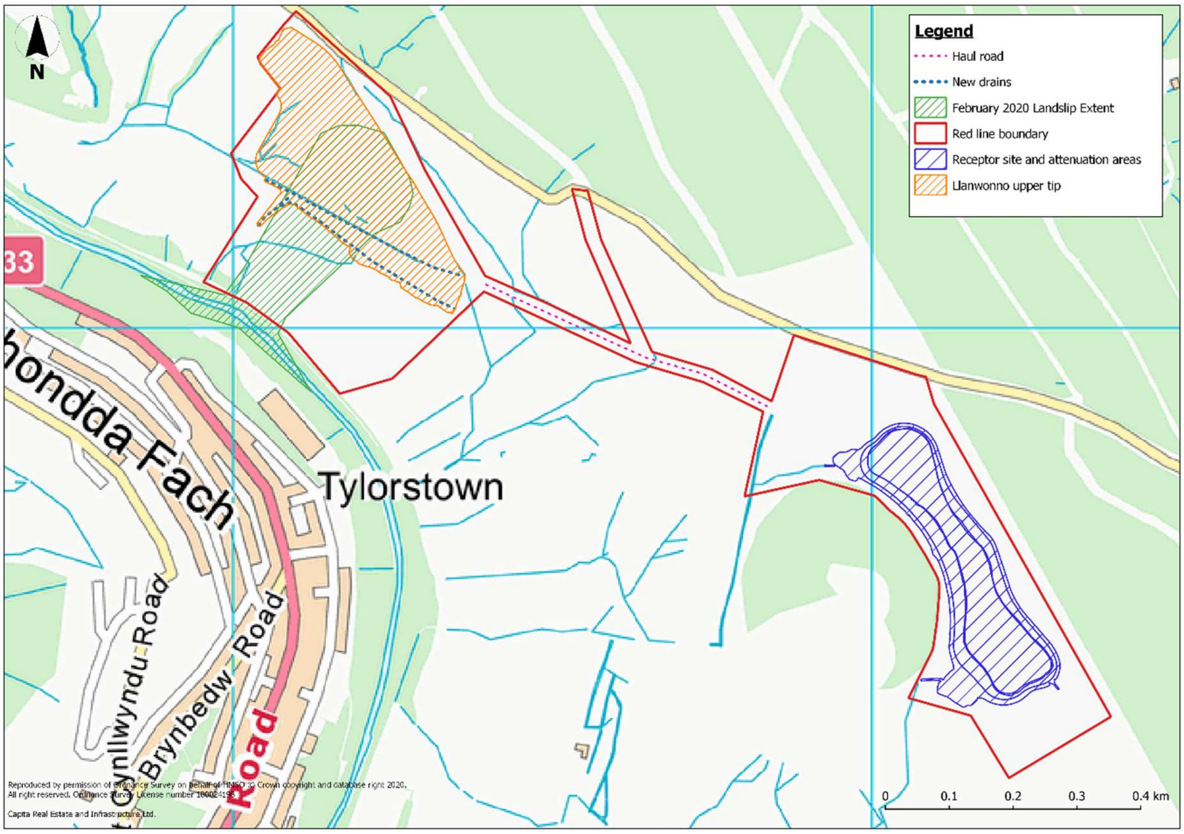

Figure 2.1 Proposed development boundary and design elements

2.2 Construction

Haulage routes and Vehicle Movements

2.2.1 The design of the Proposed Scheme allows the recovery of all the material to be undertaken without having to access the public road network. The haulage route used between the sites will be along the disused tramway and not on any public highway for the duration of the Proposed Scheme's construction. This has major advantages in that it saves approximately 3,000 HGV road journeys through Ferndale, and potentially up to 9,000 if travelling through Blaenllechau.

2.2.2 It is assumed that the transport of material from Llanwonno tip to the receptor site will require 15,000 HGV movements in total over a period of around four months, giving an average of 135 to 140 HGVs movements per day.

2.2.3 The tramway will be widened to approximately 5m, dependent on vehicle size, with a length of 550m. It will be surfaced using stone surfaced crusher run at <300mm in diameter (thickness to be confirmed by the contractor, based on conditions after site strip).

2.2.4 Further detail on the transport arrangements required during the depositing of material on the sites are discussed in the Transport Statement[2] accompanying the application.

Construction compounds

2.2.5 There will be one construction compound on site that will have an approximate area of 5700m^2. This will be located to the east of the haulage route, north-west of the Receptor Site, as depicted in Figure 2.1.

Construction plant and equipment

2.2.6 The plant likely to be used for the construction of the Proposed Scheme includes:

- Volvo A20 articulated hauler;
- Volvo A30 articulated hauler; and
- CAT 320 hydraulic excavator.

Construction practice

2.2.7 The majority of works will take place during the working week and only in the daytime. There will be no night-time working and minimal working on Saturday and Sunday mornings. All relevant Code of Construction Practice (CoCP) guidelines will be followed to reduce impacts during construction.

2.2.8 Further information on the design is available in the Tylorstown Landslip Phase 4 Environmental Statement[3].

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[2] Capita / Redstart (2021), *Tylorstown Landslip Phase 4 Transport Statement.*

[3] Capita / Redstart (2021), *Tylorstown Landslip Phase 4 Environmental Statement.*

3. Baseline Data

3.1 Baseline Scope and data sources

3.1.1 In order to assess the impacts of the proposed works on the water environment, relative to the objectives of the WFD, an assessment of the baseline conditions is required.

3.1.2 The Proposed Scheme is in proximity to fluvial (river) settings and therefore should consider the relevant RBMP. The proposals lie within the Afon Rhondda Fach valley and catchment, which is located within the Severn River Basin.

3.1.3 The Water Watch Maps produced by Natural Resources Wales (NRW) and the Severn RBMP have been used to define the current condition of the relevant water bodies, the objectives in place specific to the relevant water bodies, and any protected areas associated with the water bodies.

3.1.4 Groundwater level data has been obtained from ground investigation to provide an estimate of the groundwater levels in specific locations to predict the likelihood of potential effects of the scheme components on the groundwater bodies.

3.1.5 A drainage survey was undertaken in March 2021, identifying the location and properties of all watercourses and drains within the Redline Boundary. This was undertaken primarily for drainage purposes but has also been used to confirm the water environment and WFD baseline at the site.

3.1.6 For the purposes of this assessment, the geographical scope (the 'study area') will cover the immediate extent of the proposed development area and a 1km buffer around the redline boundary, as depicted in Figure V2-S11-0001 of the ES.

3.2 Surface water bodies

3.2.1 This section includes the WFD classifications for each WFD surface water body within the study area. All classifications and objectives are included in Table 1. A description of the network of minor watercourses in the study area is also included.

3.2.2 Three surface water designated under the WFD are present in the study area (see Appendix A for depiction):

- Afon Rhondda Fach - source to confluence Rhondda R (GB109057027210) – designated as a heavily modified water body;
- Nant Clydach - source to confluence R Taff (GB109057027250) – not designated artificial or heavily modified water body; and
- Aman R - source to confluence Afon Cynon (GB109057027130) - not designated artificial or heavily modified water body.

3.2.3 Other watercourses present within the study area but are not designated WFD water bodies include a large number of unnamed drains, ditches and adits scattered across the side of the valley.

Afon Rhondda Fach

3.2.4 The Rhondda Fach River is a tributary of the River Taff and drains a catchment of approximately 29.71 km^2. The watercourse's headwaters form in the hills above Blaenrhondda, in a marshy area between Mynydd Beili Glas and Mynydd Bwllfa. The river enters the Lluest-wen Reservoir before flowing down into Maerdy and then on through the settlements of Ferndale, Tylorstown and Ynyshir before reaching its confluence with the River Rhondda at Porth.

3.2.5 Within the study area the catchment is predominantly urban and post-industrial, characterised by a narrow floodplain with a series of settlements and towns (such as Ferndale and Tylorstown) established along its course. Areas of mostly pastoral with some arable agricultural use as well as woodland are also present with the catchment. The water body is tree lined along most of its course; however, these do not provide a consistent or thick coverage, so they do not provide abundant shading. The water body is also crossed by numerous roads, including the A4233 which runs alongside the watercourse, along the valley bottom, crossing the river in multiple locations. The Rhondda Fach has been heavily modified throughout its course, to accommodate the industrial development of the area, particularly along the stretch adjacent to the Proposed Scheme. As a result, the river is a highly modified and confined watercourse.

3.2.6 Site observations of the Afon Rhondda Fach were made from Station Road bridge down to the location of the February 2020 landslip.

3.2.7 As it flows below Station Road bridge, the channel of the Rhondda Fach bears no signs of a natural or naturalistic form as it is lined with stone and concrete and runs through a pipe directly below the bridge before discharging into a small bason directly downstream of the bridge. Evidence of the previous industrial activity and further modifications of the floodplain are visible throughout this area, in the form of stone walls and metal pipes (See Figure 3.1 below).

Figure 3.1 Heavily modified section of the Rhondda Fach river, below Station Road bridge.

3.2.8 Downstream of this, the watercourse superficially appears more naturalistic, with extensive areas of the channel bed filled with scattered pebbles and boulders (See Figure 3.2). These provide a network of naturalistic pools and riffles that supply varying flows along this reach. However, further evidence of heavy modification is also visible, with the edges of the channel being lined with concrete as well as large areas of the riparian zone (See Figure 3.3). The banks of the Rhondda Fach therefore display great stability and there is no evidence of erosion or natural processes occurring on the banks of the watercourse.

3.2.9 This section of the river is lined with trees, Although they do not appear to contribute towards the stability of the banks on this location, they do provide shading to the watercourse.

3.2.10 Ecological surveys undertaken along this reach have also identified evidence of Otter activity, meaning that this section of the Rhondda Fach provides a source of foraging for individuals in the area.

Figure 3.2 View of the Rhondda Fach facing downstream, with visible concrete banks.

Figure 3.3 Visible part of the concrete-lined bank of the Rhondda Fach.

3.2.11 At the location of the February 2020 slip, little evidence remains of the previous course of the Rhondda Fach. As mentioned above, the slipped material accumulated at the bottom of the valley is this location, shfting the course of the river. Emergency works have since been undertaken to remove the excess material and realign the channel to its previous course. Figure 3.4 and Figure 3.5 below show the current alignment of the Rhondda Fach, as a result of the realignment works.

3.2.12 The bed and banks of the river have been lined with stone, some of which are remnants of the original channel and others that have been newly imported for the purpose of realigning the watercourse. The bed substrate is generally dominated by coarse cobbles and boulders which provide riffles and varying flows. The channel has been designed into a 2-stage channel, with the lower stage consisting of steep or vertical banks and the upper stage possessing more gradual gradients.

3.2.13 Tree and vegetation cover along this stretch of the river were lost as a result the landslip, rendering the banks bare of any shading.

3.2.14 As this is a newly realigned channel, there is no evidence of natural processes, however, it is expected that these are likely to be limited and confined by the engineered stone banks of the channel, as it is in the remainder of this reach of the Rhondda Fach.

Figure 3.4 View of the Rhondda Fach at the slip location, facing upstream.

Figure 3.5 View of the slip location on the Rhondda Fach, facing downstream.

3.2.15 The Afon Rhondda Fach - source to conf Rhondda R WFD water body was classed as having '**Moderate'** ecological status in 2009 (Cycle 1), however this has declined to '**Poor**' in 2015 (Cycle 2) and poor 2018 (Cycle 2). The poor overall status was due to a poor status for fish in 2015 and 2018. These have been attributed to diffuse and point sources of sediment and organic pollution because of discharge from sewage treatment works, industrial and an abandoned mine. Also, poor fish status has also been attributed to physical barriers to migration. Specific species that were identified as failing in the watercourse are Salmon, Trout and Bullhead.

3.2.16 All water body objectives were met in 2015 except for hydrological regime and the fish element which has an objective of good by 2021.

3.2.17 WFD classifications are detailed in Table 1.

3.2.18 Mitigation measures that are noted as not yet being in place include:

- control or manage point source inputs
- control or manage diffuse source inputs;
- removal or easement of barriers to fish migration;
- to mitigate/Remediate point source impacts on receptor; and
- alter/change permits for sewage treatment works.

3.2.19 Three sets of water samples were collected from the Afon Rhondda Fach in November and December 2020, upstream of the location of the slip (as well as in a tributary draining the tip location), as part of a previous phase of the project (see Appendix E). These were tested for water quality and revealed that concentrations of dissolved copper and zinc in the Afon Rhondda Fach exceed Water Framework Directive EQS. This suggests that the chemical WFD elements of the Afon Rhondda Fach could be of a lesser quality than is reflected in the waterbody's current classification. Additionally, one of the samples obtained from the tributary contained concentrations of dissolved lead exceeding EQS; however, levels in the Rhondda Fach remained below the EQS threshold.

Table 1. WFD classification for the Afon Rhondda Fach WFD surface water body.

Elements	Classifications			
	Afon Rhondda Fach - source to confluence Rhondda R (GB109057027210)			
	2009	2015	2018 Cycle 2	Objectives[4]
Overall Status	Moderate	Poor	Poor	Good by 2021
Ecological Status Potential	Moderate	Poor	Poor	Good by 2021
Mitigation Measures Assessment	Moderate	Moderate	Moderate	Good by 2021
Fish	Moderate	Poor	Poor	Good by 2021
Invertebrates	Good	Good	Good	Good by 2015
Macrophytes & Phytobenthos	Not assessed	Good	Good	Good by 2015
Hydromorphological Supporting Elements	Not assessed	Not assessed	Not assessed	Not assessed
Hydrological Regime	Not assessed	Does not Support Good	Moderate	Good by 2021
Flow	Not assessed	Fail	Not assessed	Not assessed
Morphology	Not assessed	Supports Good	Not assessed	Supports Good by 2015
Physico-chemical quality elements	Not assessed	Not assessed	Not assessed	Not assessed
Ammonia	High	High	High	High by 2015
Dissolved Oxygen	High	High	High	High by 2015
Biological Oxygen Demand (BOD)	Not assessed	Not assessed	Not assessed	Not assessed
pH	High	High	High	High by 2015
Phosphate	High	Good	Good	High by 2015
Temperature	High	High	High	High by 2015
Specific Pollutants (Annex 8)	High	High	High	High by 2015
Chemical Status	Good	Good	Good	Good by 2015
Other pollutants	Not assessed	Not assessed	Not assessed	Not assessed
Copper	Not assessed	Good	High	Good by 2021

[4] It is assumed that the WFD objectives have been met where the previous status is assessed as high or good.

Elements	Classifications			
	Afon Rhondda Fach - source to confluence Rhondda R (GB109057027210)			
	2009	2015	2018 Cycle 2	Objectives[4]
Iron	Not assessed	Good	High	Good by 2015
Zinc	Not assessed	Good	Not assessed	Good by 2015
Priority hazardous substances	Not Assessed	Not assessed	Not assessed	Not assessed
Priority substances (Annex 10)	Not Assessed	Good	Not assessed	Good by 2015

Nant Clydach

3.2.20 The Nant Clydach is a small stream that is a tributary of the River Taff. It joins the Taff just outside Pontypridd. and drains a catchment of approximately 25.68 km^2.

3.2.21 Although the waterbody itself is not located within the study area, its catchment does extend into the area of the proposed development. The headwater of the Nant Clydach form to the east of Ferndale and Tylorstown, up on the hills, to the north of Llanwonno. The watercourse flows in a general south-easterly direction along its 13km length, through the village of Ynysybwl before reaching the River Taff, outside Pontypridd.

3.2.22 The Nant Clydach is not designated as artificial or heavily modified and its catchment is primarily occupied by woodland areas as well as areas of agricultural land use.

3.2.23 The water body was classed as having '**Poor**' ecological status in 2009 (Cycle 1), 2015 (Cycle 2) and poor 2018 (Cycle 2). The poor overall status was due to a '**Poor**' status for fish in 2015 and 2018, which has been attributed to the presence of physical barriers to fish migration in the watercourse.

3.2.24 All water body objectives were met in 2015 except for the fish element which has an objective of good by 2021.

3.2.25 WFD classifications are detailed in Table 2.

3.2.26 Mitigation measures that are noted as not yet being in place include:

- control or manage point source inputs
- control or manage diffuse source inputs; and
- removal or easement of barriers to fish migration.

Table 2. WFD classification for the Nant Clydach WFD surface water body.

Elements	Classifications			
	Nant Clydach - source to confluence R Taff (GB109057027250)			
	2009	2015	2018 Cycle 2	Objectives[5]
Overall Status	Poor	Poor	Poor	Good by 2021
Ecological Status	Poor	Poor	Poor	Good by 2021
Fish	Poor	Poor	Poor	Good by 2021
Invertebrates	High	Good	Good	Good by 2015
Macrophytes & Phytobenthos	Not assessed	Not assessed	High	High by 2021
Hydromorphological Supporting Elements	Not assessed	Not assessed	Not assessed	Not assessed
Hydrological Regime	Not High	Supports Good	Not High	Good by 2015
Flow	Pass	Pass	Not assessed	Not assessed
Morphology	Good	Supports Good	Good	Good by 2015
Physico-chemical quality elements	Not assessed	Not assessed	Not assessed	Not assessed
Ammonia	High	High	High	High by 2015
Dissolved Oxygen	High	High	High	High by 2015
Biological Oxygen Demand (BOD)	Not assessed	Not assessed	High	High by 2015
pH	High	High	High	High by 2015
Phosphate	High	High	High	High by 2015
Temperature	High	High	High	High by 2015
Specific Pollutants (Annex 8)	High	Not assessed	Not assessed	Not Assessed
Chemical Status	Good	Good	Good	Good by 2015
Other pollutants	Not assessed	Not assessed	Not assessed	Not assessed
Copper	Not assessed	Good	Not assessed	Good by 2021
Iron	Not assessed	Good	Not assessed	Good by 2015

[5] It is assumed that the WFD objectives have been met where the previous status is assessed as high or good.

Elements	Classifications			
	Nant Clydach - source to confluence R Taff (GB109057027250)			
	2009	2015	2018 Cycle 2	Objectives[5]
Zinc	Not Assessed	Good	Not assessed	Good by 2015
Priority hazardous substances	Not Assessed	Not assessed	Not assessed	Not assessed
Priority substances (Annex 10)	Not Assessed	Good	Not assessed	Good by 2015

Aman R - source to confluence Afon Cynon

3.2.27 This WFD waterbody is located approximately 1km north of the redline boundary and does not remotely interact with the proposed Scheme. No further consideration has therefore been given to this WFD waterbody.

Minor watercourses

3.2.28 A drainage survey of the study area identified a total of 22 drainage channels located on the valley side, within the study area, forming a large network collecting surface water from the top and sides of the valley and discharging it into the Afon Rhondda Fach. Most of these watercourses are artificial, consisting of either excavated drainage ditches, concrete channels or footpaths that now act as flow routes. This network of drains is depicted in Appendix B, with arrows indicating flow paths and direction. None of these watercourses are WFD waterbodies; however, they all lie within the Afon Rhondda Fach catchment.

3.2.29 Llanwonno Upper Tip is bordered and drained by ditches; two to the east (channels 13 and 14), a ditch directly to the west (channel 17) and an engineered footpath running to the south, directly below the tip, acting as a drainage ditch (channel 10/10A; see Figure 3.6).

3.2.30 Surface water captured within these channels flows downstream, along two principal flow paths (one directly below the tip and the other slightly to the south) that discharge into the Afon Rhondda Fach. Channel 22 has a naturalistic channel (see Figure 3.7) and is located directly below the tip, transporting some of the flows from the above tip down to the Afon Rhondda Fach.

3.2.31 The landslip that occurred in 2018 also removed a large section of drainage previously located on the valley side. Following the landslip, emergency mid-slope drainage arrangements were designed and constructed directly below Llanwonno Upper Tip, to capture surface water flowing down the face of the valley without any defined flow path.

Figure 3.6 Footpath below Llanwonno Upper Tip acting as drainage.

Figure 3.7 Naturalistic channel near outfall of channel 22 into the Afon Rhondda Fach.

3.2.32 Old Smokey, however, is primarily drained by shallow concrete channels that surround the mound, capturing surface water and directing it along two principal flow paths:

- The western side of Old Smokey is drained by concrete channel (channel 5) that directs surface water flows in a southerly then westerly direction, down the valley (see Figure 3.8). The lower reaches of the channel have a more natural form and are no longer concreted (see Figure 3.9), discharging surface water directly into the Afon Rhondda Fach below; and

- The eastern side of Old Smokey is also drained by a concrete channel (channel 2) that directs flows in a southerly direction, beyond the site boundary and into further drains (see Figure 3.10). The upper reaches of the channel (directly adjacent to Old Smokey) run beside a footpath and show signs of structural damage (see Figure 3.11) A review of aerial mapping and topography suggests that these flows eventually reach the Afon Rhondda Fach; however, this flow route is a much longer than its western counterpart.

3.2.33 In addition to these surveyed watercourses, there are several adits lying uphill of Llanwonno Upper Tip that are known to have mine water discharge which flows through the network of channels discussed above.

Figure 3.8 Upper reaches of channel 5. Concrete lined channel.

Figure 3.9 Lower reaches of channel 5. Naturalistic channel

Figure 3.10 Lower reaches of channel 2. Concrete lined channel.

Figure 3.11 Upper sections of Channel 2. Concrete channel with visible damage.

3.3 Groundwater Bodies

3.3.1 One groundwater body designated under the WFD is present in the study area.

- SE Valleys Carboniferous Coal Measures (GB40902G201900).

3.3.2 All classifications and objectives are included in Table 3.

SE Valleys Carboniferous Coal Measures

3.3.3 The SE Valleys Carboniferous Coal Measures groundwater body is a Drinking Water Protected Area. The water body was classed as having an overall status of poor in 2009 due to a combination of good quantitative status and poor chemical status. In 2015, these classifications had not changed and therefore indicated no improvements in the overall water body classification. Failure of the Chemical dependent surface water body status with no information to attribute this to a particular source. This has therefore been listed as no known technical solution available. Targets set to achieve poor chemical status and poor overall status by 2015 have been met.

3.3.4 Six recent boreholes (BH01 to BH07) and three existing wells (BH01A to BH03A) from previous GI have been monitored for groundwater, below the footprint of the proposed Receptor Site, with two rounds of testing completed in March 2021. The results (presented in Appendix C of this report) indicate that the equilibrium water table lies more than 70m below ground level (bgl).

Table 3. WFD classification for the WFD groundwater body affected by the Proposed Scheme.

Elements	SE Valleys Carboniferous Coal Measures (GB40902G201900)		
	Classification 2009	Classification 2015	Objectives[6]
Overall Water Body	Poor	Poor	Poor by 2015
Quantitative Status	Good	Good	Good by 2015
Quantitative Dependent Surface Water Body Status	Low	Good	Good by 2015
Quantitative GWDTEs test	Good	Good	Good by 2015
Quantitative Saline Intrusion	Good	Good	Good by 2015
Quantitative Water Balance	Good	Good	Good by 2015
Chemical Status	Poor	Poor	Poor by 2015
Chemical Dependent Surface Water Body Status	Poor	Poor	Poor by 2015
Chemical Drinking Water Protected Area	Good	Good	Good by 2015
Chemical GWDTEs Test	Good	Good	Good by 2015
Chemical Saline Intrusion	Good	Good	Good by 2015
General Chemical Test	Good	Good	Good by 2015

[6] It is assumed that the WFD objectives have been met where the previous status is assessed as high or good.

3.4 Protected Areas

3.4.1 The proposed works will need to consider the presence of any protected areas within the immediate vicinity. Under WFD, the following designations must be considered as protected areas associated with WFD waterbodies:

- Bathing Waters;
- Special Protection Areas;
- Drinking Water Protected Areas;
- Special Area of Conservation;
- Nitrate Vulnerable Zone;
- Shellfish Waters; and
- Sensitive Areas (Urban Wastewater).

3.4.2 Further information on the protected areas present across the water body can be found in the Severn RBMP.

3.4.3 As part of this assessment information has been gathered from Natural Resources Wales which provides online maps and databases which present the best available information on the protected sites across Wales.

3.4.4 A review of the data available confirmed that:

- there are no protected areas with the catchment of the Afon Rhondda Fach; and
- the Nant Clydach WFD waterbody is designated as a Drinking Water Protected Area

3.4.5 No designated protected areas will need to be considered in this assessment, given that none identified above will be directly affected by the Proposed Scheme.

3.5 Colliery material properties

3.5.1 A Ground Investigation was undertaken at Llanwonno Tip in January 2021 and included chemical testing of the colliery material at Llanwonno Tip, as well as the collection and testing of leachate samples. A summary of the results is available in Appendix D1.

3.5.2 Leachate testing of the material comprising Llanwonno Tip also showed the samples to be free from contaminants. No PAHs, monoaromatics or TPH species were present above detection limits. For metals, all except lead were below relevant screening criteria (Water Framework Directive EQS). This creates a potential for the colliery material to be acting as a source of lead pollution to the nearby Afon Rhondda Fach. Refer to Appendix D3 for these results.

3.5.3 Also, testing of the Llanwonno tip material indicates that it is porous, allowing rainwater infiltration levels similar to those currently at the Receptor Site.

3.6 Water and soil properties at the Receptor Site

3.6.1 Soil testing was also undertaken within the footprint of the proposed Receptor Site. Soils were shown to be free from contamination regarding relevant screening levels[7] for a Public Open Space (parks) land use, though several samples reported low pH. Eight of fourteen samples recorded a pH of lower than 6, and two of those eight reported a pH lower than 5. A summary of the results is available in Appendix D2.

3.6.2 Leachate testing of the soils revealed that two samples failed against relevant screening criteria (Water Framework Directive EQS) for iron, with a maximum value of 1200µg/l against a limit of 1000µg/l. Leachate testing is known to be aggressive and provide a conservative assessment of the in-situ leaching situation, so it is difficult to assess whether this marginal failure currently affects nearby watercourses (Refer to Appendix D4 for these results). The concentrations of copper, zinc, manganese, and nickel were assessed using the UK Technical Advisory Group Metal Bioavailability Assessment Tool (m-BAT) to determine their bioavailable concentrations. Calcium concentrations, a key parameter of these equations, was below detection limits so the limit has been used in its place. Only one failure was identified, with one sample of zinc from TP3 showing a bioavailable concentration of 12.78 ug/l against a limit of 10.9 ug/l.

3.6.3 A borehole (BH07), which recorded the most perched groundwater immediately after drilling, and two surface water monitoring points (located in drainage features between 20m and 40m from the proposed Receptor Site) were tested for a comprehensive suite of water quality parameters in two separate monitoring rounds. Water samples were again shown to be largely free from contamination, though bioavailable manganese concentration of 240µg/l and 180µg/l were recorded in BH07 and one of the surface water samples respectively, exceeding the limit of 123µg/l. Manganese is a common contaminant in colliery spoil so these results are not unexpected, and there is the potential for material at the Receptor Site to be adding to the manganese load in watercourses which run through a valley with numerous colliery waste tips. Dissolved Copper concentrations also exceeded EQS thresholds in all water samples.

[7] Nathanail et al. (2015),*The LQM/CIEH S4ULs for Human Health Risk Assessment.*

4. Screening

4.1 Surface water

4.1.1 In this section, the scheme components summary (described in Section 2.1) and the water body baseline information (described in Section 3) is used to assess which scheme components and surface water bodies are to be taken forward for the WFD Compliance Assessment. The following principles were applied to screen watercourses in or out for further assessment:

- All WFD waterbodies located within the redline boundary are automatically screened into the assessment.
- Any WFD waterbodies that aren't located within the redline boundary but who's catchment interacts with the redline boundary is given further consideration and can be either screened in or screened out, depending on whether a likely impact source and/or pathway are created by the proposed Scheme; and
- All non-WFD watercourses within the redline boundary are automatically screened out of the assessment but are given further consideration as a pathway, if they are tributaries of WFD waterbody.

4.1.2 To screen design elements of the Proposed Scheme in or out for further assessment, it was considered whether a likely impact source and/or pathway exists between the design element and WFD waterbodies or are created by the design element. If so, the design element was screened in.

4.1.3 Table 4 sets out the watercourses affected by the Scheme and the relevant Scheme Design Elements before providing a screening outcome for each of these, as well as a justification for this outcome.

Table 4. Surface water screening assessment for scheme components.

Scheme Design Element	Affected watercourse	Screening outcome	Justification
Removal of material from Llanwonno Tip (RH01) and associated landscaping (including associated drainage works)	Afon Rhondda Fach - source to confluence Rhondda (WFD water body. Ref. GB109057027210)	In	The removal of material and subsequent landscaping of the area (including drainage arrangements) is likely to cause changes to the surface water draining into the Afon Rhondda Fach, potentially affecting the waterbody as a result.
Construction of Haul Road (and associated drainage).	Afon Rhondda Fach - source to confluence Rhondda (WFD water body. Ref. GB109057027210)	In	Although the works associated with the haul road are unlikely to cause significant change to the Afon Rhondda Fach, there is a direct pollution pathway between it and the watercourse.
Creation of a new landform at the Receptor Site	Afon Rhondda Fach - source to confluence Rhondda (WFD water body. Ref. GB109057027210)	In	The creation of a new landform at the Receptor Site, using colliery spoil is likely to is likely to cause changes to the surface water draining into the Afon Rhondda Fach, potentially affecting the waterbody as a result.
Removal of material from Llanwonno Tip (RH01) and Construction of Haul Road (and associated landscaping drainage).	Nant Clydach - source to confluence R Taff (WFD water body. Ref. GB109057027250)	Out	These proposed design elements of the Scheme do not interact directly or indirectly with the Nant Clydach - source to confluence R Taff WFD waterbody and there is therefore no pathway for impacts to materialise.
Creation of a new landform at the Receptor Site.	Nant Clydach - source to confluence R Taff (WFD water body. Ref. GB109057027250)	Out	Although the Proposed Scheme is partly located with the its catchment, it will not affect the 'Nant Clydach - source to confluence R Taff' WFD water body. The review of LiDAR and the results of the drainage survey have confirmed that surface water in the Scheme location drains westwards, into the Rhondda Fach catchment, as opposed to the Nant Clydach catchment. The drainage proposals of the Scheme will also assure this remains the case post-construction.
All Scheme components	All minor watercourses and drains within the vicinity of the Scheme.	Out	Watercourse receptor value is low as they are not WFD watercourses. Given further consideration as a pathway for impacts to

Scheme Design Element	Affected watercourse	Screening outcome	Justification
			the Afon Rhondda Fach - source to confluence Rhondda downstream.

4.2 Groundwater – screening of relevant scheme components

4.2.1 In this section, all scheme components are assessed for their potential to impact on groundwater quantity and quality. For this screening assessment, scheme components are grouped according to their type rather than focussing on specific components. This is to allow for consideration of the generic impacts of each component at this stage. Scheme components, potential impacts and their screening outcome are provided in Table 5 below.

Table 5. Groundwater screening assessment for scheme components.

Scheme component	Affected water bodies	Screening outcome	Justification / potential impact if relevant
Removal of material from Llanwonno Tip (RH01) and associated landscaping (including associated drainage works)	SE Valleys Carboniferous Coal Measures	In	Potential to affect groundwater flow, creating or altering of pathways along which existing poor quality groundwater can migrate.
Construction of Haul Road (and associated drainage).	SE Valleys Carboniferous Coal Measures	In	Potential to affect groundwater quality, particularly during the construction and operation of the haul road.
Creation of a new landform at the Receptor Site	SE Valleys Carboniferous Coal Measures	In	Potential to affect groundwater flow, creating or altering of pathways along which existing poor quality groundwater can migrate.

5. Scope of the Assessment

5.1 WFD Elements to be assessed

5.1.1 The assessment of the Proposed Scheme and its design will be conducted for various WFD elements that are relevant to those that provide the 2015 WFD classification for the water bodies screened in to the assessment in Section 4 above.

Ecological status (potential) elements

5.1.2 The ecological elements considered in this assessment, include Fish; Invertebrates; Macrophytes; and Phytoplankton (including native and non-native species) as well as mitigation measures (as the waterbody is heavily modified). Supporting elements are also assessed in the report, including: physico-chemical quality elements (such as Dissolved Oxygen, pH, Phosphates, Temperature etc.) and hydrological regime parameters (such as flow dynamics and geomorphology).

Chemical status elements

5.1.3 Chemical Status (for priority and priority hazardous substances) is considered in this assessment, including the potential risk of contaminant release during the construction and operational phases.

Temporary works

5.1.4 Temporary works during construction are considered under the WFD but only if potential impacts are permanent. The assessment below primarily focuses on permanent measures and their impact on WFD waterbodies. However, any temporary works undertaken during construction that could result in permanent impacts to a water body (such as extensive quantities of sediment release or pollution incidents) have been considered in this assessment also. These will be adequately mitigated through construction management measures to minimise the risk to WFD waterbodies.

5.2 Information and data supporting the assessment

5.2.1 This assessment is supported by information described in the design and baseline (in Sections 2 and 3) as well as the appendices of this report, all of which have been obtained from multiple data sources:

- WFD classification data available on NRW's Water Watch page and in the Severn RBMP has been used to define the baseline WFD status of the relevant WFD waterbodies. These are provided in Section 3 above;
- A drainage survey has been undertaken to inform the drainage design of the Scheme but will also inform the WFD assessment by providing detail on all drains

and watercourses on site as well as all drainage pathways (and therefore impact pathways) from the various design elements to Rhondda Fach;

- Chemical testing results of the colliery material within Llanwonno tip; and
- Available water quality data collected from the Afon Rhondda Fach, upstream of the drainage outfalls, has also inform the WFD assessment baseline.

6. WFD Assessment

6.1 WFD Assessment

6.1.1 The purpose of the assessment is to ensure that the works are compliant with the WFD. The following sections considers the proposed works associated with the development in respect to the objectives of the WFD.

6.1.2 The surface water and groundwater assessments are provided in Sections 6.2 and 6.3 respectively. These assessments include: (i) a description of the potential impacts from each scheme component on WFD elements and receptors in the absence of mitigation; (ii) proposed mitigation measures; and (iii) an indication of whether the 3 WFD objectives (as stated in Section 1.4) are met by the Scheme, including with the application of mitigation measures.

6.2 Surface Water Assessment

6.2.1 The elements of the Proposed Scheme affecting watercourses are outlined in Section 2. The following components of the Proposed Scheme have been screened in to the WFD assessment for impacts on surface water bodies. Table 6 presents this assessment.

Design Element 1: Removal of material from Llanwonno Tip (RH01) and associated landscaping (including associated drainage works);

Design Element 2: Construction of Haul Road (and associated drainage); and

Design Element 3: Creation of a new landform at the Receptor Site.

6.2.2 The full surface water assessment for the above elements is provided in Table 6 below. A high-level summary of the findings is also provided from Section 0.

Table 6. WFD Assessment of the elements of the Proposed Scheme relevant to surface water bodies.

Key impact and WFD elements affected	Potential impacts of the element without mitigation	Proposed mitigation measures	WFD 1 objective met? (No deterioration)	WFD 2 objective met? (No prevention to meet objectives)	WFD 3 objective met? (No prevention of other WBs to meet objectives)
Design Element 1: Removal of material from Llanwonno Tip (RH01) and associated landscaping (including associated drainage works) **Key waterbodies affected:** Afon Rhondda Fach - source to confluence Rhondda					
Ecological Status *Fish* *Invertebrates* *Macrophytes & Phytobenthos*	The proposals will have no direct physical impacts on fish, invertebrates, macrophytes and phytobenthos, as the proposal are removed from the Rhondda Fach and therefore not introducing physical barriers or causing the loss of habitat. The removal of the material during construction has the potential to mobilise pollutants contained in the spoil material which, once they drain through the network of drains within the redline boundary, into the Afon Rhondda Fach, have the potential affect fish, and invertebrates, through a reduction in water quality. During the operation of the Proposed Scheme, the quantity of contaminants previously leaching from Llanwonno Upper Tip will be reduced in this location, thereby reducing the risk of contamination to fish and invertebrates. Moreover, the removal of the material from the slopes of the valley will reduce the risk of future landslips and the resulting habitat destruction, fish and invertebrate mortality.	Environmental considerations including the potential for contamination and any risks arising from the development to the environment will be considered through an appropriate risk assessment. Appropriate pollution prevention measures will also be reference in the Construction Environmental Management Plan (CEMP) and applied on site, during the excavation of material. The drainage design of the Llanwonno tip should incorporate swales into the drainage network. These are to be appropriately vegetated in order to capture and retain some of the metals (such as lead) found to be present in the colliery material, thereby reducing the amount reaching the Afon Rhondda Fach downstream. Moreover, the proposed works should avoid the fish spawning season between November and January and ensure appropriate sediment control measures are in place to prevent the discharge of sediment in to the Afon Rhondda Fach.	**Yes. No residual adverse impacts and minor beneficial impacts.**	**Yes. No residual adverse impacts and minor beneficial impacts.**	**Yes. No residual adverse impacts.**
PhysChem *Phosphates*	The removal of the material during construction has the potential to mobilise sediment and pollutants contained in	Environmental considerations including the potential for contamination and any risks	**Yes. No residual adverse impacts**	**Yes. No residual adverse impacts**	**Yes. No residual adverse impacts.**

Key impact and WFD elements affected	Potential impacts of the element without mitigation	Proposed mitigation measures	WFD 1 objective met? (No deterioration)	WFD 2 objective met? (No prevention to meet objectives)	WFD 3 objective met? (No prevention of other WBs to meet objectives)
Dissolved oxygen *pH* *Temperature* **Chemical Status** *Priority and priority hazardous substances*	the spoil material which, once it drains down into the waterbody, has the potential to reduce the Physico-chemical status of the Rhondda Fach. During the operation of the Proposed Scheme, the quantity of contaminants previously leaching from Llanwonno Upper Tip will be reduced in this location, thereby reducing the concentration of metals such as Copper, Iron and Zinc entering the Afon Rhondda Fach. Moreover, the removal of the material from the slopes of the valley will reduce the risk of future landslips and the resulting release of metal pollutants into the Rhondda Fach.	arising from the development to the environment will be considered through an appropriate risk assessment. Appropriate pollution prevention measures will also be reference in the Construction Environmental Management Plan (CEMP) and applied on site, during the excavation of material. The drainage design of the Llanwonno tip should incorporate swales into the drainage network. These are to be appropriately vegetated in order to capture and retain some of the metals (such as lead) found to be present in the colliery material, thereby reducing the amount reaching the Afon Rhondda Fach downstream.	**and minor beneficial impacts.**	**and minor beneficial impacts.**	
Hydromorphology *Flow quantity & dynamics* *Bed substrate* *Riparian zone*	The proposals will have no direct or indirect impacts on the hydromorphology of the Afon Rhondda Fach. Moreover, the removal of the material from the slopes of the valley will reduce the risk of future landslips and the associated disruptive impacts on the hydromorphology of the Rhondda Fach.	N/A	**Yes. No Change**	**Yes. No Change**	**Yes. No Change**
HMWB Mitigation Measures	The removal of material from Llanwonno Tip will not prevent the implementation of mitigation measures outlined in the RBMP.	N/A	**Yes. No Change**	**Yes. No Change**	**Yes. No Change**
Design Element 2: Construction and operation of Haul Road (and associated drainage) **Key water bodies affected** Afon Rhondda Fach - source to confluence Rhondda					
Ecological Status *Fish*	This change is not expected to have any long-term impact on any of the ecological elements of the Rhondda Fach.	Environmental considerations including the potential for contamination and any risks	**Yes. No Change**	**Yes. No Change**	**Yes. No Change**

Key impact and WFD elements affected	Potential impacts of the element without mitigation	Proposed mitigation measures	WFD 1 objective met? (No deterioration)	WFD 2 objective met? (No prevention to meet objectives)	WFD 3 objective met? (No prevention of other WBs to meet objectives)
Invertebrates *Macrophytes & Phytobenthos*	There is potential for pollution event to occur during construction, affecting the ecological status of the watercourse.	arising from the development to the environment will be considered through an appropriate risk assessment. Appropriate pollution prevention measures will also be reference in the CEMP and applied on site, during the excavation of material.			
PhysChem *Phosphates* *Dissolved oxygen* *pH* *Temperature* **Chemical Status** *Priority and priority hazardous substances*	This change is not expected to have any long-term impact on any of the physio-chemical or chemical elements of the Rhondda Fach. There is potential for pollution event to occur during construction, affecting the physico-chemical status of the watercourse.				
Hydromorphology *Flow quantity & dynamics* *Bed substrate* *Riparian zone*	This change is not expected to have any long-term impact on any of the Hydromorphological elements of the Rhondda Fach.	N/A			
HMWB Mitigation Measures	This change will not prevent the implementation of mitigation measures outlined in the RBMP.	N/A			
Design Element 3: Creation of a new landform at the Receptor Site **Key water bodies affected** Afon Rhondda Fach - source to confluence Rhondda					
Ecological Status *Fish* *Invertebrates* *Macrophytes & Phytobenthos*	The deposition of material at the receptor site is creating a new source of chemical and sediment pollution that could reach the Afon Rhondda Fach downstream. However, based on the review of mapping and the results of the drainage survey, it has been concluded that the moving the material to this new location has increased the length of	Environmental considerations including the potential for contamination and any risks arising from the development to the environment will be considered through an appropriate risk assessment. Appropriate pollution prevention measures will also be	**Yes. Negligible residual adverse impacts**	**Yes. Negligible residual adverse impacts**	**Yes. Negligible residual adverse impacts**

Key impact and WFD elements affected	Potential impacts of the element without mitigation	Proposed mitigation measures	WFD 1 objective met? (No deterioration)	WFD 2 objective met? (No prevention to meet objectives)	WFD 3 objective met? (No prevention of other WBs to meet objectives)
	the pathway from the contamination source (the material) to the receptor (Afon Rhondda Fach), reducing the amount of contaminants reaching affecting ecological receptors in the Afon Rhondda Fach. This is therefore considered that to constitute a minor improvement to the baseline situation. The material poses a risk of leaching contaminants and sediment during its handling and transport, during construction.	reference in the CEMP and applied on site, during the excavation of material. The drainage design of the Receptor Site should include the integration of swales into the drainage network. These are to be appropriately vegetated in order to capture and retain some of the metals found to be leaching from the material forming the receptor site, thereby reducing the amount reaching the Afon Rhondda Fach.			
PhysChem *Phosphates* *Dissolved oxygen* *pH* *Temperature* **Chemical Status** *Priority and priority hazardous substances*	The deposition of material at the receptor site is creating a new source of chemical and sediment pollution that could reach the Afon Rhondda Fach downstream. However, based on the review of mapping and the results of the drainage survey, it has been concluded that the moving the material to this new location has increased the length of the pathway from the contamination source (the material) to the receptor (Afon Rhondda Fach), reducing the amount of contaminants reaching the Afon Rhondda Fach. This is therefore considered that to constitute a minor improvement to the baseline situation. The material poses a risk of leaching contaminants and sediment during its handling and transport, during construction.				
Hydromorphology *Flow quantity & dynamics* *Bed substrate* *Riparian zone*	This change is not expected to have any long-term impact on any of the Hydromorphological elements of the Rhondda Fach, as the works are remote from the river and the hydrology is not significantly changed.	N/A	**Yes. No Change**	**Yes. No Change**	**Yes. No Change**

Key impact and WFD elements affected	Potential impacts of the element without mitigation	Proposed mitigation measures	WFD 1 objective met? (No deterioration)	WFD 2 objective met? (No prevention to meet objectives)	WFD 3 objective met? (No prevention of other WBs to meet objectives)
HMWB Mitigation Measures	The deposition of colliery material at the Receptor Site will not prevent the implementation of mitigation measures outlined in the RBMP and may contribute towards the achievement of one of these ("control or manage diffuse source inputs"), by increasing the pathway between source and receptor.	N/A	**Yes. No residual adverse impacts and minor beneficial impacts.**	**Yes. No residual adverse impacts and minor beneficial impacts.**	**Yes. No residual adverse impacts.**

Summary of surface water assessment

Minor adverse impacts

6.2.3 The deposition of material at the receptor site is not creating a new source of chemical and sediment pollution, as the material is already currently located within the Afon Rhondda Fach catchment, with surface water draining into the WFD watercourse. However, the handling of the material is likely to mobilise pollutants and eventually lead to increased leaching of metals such as lead once the material has been deposited. This could in turn affect ecological elements of the watercourse, such as fish, which already have a failing WFD status.

Minor beneficial impacts

6.2.4 Based on the review of mapping and the results of the drainage survey, it has been concluded that the moving the material to the Receptor Site will increase the length of the pathway from the contamination source (the material) to the receptor (Afon Rhondda Fach), reducing the amount of contaminants reaching the Afon Rhondda Fach. This is therefore considered to constitute a minor improvement to the current baseline scenario.

Mitigation measures

6.2.5 The following mitigation measures have been identified as being required to address the impacts on surface water bodies discussed above and ensure the compliance of the Proposed Scheme with the WFD:

- To prevent any pollution events during construction, appropriate pollution prevention measures will be included in the CEMP and applied across the construction site, particularly during the excavation and handling of material. Where relevant, the proposed works shall comply with and refer to the Department for Environment, Food and Rural Affairs (DEFRA) & EA's Pollution Prevention Guidance[8] as well as NRW guidance[9];
- The proposed works should avoid the fish spawning season between November and January and ensure appropriate sediment control measures are in place to prevent the discharge of sediment in to the Afon Rhondda Fach;

[8] Department for Environment, Food and Rural Affairs & Environment Agency (2016), *Guidance: Pollution prevention for businesses*. https://www.gov.uk/guidance/pollution-prevention-for-businesses#construction-inspection-and-maintenance.
[9] Natural Resources Wales (2014), *How to comply with your environmental permit.* https://cdn.cyfoethnaturiol.cymru/media/2110/how-to-comply-with-your-environmental-permit.pdf?mode=pad&rnd=131467604540000000

- The drainage design of the Llanwonno tip should incorporate swales into the drainage network. These are to be appropriately vegetated in order to capture and retain some of the metals (such as lead) found to be present in the colliery material, thereby reducing the amount reaching the Afon Rhondda Fach downstream;
- The drainage design of the Receptor Site should incorporate swales and wetlands into the drainage network. These are to be appropriately vegetated (with rush species for example) in order to capture and retain some of the metals (such as lead) found to be present in the colliery material, thereby reducing the amount reaching the Afon Rhondda Fach downstream; and
- Topsoil should be reinstated to cap both the remainder of Llanwonno tip and the Receptor Site, allowing natural regeneration of vegetation in these areas. This would reduce the mobilisation of sediment and leachate following the deposition of the colliery material. The effectiveness of this mitigation measure is expected to increase with time, as vegetation establishes itself and stabilises the topsoil capping.

6.2.6 Provided these mitigation measures are implemented, the Scheme is considered to have negligible impacts on WFD surface waterbodies and thereby complies with the WFD.

6.3 Groundwater Assessment

6.3.1 The following components of the Proposed Scheme have been screened in for consideration in the WFD assessment for impacts on groundwater bodies:

Design Element 1: Removal of material from Llanwonno Tip (RH01) and associated landscaping (including associated drainage works); and

Design Element 2: Creation of a new landform at the Receptor Site.

6.3.2 The full groundwater assessment for the above elements is provided in Table 7 below.

Table 7. WFD Assessment of the elements of the Proposed Scheme relevant to groundwater bodies

WFD Element	Potential impacts of the element without mitigation	Proposed mitigation measures	WFD 1 objective met? (No deterioration)	WFD 2 objective met? (No prevention to meet objectives)	WFD 3 objective met? (No prevention of other WBs to meet objectives)
Design Element 1: Removal of material from Llanwonno Tip (RH01) and associated landscaping (including associated drainage works) **Key water bodies affected:** SE Valleys Carboniferous Coal Measures					
Quantitative	Although the removal of 195,000m^3 of material from Llanwonno Tip poses a risk to groundwater flows, a dramatic increase in levels as a result of the Scheme is highly unlikely, as the phreatic surface which presents itself in the remnant and lowered material mass is almost certainly going to be less elevated than in the pre-slip taller landform. It is therefore considered that the impact is negligible but that further monitoring should be undertaken to confirm this.	Boreholes will be drilled at a time when most of the material has been moved (once the valley slope is stable) in order to monitor whether groundwater levels remain stable (within seasonal variations), particularly in the vicinity of springs, streams and former ponding area. Groundwater levels will be monitored over 6 months, during winter, employing a once monthly frequency. Appropriate pollution prevention measures will also be reference in the CEMP and applied on site, during the excavation of material. Reference shall be made to DEFRA) & the EA's Pollution Prevention Guidance as well as NRW guidance.	**Yes. Negligible residual adverse impacts**	**Yes. Negligible residual adverse impacts**	**Yes. Negligible residual adverse impacts**
Chemical	The removal of 195,000m^3 of material from Llanwonno Tip is likely to mobilise sediment and contaminants that have the potential to enter groundwater bodies both during construction, when these are likely to be mobilised, and during operation, when the newly exposed material may be more susceptible to erosion and leaching, following the removal of the covering material. Previous reports[10][11] indicate that some hydraulic connection is considered likely between the colliery spoil and the	Environmental considerations including the potential for contamination and any risks arising from the development to the environment will be considered through an appropriate risk assessment. Appropriate pollution prevention measures will also be reference in the CEMP and applied on site, during the excavation of material. Reference shall be made to DEFRA) & the EA's Pollution Prevention Guidance as well as NRW guidance. The drainage design of the Llanwonno tip should incorporate swales into the drainage network. These are to be	**Yes. Negligible residual adverse impacts**	**Yes. Negligible residual adverse impacts**	**Yes. Negligible residual adverse impacts**

[10] Halcrow Group Ltd. (2004), *Llanwonno Tips Reclamation Scheme Stability Report*

[11] Halcrow UK (2000), *Llanwonno Tips Reclamation Scheme Option Assessment Report*, Ref: KJ/LWTR/R1

WFD Element	Potential impacts of the element without mitigation	Proposed mitigation measures	WFD 1 objective met? (No deterioration)	WFD 2 objective met? (No prevention to meet objectives)	WFD 3 objective met? (No prevention of other WBs to meet objectives)
	superficial deposits which suggest that this would remain the case after the removal of material. However, the removal of the material from Llanwonno Tip also presents a beneficial impact, as this will reduce the volume of material from which contaminants can leach into the groundwater in this location.	appropriately vegetated to capture and retain some of the metals (such as Lead) found to be present in the colliery material, thereby reducing the amount reaching the groundwater below. It is also recommended that some form of seeding be applied to the newly exposed tip side, in order to encourage natural regeneration and reduce the risk of erosion, thereby reducing the potential for contaminants and sediment to reach the groundwater below.			
Design Element 2: Construction and operation of Haul Road (and associated drainage) **Key water bodies affected** Afon Rhondda Fach - source to confluence Rhondda					
Quantitative	The construction of the haul route as well as its use during the construction period is not considered to have any impacts on groundwater flows and availability, as no significant works are expected below ground.	N/A	**Yes. No Change**	**Yes. No Change**	**Yes. No Change**
Chemical	The construction of the haul road has the potential to mobilise sediment and contaminants that could enter groundwater bodies. Also, the risk of spillages exists during the use of the haul road to transport colliery material from Llanwonno Tip and the receptor Site.	Environmental considerations including the potential for contamination and any risks arising from the development to the environment will be considered through an appropriate risk assessment. Appropriate pollution prevention measures will also be reference in the CEMP and applied on site, during the excavation of material. Reference shall be made to DEFRA) & the EA's Pollution Prevention Guidance as well as NRW guidance.	**Yes. No residual adverse impacts and minor beneficial impacts.**	**Yes. No residual adverse impacts and minor beneficial impacts.**	**Yes. No residual adverse impacts and minor beneficial impacts.**
Design Element 3: Creation of a new landform at the Receptor Site. **Key water bodies affected:** SE Valleys Carboniferous Coal Measures					

WFD Element	Potential impacts of the element without mitigation	Proposed mitigation measures	WFD 1 objective met? (No deterioration)	WFD 2 objective met? (No prevention to meet objectives)	WFD 3 objective met? (No prevention of other WBs to meet objectives)
Quantitative	The deposition of material at the Receptor Site has the potential to affect groundwater flow paths within the waterbody below. However, the review of Ground Investigation (GI) results confirm that ground water was not encountered within 19m of the surface at the receptor site (See Appendix D2), meaning that the deposited material at the receptor site is unlikely to have any impact on groundwater flows and availability.	Monitoring wells to be installed prior to the placement of material on the receptor site, to monitor any changes in groundwater levels with at least two rounds of water level monitoring before placement of the material at the Receptor Site.	**Yes. Negligible residual adverse impacts**	**Yes. Negligible residual adverse impacts**	**Yes. Negligible residual adverse impacts**
Chemical	The deposition of material at the receptor site is creating a new source of chemical and sediment pollution that could reach the groundwater body below. However, GI results confirm that ground water was not encountered within 19m of the surface at the receptor site (See Appendix D2), meaning that any sediment or leachate from the deposited material is unlikely to find a direct pathway to the waterbody below. Moreover, based on the results of the GI, depth of groundwater appears to be greater at the Receptor Site than at Llanwonno Tip, meaning that, by moving the material to this location, the length of the pathway from the contamination source (the material) to the receptor (SE Valleys Carboniferous Coal Measures waterbody) has been increased. This is therefore considered to constitute a minor improvement to the baseline situation. The material poses a risk of leaching contaminants and sediment during its handling and transport, during construction.	Environmental considerations including the potential for contamination and any risks arising from the development to the environment will be considered through an appropriate risk assessment. Appropriate pollution prevention measures will also be reference in the CEMP and applied on site, during the excavation of material. Reference shall be made to DEFRA) & the EA's Pollution Prevention Guidance as well as NRW guidance. The drainage design of the Receptor Site should include the integration of swales into the drainage network. These should be appropriately vegetated to capture and retain some of the metals (such as Lead) found to be leching from the deposited material, thereby reducing the amount reaching the groundwater below. The placement of seeded topsoil on top of the newly formed Receptor Site would reduce the likelihood of metal and sediment mobilisation.	**Yes. No residual adverse impacts and minor beneficial impacts.**	**Yes. No residual adverse impacts and minor beneficial impacts.**	**Yes. No residual adverse impacts and minor beneficial impacts.**

Summary of groundwater assessment

Negligible adverse impacts

6.3.3 Based on the available information on the depth of groundwater and the nature of the Proposed Scheme, it is considered that the Scheme will not create any barriers to groundwater movement. Although a risk of increasing groundwater levels exists, this is considered to negligible and mitigation measures below will ensure that any increase in risk is identified.

6.3.4 The risk of groundwater contamination from construction activities is also considered to be negligible, provided best-practice working methods are employed, as suggested in the mitigation measures below.

6.3.5 A risk of groundwater contamination post-construction has been identified, as the moved material is likely to contain mobilisable contaminants. However, this risk is negligible once the design mitigation measures below are applied. As a whole, the Scheme is considered to provide an improvement to the current baseline, by moving 160,000m^3 of material to a location with deeper groundwater strata and thereby reducing the likelihood of leachate reaching the SE Valleys Carboniferous Coal Measures WFD waterbody.

Mitigation measures

6.3.6 The following mitigation measures have been identified as being required to address the impacts on groundwater discussed above and ensure the compliance of the Proposed Scheme with the WFD:

- Monitoring wells to be installed prior to the placement of material on the Receptor Site, to monitor any changes in groundwater levels during the material placement stages, with at least two rounds of water level monitoring before placement of the material at the Receptor Site;
- Boreholes will be drilled at Llanwonno Upper Tip, at a time when most of the material has been moved (once the valley slope is stable), in order to monitor whether groundwater levels remain stable (within seasonal variations), particularly in the vicinity of springs, streams and former ponding area. Groundwater levels will be monitored over 6 months, during winter, employing a once a month frequency;
- The construction works should avoid the fish breeding season between November and January, where possible, and ensure appropriate sediment control measures are in place to prevent the discharge of sediment in to the Afon Rhondda Fach;
- To prevent any pollution events during construction, appropriate pollution prevention measures will be included in the CEMP and applied across the construction site,

particularly during the excavation and handling of material. Where relevant, the proposed works shall comply with and refer to DEFRA & the EA's Pollution Prevention Guidance as well as NRW guidance.

6.3.7 Moreover, mitigation measures integrated into the design to prevent degradation to surface water WFD bodies, such as the integration of swales into the drainage design and the re-use of topsoil onsite, will also contribute towards mitigating for impacts on groundwater WFD bodies.

7. Conclusions and Recommendations

7.1 Conclusions

7.1.1 The Proposed Scheme and associated construction works have been assessed in relation to the objectives of the WFD. Each proposed activity and design element have been assessed against the WFD to ensure all objectives/criterion are met for compliance to be achieved.

7.1.2 The Proposed Scheme was found to potentially have minor adverse and positive impacts on local WFD waterbodies (both surface water and groundwater bodies). However, a few mitigation measures have been recommended in this report to reduce the severity of the adverse impacts to a negligible level.

7.1.3 In conclusion, provided recommended mitigation measures are applied, the Proposed Scheme satisfies the relevant criteria for compliance with the WFD. The proposed works can be said to satisfy the following statements:

- WFD 1: The proposed works will not result in a deterioration of current ecological status or potential;
- WFD 2: The proposed works will not cause failure to meet Good Ecological Status (GES) by the target timeframe; and
- WFD 3: The proposed works will not permanently prevent or compromise the relevant environmental objectives being met in other water bodies.

7.2 Recommendations

7.2.1 Any final scheme should take on board the mitigation measures outlines in the tables within Section 6 of this Report.

7.2.2 Should further detailed design information be released, or design changes made which invalidate the assumptions used and/or figures used in calculations within this assessment, re-evaluation of the compliance assessment would be required.

7.2.3 Should any additional works be identified during the proposed activities which fall outside of those specified in this assessment, further assessment would be required and compliance with the WFD assured.

Appendix A – WFD Waterbodies Plan

Appendix B – Other Watercourses Plan

Appendix C – Recorded Groundwater Levels

Appendix C1 – Groundwater levels at Llanwonno Tip

The groundwater depths within and beneath the Llanwonno Tips were recorded with Piezometers installed by Thyssen Geotechnical Ltd in 1993(1) and 1995(2) and Exploration Associates in 2001(3). The results of this monitoring are presented in the table below, Further details of the monitoring process are available in Halcrow's 2004 Stability Report.

Borehole/ Piezometer No	Borehole Elevation (mOD)	Piezometer/ Standpipe Tip Elevation (mOD)	Elevation of Base of Tip (mOD)	Elevation of Base of Superficial Deposits (mOD)	Max Water Level (mOD)	Min Water Level (mOD)	Remarks
BH4(1)	317.39	302.39	<302.39	Not proved	302.48	302.48	One reading only (9.10.93). Piezometer in Upper Tip colliery spoil.
BH6(1)	318.66	306.51	306.51	<305.16	Dry	Dry	One reading only (9.10.93). Piezometer at base of Upper Tip colliery spoil.
BH7(1)	267.29	256.37	256.39	<254.79	Dry	Dry	One reading only (9.10.93). Piezometer at base of colliery spoil in the Lower Tip.
LWN1a(2)	339.66	316.66	332.16	331.57	318.73	317.64	Piezometer in sandstone.
LWN1b(2)	339.73	332.13	332.13	331.57	Dry	Dry	Piezometer at base of Upper Tip colliery spoil.
LWN2a(2)	304.47	287.21	296.11	289.25	293.07	288.96	Piezometer in siltstone above No.1 Rhondda Rider coal seam.
LWN2b(2)	304.51	296.11	296.11	289.25	298.54	297.00	Piezometer at base of Upper Tip colliery spoil.
LWN3a(2)	317.62	283.12	293.62	293.12	294.71	292.61	Piezometer in mudstone.
LWN3b(2)	317.62	294.12	293.62	293.12	294.67	293.96	Piezometer at base of Upper Tip colliery spoil.
LWN4(2)	266.06	248.06	247.96	244.06	248.85	248.5	Piezometer in base of Lower Tip colliery spoil.

Borehole/ Piezometer No	Borehole Elevation (mOD)	Piezometer/ Standpipe Tip Elevation (mOD)	Elevation of Base of Tip (mOD)	Elevation of Base of Superficial Deposits (mOD)	Max Water Level (mOD)	Min Water Level (mOD)	Remarks
LWT 1a(3)	299.01	279.72	N/A	296.21	280.48	279.88	Piezometer in Siltstone
LWT 1b(3)	299.01	296.36	N/A	296.21	296.61	296.48	Piezometer in Superficial Deposits
LWT 2a (3)	340.18	328.87	333.78	331.08	329.39	328.87	Piezometer in Sandstone
LWT 2b(3)	340.18	334.08	333.78	331.08	334.08	Dry	Piezometer in base of colliery spoil in the Upper Tip.
LWT 3a(3)	315.04	303.55	304.29	302.54	302.65	302.65	Piezometer in Superficial Deposits below Colliery Spoil tip
LWT 3b(3)	315.04	306.54	304.29	302.54	306.42	306.42	Piezometer near base of Upper Tip colliery spoil.
LWT 4Aa(3)	328.50	311.68	320.25	319.25	311.79	311.68	Piezometer in Sandstone
LWT 4Ab(3)	328.50	318.81	320.25	319.25	Dry	Dry	Piezometer in Superficial Deposits below Colliery Spoil tip.
LWT 5a(3)	314.12	298.72	300.92	293.02	299.89	298.93	Piezometer in Superficial Deposits below Colliery Spoil tip
LWT 5b(3)	314.12	301.01	300.92	293.02	302.44	301.19	Piezometer in base of Upper Tip colliery spoil
LWT 6a(3)	303.64	288.00	295.54	288.14	290.45	288.13	Piezometer in Superficial Deposits below Colliery Spoil tip
LWT 6b(3)	303.64	296.12	295.54	288.14	297.87	297.42	Piezometer in base of Upper Tip colliery spoil

Borehole/ Piezometer No	Borehole Elevation (mOD)	Piezometer/Standpipe Tip Elevation (mOD)	Elevation of Base of Tip (mOD)	Elevation of Base of Superficial Deposits (mOD)	Max Water Level (mOD)	Min Water Level (mOD)	Remarks
LWT 7a(3)	287.39	273.62	279.09	273.94	278.29	276.96	Piezometer at base of Superficial Deposits
LWT 7b(3)	287.39	279.75	279.09	273.94	279.85	279.80	Piezometer in base of Upper Tip colliery spoil
LWT 8a(3)	259.75	235.16	238.15	232.25	235.34	235.33	Piezometer in Superficial Deposits below colliery spoil tip
LWT 8b(3)	259.75	238.22	238.15	232.25	Dry	Dry	Piezometer in base of Lower Tip colliery spoil

Appendix C2 – Groundwater levels at the Receptor Site

The groundwater depths beneath the Receptor Site were recorded with Piezometers on 19/03/2021 and 06/04/2021. BH07 is not located within the footprint of the receptor site, but to the south of it.

	Location								
	BH01	BH02	BH03	BH05	BH06	BH07	BH01A	BH02A	BH03A
Response zone/ Hole depth (m)	17-20	21-24	5-8	17-20	17-20	5-8	65	70	69
GWL (m) 19.03.2021	DRY	23.20	DRY	19.85	DRY	6.43	DRY	DRY	DRY
GWL (m) 06.04.2021	DRY	DRY	DRY	DRY	DRY	DRY	DRY	DRY	DRY

Appendix D – Summary contaminated land information

Appendix D1 – Llanwonno Tip summary contaminated land information (Soil)

Determinand	Screening value	Min	Max
General			
pH - Automated	6-8	5.8	7.4
Total Sulphate as SO4	-	330	6000
Total Organic Carbon (TOC)	-	0.7	3.5
PAHs			
Naphthalene	1200	0.28	0.89
Acenaphthylene	29000	< 0.05	< 0.05
Acenaphthene	29000	< 0.05	< 0.05
Fluorene	20000	< 0.05	0.2
Phenanthrene	6200	0.31	1.5
Anthracene	150000	< 0.05	0.23
Fluoranthene	6300	< 0.05	0.94
Pyrene	15000	< 0.05	0.78
Benzo(a)anthracene	49	< 0.05	0.51
Chrysene	93	< 0.05	0.55
Benzo(b)fluoranthene	13	< 0.05	0.38
Benzo(k)fluoranthene	370	< 0.05	0.21
Benzo(a)pyrene	11	< 0.05	0.23
Indeno(1,2,3-cd)pyrene	150	< 0.05	< 0.05
Dibenz(a,h)anthracene	1.1	< 0.05	< 0.05
Benzo(ghi)perylene	1400	< 0.05	< 0.05
Speciated Total EPA-16 PAHs	-	< 0.08	6.28
Metals			
Arsenic (aqua regia extractable)	170	5.6	38
Lead (aqua regia extractable)	1300	18	68
Manganese (aqua regia extractable)	-	120	460

Appendix D2 – Receptor site summary contaminated land information (Soil)

Determinand	Screening value	Min	Max
General			
pH - Automated	6-8	4.8	8.9
Calorific value	-	2.1	8.1
PAHs			
Naphthalene	1200	< 0.10	0.88
Acenaphthylene	29000	< 0.10	0.33
Acenaphthene	29000	< 0.10	0.47
Fluorene	20000	< 0.10	0.55
Phenanthrene	6200	< 0.10	2.8
Anthracene	150000	< 0.10	0.51
Fluoranthene	6300	< 0.10	2.7
Pyrene	15000	< 0.10	2.5
Benzo(a)anthracene	49	< 0.10	1.1
Chrysene	93	< 0.10	1.8
Benzo(b)fluoranthene	13	< 0.10	0.81
Benzo(k)fluoranthene	370	< 0.10	1.5
Benzo(a)pyrene	11	< 0.10	0.69
Indeno(1,2,3-cd)pyrene	150	< 0.10	0.39
Dibenz(a,h)anthracene	1.1	< 0.10	0.54
Benzo(ghi)perylene	1400	< 0.10	0.58
Speciated Total EPA-16 PAHs	-	< 2.0	18
Metals			
Arsenic (aqua regia extractable)	170	6.4	19
Lead (aqua regia extractable)	1300	6.1	190
Manganese (aqua regia extractable)	-	59	1400

Appendix D3 – Screening of leachate from Llanwonno Tip material

Appendix D4 – Screening of leachate from existing soils at the Receptor Site

Appendix E – Summary Water Quality information

REDSTART™

Capita Property and Infrastructure Ltd
St David's House
Pascal Close
St Mellons
Cardiff
CF3 0LW

Tel +44 (0) 29 2080 3500
Fax+44 (0) 29 2036 6199

REDSTART™

Appendix 11.2

Drainage Strategy

Appendix A

Drawings

A.1 Topographic survey

VINCI SURVEYS
24 BRIDGE STREET
NEWPORT
GWENT
NP20 4SF

VINCI SURVEYS
WEB: WWW.VINCISURVEYS.COM
MAIL: INFO@VINCISURVEYS.COM
MOB: 07951943789
FACEBOOK: /VINCISURVEYS
TWITTER: @VINCISURVEYS

2. Due to unavoidable inaccuracies during the reproduction process these drawings should not be scaled. Where dimensions are critical VINCI SURVEYS should be requested to confirm dimensions based on survey information. Scales appearing at the base of this plan are for indicative purposed only.
3. This plan has been prepared in accordance with B.S. 1192, Part 1 in relation to scale and dimension. Tolerances permitted within the British Standard should be observed.
4. All dimensions and particulars should be checked on site. Any discrepancies sohuld be reported to VINCI SURVEYS before any work commences.

VINCI SURVEYS

Station	Easting	Northing	Level
ST1	301024.634	196152.782	229.597
ST1A	301424.950	196052.676	318.845
ST2	301633.731	195950.365	358.466
ST3	301789.287	195874.378	392.359
ST4	301784.167	195706.277	386.235
ST5	301924.577	195774.468	403.055
ST6	301961.963	195815.759	405.653
ST7	301923.665	195886.615	405.913
ST8	301781.025	195960.003	399.051
ST9	301581.297	196056.825	366.135
ST10	301294.684	196135.332	314.017
ST11	300903.480	196275.848	261.390
ST12	301187.127	196347.656	338.764
ST13	301494.536	196198.629	375.857
ST14	301752.087	196053.774	406.663

Job: TOPOGRAPHICAL SURVEY
TYLORSTOWN

N
APPROX

KEY

Symbol	Key
38.32	SPOT LEVEL
INV 183+05	INVERT LEVEL
	CHANNEL
+	DITCH
	TOP OF DITCH
	WALL
	TOP OF WALL
	BOTTOM OF BANK
	TOP OF BANK

ABBREVIATIONS

av	air vent
bol	bollard
bt	telecoms cover
cl	cover level
conc	concrete
fb	flower bed
fl	floor level
g	gully
ic	inspection cover
il	invert level
mh	manhole
ret.	retaining wall
re	rodding eye
rg	road gully
rs	road sign
dp	downpipe
sp	signpost
st rt wl	stone ret. wall

Client: WALTERS/RCT

Scale:	Date:	Drawn By:	Checked By:	Job Ref.
1:2500 @A0	04/05/2021	SR	SR	001

NOTES:

CO-ORDINATES RELATED TO A SURVEY GRID DERIVED FROM VRS/OSTN15
LEVELS RELATED TO A SURVEY DATUM DERIVED FROM VRS/OSGM15
2D LEVELS WITH CONTOURS

Appendix B

Documents

B.1 Ground investigation reports

Unit 15, Crosby Yard, Wildmill,
Bridgend, Mid Glamorgan, CF31 1JZ, UK
Tel: +44 (0) 1656 646588 Fax: +44 (0) 1656 646606
EMail: exploration@bridgend.esgl.co.uk

Llanwonno Tips Reclamation Scheme

Report on Ground Investigation

151258

Client:
Rhondda Cynon Taff CBC
Economic & Community Development Team
Valleys Innovation Centre
Navigation Park
Abercynon
CF45 4SN

Engineer:
Halcrow Group Limited
31-33 Newport Road
Cardiff
CF24 0AB

LWTR/017D
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CONTENTS

151258 Volume I

1. INTRODUCTION

On the instruction of Halcrow Group Limited (HGL), a ground investigation was carried out by Exploration Associates (EA) at Llanwonno Tips. The instruction to proceed with the ground investigation was given by Rhondda Cynon Taff CBC in a fax dated the 5th of November 2001, reference QA 166K/BP 026459

This factual report provides a description of the site, a summary of the investigation procedures adopted and presents the findings of the exploratory holes, laboratory test results and in situ testing results.

The work was carried out in general accordance with the relevant British Standards and the enclosed general notes.

2. THE SITE

The site is located near Ferndale on an unclassified road leading from Blaenllechau to Llanwonno, as shown on the Site Location Plan, Enclosure A, Drawing 1. The approximate National Grid Reference of the site is ST 011 963.

The site is generally square in shape, but is split into three linear tiers running parallel to the hill side. Access to the site was constructed on a temporary basis from the Llanwonno to Blaenllechau road and via Forestry Commission tracks. The site was covered by rough grassland and ferns.

Access to borehole position LWT2 was achieved through Mrs Barbara Williams` land to the East of the site.

3 FIELDWORK

3.1 General

The fieldwork was carried out during the period between 29th of October 2001, and the 17th of December 2001 generally comprised the drilling of cable percussive boreholes, rotary boreholes and excavation of trial pits, along with associated in situ testing, sampling and the installation of piezometer instrumentation.

The fieldwork was carried out in general accordance with BS 5930: 1999.

3.2 Boreholes

Nine 200mm nominal diameter boreholes were drilled using standard cable percussion techniques to depths of between 9.30 metres and 27.70 metres below existing ground level.

During the course of the cable light percussion drilling, 100mm nominal diameter undisturbed samples, large disturbed (bulk) and small disturbed (jar) were obtained at regular intervals for identification and descriptive purposes, and to facilitate laboratory testing. On encountering groundwater, levels were recorded at 5 minute intervals up to 20 minutes in total.

Six of the eight cable light percussive boreholes were continued using rotary coring techniques to depths of between 14.75 metres and 41.50 metres below existing ground level. Two boreholes, LWT1 and LWT4A, were commenced from ground level using a combination of rotary open hole to depths of 3.50 metres and 11.70 metres and rotary cored to a depth of 23.50 and 16.70 metres, respectively. During the course of drilling, 76mm nominal diameter core was recovered for identification and descriptive purposes.

Photographs of the core are presented within Volume II.

The depths and descriptive details of the strata encountered including comments on the groundwater conditions, details of samples taken and drilling progress are shown on the Borehole Records, Enclosure B. The locations of the boreholes are shown on the Exploratory Hole Location Plan, Enclosure A Drawing 2.

3.3 In Situ Testing

In situ Standard Penetration Tests (SPTs) were performed during the cable percussion drilling, at specified intervals to provide an indication of penetration resistance. The results of which, uncorrected for the effects of overburden pressure, are presented on the individual borehole records in Enclosure B.

3.4 Trial Pits

Five trial pits were excavated using a 15 ton 360 hydraulic tracked excavator to a minimum depth of 2.00 metres and a maximum depth of 3.50 metres below existing ground level. From these large disturbed (bulk) and small disturbed (jar) samples were taken at intervals specified by the HGL Engineer. Trial Pit records are presented within Enclosure B.

3.5 Instrumentation

A total of sixteen 19mm nominal diameter piezometer standpipes were installed in the boreholes, two in each borehole, with the general rule of one in superficial deposits and one in bedrock.

For full details reference should be made to the individual exploratory hole records, Enclosure B.

3.6 Survey

On completion of the drilling a survey was carried out by John Vincent Surveys. The resultant levels and co-ordinates are presented on the individual exploratory hole records. The locations of which are presented on Drawing 2, Enclosure A.

3.7 Hand Dug Pits

A total of ten hand dug pits were undertaken by Dr. Peter Sturgess, of Hyder Consulting. These Pits were dug to a maximum depth of 25cm, with small disturbed (jar) samples taken at every 5cm intervals. These samples were then used for both laboratory and chemical testing. The results of which are presented in Enclosure C.

3.8 Groundwater Monitoring

Groundwater monitoring was undertaken to provide data on the groundwater conditions, the results of these tests can be seen in Enclosure D. If the boreholes were dry then soakaway type tests were undertaken to check that the instruments were functioning.

4 LABORATORY TESTING

4.1 Routine Testing

A laboratory testing schedule was prepared by HGL. The testing undertaken by EA as summarised below:

- Moisture Content (Refer to BS1377:1990, Part2, Method 3.2)
- Atterberg Limits (Refer to BS1377:1990, Part2, Methods 4.3 and 5.3)
- Dry Density (Refer to BS1377:1990, Part2, Method 7.3)
- Shear Box (Refer to BS1377:1990, Part7, Method 5)
- pH (Refer to BS1377:1990, Part3, Method 9)
- Particle Density (Refer to BS1377:1990, Part 2, Method 7.3)
- Sedimentation by pipette analysis (Refer to BS1377:1990, Part 2, Method 9.4)
- Sieve tests (See Below)

The aforementioned testing was carried out in general accordance with methods given in BS1377: 1990.

It should be noted that the samples taken from the hand dug pits (HD1 to HD10) by Hyder, were insufficient to produce a sieve analysis to BS 1377:1990. However to obtain a rough idea of the soil characteristics, non British Standard sieve tests were conducted as instructed by the engineer.

The results of the laboratory testing are presented in Enclosure C.

4.2 Chemical Testing

A chemical testing schedule was prepared by Dr Peter Sturgess of Hyder Consultancy on samples taken from small disturbed (jar) samples, the testing was undertaken by TES Bretby as presented in Enclosure C.

5 GROUND CONDITIONS

5.1 Published Geology

Reference to British Geological Survey 1:50,000 Scale Series, Sheet 248 Pontypridd; indicates the solid geology of the area is shown to be the Rhondda Beds which form part of the of the Upper Coal Measures/ Pennant Measures of Carboniferous age.

5.2 Strata Encountered

The strata encountered on site generally confirmed the published geology.

For full details of the strata encountered, reference should be made to the Exploratory Hole Records found in Enclosure B.

5.3 Groundwater

Groundwater was encountered in three of the eight boreholes, borehole 3 at 9.50 metres, borehole 6 at 6.20 metres and 15.10 metres and borehole 7 at 10.00 metres. Groundwater was recorded as damp or wet in two others, Boreholes 1 and 5, at depths of 6.70 metres and 11.50 to 13.20 metres respectively.

It should be noted that groundwater levels may at times vary when compared to those recorded during field operations, due to climatic variations and other conditions.

For additional groundwater information, reference should be made to the individual Exploratory Hole Record, which can be found in Enclosure B.

For and on behalf of Exploration Associates
A division of Environmental Services Group Limited

C.A. White
B.Sc. (Hons)
Engineering Geologist.

S.Clarke
Senior Engineering Geologist

EXPLORATION ASSOCIATES
CW/SC/151258/Feb2002.

REFERENCES

1. BRITISH STANDARDS INSTITUTION
   Code of practice for site investigations (formerly CP2001)
   BS5930:1999

2. BRITISH STANDARDS INSTITUTION
   Methods of test for soils for civil engineering purposes.
   BS1377:1990

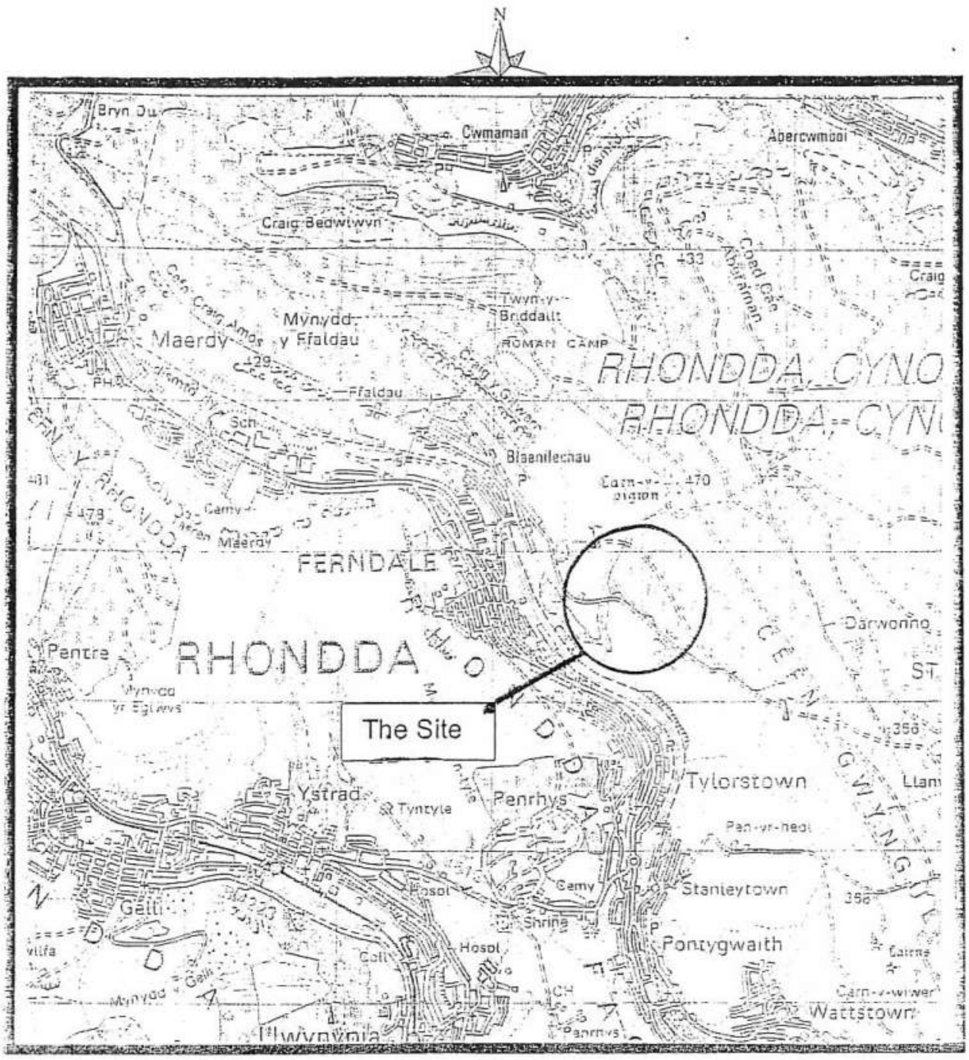
3. ORDNANCE SURVEY
   Sheet No 170.
   1:50,000 Landranger Series

4. BRITISH GEOLOGICAL SURVEY
   Sheet 248
   1:63,360 Solid and Drift Edition

ENCLOSURE A

Drawings

Site Location Plan	Drawing 1
Exploratory Location Plan	Drawing 2



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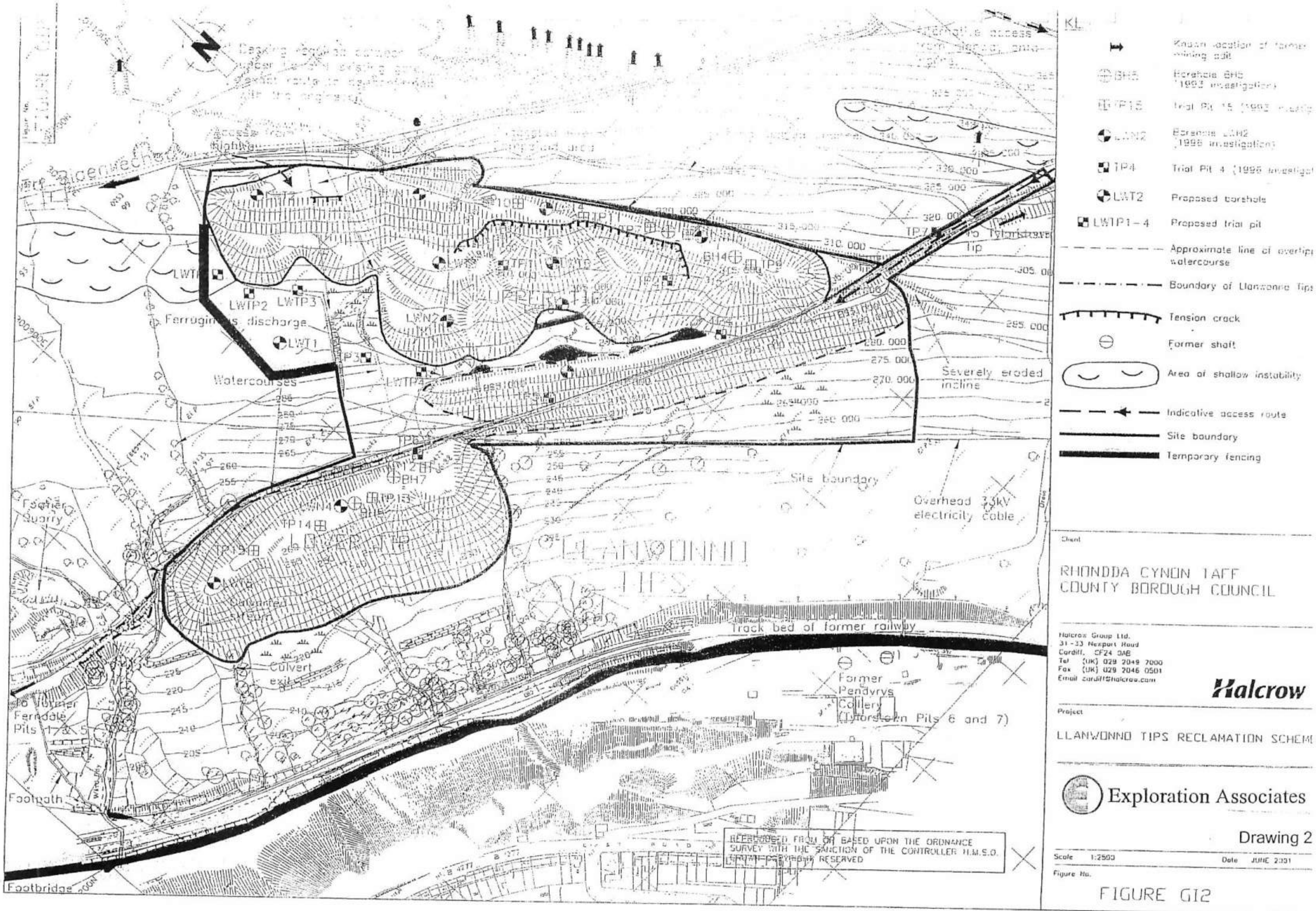
Scale 1:50,000

Site Location Plan	Project Llanwonno Tips Reclamation Scheme Halcrow Group Limited	Contract 151258
Exploration Associates		Drawing 1


Ferruginous discharge
Watercourses
LWT1
LWTP2
LWTP3
LWN2
LWN4
TP14
TP13
BH7
BH4
TP9
TP3
TP6
TP7
UPPER TIP
LOWER TIP
Culverted stream
Culvert exit
Site boundary
Severely eroded incline
Overhead 33kV electricity cable
LLANWONNO TIPS
Track bed of former railway
Former Pendyrys Colliery (Tylorstown Pits 6 and 7)
To former Ferndale Pits 1 & 5
Footpath
Footbridge
Quarry
REPRODUCED FROM OR BASED UPON THE ORDNANCE SURVEY WITH THE SANCTION OF THE CONTROLLER H.M.S.O. CROWN COPYRIGHT RESERVED
Known location of former mining adit
BH5 Borehole BH5 (1993 investigation)
TP15 Trial Pit 15 (1993 investigation)
LWN2 Borehole LWN2 (1996 investigation)
TP4 Trial Pit 4 (1996 investigation)
LWT2 Proposed borehole
LWTP1-4 Proposed trial pit
Approximate line of overtipped watercourse
Boundary of Llanwonno Tips
Tension crack
Former shaft
Area of shallow instability
Indicative access route
Site boundary
Temporary fencing
Client
RHONDDA CYNON TAFF COUNTY BOROUGH COUNCIL
Halcrow Group Ltd.
31-33 Newport Road
Cardiff, CF24 0AB
Tel (UK) 029 2049 7000
Fax (UK) 029 2046 0501
Email cardiff@halcrow.com
Halcrow
Project
LLANWONNO TIPS RECLAMATION SCHEME
Exploration Associates
Drawing 2
Scale 1:2500
Date JUNE 2001
Figure No.
FIGURE GI2

ENCLOSURE B

Exploratory Hole Records

Key to Symbols

Borehole Records (Boreholes LWT1 to LWT4, LWT4A, LWT5 to LWT8)

Trial Pit Records (Trial Pits LWTP1 to LWTP5)

Key to Exploratory Hole Records

SAMPLES

Undisturbed

U	Driven tube sample } nominally 100 mm diameter and full recovery unless otherwise stated
TW	Pushed thin wall tube sample } nominally 100 mm diameter and full recovery unless otherwise stated
P	Pushed piston sample } nominally 100 mm diameter and full recovery unless otherwise stated
L	Liner sample (from Windowless or similar sampler), full recovery unless otherwise stated
CBR	CBR mould sample
BLK	Block sample
CS	Core sample (from rotary core) taken for laboratory testing

Disturbed

D	Small sample
B	Bulk sample

Other

W	Water sample
G	Gas sample
	Environmental chemistry samples (in more than one container where appropriate)
ES	Soil sample
EW	Water sample

TEST RESULTS

S or C — Standard Penetration Test, open shoe (S) or solid cone (C)

The Standard Penetration Test is defined in BS 1377 : Part 9 (1990). The incremental blow counts are given in the Field Records column; each increment is 75 mm unless stated otherwise and any penetration under self weight in mm (SW) is noted. Where the full 300 mm test drive is achieved the total number of blows for the test drive is presented as N = ** in the Test column. Where the test drive blows reach 50 (either in total or for a single increment) the total blow count beyond the seating drive is given (without the N = prefix).

IVp IVr	In situ vane test results given as peak and remoulded shear strengths (kN/m^2).
HVp HVr	Hand vane test results given as mean peak and mean remoulded shear strengths (kN/m^2).
PP	Pocket penetrometer test results given as mean undrained shear strength (kN/m^2).

DRILLING RECORDS

** Denotes driller description

The mechanical indices (TCR/SCR/RQD & If) are defined in BS 5930 (1999)

TCR	Total Core Recovery, %
SCR	Solid Core Recovery, %
RQD	Rock Quality Designation, %
If	Fracture spacing, mm. Minimum, typical and maximum spacings are presented. The term non-intact (NI) is used where the core is fragmented.

Flush returns, estimated percentage with colour where relevant, are given in the Records column

CRF	Core recovered (length in m) in the following run
AZCL	Assessed zone of core loss

GROUNDWATER

▼	Groundwater strike
▽	Groundwater level after standing period

INSTALLATION

Standpipe/ piezometer — Details of standpipe/piezometer installations are given on the Record. Legend column shows installed instrument depths including slotted pipe section or tip depth, response zone filter material type and layers of backfill. Details of backfill are provided in Remarks at the base of record.

NOTES

1. Water level observations during boring and drilling are given at the foot of the log and in the Legend column.
2. The assessment of SCR, RQD and Fracture Spacing excludes artificial fractures
3. The declination of bedding and joints is given with respect to the normal to the core axis. Thus in a vertical borehole this will be the dip.
4. Legends are in accordance with BS 5930 (1999)

REFERENCES

BS 1377 : 1990 : British Standard Methods of test for soils for civil engineering purposes. British Standards Institution

BS 5930 : 1999 : Code of Practice for site investigations. British Standards Institution

Borehole Log

Exploration Associates

Drilled by MJ Logged by CW Checked by SC	**Equipment and Methods** Rotary Open Hole 115 mm diameter from 0.00m to 3.50m. Rotary Cored 76 mm diameter from 3.50m to 23.50m using air flush.	Ground Level National Grid Coordinates	+299.01 m OD E 301024.01 N 196377.86

Samples and Tests / Strata

Depth	TCR SCR RQD	If	Records	Date Casing	Time Water	Description	Depth, Level (Thickness)
				06/12/2001 0.00	dry	Boulder Clay.**	(2.80)
							2.80 +296.21
3.50 - 5.00m	81 65 57	NI 30 100				Moderately weak to moderately strong grey brown fine medium SANDSTONE. Highly weathered to non intact fracture discontinuity set 1 is subhorizontal closely spaced planar rough moderately open with some clay infilling and some carbonisation. Two subvertical fractures 80 - 90 degrees from 3.50m to 4.40m terminating on a subhorizontal fracture planar rough and open with sandy clay infill. From 3.50 to 3.80m Non intact: Recovered as red brown and grey slightly clayey angular medium coarse GRAVEL of highly weathered sandstone.	(2.20)
							5.00 +294.01
5.00 - 6.20m	88 54 31	NI NI 90				Very weak and weak dark grey SILTSTONE. Highly weathered, fracture discontinuities are subhorizontal very closely spaced to non intact rough planar tight with red ferrous staining and carbonisation. ... From 5.20 to 5.50m Non intact: Recovered as dark grey sandy GRAVEL of siltstone.	(0.70)
							5.70 +293.31
6.20 - 7.70m	93 53 23	NI 70 120				Strong grey fine medium SANDSTONE. Slightly weathered - with occasional iron staining, fracture discontinuities are horizontal closely spaced rough planar and tight with occasional carbonisation and occasional clay infill. From 6.60 to 6.90m Non intact: Recovered as highly weathered sandy GRAVEL of sandstone. ... From 7.50m. Fracture discontinuities medium spaced are horizontal closely spaced rough planar and tight, with occasional carbonisation and occasional clay infill.	(6.50)
7.70 - 9.20m	94 94 93	180 400 500					
9.20 - 11.00m	79 66 50	NI 150 300					

Groundwater

Borehole wet at 6.70m.

Remarks

Standpipe piezometer installed, 19 mm diameter, response zone from 18.00m to 20.00m
Hole backfill : 0.00m to 0.30m Concrete (c), 0.30m to 0.50m Grout (g), 0.50m to 1.00m Bentonite (b), 3.00m to 3.50m Bentonite (b), 3.50m to 17.50m Grout (g), 17.50m to 18.00m Bentonite (b), , 20.00m to 20.50m Bentonite (b), 20.50m to 23.50m Grout (g). Surface protection : Stop Cock Cover
Standpipe Piezometer installed, 19mm diameter, response zone from 1.00m to 3.00m.

Notes : For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.
Scale 1 : 50

Project	LLANWONNO TIPS
Project no.	151258
Carried out for	Rhondda Cynon Taff

Borehole **LWT1**

Sheet 1 of 3

Borehole Log

Exploration Associates

Drilled by MJ Logged by CW Checked by SC	Equipment and Methods See sheet 1	Ground Level +299.01 m OD National Grid Coordinates E 301024.01 N 196377.86

Samples and Tests / Strata

Depth	TCR SCR RQD	If	Records	Date Casing	Time Water	Description	Depth,Level (Thickness)	Legend
9.20 - 11.00m	79 66 50	NI 150 300				As sheet 1	(6.50)	
11.00 - 12.20m	93 67 31						12.20 +286.81	
12.20 - 14.00m	82 29 22	NI NI 10				Generally weak but very weak in non intact zones dark grey SILTSTONE. Highly weathered to non intact, fracture discontinuities are extremely closely to very closely spaced and randomly orientated.	(7.00)	
14.00 - 15.20m	98 60 33							
15.20 - 16.70m	96 76 30							
16.70 - 18.50m	83 73 46							
18.50 - 19.70m	100 89 59						19.20 +279.81	
19.70 - 21.20m		40 250 450				Strong grey medium SANDSTONE. Slightly weathered, fracture discontinuity set 1 are horizontal medium spaced planar rough and tight with carbonisation. Fracture set 2 are subvertical - 50 degrees, widely spaced moderately open with red ferrous staining and clay infill.	(4.30)	

Groundwater

Remarks
TCR/SCR/RQD: 19.70m to 20.00m 97/95/80

Notes : For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.
Scale 1 : 50

Project LLANWONNO TIPS
Project no. 151258
Carried out for Rhondda Cynon Taff

Borehole
LWT1

Borehole Log

Exploration Associates

Drilled by MJ Logged by CW Checked by SC	Equipment and Methods See sheet 1	Ground Level +299.01 m OD National Grid Coordinates E 301024.01 N 196377.86

Samples and Tests / Strata

Depth	TCR SCR RQD	If	Records	Date Casing	Time Water	Description	Depth,Level (Thickness)	Legend
19.70 - 21.20m	97 95 80							
21.20 - 22.70m	98 96 81	40 250 450				As sheet 2	(4.30pen)	
22.70 - 23.50m	100 99 71			06/12/2001 3.50				
						EXPLORATORY HOLE ENDS AT 23.50 m.	23.50 +275.51	

Groundwater

Remarks

Notes : For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.
Scale 1 : 50

Project LLANWONNO TIPS
Project no. 151258
Carried out for Rhondda Cynon Taff

Borehole LWT1

Borehole Log

Exploration Associates

Drilled by GR/RD Logged by CW Checked by SC	Equipment and Methods Cable Percussion 200 mm diameter from 0.00m to 9.30m. Rotary Cored 76 mm diameter from 9.30m to 14.30m using air flush.	Ground Level +340.18 m OD National Grid Coordinates E 301107.39 N 196446.67

Samples and Tests / Strata

Depth	Type & No.	Records	Date Casing	Time Water	Description	Depth, Level (Thickness)
			29/11/2001 0.00			
1.20 - 1.65		C,N=4 1,1/1,1,1,1	1.20			
1.20 - 1.50	B1					
2.00 - 2.45		C,N=9 1,1/2,3,2,2	29/11/2001 2.40	dry		
			30/11/2001 2.40	dry	... From 2.00 to 3.00m becoming very clayey.	
2.00 - 2.30	B2					
3.00 - 3.45	B3	C,N=8 2,2/2,2,2,2	3.00	dry	MADE GROUND: Loose dark grey and black slightly clayey very sandy angular fine to coarse GRAVEL of mudstone and coal.	(6.40)
4.00 - 4.45	B4	C,N=8 3,2/2,2,2,2	4.00	dry		
5.00 - 5.45	B5	C,N=8 2,1/2,2,2,2	5.00	dry		
6.00 - 6.45	B6	C,N=8 2,2/2,2,2,2	6.00	dry		
			30/11/2001 6.50	dry		6.40 +333.78
			03/12/2001 6.50	dry	Medium dense dark orange brown very clayey sandy slightly gravely angular COBBLES of siltstone and sandstone. Gravel is fine to coarse and angular.	(0.70)
7.00 - 7.45	B7	C,N=13 2,2/2,3,3,5	7.00	dry		7.10 +333.08
8.00 - 8.45	B8	C,N=29 3,7/7,6,7,9	8.00	dry	Medium dense becoming dense dark orange brown slightly clayey sandy angular dominantly coarse GRAVEL with occasional subangular cobbles of siltstone and sandstone. Sand is fine to coarse.	(2.00)
9.00 - 9.24	B9	C,50 5,6/17,33 for 10mm	9.00	dry		
			03/12/2001 9.00	dry		9.10 +331.08
			05/12/2001 9.30 9.00	dry dry	Strong grey fine medium grained SANDSTONE. Slighty weathered fracture discontinuities are subhorizontal closely spaced rough planar tight with rare sandy silt infilling.	(5.65)

Depth	TCR SCR RQD	If	Records	Date Casing	Time Water
9.30 - 9.35 9.30 - 10.80m	75 65 38		C,50 25 for 40mm,/50 for 10mm		

Legend: c, g, b, g

Groundwater

Groundwater Not Encountered.

Remarks

Standpipe piezometer installed, 19 mm diameter, response zone from 10.50m to 11.50m
Chiselling : 7.10m to 7.30m 30minutes, Chisel, 8.35m to 8.60m 30minutes, Chisel, 9.00m to 9.30m 60minutes, Chisel
Hole backfill : 0.00m to 0.50m Concrete (c), 0.50m to 5.00m Grout (g), 5.00m to 5.50m Bentonite (b), 6.50m to 7.00m Bentonite (b), 7.00m to 10.00m Grout (g), 10.00m to 10.50m Bentonite (b), 11.50m to 12.00m Bentonite (b), 12.00m to 14.75m Grout (g). Surface protection : Stop Cock Cover
Standpipe Piezometer installed. 19mm diameter, response zone from 5.50m to 6.50m.

Notes : For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.
Scale 1 : 50

Project	LLANWONNO TIPS
Project no.	151258
Carried out for	Rhondda Cynon Taff

Borehole **LWT2**

Sheet 1 of 2

Borehole Log

Exploration Associates

Drilled by	GR/RD	Equipment and Methods	Ground Level	+340.18 m OD
Logged by	CW	See sheet 1	National Grid Coordinates	E 301107.39
Checked by	SC			N 196446.67

Samples and Tests / Strata

Depth	TCR SCR RQD	If	Records	Date Casing	Time Water	Description	Depth,Level (Thickness)	Legend
9.30 - 10.80m	75 65 38	60 100 220				As sheet 1	(5.65pen)	
10.80 - 12.30m	90 75 59					From 12.05 to 12.29m Non intact: Recovered as clayey sandy subangular fine to coarse GRAVEL of carbonised ferrous stained sandstone.		
12.30 - 13.80m	93 89 57	60 100 220				At 12.90 to 13.20m With occasional subhorizhontal carbonised bands - not disturbed by drilling		
13.80 - 14.75m	53 31 29			05/12/2001 9.30	dry	At 14.25 to 14.40m with one subvertical fracture 70 - 80 degrees terminating on a horizontal fracture.		
				05/12/2001		EXPLORATORY HOLE ENDS AT 14.75 m.	14.75 +325.43	

Groundwater

Remarks

Notes : For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.
Scale 1 : 50

Project	LLANWONNO TIPS
Project no.	151258
Carried out for	Rhondda Cynon Taff

Borehole
LWT2

Borehole Log

Exploration Associates

Drilled by JR/MJ Logged by CW Checked by SC	Equipment and Methods Cable Percussion 200 mm diameter from 0.00m to 13.40m. Rotary Cored 76 mm diameter from 13.40m to 18.50m using air flush.	Ground Level +315.04 m OD National Grid Coordinates E 301147.81 N 196319.12

Samples and Tests / Strata

Depth	Type & No.	Records	Date Casing	Time Water	Description	Depth,Level (Thickness)
			04/12/2001 0.00	dry		
0.50 - 1.00	U1	Sample failed No recovery				
1.00 - 1.45	B2	C,N=5 1,-/1,1,1,2			From 1.00m Loose.	
2.00 - 2.50	U3	15 blows 450mm recovered	1.80	dry		
					... At 2.50m becoming very sandy.	
3.00 - 3.45	B4	C,N=14 1,2/1,2,2,9	3.00	dry	From 3.00m becoming medium dense.	
3.75 - 3.85	U5	20 blows Sample failed No recovery				
4.00 - 4.50	U6	43 blows	3.80			
4.50	D7				MADE GROUND: Medium dense dark grey and black clayey sandy angular fine to coarse GRAVEL, with occasional subangular cobbles of mudstone and coal.	(10.75)
4.75 - 5.20	B8	C,N=19 2,8/6,5,5,3	4.75	dry		
5.50 - 5.60	U9	25 blows Sample failed No recovery	5.40	dry		
5.75 - 6.20	B10	C,N=15 2,3/3,2,4,6	5.70		... From 5.75m with soft grey CLAY pockets.	
6.50 - 7.00	U11	Sample failed No recovery	6.40			
			04/12/2001 7.00	dry		
			05/12/2001 7.00	dry		
7.00 - 7.50	U12	30 blows 450mm recovered	7.00	dry		
7.75 - 8.20	B13	C,N=20 3,5/5,6,5,4	7.75	dry	... From 7.75m becoming less sandy	
8.50 - 9.00	U14	50 blows 450mm recovered	8.40	dry		
9.25 - 9.70	B15	C,N=17 2,3/3,4,6,4	9.20	dry		

Legend: c, g, b, b, 1, g

Groundwater

No. Struck Behaviour

1 9.50m Rising to 9.40m after 20 mins. Sealed 11.00.

Remarks

Monitor ground water. (20mins)
Standpipe piezometer installed, 19 mm diameter, response zone from 11.00m to 12.00m
Hole backfill : 0.00m to 0.30m Concrete (c), 0.30m to 6.50m Grout (g), 6.50m to 7.00m Bentonite (b), 9.00m to 9.50m Bentonite (b), 9.50m to 10.50m Grout (g), 10.50m to 11.00m Bentonite (b), 12.00m to 12.50m Bentonite (b), 12.50m to 18.50m Grout (g). Surface protection : Stop Cock Cover
Standpipe Piezometer installed, 19mm diameter, response zone from 7.00m to 9.00m.

Notes : For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.
Scale 1 : 50

Project LLANWONNO TIPS
Project no. 151258
Carried out for Rhondda Cynon Taff

Borehole **LWT3**

Borehole Log

Exploration Associates

Drilled by JR/MJ Logged by CW Checked by SC	Equipment and Methods See sheet 1	Ground Level +315.04 m OD National Grid Coordinates E 301147.81 N 196319.12

Samples and Tests / Strata

Depth	Type & No.	Records	Date Casing	Time Water	Description	Depth, Level (Thickness)
10.00 - 10.40	B16	C,9 2,1/2,2,1,4 for 25mm	10.00	damp	As sheet 1	(10.75)
10.80 - 11.00	B19					10.75 +304.29
11.00 - 11.50	U17	30 blows 450mm recovered	10.90	dry	Very stiff slightly sandy slightly gravelly SILT. Sand is fine to coarse, gravel is angular to subangular fine to coarse of siltstone and sandstone.	11.00 +304.04
11.50	D18					
11.75 - 12.15	B19	C,50 6,4/4,3,14,29 for 20mm	11.75	dry	Very stiff orange brown slightly sandy slightly gravelly SILT, with occasional subangular to subrounded cobbles of sandstone. Sand is fine to coarse, gravel is angular to subangular of siltstone and sandstone.	(1.50)
12.50 - 12.84	B20	C,50 4,11/15,20,15 for 40mm	12.50	dry		12.50 +302.54
			05/12/2001 13.00	dry	Sandstone.**	(0.50)
			06/12/2001 06/12/2001 13.40	dry		13.00 +302.04
13.40 - 13.50m			07/12/2001 13.40 13.00	dry dry		
13.40 - 13.42		C,50 25 for 10mm,/50 for 10mm			Orange brown generally weak occasionally moderately weak SANDSTONE. Highly weathered. fracture discontinuities are extremely closely spaced randomly orientated generally non intact: Recovered as sandy angular fine to coarse GRAVEL.	
13.50 - 15.00m	47 14 0	NI NI 40				(2.50)
15.00 - 15.50m	60 0 0					
					From 15.50 to 15.90m Non-intact: Recovered as very clayey sandy angular fine to medium GRAVEL of siltstone.	15.50 +299.54
15.50 - 17.00m	67 35 0	NI 60 240			Very weak becoming moderately weak dark grey SILTSTONE. Moderately weathered fracture discontinuities are horizontal closely spaced planar smooth moderately open with some clay infill.	
					From 17.00 to 17.40m non intact: Recovered as clayey slightly sandy GRAVEL of siltstone.	(3.00pen)
17.00 - 18.50m	63 45 42		07/12/2001 18.50	dry		
					EXPLORATORY HOLE ENDS AT 18.50 m.	18.50 +296.54

Depth	TCR SCR RQD	If	Records	Date Casing	Time Water

Groundwater
No. Struck Behaviour

Remarks
TCR/SCR/RQD: 13.40m to 13.50m //0
Chiselling : 11.80m to 12.50m 105minutes, Chisel, 12.50m to 13.00m 75minutes, Chisel, 13.00m to 13.40m 90minutes, Chisel

Notes : For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.
Scale 1 : 50

Project LLANWONNO TIPS
Project no. 151258
Carried out for Rhondda Cynon Taff

Borehole LWT3

Borehole Log

Exploration Associates

Drilled by JR/MJ Logged by CW Checked by SC	Equipment and Methods Cable Percussion 200 mm diameter from 0.00m to 10.50m.	Ground Level +328.50 m OD National Grid Coordinates E 301221.55 N 196298.30

Samples and Tests / Strata

Depth	Type & No.	Records	Date Casing	Time Water	Description	Depth,Level (Thickness)	Legend
			13/12/2001 0.00				a
0.50 - 0.95	B1	C,N=2 1,-/-,1,-,1			From 0.50m Very loose.		
1.25 - 1.75	U2	20 blows 450mm recovered					
1.75	D3						
2.00 - 2.45	B4	C,N=6 1,-/1,2,2,1	2.00	dry	From 2.00m Becoming medium dense.		
2.75 - 3.25	U5	16 blows 450mm recovered	2.50	dry			
3.25	D6						
3.50 - 3.95	B7	C,N=17 2,2/4,5,5,3	3.50	dry			
4.25 - 4.75	U8	25 blows 450mm recovered	4.50	dry	MADE GROUND: Medium dense dark grey and black slightly silty sandy angular fine to coarse GRAVEL of mudstone and coal.	(8.25)	
4.75	D9						
5.00 - 5.45	B10	C,N=9 1,2/2,2,2,3	5.00	dry			
			13/12/2001 5.70				
			14/12/2001 5.70				
5.75 - 6.25	U11	25 blows 450mm recovered	5.70	dry			
6.25	D12						
6.50 - 6.95	B13	C,N=15 1,3/3,4,4,4	6.50	dry			
7.25 - 7.75	U14	33 blows 450mm recovered	7.20	dry	... From 6.50 to 7.75m becoming slightly clayey.		
7.75	D15						
8.00 - 8.45	B16	C,N=21 3,4/4,6,5,6	8.00	dry			
						8.25 +320.25	
8.50 - 8.70	U17	50 blows Sample failed. No recovery	8.40	dry	Medium dense orange brown slightly silty sandy angular fine to coarse GRAVEL of siltstone and sandstone.	(1.00)	
8.75 - 9.20	B18	C,N=28 5,5/5,6,8,9	8.75	dry			
						9.25 +319.25	
9.50 - 9.60	U19	25 blows Sample failed. No recovery	9.30	dry	Recovered as: Very dense orange brown slightly clayey sandy angular fine to coarse GRAVEL, with some subrounded cobbles, of moderately weak weathered sandstone. Sand is fine to coarse,	(1.25)	
9.75 - 9.93	B20	C,50 25 for 70mm,- for 0mm/25 for 50mm,25 for 55mm	9.75	dry			

Groundwater
Groundwater not encountered.

Remarks
Chiselling : 9.75m to 10.50m 120minutes, Chisel
Hole backfill : 0.00m to 10.50m Arisings (a). Surface protection : <none>

Notes : For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.
Scale 1 : 50

Project LLANWONNO TIPS
Project no. 151258
Carried out for Rhondda Cynon Taff

Borehole LWT4

Borehole Log

Exploration Associates

Drilled by JR/MJ Logged by CW Checked by SC	Equipment and Methods See sheet 1	Ground Level National Grid Coordinates	+328.50 m OD E 301221.55 N 196298.30

Samples and Tests / Strata

Depth	Type & No.	Records	Date / Casing	Time / Water	Description	Depth,Level (Thickness)	Legend
			14/12/2001 10.50		As sheet 1	(1.25pen)	a
					EXPLORATORY HOLE ENDS AT 10.50 m.	10.50 +318.00	
			13/12/2001				
			13/12/2001 0.00				

Groundwater

Remarks

Notes : For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column. Scale 1 : 50	Project: LLANWONNO TIPS Project no. 151258 Carried out for: Rhondda Cynon Taff	Borehole LWT4 Sheet 2 of 2

Borehole Log

Exploration Associates

Drilled by MJ Logged by CW Checked by SC	Equipment and Methods Rotary Open Hole 115 mm diameter from 0.00m to 11.70m. Rotary Cored 76 mm diameter from 11.70m to 16.70m.	Ground Level National Grid Coordinates

Samples and Tests / Strata

Depth	TCR SCR RQD	If	Records	Date / Casing	Time / Water	Description	Depth,Level (Thickness)	Legend
				12/12/2001 0.00	dry			c
								g
						See LWT4.	(10.50)	
								b
								b

Groundwater
Groundwater Not Encountered.

Remarks
Borehole excavated 7m north-west of LWT4.
Standpipe piezometer installed, 19 mm diameter, response zone from 14.00m to 16.70m
Hole backfill : 0.00m to 0.30m Concrete (c), 0.30m to 7.50m Grout (g), 7.50m to 8.00m Bentonite (b), 9.80m to 11.00m Bentonite (b), 11.00m to 13.00m Grout (g), 13.00m to 14.00m Bentonite (b). Surface protection : Stop Cock Cover
Standpipe Piezometer installed, 19mm diameter, response zone from 8.00m to 9.80m.

Notes : For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column. Scale 1 : 50	Project LLANWONNO TIPS Project no. 151258 Carried out for Rhondda Cynon Taff	Borehole LWT4A Sheet 1 of 2

Borehole Log

Exploration Associates

Drilled by MJ Logged by CW Checked by SC	Equipment and Methods See sheet 1	Ground Level National Grid Coordinates

Samples and Tests

Depth	TCR SCR RQD	If	Records	Date Casing	Time Water
				12/12/2001 11.50	dry
				13/12/2001 11.50	dry
11.70 - 12.70m	84 84 80				
		70 100 400			
12.70 - 14.20m	79 61 35				
14.20 - 15.20m	67 16 0				
		40 160 320			
15.20 - 16.70m	98 94 77				
				13/12/2001 11.50	dry

Strata

Description	Depth, Level (Thickness)
As sheet 1	(10.50)
Recovered as: Very dense orange brown slightly clayey sandy angular fine to coarse GRAVEL, with some subrounded cobbles, of moderately weak weathered sandstone. Sand is fine to coarse.	10.50 (1.20)
Strong grey SANDSTONE slightly weathered. Fracture discontinuities are closely spaced horizontal rough planar open with rare clay infilling and black. carbonisation. From 12.00 to 12.40m One subvertical fracture 60 - 70 degrees with red ferrous staining. From 13.10 to 13.30m Non Intact. Recovered as slightly clayey slightly sandy subangular gravel. From 14.20 to 14.65m Non Intact Recovered as slightly sandy fine to coarse angular gravel. From 14.20 to 16.70m subvertical 60 - 70 degrees rough planar open with carbonised and ferrous stained surfaces.	11.70 (5.00pen)
EXPLORATORY HOLE ENDS AT 16.70 m.	16.70

Legend: b, g, b

Groundwater

Remarks

Notes : For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.
Scale 1 : 50

Project LLANWONNO TIPS
Project no. 151258
Carried out for Rhondda Cynon Taff

Borehole LWT4A

Borehole Log

Exploration Associates

Drilled by	RD/MJ
Logged by	CW
Checked by	SC

Equipment and Methods
Cable Percussion 200 mm diameter from 0.00m to 21.40m. Rotary Cored 76 mm diameter from 21.40m to 41.50m using air flush.

Ground Level	+314.12 m OD
National Grid Coordinates	E 301197.33 N 196273.27

Samples and Tests

Depth	Type & No.	Records	Date Casing	Time Water
			05/12/2001 0.00	
1.00 - 1.45		C,N=6 1,1/2,1,2,1		
1.00 - 1.30	B1			
1.50	U2	25 blows Sample failed. No recovery		
2.25 - 2.70		C,N=8 1,1/2,2,2,2		
2.25 - 2.55	B3			
3.00 - 3.50	U4	19 blows 450mm recovered		
3.50	D5			
3.75 - 4.20		C,N=9 2,3/2,3,2,2		
3.75 - 4.00	B6			
4.50 - 5.00	U7	28 blows 450mm recovered		
5.00	D8			
5.25 - 5.70		C,N=15 3,2/4,4,3,4		
5.25 - 5.50	B9			
6.00 - 6.50	U10	27 blows 450mm recovered		
6.50	D11			
6.75 - 7.20		C,N=17 2,2/3,4,5,5		
6.75 - 7.00	B12			
6.75 - 7.00	B13			
7.50 - 8.00	U14	31 blows 450mm recovered		
8.00	D15			
			05/12/2001 8.20	dry
			06/12/2001 8.30	dry
			8.30	dry
8.30 - 8.65		C,45 10,11/14,14,17		
8.30 - 8.60	D16			
9.30 - 9.80	U17	31 blows 450mm recovered		
9.80	D18			
9.90 - 10.35		C,N=28 2,4/7,7,9,5		
9.90 - 10.20	B19			

Strata

Description	Depth,Level (Thickness)	Legend
MADE GROUND: Dark grey and black sandy angular fine to coarse GRAVEL of mudstone ironstone and coal. Sand is fine to coarse. From 1.00m Loose. From 5.25 becoming Medium dense. From 7.50m becoming generally dense.	(10.50)	

Groundwater
From 11.50 to 13.20m becoming damp.

Remarks
Unidentified obstruction 8.30 to 9.30m.
Standpipe piezometer installed, 19 mm diameter, response zone from 14.50m to 15.50m

Chiselling : 8.00m to 9.30m 300minutes, Chisel
Hole backfill : 0.00m to 0.30m Concrete (c), 0.30m to 10.00m Grout (g), 10.00m to 11.00m Bentonite (b), 13.00m to 13.50m Bentonite (b), 13.50m to 14.00m Grout (g), 14.00m to 14.50m Bentonite (b), 15.50m to 16.50m Bentonite (b), 16.50m to 21.40m Grout (g), . Surface protection : Stop Cock Cover
Standpipe Piezometer installed, 19mm diameter, response zone from 14.50m to 15.50m.

Notes : For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.
Scale 1 : 50

Project	LLANWONNO TIPS
Project no.	151258
Carried out for	Rhondda Cynon Taff

Borehole LWT5

Borehole Log

Exploration Associates

Drilled by	RD/MJ	Equipment and Methods	Ground Level	+314.12 m OD
Logged by	CW	See sheet 1	National Grid Coordinates	E 301197.33
Checked by	SC			N 196273.27

Samples and Tests

Depth	Type & No.	Records	Date Casing	Time Water
10.50 - 11.00	U20	35 blows 450mm recovered		
11.00	D21			
11.20 - 11.65	B22			
11.20 - 11.65		C,N=27 3,5/6,6,9,6		wet
12.00 - 12.50	U23	36 blows Sample failed. No recovery		
12.75 - 13.20		C,N=14 2,2/4,4,3,3		wet
13.20	D24			
13.50 - 14.00	U25	19 blows 450mm recovered		
			06/12/2001 14.00	dry
			07/12/2001 14.00	12.90
14.00	D26			
14.30 - 14.75		C,N=26 5,5/6,6,6,8		
14.30 - 14.60	B27			
15.00 - 15.50	U28	39 blows 450mm recovered		
15.50	D29			
15.75 - 16.15		C,50 9,10/9,15,17,9 for 25mm		
15.75 - 16.25	B30			
16.75 - 17.07		C,50 10,15/19,21,10 for 15mm		
16.75 - 17.25	B31			
			07/12/2001 17.60	16.20
			08/12/2001 17.60	16.20
17.75 - 17.91		C,50 20,5 for 5mm/40,10 for 5mm		
17.75 - 18.25	B32			
18.75 - 18.99		C,46 9,11/35,11 for 15mm		
18.75 - 19.25	B33			
19.25 - 19.57		C,50 7,14/19,20,11 for 20mm		
19.75 - 20.50	B34			

Strata

Description	Depth, Level (Thickness)
As sheet 1	(10.50)
	10.50 +303.62
MADE GROUND: Medium dense light and dark orange brown very silty very sandy subangular to subrounded fine to coarse GRAVEL of mudstone, siltstone, sandstone and ironstone. Sand is fine to coarse. ... At 11.50m with very sandy SILT / very silty SAND pockets. Sand is fine to coarse.	(2.70)
	13.20 +300.92
Firm orange brown mottled grey slightly sandy gravelly CLAY. Sand is fine to coarse, gravel is subangular to subrounded of weak mudstone, siltstone and sandstone.	(2.30)
	15.50 +298.62
Very dense clayey very sandy subangular to subrounded GRAVEL of sandstone, with some subangular cobbles of sandstone.	(5.00)

Groundwater

Remarks

Chiselling : 15.50m to 16.75m 180minutes, Chisel, 16.75m to 17.60m 135minutes, Chisel, 17.60m to 19.75m 240minutes, Chisel, 19.75m to 20.50m 105minutes, Chisel

Notes : For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.
Scale 1 : 50

Project	LLANWONNO TIPS
Project no.	151258
Carried out for	Rhondda Cynon Taff

Borehole **LWT5**

Borehole Log

Exploration Associates

Drilled by RD/MJ Logged by CW Checked by SC	Equipment and Methods See sheet 1	Ground Level +314.12 m OD National Grid Coordinates E 301197.33 N 196273.27

Samples and Tests / Strata

Depth	Type & No.		Records	Date Casing	Time Water	Description	Depth,Level (Thickness)
						As sheet 2	(5.00)
20.50	D35						20.50 +293.62
20.75 - 21.20			C,N=26 3,4/5,5,6,10			Stiff dark grey mottled black and yellow gravelly CLAY. Gravel is angular fine to coarse of siltstone and mudstone.	(0.60)
20.75 - 21.10	B36						21.10 +293.02
				08/12/2001 21.40	16.20	Very weak to weak grey MUDSTONE: Recovered as very clayey slightly sandy GRAVEL.	(0.40)
				10/12/2001 21.40			21.50 +292.62
21.40 - 21.58	D37		S,50 25 for 70mm,/29,21 for 30mm	21.40	16.20		
21.50 - 23.00m	100 40 9					Very weak dark grey SILTSTONE. Highly weathered to non intact, fracture discontinuities are extremely closely spaced and randomly orientated. ... From 21.50 to 22.70m Non intact: Recovered as grey clayey sandy GRAVEL of weathered sandstone.	
23.00 - 24.50m	80 0 0	NI 20 70				From 23.00 to 24.50m Non intact: Recovered as grey sandy GRAVEL of siltstone.	(4.50)
24.50 - 26.00m	100 13 0					From 24.70m to 25.80m Non intact: Recovered as grey clayey sandy GRAVEL of siltstone.	
							26.00 +288.12
26.00 - 27.50m	100 100 73					Strong dark grey fine to medium SANDSTONE. Moderately weathered fracture discontinuities are horizontal closely spaced smooth planar and tight.	
27.50 - 29.00m	99 99 87	NI 70 200					(5.70)
29.00 - 30.50m	99 99 99						
Depth	TCR SCR RQD	If	Records	Date Casing	Time Water		

Groundwater

Remarks
Chiselling : 21.10m to 21.40m 60minutes, Chisel

Notes : For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.
Scale 1 : 50

Project: LLANWONNO TIPS
Project no.: 151258
Carried out for: Rhondda Cynon Taff

Borehole **LWT5**

Borehole Log

Exploration Associates

Drilled by	RD/MJ	Equipment and Methods	Ground Level	+314.12 m OD
Logged by	CW	See sheet 1	National Grid	E 301197.33
Checked by	SC	.	Coordinates	N 196273.27

Samples and Tests

Depth	TCR SCR RQD	If	Records	Date Casing	Time Water
29.00 - 30.50m	99 99 99	NI 70 200			
30.50 - 32.00m	99 68 67	NI NI NI			
32.00 - 33.50m	97 92 47	NI 70 200			
33.50 - 35.00m	98 80 42			10/12/2001 35.00	
35.00 - 36.50m	97 93 55				
36.50 - 38.00m	96 85 47	70 200 400			
38.00 - 39.50m	99 95 55				
39.50 - 41.00m	99 99 69				

Strata

Description	Depth, Level (Thickness)	Legend
As sheet 3 Non intact: Recovered as grey sandy GRAVEL of sandstone.	(5.70) 31.70 +282.42	
Weak to moderately weak dark grey SILTSTONE. Slightly weathered fracture discontinuities are horizontal closely spaced smooth planar and tight.	(2.20) 33.90 +280.22	
Weak black COAL. Recovered as angular fine to coarse GRAVEL.	34.10 +280.02	
Weak to moderately weak dark grey fossiliferous SILTSTONE. Slightly weathered fracture discontinuities are horizontal closely spaced smooth planar and tight. ...From 36.00m becoming moderately strong.	(7.40)	

Groundwater

Remarks

Notes : For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.
Scale 1 : 50

Project	LLANWONNO TIPS
Project no.	151258
Carried out for	Rhondda Cynon Taff

Borehole **LWT5**

Borehole Log

Exploration Associates

Drilled by RD/MJ Logged by CW Checked by SC	Equipment and Methods See sheet 1	Ground Level National Grid Coordinates	+314.12 m OD E 301197.33 N 196273.27

Samples and Tests / Strata

Depth	TCR SCR RQD	If	Records	Date Casing	Time Water	Description	Depth,Level (Thickness)	Legend
39.50 - 41.00m	99 99 69	70 200 400				As sheet 4	(7.40pen)	
41.00 - 41.50m	100 100 60			10/12/2001				
						EXPLORATORY HOLE ENDS AT 41.50 m.	41.50 +272.62	

Groundwater

Remarks

Notes : For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.
Scale 1 : 50

Project LLANWONNO TIPS
Project no. 151258
Carried out for Rhondda Cynon Taff

Borehole LWT5
Sheet 5 of 5

09/05/2002 11:08:50 ESGLog v2.10

Borehole Log

Exploration Associates

Drilled by	JR/MJ	Equipment and Methods	Ground Level	+303.64 m OD
Logged by	CW	Cable Percussion 200 mm diameter from 0.00m to 15.50m. Rotary Cored 76 mm diameter from 15.50m to 20.50m with air flush.	National Grid Coordinates	E 301183.12
Checked by	SC			N 196249.98

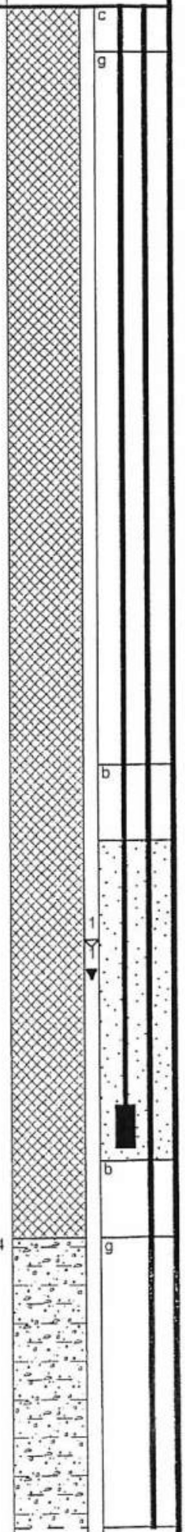
Samples and Tests

Depth	Type & No.	Records	Date / Casing	Time / Water
			06/12/2001 0.00	dry
0.50 - 1.00	U1	14 blows No recovery No recovery		
1.00 - 1.45	B2	C,N=3 1,-/1,-,1,1	1.00	
1.75 - 2.25	U3	30 blows	1.50	dry
2.50 - 2.95	B4	C,N=4 1,1/1,1,1,1	2.50	dry
3.25 - 3.75	U5	25 blows 450mm recovered	3.00	dry
4.00 - 4.45	B6	C,N=13 2,2/2,2,5,4	4.00	dry
4.75 - 5.25	U7	50 blows 450mm recovered	4.50	dry
5.50 - 5.90	B8	C,24 3,4/6,5,5,8 for 25mm	5.50	dry
6.25 - 6.75	U9	20 blows Sample failed. No recovery	6.00	dry
			06/12/2001 7.00	6.80
			07/12/2001 7.00	5.50
7.00 - 7.45	B10	C,N=18 1,2/4,3,4,7	7.00	dry
7.75 - 8.25	U11	50 blows Sample failed. No recovery		
8.10 - 8.30	B12			
8.50 - 9.00	U13		8.00	dry
9.00	D14			
9.25 - 9.70	B15	C,N=32 3,7/9,7,8,8	9.25	dry

Strata

Description	Depth, Level (Thickness)
MADE GROUND: Very loose becoming medium dense dark grey and black very sandy angular fine to coarse GRAVEL of mudstone and coal. From 1.00m Very loose. ... From 2.50m becoming loose with some angular cobbles of slag and ironstone. ... From 4.00m becoming slightly silty. ... From 7.00m becoming very clayey.	(8.10)
	8.10 +295.54
Stiff grey mottled brown slightly sandy gravelly CLAY, sand is fine to coarse, gravel is angular fine to coarse of mudstone, siltstone and sandstone.	(2.00)

Legend



Groundwater

No.	Struck	Behaviour
1	6.40m	Rising to 6.20m after 20 mins.

Remarks

Monitor groundwater levels (40 mins).
Standpipe piezometer installed, 19 mm diameter, response zone from 14.50m to 16.50m
Chiselling : 9.30m to 9.50m 30minutes, Chisel
Hole backfill : 0.00m to 0.30m Concrete (c), 0.30m to 5.00m Grout (g), 5.00m to 5.50m Bentonite (b), 7.60m to 8.10m Bentonite (b), 8.10m to 14.00m Grout (g), 14.00m to 14.50m Bentonite (b), 15.50m to 16.50m Bentonite (b), 16.50m to 20.50m Grout (g). Surface protection : Stop Cock Cover
Standpipe Piezometer installed. 19mm diameter, response zone from 5.50m to 7.60m.

Notes : For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.
Scale 1 : 50

Project	LLANWONNO TIPS
Project no.	151258
Carried out for	Rhondda Cynon Taff

Borehole **LWT6**

Borehole Log

Exploration Associates

Drilled by JR/MJ Logged by CW Checked by SC	Equipment and Methods See sheet 1	Ground Level +303.64 m OD National Grid Coordinates E 301183.12 N 196249.98

Samples and Tests / Strata

Depth	Type & No.	Records	Date Casing	Time Water	Description	Depth, Level (Thickness)
10.00 - 10.50	U16	33 blows 450mm recovered	9.80	dry	As sheet 1	10.10 +293.54
10.50 - 11.00	U17	30 blows 450mm recovered	10.30	dry	Stiff light and dark orange brown sandy slightly gravelly SILT. Sand is fine to coarse, gravel is subangular to rounded of siltstone and sandstone.	(1.90)
11.00 - 11.50	U18	40 blows Sample failed. No recovery				
11.50 - 11.95	B19	C,N=49 5,5/8,11,11,19	11.50	dry		12.00 +291.64
12.50 - 12.95	B20	C,N=38 4,5/9,11,10,8	12.50 07/12/2001 13.00	dry dry	Stiff to very stiff orange brown sandy slightly gravelly SILT, with occasional subrounded cobbles of sandstone. Sand is fine to coarse, gravel is subrounded to rounded fine to coarse of siltstone and sandstone.	(1.00) 13.00 +290.64
13.25 - 13.36	B21	C,50 13,12 for 10mm/50 for 20mm	10/12/2001 13.00 13.20	damp dry	Recovered as: Very dense grey and orange brown slightly clayey sandy subangular fine to coarse GRAVEL of moderately strong weathered sandstone. ... From 14.50m with no clay becoming very sandy.	(2.50)
14.00 - 14.45	B22	C,N=39 5,7/9,9,11,10	14.00	dry		
14.75 - 15.11	B23	C,50 4,7/7,8,35 for 60mm	14.70 10/12/2001 15.50	dry		15.50 +288.14
15.50 - 15.55		C,50 25 for 40mm,/50 for 10mm	11/12/2001 15.50 15.00	14.90	Generally moderately weak to moderately strong locally very weak non intact grey brown SANDSTONE. Highly weathered to moderately weathered, fracture discontinuity set 1 is subvertical 60 - 70 degrees widely spaced rough planar moderately open with very clayey gravel infill. Fracture set 2 are subhorizontal closely spaced rough planar moderately open with sandy clay infill. ... From 18.00 to 18.50m Non intact: Recovered as clayey sandy angular fine to coarse GRAVEL of sandstone. ... From 19.40 to 20.40m Non intact: Recovered as clayey GRAVEL angular fine to coarse of sandstone.	(5.00)
15.50 - 16.50m	96 / 80 / 33					
16.50 - 18.00m	64 / 31 / 0 ; If: NI 100 230					
18.00 - 19.00m	80 / 48 / 42		11/12/2001 15.50 12/12/2001 15.50			
19.00 - 20.50m	92 / 33 / 15					
Depth	TCR SCR RQD / If	Records	Date Casing	Time Water		

Groundwater

No.	Struck	Behaviour
2	15.10m	Rising to 14.70m after 20 mins.

Remarks

Chiselling : 11.60m to 12.00m 60minutes, Chisel, 12.00m to 12.50m 60minutes, Chisel, 12.50m to 13.00m 75minutes, Chisel, 13.00m to 13.60m 90minutes, Chisel, 13.80m to 14.00m 60minutes, Chisel, 14.60m to 15.00m 90minutes, Chisel, 15.00m to 15.50m 90minutes, Chisel

Notes : For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.
Scale 1 : 50

Project LLANWONNO TIPS
Project no. 151258
Carried out for Rhondda Cynon Taff

Borehole LWT6
Sheet 2 of 3

Borehole Log

Exploration Associates

Drilled by JR/MJ Logged by CW Checked by SC	Equipment and Methods See sheet 1	Ground Level National Grid Coordinates	+303.64 m OD E 301183.12 N 196249.98

Samples and Tests / Strata

Depth	TCR SCR RQD	If	Records	Date Casing	Time Water	Description	Depth,Level (Thickness)	Legend
19.00 - 20.50m	92 33 15	NI 100 230		12/12/2001 15.50		As sheet 2 ... From 19.40 to 20.40m Non intact: Recovered as clayey GRAVEL angular fine to coarse of sandstone.	(5.00pen)	g
						EXPLORATORY HOLE ENDS AT 20.50 m.	20.50 +283.14	

Groundwater
No. Struck Behaviour

Remarks

Notes : For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.
Scale 1 : 50

Project	LLANWONNO TIPS
Project no.	151258
Carried out for	Rhondda Cynon Taff

Borehole
LWT6
Sheet 3 of 3

Borehole Log

Exploration Associates

Drilled by JR/MJ Logged by CW Checked by SC	Equipment and Methods Cable Percussion 200 mm diameter from 0.00m to 14.75m. Rotary Cored 76 mm diameter from 14.75m to 24.75m using air flush.	Ground Level +287.39 m OD National Grid Coordinates E 301145.79 N 196204.68

Samples and Tests / Strata

Depth	Type & No.	Records	Date Casing	Time Water	Description	Depth, Level (Thickness)
			11/12/2001 0.00	dry		
0.50 - 0.95	B1	C,N=2 1,-/-,1,1,-			From 0.50m very loose.	
1.25 - 1.75	U2	20 blows 450mm recovered	1.20			
1.75	D3					
2.00 - 2.45	B4	C,N=2 1,-/1,-,1,-	2.00	dry		
2.75 - 3.25	U5	15 blows 450mm recovered	2.70	dry		
3.25	D6					
3.50 - 3.95	B7	C,N=5 1,-/1,1,1,2	3.50	dry	From 3.50m becoming loose.	
					MADE GROUND: Loose becoming medium dense dark grey and black slightly clayey, sandy, angular fine to coarse GRAVEL of ash, coal and siltstone.	(8.30)
4.25 - 4.75	U8	16 blows 450mm recovered	4.20	dry		
4.75	D9					
5.00 - 5.45	B10	C,N=6 1,2/1,1,2,2	5.00	dry		
5.75 - 6.25	U11	22 blows 450mm recovered	5.70	dry		
6.25	D12					
6.50 - 6.95	B13	C,N=16 2,2/4,4,3,5	6.50	dry	From 6.50m becoming medium dense.	
7.25 - 7.75	U14	40 blows No recovery	7.20			
7.75	D15					
8.00 - 8.45	B16	C,N=27 2,4/4,5,8,10	8.00	dry		
						8.30 +279.09
8.50 - 9.00	U17	32 blows 450mm recovered	8.40	dry		
9.00 9.00 - 9.45	D18 B19	C,N=23 4,4/4,5,7,7	9.00	dry	Firm to stiff orange grey slightly sandy gravelly CLAY. Gravel is fine to coarse angular sandstone.	(1.95)
9.75 - 10.25	U20	40 blows 450mm recovered	9.70	damp		

Legend: c, g, b, b, g

Groundwater
No. Struck Behaviour
1 10.00m Rising to 9.75m after 20 mins.

Remarks
Monitor groundwater (20mins).
Standpipe piezometer installed, 19 mm diameter, response zone from 12.00m to 14.00m
Chiselling : 9.50m to 9.75m 45minutes, Chisel
Hole backfill : 0.00m to 0.30m Concrete (c), 0.30m to 5.30m Grout (g), 5.30m to 5.80m Bentonite (b), 7.80m to 8.30m Bentonite (b), 8.30m to 11.00m Grout (g), 11.00m to 12.00m Bentonite (b), 14.00m to 15.00m Bentonite (b), 15.00m to 24.72m Grout (g), . Surface protection : Stop Cock Cover
Standpipe Piezometer installed, 19mm diameter, response zone from 5.80m to 7.80m.

Notes : For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.
Scale 1 : 50

Project LLANWONNO TIPS
Project no. 151258
Carried out for Rhondda Cynon Taff

Borehole LWT7
Sheet 1 of 3

Borehole Log

Exploration Associates

Drilled by	JR/MJ	Equipment and Methods	Ground Level	+287.39 m OD
Logged by	CW	See sheet 1	National Grid Coordinates	E 301145.79
Checked by	SC			N 196204.68

Samples and Tests / Strata

Depth	Type & No.	Records	Date Casing	Time Water	Description	Depth,Level (Thickness)
			12/12/2001 10.00	8.80	As sheet 1	
10.25	D21					10.25 +277.14
10.50 - 10.62	B22	C,50 17,8 for 20mm/50 for 20mm	10.50	8.80	Dense to very dense clayey sandy angular to subrounded GRAVEL of siltstone, with some cobbles and occasional boulders. Sand is fine to coarse.	(3.20)
11.25 - 11.70	B23	C,N=29 10,13/9,7,5,8	11.25	9.30		
12.00 - 12.45	B24	C,N=33 7,10/9,10,4,10	12.00	10.10		
12.75 - 13.10	B25	C,50 6,9/14,13,23 for 45mm	12.75	10.15		
13.50 - 13.61	B26	C,50 7 for 25mm,12 for 25mm/50 for 60mm	13.50	10.20		13.45 +273.94
14.00 - 14.44	B27	C,50 6,7/9,12,14,15 for 60mm	14.00	10.70	Very weak, highly weathered orange brown SILTSTONE, recovered as silty sandy and angular fine to coarse gravel.	(1.05)
14.00	D28					
			12/12/2001 14.50	11.20		14.50 +272.89

Depth	TCR SCR RQD	If	Records	Date Casing	Time Water	Description	Depth,Level (Thickness)
		NI NI NI		14/12/2001 14.50		From 14.75 to 15.10m Non intact: recovered as a slightly clayey angular fine to coarse GRAVEL.	
14.75 - 14.82	D28		S,50 25 for 60mm,/50 for 10mm	14.50	11.20		
14.75 - 16.25m	95 36 0					Weak orange brown and grey SILTSTONE. Highly weathered to locally not intact, fracture discontinuities are randomly orientated very closely spaced rough planar with red ferrous staining and some clay infilling.	(3.75)
		NI 30 60				From 16.25 to 16.75m Non intact: recovered as a slightly clayey angular fine to medium GRAVEL.	
16.25 - 17.75m	73 18 0					From 17.05 to 17.35m Non intact: recovered as a clayey subangular fine to coarse GRAVEL of siltstone.	
						From 17.65 to 17.95m Non intact: Recovered as a clayey angular to subangular fine coarse GRAVEL of siltstone.	
17.75 - 19.25m	93 52 23						18.25 +269.14
		30 60 100				Moderately strong to strong grey SANDSTONE. Moderately weathered, fracture discontinuities are mainly horizontal with one subvertical fracture at 18.45 to 18.70m terminating on a horizontal fracture. Fractures are closely spaced rough planar tight with red ferrous staining.	(2.50)
19.25 - 20.75m	100 73 44						

Groundwater

No. Struck Behaviour

Remarks

Chiselling : 10.20m to 10.50m 45minutes, Chisel, 10.80m to 11.00m 30minutes, Chisel, 11.60m to 11.80m 30minutes, Chisel, 12.60m to 13.00m 60minutes, Chisel, 13.50m to 14.00m 60minutes, Chisel, 14.50m to 14.75m 90minutes, Chisel

Notes : For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.
Scale 1 : 50

Project	LLANWONNO TIPS
Project no.	151258
Carried out for	Rhondda Cynon Taff

Borehole LWT7

Borehole Log

Exploration Associates

Drilled by JR/MJ Logged by CW Checked by SC	Equipment and Methods See sheet 1	Ground Level National Grid Coordinates	+287.39 m OD E 301145.79 N 196204.68

Samples and Tests / Strata

Depth	TCR SCR RQD	If	Records	Date Casing	Time Water	Description	Depth,Level (Thickness)	Legend
19.25 - 20.75m	100 73 44	30 60 100				As sheet 2	(2.50)	g
							20.75 +266.64	
20.75 - 22.25m	98 69 20	30 50 100				Moderately strong and strong interlaminated light and dark grey SILTSTONE and SANDSTONE with rare ironstone nodules. Fracture discontinuities are horizontal rough planar and tight with red ferrous staining.	(1.45)	
							22.20 +265.19	
22.25 - 23.75m	100 95	150 300 500				Strong grey SANDSTONE. Slightly weathered. fracture are discontinuities horizontal medium spaced rough planar tight with red ferrous staining.	(2.55pen)	
23.75 - 24.75m	93 89 85			14/12/2001 14.50				
						EXPLORATORY HOLE ENDS AT 24.75 m.	24.75 +262.64	

Groundwater No. Struck Behaviour	Remarks

Notes : For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column. Scale 1 : 50	Project LLANWONNO TIPS Project no. 151258 Carried out for Rhondda Cynon Taff	Borehole **LWT7** Sheet 3 of 3

Borehole Log

Exploration Associates

Drilled by RD/MJ Logged by CW Checked by SC	Equipment and Methods Cable Percussion 200 mm diameter from 0.00m to 27.70m. Rotary Open Hole 76 mm diameter from 27.70m to 32.70m using air flush.	Ground Level +259.75 m OD National Grid Coordinates E 300874.47 N 196284.64

Samples and Tests / Strata

Depth	Type & No.	Records	Date Casing	Time Water
			10/12/2001 0.00	dry
1.00 - 1.45		C,N=10 2,1/3,2,4,1		
1.00 - 1.30	B1			
1.50 - 2.00	U2			
			10/12/2001 2.00	dry
			11/12/2001 2.00	dry
2.00	D3			
2.25 - 2.70		C,N=11 1,1/2,3,4,2	2.00	dry
2.25 - 2.50	B4			
3.00 - 3.50	U5	14 blows 450mm recovered	2.90	dry
3.50	D6			
3.75 - 4.20		C,N=8 1,3/2,2,2,2	3.40	dry
3.75 - 4.00	B7			
4.50 - 5.00	U8	22 blows 450mm recovered	4.20	dry
5.00	D9			
5.25 - 5.70	B10	C,N=10 3,3/3,3,2,2	5.10	dry
6.00 - 6.20	U11	40 blows Sample failed - transferred to bulk.		
6.75 - 7.20		C,N=16 3,4/4,5,4,3	6.50	dry
6.75 - 7.00	B12			
7.50 - 8.00	U13	28 blows 450mm recovered	7.40	dry
8.00	D14			
8.25 - 8.70		C,N=10 3,2/2,2,3,3	8.10	dry
8.25 - 8.50	B15			
9.00 - 9.50	U16	24 blows 450mm recovered	8.80	dry
9.50	D17			
9.75 - 10.20		C,N=14 2,2/4,3,4,3	9.50	
9.75 - 10.00	B18			

Description	Depth, Level (Thickness)	Legend
MADE GROUND: Medium dense dark grey and black slightly clayey very sandy angular fine to coarse GRAVEL of mudstone, siltstone, sandstone and coal. ... From 1.30m with some subangular cobbles. ... From 6.00 with subangular wood and brick fragments.	(8.00)	c / g
MADE GROUND: Firm dark grey mottled yellow slightly slightly gravelly CLAY. Sand is fine to coarse, gravel is angular fine to coarse of mudstone, sandstone and coal.	8.00 +251.75 (0.75)	
MADE GROUND: Medium dense dark grey and black slightly silty very sandy angular fine to coarse GRAVEL of mudstone, siltstone, sandstone and coal. From 9.75m very clayey with occasional cobble of sandstone and ironstone.	8.75 +251.00 (12.85)	

Groundwater

Groundwater not encountered.

Remarks

Standpipe piezometer installed, 19 mm diameter, response zone from 22.50m to 24.50m
Chiselling : 6.00m to 6.20m 45minutes, Chisel
Hole backfill : 0.00m to 0.30m Concrete (c), 0.30m to 19.00m Grout (g), 19.00m to 19.60m Bentonite (b), 21.60m to 23.00m Bentonite (b), 25.00m to 25.50m Bentonite (b), 25.50m to 32.70m Grout (g). Surface protection : Stop Cock Cover
Standpipe Piezometer installed, 19mm diameter, response zone from 19.60m to 21.60m.

Notes : For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.
Scale 1 : 50

Project LLANWONNO TIPS
Project no. 151258
Carried out for Rhondda Cynon Taff

Borehole LWT8

Borehole Log

Exploration Associates

Drilled by	RD/MJ	Equipment and Methods	Ground Level	+259.75 m OD
Logged by	CW	See sheet 1	National Grid Coordinates	E 300874.47
Checked by	SC			N 196284.64

Samples and Tests / Strata

Depth	Type & No.	Records	Date / Casing	Time / Water	Description	Depth,Level (Thickness)	Legend
10.50 - 11.00	U19	19 blows 450mm recovered	10.30	dry			
					From 10.50 to 11.25m becoming dark grey mottled light brown		
11.00	D20						
11.25 - 11.70		C,N=11 2,3/3,2,3,3	11.25	dry			
11.25 - 11.50	B21						
12.00 - 12.50	U22	21 blows 450mm recovered	12.00	dry			
			11/12/2001 12.00	dry			
			12/12/2001 12.00	dry	From 12.75m to 13.00m: Recovered as slightly sandy angular GRAVEL and COBBLES of moderately weak to moderately strong grey shale.		
12.50	D23						
12.75 - 13.20		C,N=43 3,5/9,10,10,14					
12.75 - 13.00	B24						
13.50 - 14.00	U25	31 blows 450mm recovered					
14.00	D26						
14.25 - 14.70		C,N=27 2,4/5,5,8,9					
14.25 - 14.50	B27						
15.00 - 15.50	U28	29 blows 450mm recovered			As sheet 1	(12.85)	
15.50	D29						
15.75 - 16.20		C,N=47 9,8/7,10,14,16			... From 15.75m becoming very silty.		
15.75 - 16.00	B30						
16.50 - 17.00	U31	40 blows 450mm recovered					
16.50	D32						
17.25 - 17.68		C,50 6,7/11,11,14,14 for 30mm					
17.25	B33						
17.25	B34						
18.75 - 19.20		C,N=35 5,10/9,9,8,9					
18.75 - 19.00	B35						
			12/12/2001 19.50	dry			
			13/12/2001 19.50 19.50	dry			
19.50 - 19.70	U36	50 blows Sample failed. No recovery					

Groundwater

Remarks
Chiselling : 12.80m to 13.20m 75minutes, Chisel, 16.10m to 16.30m 45minutes, Chisel, 17.90m to 18.50m 90minutes, Chisel, 19.70m to 20.10m 75minutes, Chisel

Notes : For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.
Scale 1 : 50

Project	LLANWONNO TIPS
Project no.	151258
Carried out for	Rhondda Cynon Taff

Borehole **LWT8**

Borehole Log

Exploration Associates

Drilled by RD/MJ Logged by CW Checked by SC	Equipment and Methods See sheet 1	Ground Level +259.75 m OD National Grid Coordinates E 300874.47 N 196284.64

Samples and Tests / Strata

Depth	Type & No.	Records	Date Casing	Time Water	Description	Depth, Level (Thickness)
20.25 - 20.70		C,N=40 6,7/10,10,11,9	19.50		As sheet 1	(12.85)
20.25 - 20.50	B37					
21.00 - 21.50	U38	44 blows 450mm recovered				
21.50	D39					
						21.60 +238.15
21.70	D40				Very dense brown very silty slightly sandy angular fine to coarse GRAVEL of sandstone, with some cobbles. ... From 24.50m becoming silty.	(5.90)
21.70 - 22.20	U41	44 blows 450mm recovered				
22.20	D42					
22.50 - 22.90		C,42 6,5/7,10,10,15 for 25mm				
22.50 - 22.80	B43					
			13/12/2001 23.40	dry		
			14/12/2001 23.40 23.50	dry		
23.50 - 23.87		C,50 12,13 for 65mm/16,15,15,4 for 5mm				
23.50 - 24.50	B44					
24.50 - 25.50	B45					
24.50 - 24.87		C,50 12,13/12,17,21 for 70mm	24.50			
25.50 - 25.95		C,N=42 6,11/10,11,10,11	25.50			
25.50 - 26.50	B46					
26.50 - 27.50	B47					
26.50 - 26.88		C,50 11,14/19,21,10	26.50			
			14/12/2001 27.70	dry		27.50 +232.25

Depth	TCR SCR RQD	If	Records	Date Casing	Time Water	Description	Depth, Level (Thickness)
				17/12/2001 27.70 27.50	dry	Moderately strong to strong grey fine medium SANDSTONE. Moderately to highly weathered fracture discontinuity set 1 are closely spaced horizontal rough planar and tight. Fracture set 2 are widely spaced subvertical fractures rough planar and moderately open with sandy clay infill.	(5.20)
27.50 - 27.61			C,50 25 for 40mm,- for 0mm/50 for 70mm				
27.70 - 27.83			C,50 25 for 55mm,- for 0mm/50	27.50			
27.70 - 29.20m	93 75 31	NI 150 290					
29.20 - 30.70m	93 68 33						

Legend: b, b, g

Groundwater

Remarks
23.40m to 27.70m Water added to assist drilling.
Chiselling : 22.80m to 23.40m 135minutes, Chisel, 23.40m to 24.50m 135minutes, Chisel, 24.50m to 25.00m 60minutes, Chisel, 26.70m to 27.50m 120minutes, Chisel, 27.50m to 27.70m 60minutes, Chisel

Notes : For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.
Scale 1 : 50

Project LLANWONNO TIPS
Project no. 151258
Carried out for Rhondda Cynon Taff

Borehole **LWT8**

Borehole Log

Exploration Associates

Drilled by RD/MJ Logged by CW Checked by SC	Equipment and Methods See sheet 1	Ground Level National Grid Coordinates	+259.75 m OD E 300874.47 N 196284.64

Samples and Tests / Strata

Depth	TCR SCR RQD	If	Records	Date Casing	Time Water	Description	Depth,Level (Thickness)	Legend
29.20 - 30.70m	93 68 33					Non intact: Recovered as grey brown sandy slightly gravelly CLAY.		g
30.70 - 31.50m	94 69 0					As sheet 3	(5.20pen)	
31.50 - 32.20m	83 71 43							
32.20 - 32.70m	96 64 60			17/12/2001 27.70	dry			
						EXPLORATORY HOLE ENDS AT 32.70 m.	32.70 +227.05	

Groundwater

Remarks

Notes : For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.
Scale 1 : 50

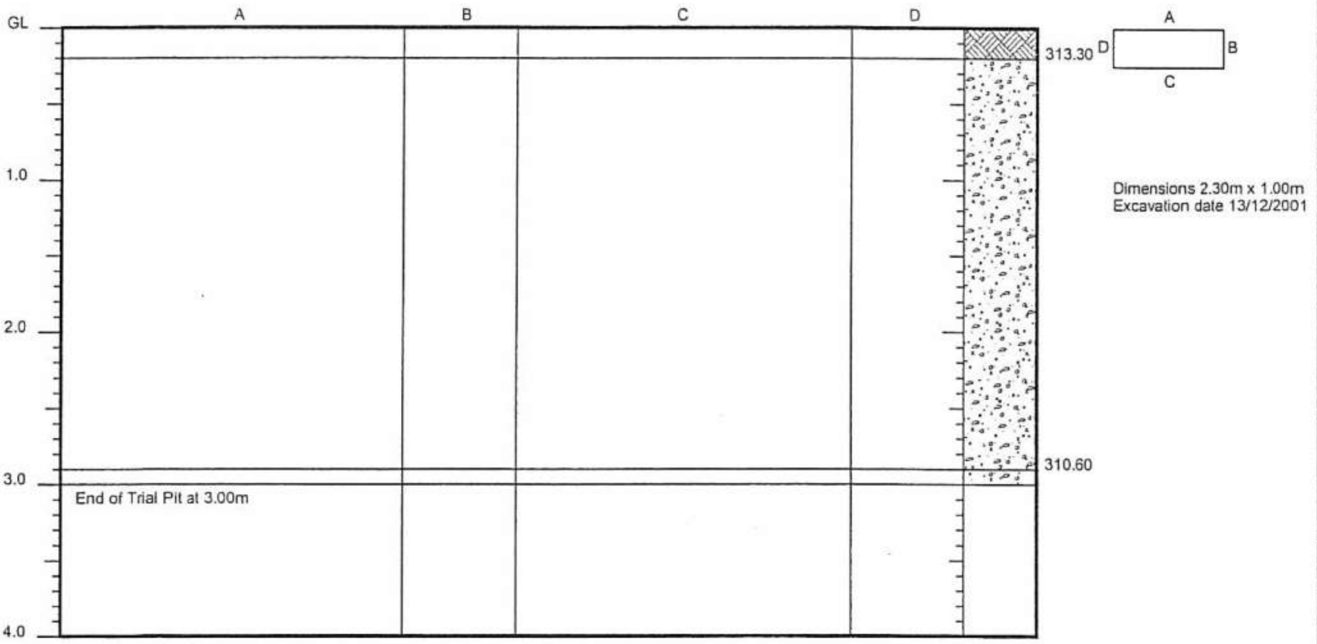
Project	LLANWONNO TIPS
Project no.	151258
Carried out for	Rhondda Cynon Taff

Borehole
LWT8

Trial Pit Log

Exploration Associates

Logged by CW Checked by SC	**Equipment and Methods** Trial Pit/Trench dug using 15 tonne tracked excavator from 0.00m to 3.00m.	Ground Level +313.50 m OD National Grid Coordinates E 301020.54 N 196457.70



Samples and Tests / Strata

Depth (m)	Type & No.	Records	Depth (m)	No.	Description
			0.00-0.20	1	TOPSOIL: Firm orange brown slightly sandy slightly gravelly SILT, with abundant rootlets and some roots. Sand is fine to coarse, gravel is subangular of sandstone.
0.70-0.90 1.70-1.90	B1 B2		0.20-2.90	2	Orange brown mottled grey silty sandy subangular to subrounded GRAVEL of sandstone. Sand is fine to coarse. ... From 1.00m with occasional subangular fine to coarse cobbles and rare tabular boulders of sandstone, upto 1.00m x 0.70m.
2.90-3.00	B3		2.90-3.00	3	Light grey mottled orange brown very clayey slightly sandy angular fine to coarse GRAVEL of mudstone and sandstone.

Groundwater
Damp at 2.00m.

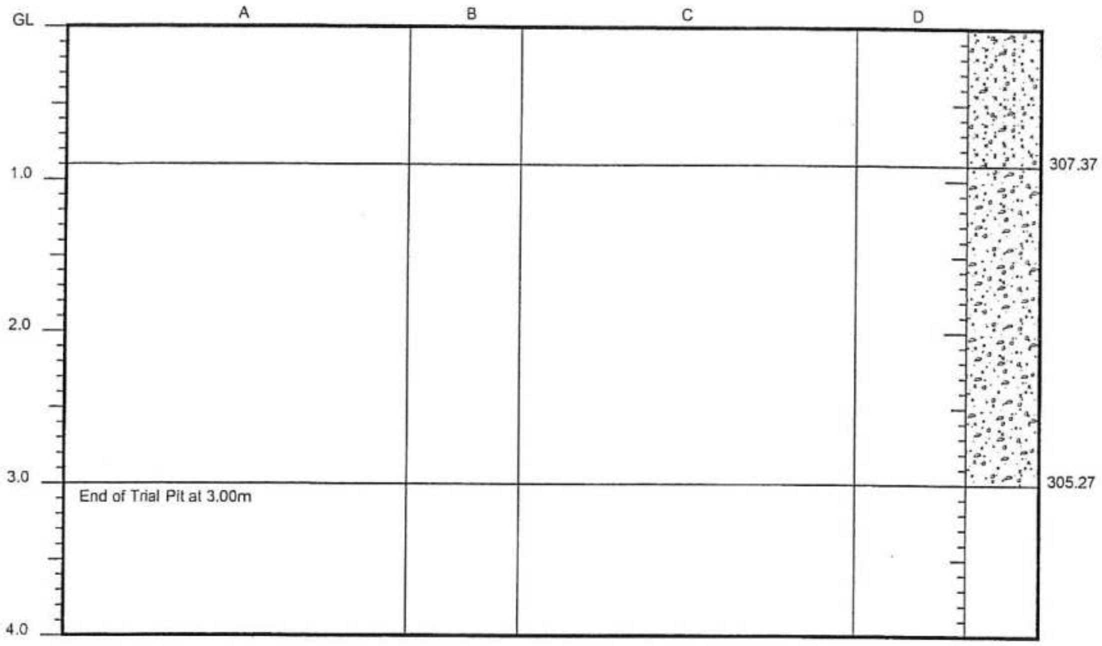
Remarks
Stability : Stable, Shoring : None
Hole backfill : 0.00m to 3.00m Arisings (a).

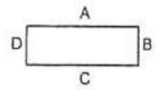
Notes : For explanation of symbols and abbreviations see key sheet. All depths in metres. Scale 1 : 50	Project LLANWONNO TIPS Project no. 151258 Carried out for Rhondda Cynon Taff	Trial Pit LWTP1 Sheet 1 of 1

Trial Pit Log

Exploration Associates

Logged by CW Checked by SC	Equipment and Methods Trial Pit/Trench dug using 15 tonne tracked excavator from 0.00m to 3.00m.	Ground Level +308.27 m OD National Grid Coordinates E 301036.60 N 196418.59





Dimensions 2.30m x 0.80m
Excavation date 13/12/2001

Samples and Tests / Strata

Depth (m)	Type & No.	Records	Depth (m)	No.	Description
0.40-0.60	B1		0.00-0.90	1	Very soft light grey mottled orange sandy slightly gravelly SILT, with abundant rootlets and many roots. Sand is fine to coarse, gravel is subangular to subrounded fine to coarse of siltstone and sandstone. Strong organic odour noted.
1.60-1.80	B2		0.90-3.00	2	Orange brown mottled grey silty slightly sandy subangular to subrounded fine to coarse GRAVEL of siltstone and sandstone, with some subangular cobbles and occasional boulders of sandstone.
2.80	D3				

Groundwater	Remarks
No. Struck Behaviour	Stability : Stable, Shoring : None

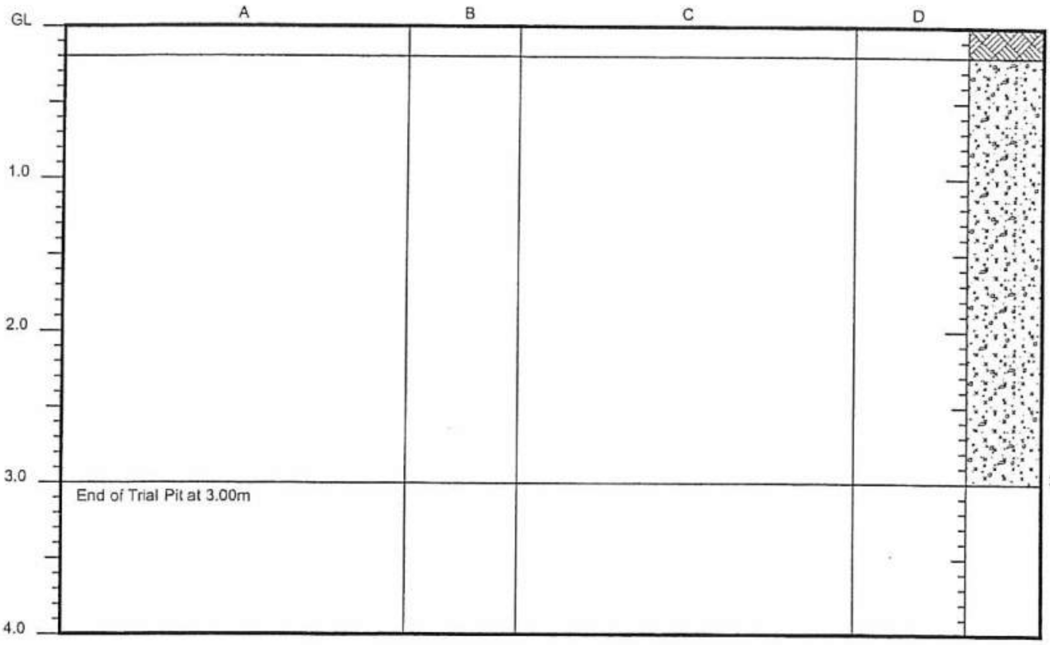
Notes : For explanation of symbols and abbreviations see key sheet. All depths in metres. Scale 1 : 50	Project LLANWONNO TIPS Project no. 151258 Carried out for Rhondda Cynon Taff	Trial Pit LWTP2 Sheet 1 of 1

09/05/2002 11:09:25 ESGLog v2.10

Trial Pit Log

Exploration Associates

Logged by CW Checked by SC	Equipment and Methods Trial Pit/Trench dug using 15 tonne tracked excavator from 0.00m to 3.00m.	Ground Level +305.04 m OD National Grid Coordinates E 301062.66 N 196382.42



Dimensions 2.00m x 1.00m
Excavation date 13/12/2001

Samples and Tests / Strata

Depth (m)	Type & No.	Records	Depth (m)	No.	Description
			0.00-0.20	1	TOPSOIL: Soft and firm brown sandy slightly gravelly CLAY, with abundant rootlets and some roots. Sand is fine to coarse, gravel is fine to medium of sandstone.
0.20 0.40-0.60 1.40 2.40-2.60	D1 B2 D3 B4		0.20-3.00	2	Soft light grey mottled orange brown slightly sandy slightly gravelly SILT. Sand is fine to coarse, gravel is subangular to subrounded fine to coarse of siltstone and sandstone. ... From 0.60m becoming firm, with occasional brown clay lenses upto 10cm thick.

Groundwater
Damp at 0.60m.

Remarks
Stability : Stable, Shoring : None
Hole backfill : 0.00m to 3.00m Arisings (a).

Notes : For explanation of symbols and abbreviations see key sheet. All depths in metres.

Scale 1 : 50

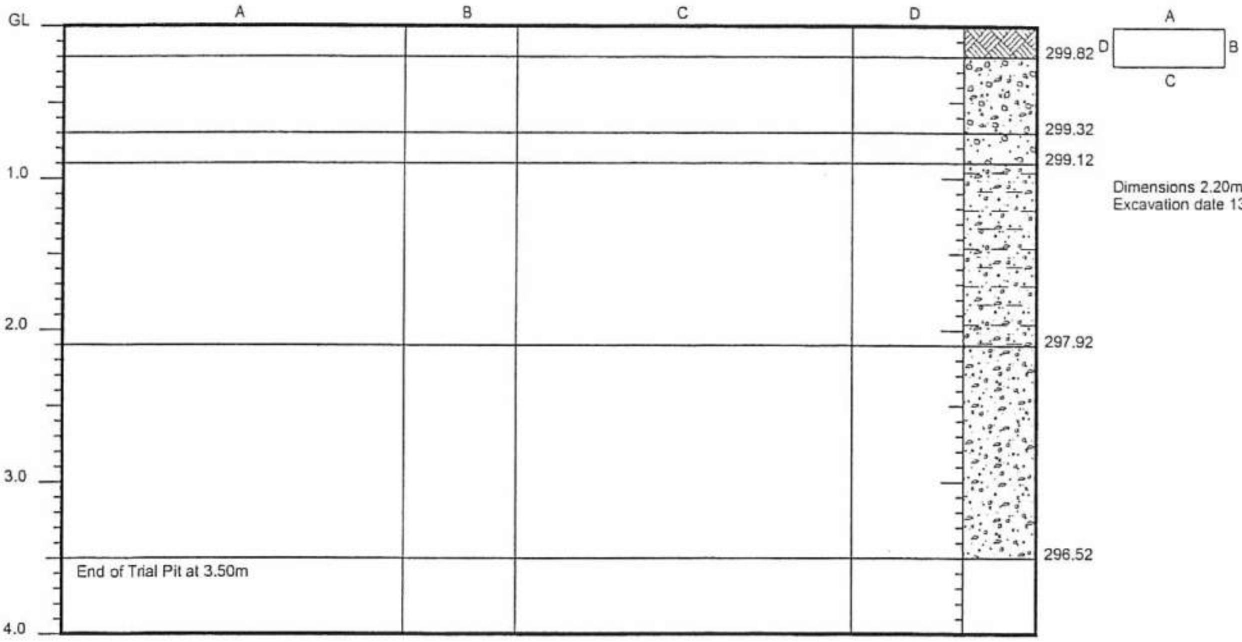
Project	LLANWONNO TIPS
Project no.	151258
Carried out for	Rhondda Cynon Taff

Trial Pit
LWTP3
Sheet 1 of 1

Trial Pit Log

Exploration Associates

Logged by CW Checked by SC	Equipment and Methods Trial Pit/Trench dug using 15 tonne tracked excavator from 0.00m to 3.50m.	Ground Level +300.02 m OD National Grid Coordinates E 301029.44 N 196380.74



Dimensions 2.20m x 1.00m
Excavation date 13/12/2001

Samples and Tests

Depth (m)	Type & No.	Records
0.10-0.20	B1	
0.20-0.40	B2	
0.70-0.90	B3	
1.00-1.20	B4	
1.90	D5	
2.20-2.50	B6	
2.90	D7	
3.50	D8	
3.50	D9	

Strata

Depth (m)	No.	Description
0.00-0.20	1	TOPSOIL: Soft brown slightly sandy slightly sandy CLAY, with abundant rootlets. Sand is fine to coarse, gravel is rounded to fine to coarse of quartzite and angular of mudstone
0.20-0.70	2	Orange brown very clayey sandy angular to subangular fine to coarse GRAVEL and COBBLES of sandstone, with some boulders.
0.70-0.90	3	Recovered as: Black sandy gravelly COBBLES of carbonised sandstone.
0.90-2.10	4	Firm grey slightly sandy gravelly CLAY. Sand is fine to coarse, gravel is angular fine to medium of mudstone and sandstone.
2.10-3.50	5	Orange brown silty sandy angular to subrounded fine to coarse GRAVEL of mudstone, siltstone and sandstone.

Groundwater
Groundwater not encountered.

Remarks
Stability : Stable, Shoring : None
Hole backfill : 0.00m to 3.50m Arisings (a).

Notes : For explanation of symbols and abbreviations see key sheet. All depths in metres.

Scale 1 : 50

Project	LLANWONNO TIPS
Project no.	151258
Carried out for	Rhondda Cynon Taff

Trial Pit
LWTP5
Sheet 1 of 1

ENCLOSURE C

Laboratory Test Results

Key to Laboratory Test Results

U	Undisturbed Sample
P	Piston Sample
TWS	Thin Wall Sample
B	Bulk Sample - Disturbed
D	Jar Sample - Disturbed
W	Water Sample
pH	Acidity/Alkalinity Index
SO_3	% - Total Sulphate Content (acid soluble)
SO_3	g/ltr - Water Soluble Sulphate (Water or 2:1 Aqueous Soil Extract)
+	Calcareous Reaction
Cl	Chloride Content
I_p	Plasticity Index
<425	% of material in sample passing 425 micron sieve
w_L	Liquid Limit
w_p	Plastic Limit
w	Water Content
NP	Non Plastic
γ_b	Bulk Density
γ_d	Dry Density
Ps	Particle Density
U/D	Undrained/Drained Triaxial
U/C	Unconsolidated/Consolidated Triaxial
T/M	Single Stage/Multistage Triaxial
100/38	Sample Diameter (mm)
REM	Remoulded Triaxial Test Specimen
TST	Triaxial Suction Test
V	Vane Test
DSB	Drained Shear Box
RSB	Residual Shear Box
RS	Ring Shear
σ_3	Cell Pressure
σ_1-σ_3	Deviator Stress
c	Cohesion
c'	Effective Cohesion Intercept
ϕ	Angle of Shearing Resistance - Degrees
ϕ'	Effective Angle of Shearing Resistance
εf	Strain at Failure
*	Failed under 1st Load
**	Failed under 2nd Load
#	Untestable
##	Excessive Strain
p'o	Effective Overburden Pressure
m_v	Coefficient of Volume Decrease
c_v	Coefficient of Consolidation
Opt	Optimum
Nat	Natural
Std	Standard Compaction - 2.5kg Rammer (¶ CBR)
Hvy	Heavy Compaction - 4.5kg Rammer (§ CBR)
Vib	Vibratory Compaction
CBR	California Bearing Ratio
Sat m.c.	Saturation Moisture Content
MCV	Moisture Condition Value

Notes:	Project Project No. Carried out for	Figure

Samples				Classification					Strength			Other Tests
Hole	Depth	Type	Description	<425 I_P	Prep w_L	w_P	Water %	γ_b Mg/m^3	Test	σ_3 kPa	C kPa	
HD1	0.00 - 0.05	D	Silty gravelly SAND				34	1.48 Dry= 1.10				pH = 4.3 Particle Size analysis
HD1	0.05 - 0.10	D	Silty SAND and GRAVEL				15	1.65 Dry= 1.44				pH = 4.8 Particle Size analysis
HD1	0.10 - 0.15	D	Silty very sandy GRAVEL				12	1.53 Dry= 1.36				pH = 4.2 Particle Size analysis
HD1	0.15 - 0.20	D	Silty SAND and GRAVEL				12	1.70 Dry= 1.52				pH = 5.5 Particle Size analysis
HD1	0.20 - 0.25	D	Slightly silty very sandy GRAVEL				8.4	1.71 Dry= 1.58				pH = 4.9 Particle Size analysis
HD2	0.00 - 0.05	D	Silty gravelly SAND				21	1.51 Dry= 1.25				pH = 6.1 Particle Size analysis
HD2	0.05 - 0.10	D	Silty gravelly SAND				17	1.69 Dry= 1.44				pH = 6.2 Particle Size analysis
HD2	0.10 - 0.15	D	Silty gravelly SAND				13	1.78 Dry= 1.58				pH = 6.5 Particle Size analysis
HD2	0.15 - 0.20	D	Silty very sandy GRAVEL				9.9	1.52 Dry= 1.38				pH = 6.4 Particle Size analysis
HD2	0.20 - 0.25	D	Slightly silty sandy GRAVEL.				7.0	1.62 Dry= 1.51				pH = 6.1 Particle Size analysis
HD3	0.00 - 0.05	D	Slightly silty gravelly SAND				73	0.99 Dry= 0.57				pH = 5.6 Particle Size analysis
HD3	0.05 - 0.10	D	Slightly silty gravelly SAND				46	1.30 Dry= 0.89				pH = 4.2 Particle Size analysis
HD3	0.10 - 0.15	D	Slightly silty very gravelly SAND				22	1.46 Dry= 1.19				pH = 4.0 Particle Size analysis

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Exploration Associates

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LLANWONNO TIPS
Rhondda Cynon Taff

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Samples				Classification					Strength			Other Tests
Hole	Depth	Type	Description	<425 I_P	Prep w_L	w_P	Water %	γ_b Mg/m^3	Test	σ_3 kPa	C kPa	
HD3	0.15 - 0.20	D	Slightly silty very gravelly SAND				12	1.59 Dry= 1.42				pH = 4.7 Particle Size analysis
HD3	0.20 - 0.25	D	Slightly silty very sandy GRAVEL				8.3	1.61 Dry= 1.49				pH = 4.9 Particle Size analysis
HD4	0.00 - 0.05	D	Slightly gravelly SAND				82	1.20 Dry= 0.66				pH = 6.4 Particle Size analysis
HD4	0.05 - 0.10	D	Slightly silty very gravelly SAND				65	1.19 Dry= 0.72				pH = 4.4 Particle Size analysis
HD4	0.10 - 0.15	D	Silty very gravelly SAND				61	1.28 Dry= 0.79				pH = 4.1 Particle Size analysis
HD4	0.15 - 0.20	D	Silty gravelly SAND				49	1.36 Dry= 0.91				pH = 4.5 Particle Size analysis
HD4	0.20 - 0.25	D	Silty slightly gravelly SAND				36	1.44 Dry= 1.06				pH = 3.7 Particle Size analysis
HD5	0.00 - 0.05	D	Slightly silty SAND and GRAVEL				32	1.20 Dry= 0.91				pH = 4.0 Particle Size analysis
HD5	0.05 - 0.10	D	Slightly silty very sandy GRAVEL				18	1.41 Dry= 1.19				pH = 4.0 Particle Size analysis
HD5	0.10 - 0.15	D	Slightly silty SAND and GRAVEL				17	1.48 Dry= 1.27				pH = 4.0 Particle Size analysis
HD5	0.15 - 0.20	D	Slightly silty SAND and GRAVEL				14	1.60 Dry= 1.40				pH = 4.4 Particle Size analysis
HD5	0.20 - 0.25	D	Slightly silty very sandy GRAVEL				12	1.64 Dry= 1.46				pH = 4.1 Particle Size analysis
HD6	0.00 - 0.05	D	Slightly silty very gravelly SAND				67	1.02 Dry= 0.61				pH = 4.2 Particle Size analysis

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Samples				Classification					Strength			Other Tests
Hole	Depth	Type	Description	<425 I_P	Prep w_L	w_P	Water %	γ_b Mg/m^3	Test	σ_3 kPa	C kPa	
HD6	0.05 - 0.10	D	Sandy slightly gravelly CLAY / SILT				48	1.39 Dry= 0.94				pH = 4.9 Particle Size analysis
HD6	0.10 - 0.15	D	sandy slightly gravelly CLAY / SILT				43	1.50 Dry= 1.05				pH = 4.6 Particle Size analysis
HD6	0.15 - 0.20	D	Sandy gravelly CLAY / SILT				30	1.55 Dry= 1.20				pH = 4.9 Particle Size analysis
HD6	0.20 - 0.25	D	sandy slightly gravelly CLAY / SILT				31	1.49 Dry= 1.14				pH = 5.6 Particle Size analysis
HD7	0.00 - 0.05	D	Slightly silty very sandy GRAVEL				234	0.78 Dry= 0.23				pH = 6.2 Particle Size analysis
HD7	0.05 - 0.10	D	Slightly silty very sandy GRAVEL				30	1.30 Dry= 1.00				pH = 6.2 Particle Size analysis
HD7	0.10 - 0.15	D	Slightly silty sandy GRAVEL				19	1.20 Dry= 1.01				pH = 6.5 Particle Size analysis
HD7	0.15 - 0.20	D	Slightly silty sandy GRAVEL				18	1.24 Dry= 1.05				pH = 6.1 Particle Size analysis
HD7	0.20 - 0.25	D	Slightly silty sandy GRAVEL				13	1.48 Dry= 1.31				pH = 6.0 Particle Size analysis
HD8	0.00 - 0.05	D	Very silty gravelly SAND				244	0.91 Dry= 0.27				pH = 5.9 Particle Size analysis
HD8	0.05 - 0.10	D	Slightly silty gravelly SAND				125	0.95 Dry= 0.42				pH = 4.4 Particle Size analysis
HD8	0.10 - 0.15	D	Silty gravelly SAND				127	0.91 Dry= 0.40				pH = 4.1 Particle Size analysis
HD8	0.15 - 0.20	D	Sandy slightly gravelly CLAY / SILT				60	1.46 Dry= 0.91				pH = 4.7 Particle Size analysis

Remarks

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Laboratory - Results Summary	Project LLANWONNO TIPS Rhondda Cynon Taff	Contract 151258
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Samples				Classification					Strength			Other Tests
Hole	Depth	Type	Description	<425 I_P	Prep w_L	w_P	Water %	γ_b Mg/m^3	Test	σ_3 kPa	C kPa	
HD8	0.20 - 0.25	D	Very sandy gravelly CLAY / SILT				37	1.56 Dry= 1.14				pH = 4.5 Particle Size analysis
HD9	0.00 - 0.05	D	Slightly silty gravelly SAND				44	1.29 Dry= 0.89				pH = 6.2 Particle Size analysis
HD9	0.05 - 0.10	D	Slightly silty SAND and GRAVEL				17	1.59 Dry= 1.36				pH = 4.3 Particle Size analysis
HD9	0.10 - 0.15	D	Silty SAND and GRAVEL				14	1.61 Dry= 1.41				pH = 4.2 Particle Size analysis
HD9	0.15 - 0.20	D	Silty SAND and GRAVEL				14	1.63 Dry= 1.43				pH = 4.0 Particle Size analysis
HD9	0.20 - 0.25	D	Silty gravelly SAND				17	1.71 Dry= 1.46				pH = 4.2 Particle Size analysis
HD10	0.00 - 0.05	D	Slightly silty very gravelly SAND				68	1.11 Dry= 0.66				pH = 5.5 Particle Size analysis
HD10	0.05 - 0.10	D	Silty gravelly SAND				47	1.34 Dry= 0.91				pH = 3.8 Particle Size analysis
HD10	0.10 - 0.15	D	Silty slightly gravelly SAND				43	1.34 Dry= 0.94				pH = 4.2 Particle Size analysis
HD10	0.15 - 0.20	D	Very silty gravelly SAND				52	1.31 Dry= 0.85				pH = 4.1 Particle Size analysis
HD10	0.20 - 0.25	D	Silty sandy GRAVEL				22	1.60 Dry= 1.31				pH = 4.1 Particle Size analysis
LWT2	3.00 - 3.45	B	MADE GROUND: loose dark grey and black slightly clayey very sandy angular fine to coarse GRAVEL of mudstone and coal.	41 24	425µ 49	Sieve 25	11					pH = 7.0 Ps = 2.32 measured Particle Size analysis SO3 = 0.03% Passing 2mm = 39%

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Laboratory - Results Summary

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Samples				Classification					Strength			Other Tests
Hole	Depth	Type	Description	<425 I_P	Prep w_L	w_P	Water %	γ_b Mg/m^3	Test	σ_3 kPa	C kPa	
LWT2	5.00 - 5.45	B	MADE GROUND: loose dark grey and black slightly clayey very sandy angular fine to coarse GRAVEL of mudstone and coal.	39 25	425μ 50	Sieve 25	6.4					Ps = 2.62 measured Shearbox Test Particle Size analysis
LWT2	8.00 - 8.45	B	Medium dense becoming dense dark orange brown slightly clayey sandy angular dominantly coarse GRAVEL with occasional subangular cobbles of siltstone and sandstone.	41 13	425μ 34	Sieve 21	8.6					pH = 7.2 Ps = 2.70 measured Particle Size analysis SO3 = 0.02% Passing 2mm = 46%
LWT3	2.00 - 2.50	U	MADE GROUND: Loose dark grey sandy angular fine to coarse GRAVEL of weak mudstone and coal	44 33	425μ 59	Sieve 26	5.5	1.80 Dry= 1.69				Shearbox Test
LWT3	3.00 - 3.45	B	MADE GROUND: medium dense dark grey and black clayey sandy angular fine to coarse GRAVEL with occasional subangular cobbles of mudstone and coal.	32 22	425μ 45	Sieve 23	5.1					pH = 8.1 Ps = 2.42 measured Particle Size analysis SO3 = <0.01% Passing 2mm = 40%
LWT3	7.00 - 7.50	U	Dark brown and black slightly sandy very gravelly CLAY	22 15	425μ 32	Sieve 17	6.1	1.80 Dry= 1.68				Shearbox Test
LWT3	7.75 - 8.20	B	MADE GROUND: Medium dense dark grey and black clayey sandy angular fine to coarse GRAVEL with occasional subangular cobbles of mudstone and coal.	41 20	425μ 46	Sieve 26	6.9					Particle Size analysis
LWT3	10.80- 11.00	B	Very stiff slightly sandy slightly gravelly SILT. Sand is fine to coarse gravel is angular to subangular fine to coarse of siltstone and sandstone.									Particle Size analysis
LWT3	11.00- 11.50	U	Very stiff orange brown slightly sandy slightly gravelly SILT. sand is fine to coarse, gravel is angular to subangular fine to coarse of siltstone and sandstone	98 15	Natural 31	16	13	2.06 Dry= 1.72				pH = 6.1 Ps = 2.69 measured Shearbox Test SO3 = 0.53% Passing 2mm = 99%

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Samples				Classification					Strength			Other Tests
Hole	Depth	Type	Description	<425 I_P	Prep w_L	w_P	Water %	γ_b Mg/m^3	Test	σ_3 kPa	C kPa	
LWT4	2.75 - 3.25	U	Medium dense dark grey slightly silty very sandy angular fine to coarse GRAVEL of mudstone and coal.	46 30	425µ 58	Sieve 28	9.3					pH = 6.3 Ps = 2.23 measured Shearbox Test Particle Size analysis SO3 = 0.39% Passing 2mm = 36%
LWT4	6.50 - 6.95	B	Medium dense dark grey slightly silty sandy angular fine to coarse GRAVEL of mudstone and coal.	26 23	425µ 45	Sieve 22	7.2					Particle Size analysis
LWT4	7.25 - 7.75	U	Medium dense dark grey slightly silty sandy angular fine to coarse GRAVEL of mudstone and coal.	32 23	425µ 46	Sieve 23	6.8					Particle Size analysis
LWT4	8.75 - 9.20	B	Medium dense orange brown slightly silty sandy angular fine to coarse GRAVEL of siltstone and sandstone.	39 15	425µ 36	Sieve 21	4.1					pH = 7.2 Ps = 2.64 measured Particle Size analysis SO3 = 0.05% Passing 2mm = 31%
LWT5	9.30 - 9.80	U	MADE GROUND: dark grey and black sandy angular fine to coarse GRAVEL of mudstone ironstone and coal. Sand is fine to coarse.	33 23	425µ 46	Sieve 23	10	2.14 Dry= 1.95				pH = 8.4 Ps = 2.26 measured SO3 = 0.05% Passing 2mm = 66%
LWT5	10.50- 11.00	U	MADE GROUND: medium dense light and dark orange brown very silty very sandy GRAVEL. Sand is fine to coarse, gravel is subangular to subrounded of mudstone siltstone sandstone and ironstone	46 24	425µ 48	Sieve 24	9.8	1.96 Dry= 1.79				Particle Size analysis
LWT5	11.20- 11.65	B	Medium dense gravelly very sandy SILT, very silty SAND.	42 22	425µ 46	Sieve 24	12					Shearbox Test Particle Size analysis
LWT5	13.50- 14.00	U	Firm orange brown mottled grey slightly sandy slightly gravelly CLAY. Sand is fine to coarse, gravel is angular fine to coarse of siltstone and sandstone.	60 22	425µ 44	Sieve 22	13					pH = 5.9 Shearbox Test Particle Size analysis SO3 = 0.52% Passing 2mm = 67%

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Laboratory - Results Summary

Project: LLANWONNO TIPS, Rhondda Cynon Taff

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Hole	Depth	Type	Description	<425 I_P	Prep w_L	w_P	Water %	γ_b Mg/m^3	Test	σ_3 kPa	C kPa	Other Tests
LWT6	1.75 - 2.25	U	MADE GROUND: very loose dark grey and black slightly silty very sandy angular fine to coarse gravel of mudstone and coal.	52 24	425µ 51	Sieve 27	3.8	1.81 Dry= 1.70				pH = 6.5 Ps = 2.54 measured Shearbox Test Particle Size analysis SO3 = 0.19% Passing 2mm = 44%
LWT6	8.50 - 9.00	U	Stiff grey mottled brown slightly sandy gravelly CLAY. Sand is fine to coarse gravel is angular fine to coarse of mudstone siltstone and sandstone.	46 13	425µ 28	Sieve 15	9.4	1.80 Dry= 1.65				Shearbox Test Particle Size analysis
LWT6	10.50- 11.00	U	Stiff light and dark orange brown slightly sandy slightly gravelly SILT sand is fine to coarse gravel is rounded to subangular of siltstone and sandstone.	69 17	425µ 35	Sieve 18	9.7	1.81 Dry= 1.59				pH = 6.5 Ps = 2.68 measured Shearbox Test Particle Size analysis SO3 = 0.18% Passing 2mm = 99%
LWT7	2.00 - 2.45	B	Loose becoming medium dense dark grey and black slightly silty sandy angular fine to coarse GRAVEL of ash coal and sandstone.									pH = 8.3 Particle Size analysis SO3 = 0.09% Passing 2mm = 36%
LWT7	2.75 - 3.25	U	MADE GROUND:loose becoming medium dense dark grey and black slightly clayey sandy angular fine to coarse GRAVEL of coal and siltstone.	24 18	425µ 39	Sieve 21	8.9	1.80 Dry= 1.65				Ps = 2.28 measured Shearbox Test
LWT7	5.00 - 5.45	B	Loose becoming medium dense dark grey and black slightly clayey sandy angular fine to coarse GRAVEL of ash coal and sandstone.									Particle Size analysis
LWT7	5.75 - 6.25	U	MADE GROUND: Loose becoming medium dense dark grey and black slightly clayey sandy angular fine to coarse GRAVEL of coal, ash and siltstone	27 13	425µ 31	Sieve 18	6.6					Ps = 2.37 measured Shearbox Test
LWT7	8.50 - 9.00	U	Dark orange brown slightly sandy gravelly CLAY. Gravel is angular fine to coarse of sandstone.	75 22	425µ 49	Sieve 27	16	1.79 Dry= 1.47				Shearbox Test

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Laboratory - Results Summary

Project: LLANWONNO TIPS, Rhondda Cynon Taff

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Samples				Classification					Strength			Other Tests
Hole	Depth	Type	Description	<425 I_P	Prep w_L	w_P	Water %	γ_b Mg/m^3	Test	σ_3 kPa	C kPa	
LWT7	9.00 - 9.45	B	Firm to stiff orange mottled grey slightly sandy gravelly CLAY. gravel is angular fine to coarse of sandstone									Particle Size analysis
LWT8	6.75 - 7.00	B	MADE GROUND: Medium dense dark grey and black silty slightly sandy angular fine to coarse GRAVEL of mudstone sandstone and siltstone and coal.									Particle Size analysis
LWT8	7.50 - 8.00	U	MADE GROUND: Medium dense dark grey and black slightly clayey very sandy angular fine to coarse GRAVEL of mudstone, siltstone, sandstone, coal and wood.	11	425µ 30	Sieve NP	3.7	1.84 Dry= 1.77				Ps = 2.22 measured
LWT8	15.75- 16.00	B	MADE GROUND: medium dense dark grey and black silty slightly sandy angular fine to coarse GRAVEL of sandstone siltstone and coal.									Particle Size analysis
LWT8	16.50- 17.00	U	MADE GROUND: Medium dense dark grey and black slightly clayey very sandy angular fine to coarse GRAVEL of mudstone, siltstone, sandstone and coal.	13	425µ 29	Sieve NP	9.5	2.10 Dry= 1.92				Ps = 2.31 measured
LWT8	21.70- 22.20	U	Grey brown slightly gravelly slightly sandy CLAY with occasional orange brown sand partings	53 20	425µ 46	Sieve 26	15	1.80 Dry= 1.46				Shearbox Test Particle Size analysis
LWT8	25.50- 26.50	B	Very dense brown very clayey slightly sandy angular fine to coarse GRAVEL, with some cobbles of sandstone				5.2					Particle Size analysis

Remarks

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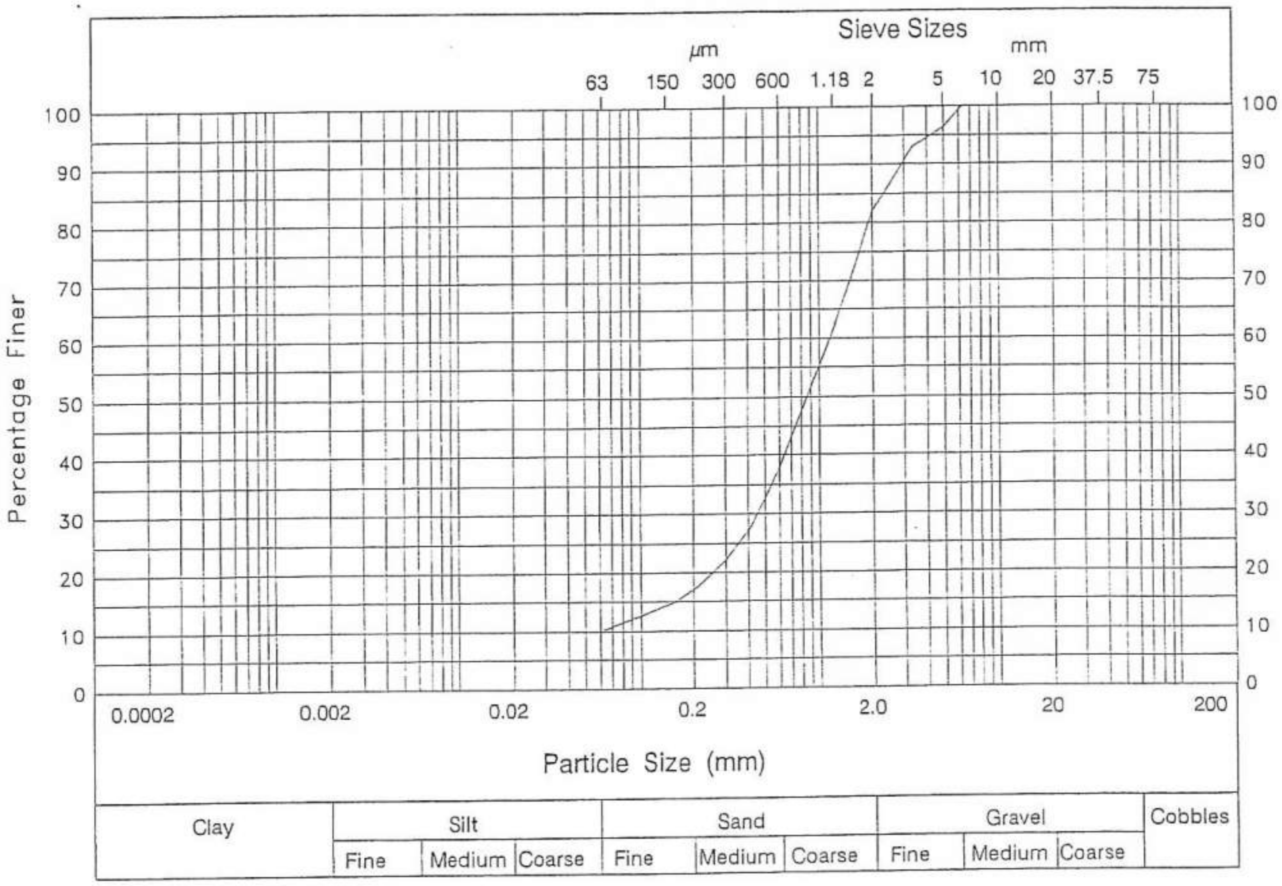
Laboratory - Results Summary	Project LLANWONNO TIPS Rhondda Cynon Taff	Contract 151258
Exploration Associates		Sheet L1/1

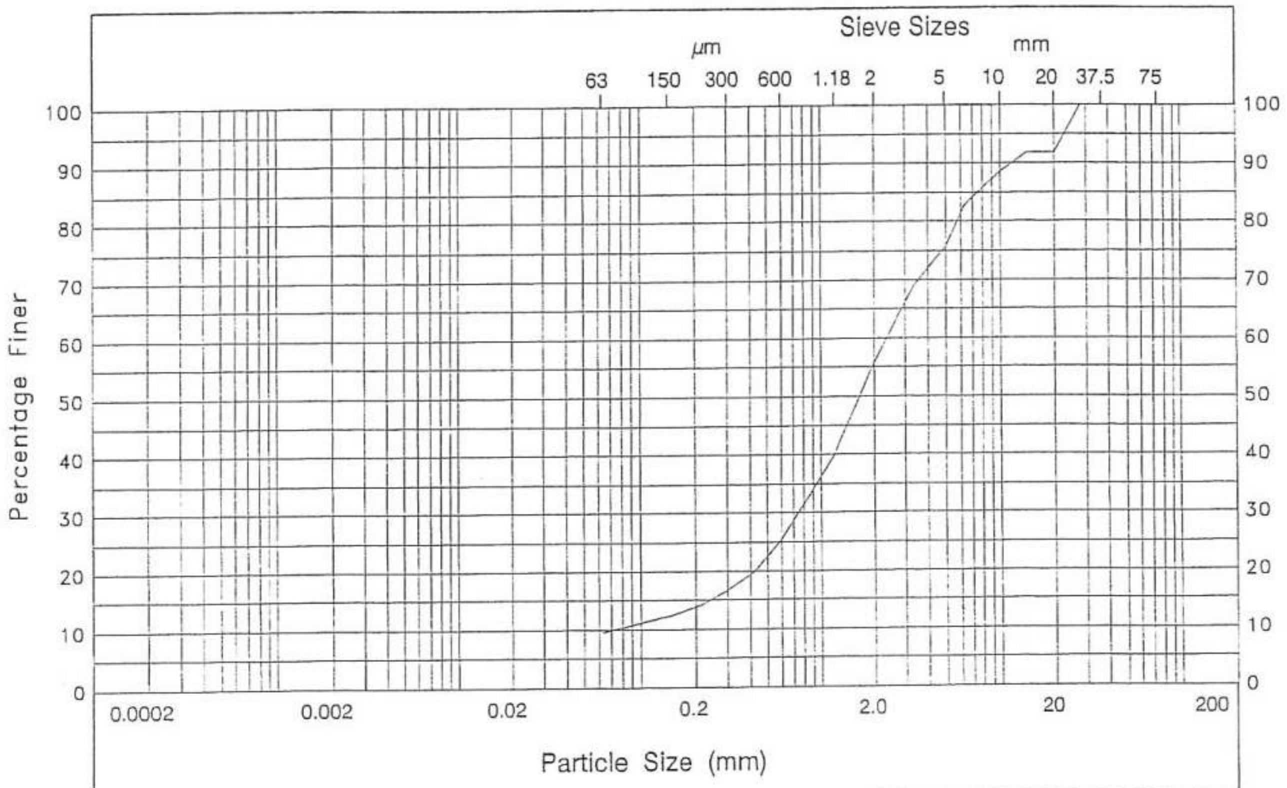


Particle Size	% Passing	Particle Size	% Passing
6.3 mm	100		
5 mm	96		
3.35 mm	93		
2 mm	82		
1.18 mm	61		
600 µm	38		
425 µm	28		
300 µm	22		
212 µm	18		
150 µm	15		
63 µm	10		

Hole HD1	Description Silty gravelly SAND
Depth 0.00 -0.05	
Type D	
Test Performed Wet	Uniformity Coefficient = 18

Form 25/4

Laboratory - Particle Size Plot	**Project** LLANWONNO TIPS Rhondda Cynon Taff	**Contract** 151258
Exploration Associates		**Sheet** P2/1



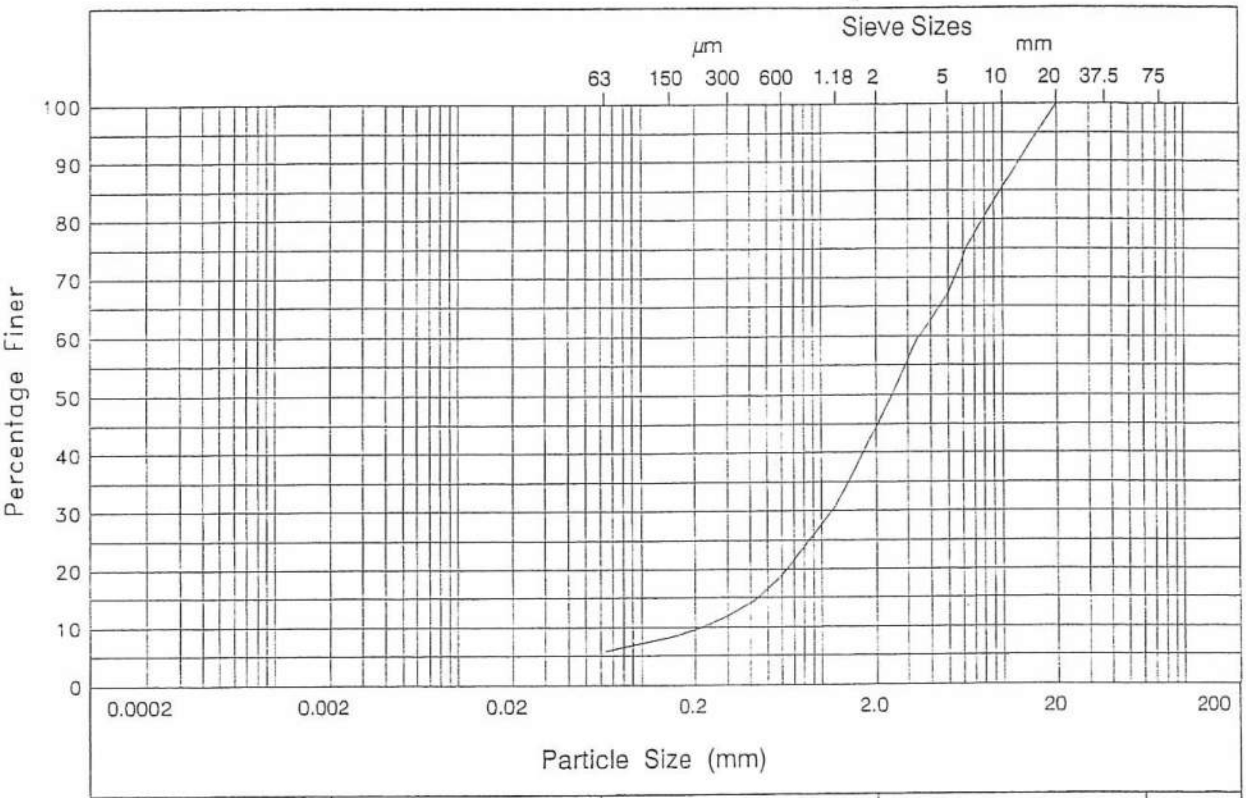
Clay	Silt			Sand			Gravel			Cobbles
	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	

Particle Size	% Passing	Particle Size	% Passing
28 mm	100	212 µm	14
20 mm	92	150 µm	12
14 mm	92	63 µm	10
10 mm	89		
6.3 mm	83		
5 mm	76		
3.35 mm	69		
2 mm	56		
1.18 mm	40		
600 µm	25		
425 µm	20		
300 µm	17		

Hole HD1	Description Silty SAND and GRAVEL
Depth 0.05 -0.10	
Type D	
Test Performed Wet	Uniformity Coefficient = 37

Form 25/4

Laboratory - Particle Size Plot	Project LLANWONNO TIPS Rhondda Cynon Taff	Contract 151258
Exploration Associates		Sheet P2/2



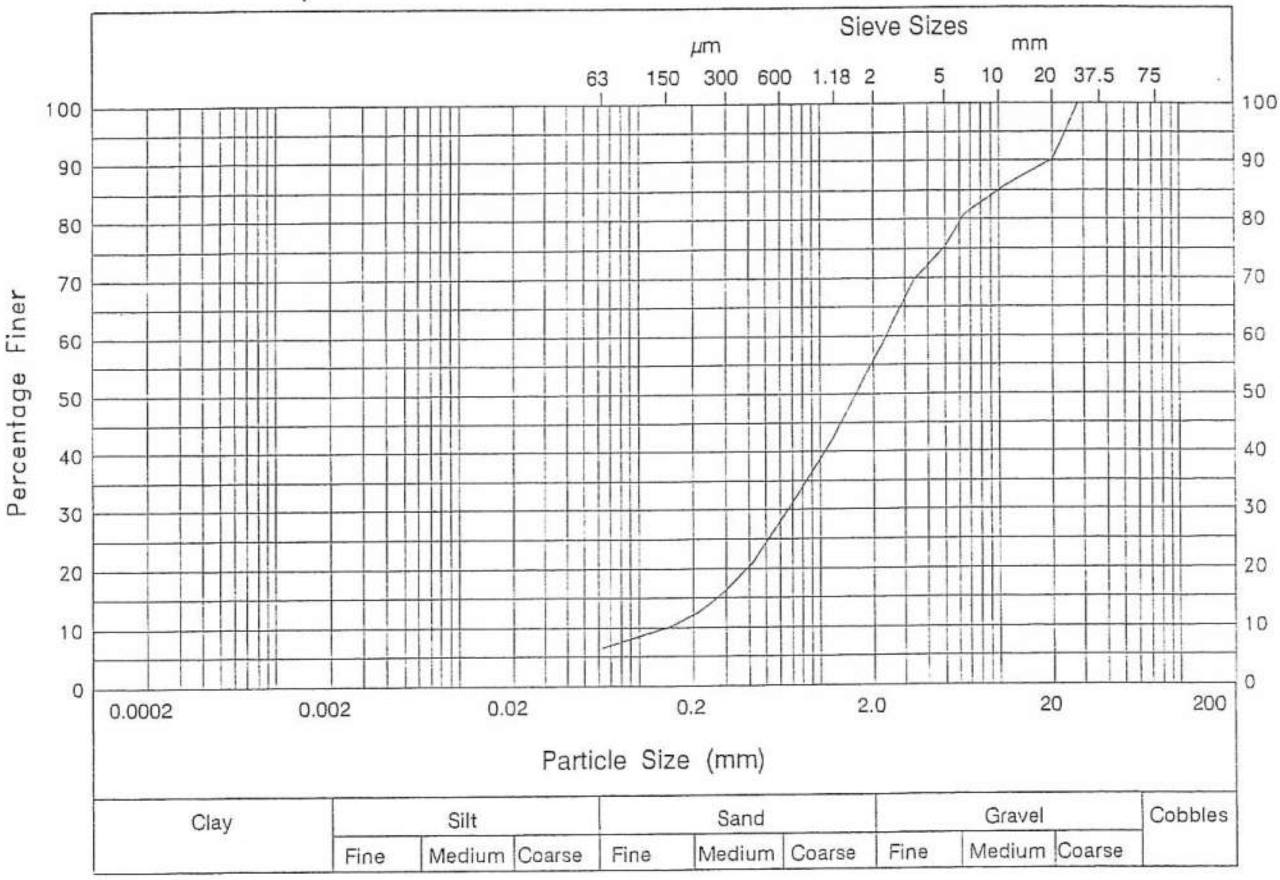
Clay	Silt			Sand			Gravel			Cobbles
	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	

Particle Size	% Passing	Particle Size	% Passing
20 mm	100	150 μm	8
14 mm	93	63 μm	6
10 mm	86		
6.3 mm	75		
5 mm	67		
3.35 mm	59		
2 mm	44		
1.18 mm	31		
600 μm	19		
425 μm	15		
300 μm	12		
212 μm	10		

Hole HD1	Description: Silty very sandy GRAVEL
Depth 0.10 -0.15	
Type D	
Test Performed: Wet	Uniformity Coefficient = 17

Form 25/4

Laboratory - Particle Size Plot	**Project** LLANWONNO TIPS Rhondda Cynon Taff	**Contract** 151258
Exploration Associates		**Sheet** P2/3



Particle Size	% Passing	Particle Size	% Passing
28 mm	100	212 µm	13
20 mm	90	150 µm	10
14 mm	88	63 µm	7
10 mm	85		
6.3 mm	81		
5 mm	75		
3.35 mm	70		
2 mm	56		
1.18 mm	42		
600 µm	28		
425 µm	21		
300 µm	16		

Hole HD1	Description Silty SAND and GRAVEL
Depth 0.15 -0.20	
Type D	
Test Performed Wet	Uniformity Coefficient = 31

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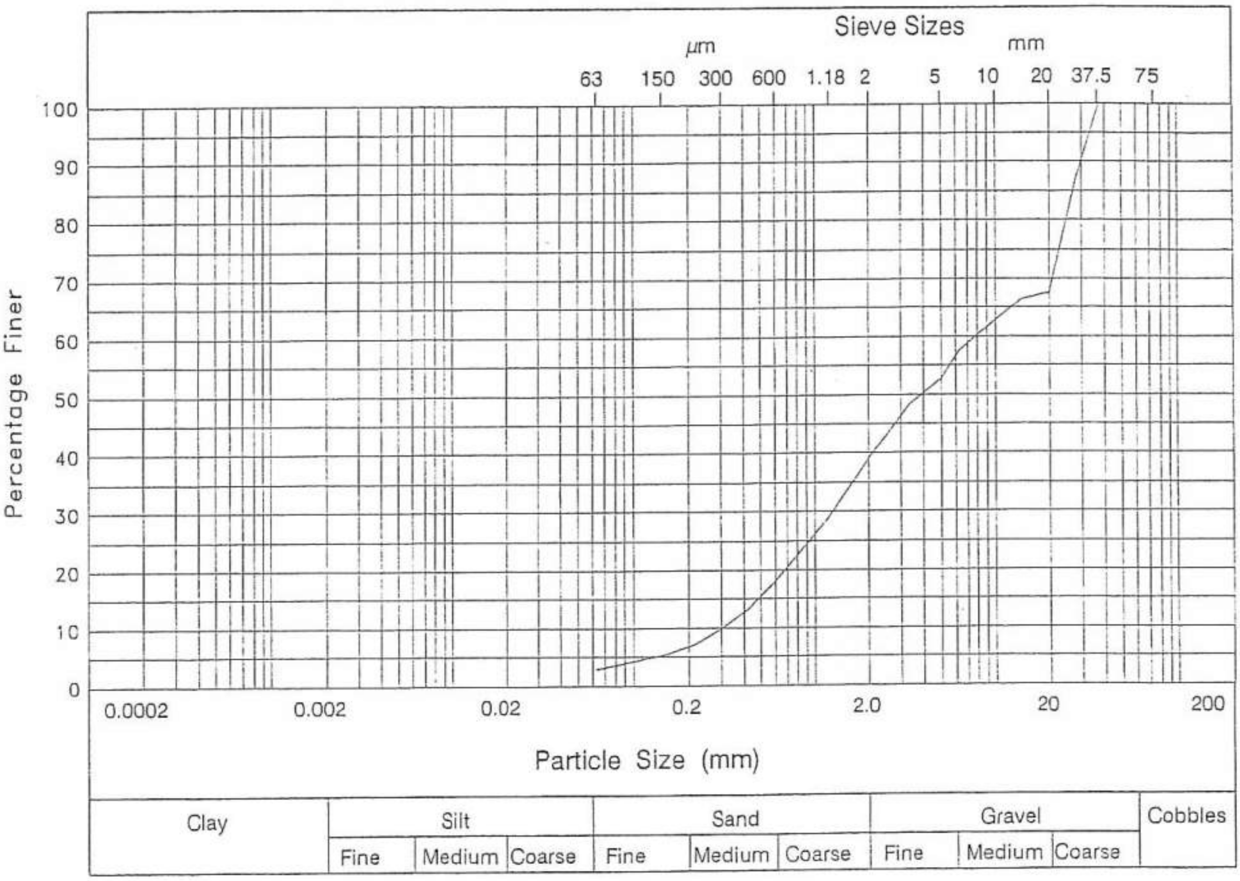
Laboratory - Particle Size Plot	**Project** LLANWONNO TIPS Rhondda Cynon Taff	**Contract** 151258
Exploration Associates		**Sheet** P2/4

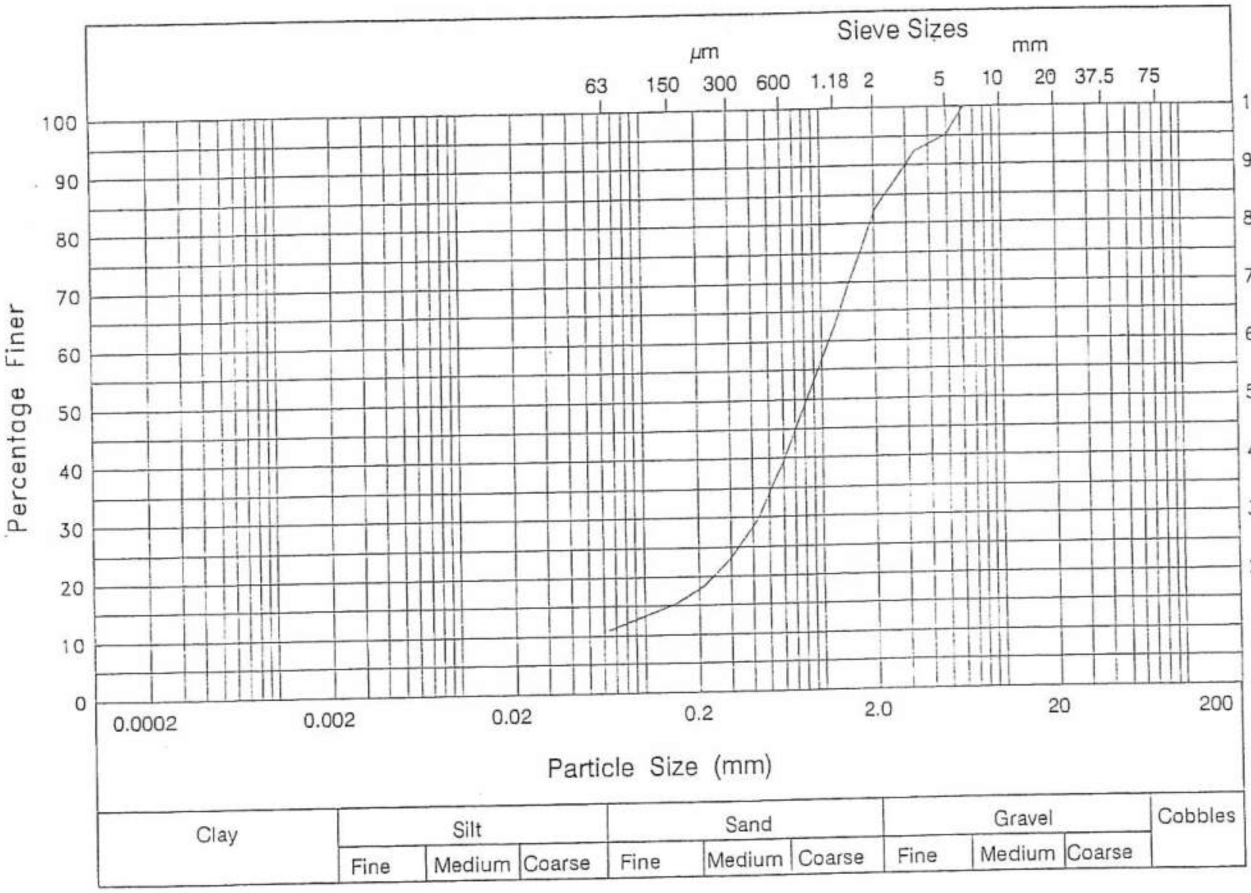


Particle Size	% Passing	Particle Size	% Passing
37.5 mm	100	300 µm	10
28 mm	87	212 µm	7
20 mm	68	150 µm	5
14 mm	66	63 µm	3
10 mm	63		
6.3 mm	58		
5 mm	53		
3.35 mm	48		
2 mm	39		
1.18 mm	29		
600 µm	18		
425 µm	13		

Hole HD1	**Description** Slightly silty very sandy GRAVEL
Depth 0.20 -0.25	
Type D	
Test Performed Wet	Uniformity Coefficient = 25

Form 25/4

Laboratory - Particle Size Plot	**Project** LLANWONNO TIPS, Rhondda Cynon Taff	**Contract** 151258
Exploration Associates		**Sheet** P2/5



Particle Size	% Passing	Particle Size	% Passing
6.3 mm	100		
5 mm	95		
3.35 mm	92		
2 mm	82		
1.18 mm	62		
600 µm	40		
425 µm	29		
300 µm	23		
212 µm	18		
150 µm	15		
63 µm	11		

Hole HD2	Description: Silty gravelly SAND
Depth 0.00 -0.05	
Type D	
Test Performed: Wet	Uniformity Coefficient not applicable.

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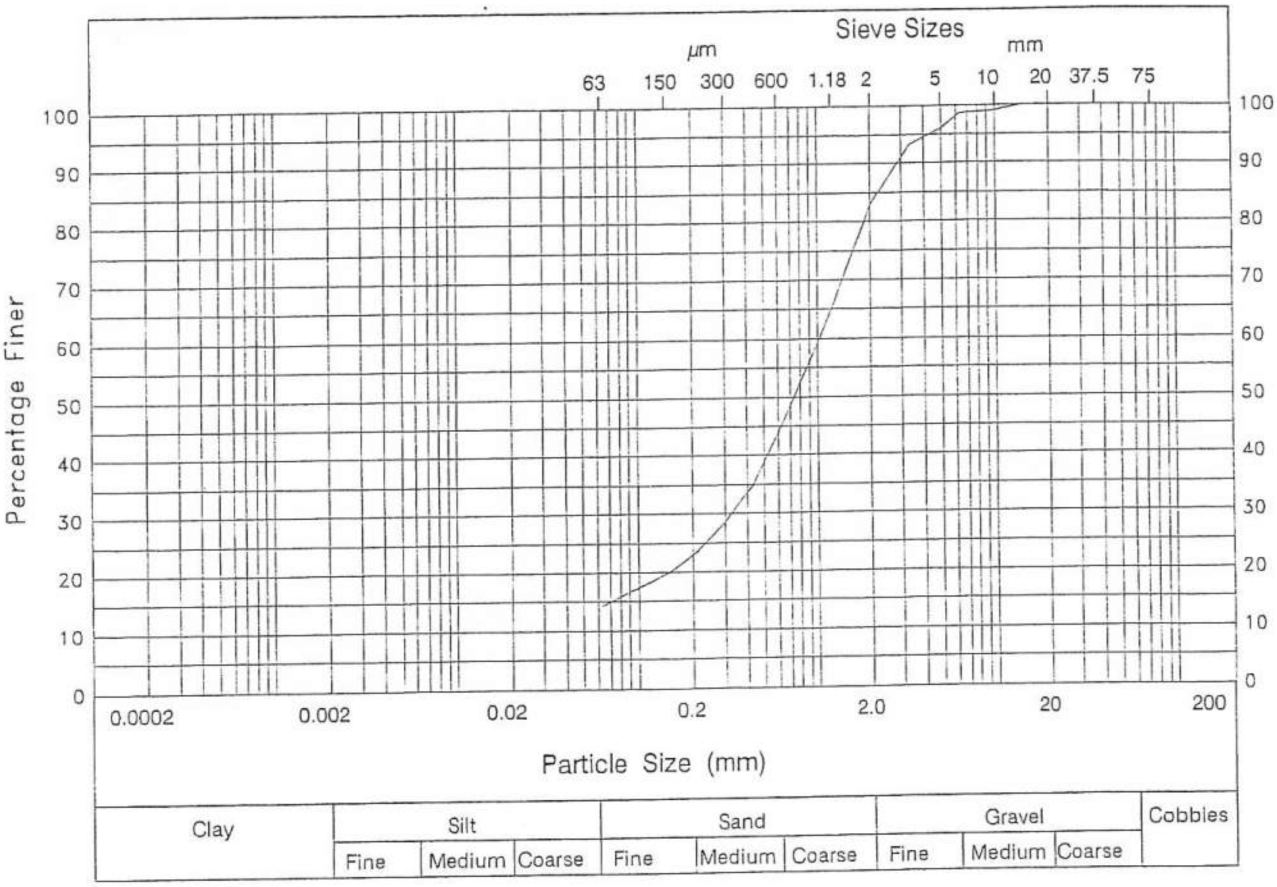
Laboratory - Particle Size Plot	**Project** LLANWONNO TIPS Rhondda Cynon Taff	**Contract** 151258
Exploration Associates		**Sheet** P2/6

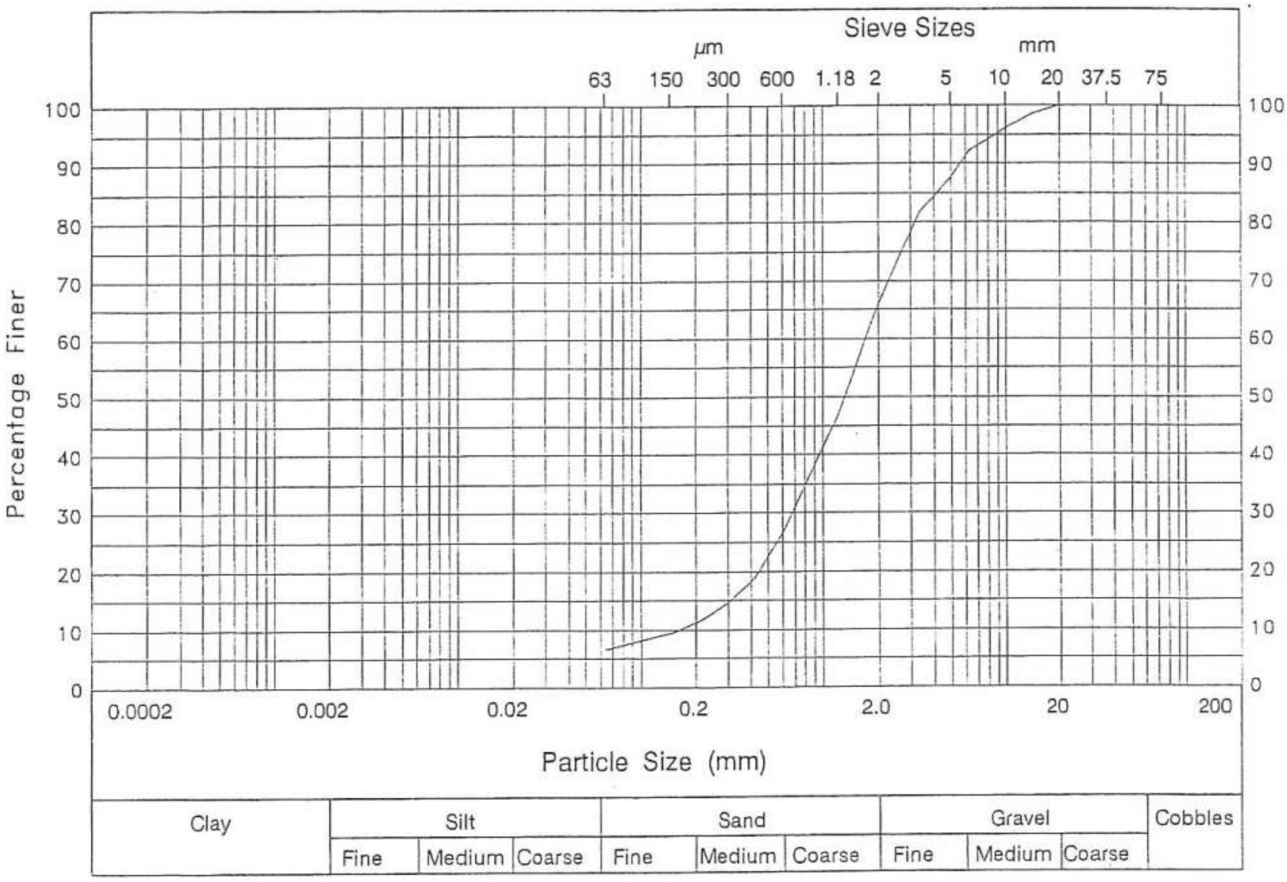


Particle Size	% Passing	Particle Size	% Passing
14 mm	100	63 µm	14
10 mm	99		
6.3 mm	99		
5 mm	96		
3.35 mm	93		
2 mm	83		
1.18 mm	64		
600 µm	44		
425 µm	35		
300 µm	29		
212 µm	24		
150 µm	20		

Hole HD2	Description Silty gravelly SAND
Depth 0.05 -0.10	
Type D	
Test Performed Wet	Uniformity Coefficient not applicable.

Form 25/4

Laboratory - Particle Size Plot	Project LLANWONNO TIPS Rhondda Cynon Taff	Contract 151258
Exploration Associates		Sheet P2/7

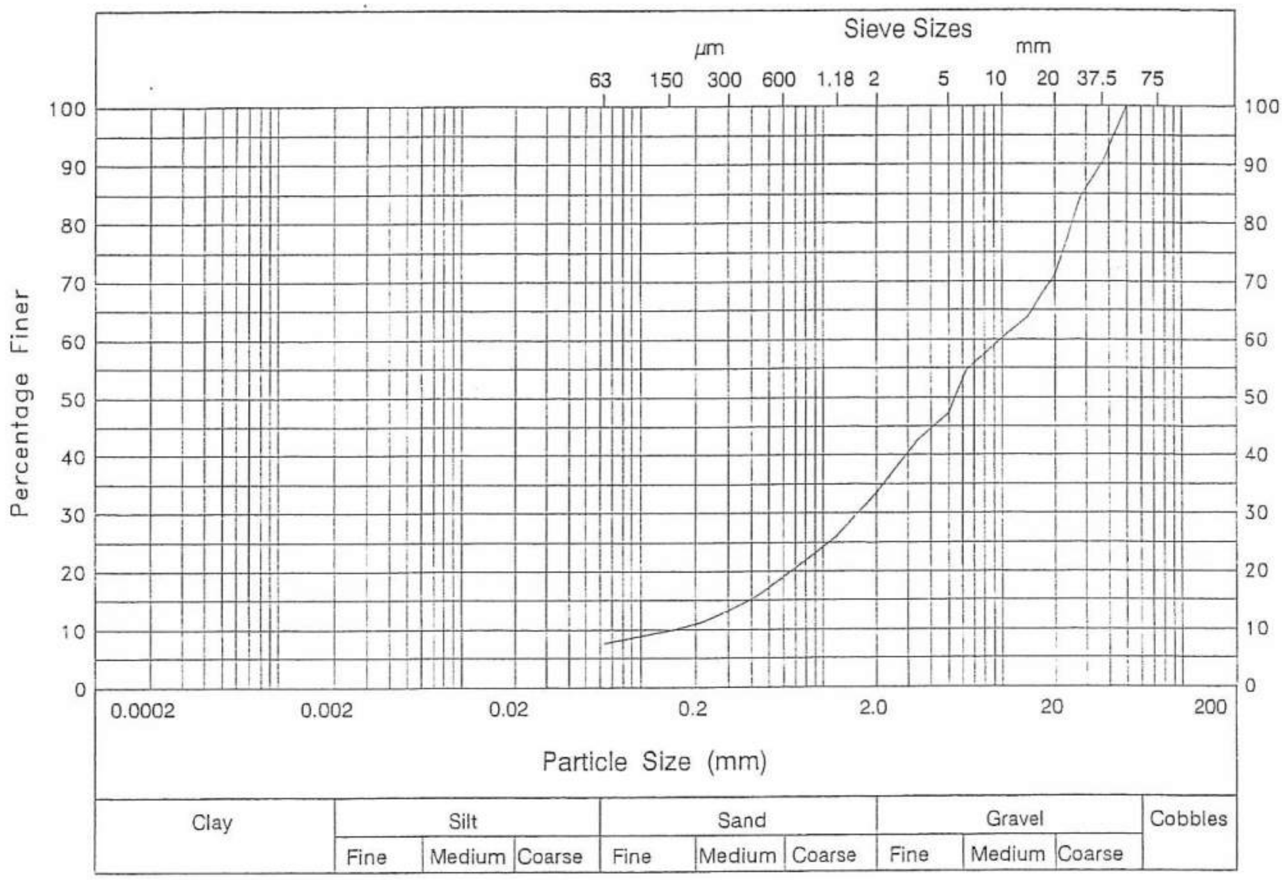


Particle Size	% Passing	Particle Size	% Passing
20 mm	100	150 µm	10
14 mm	98	63 µm	7
10 mm	96		
6.3 mm	92		
5 mm	88		
3.35 mm	82		
2 mm	66		
1.18 mm	46		
600 µm	27		
425 µm	19		
300 µm	15		
212 µm	12		

Hole HD2	Description Silty gravelly SAND
Depth 0.10 -0.15	
Type D	
Test Performed Wet	Uniformity Coefficient = 11

Form 25/4

Laboratory - Particle Size Plot	**Project** LLANWONNO TIPS Rhondda Cynon Taff	**Contract** 151258
Exploration Associates		**Sheet** P2/8

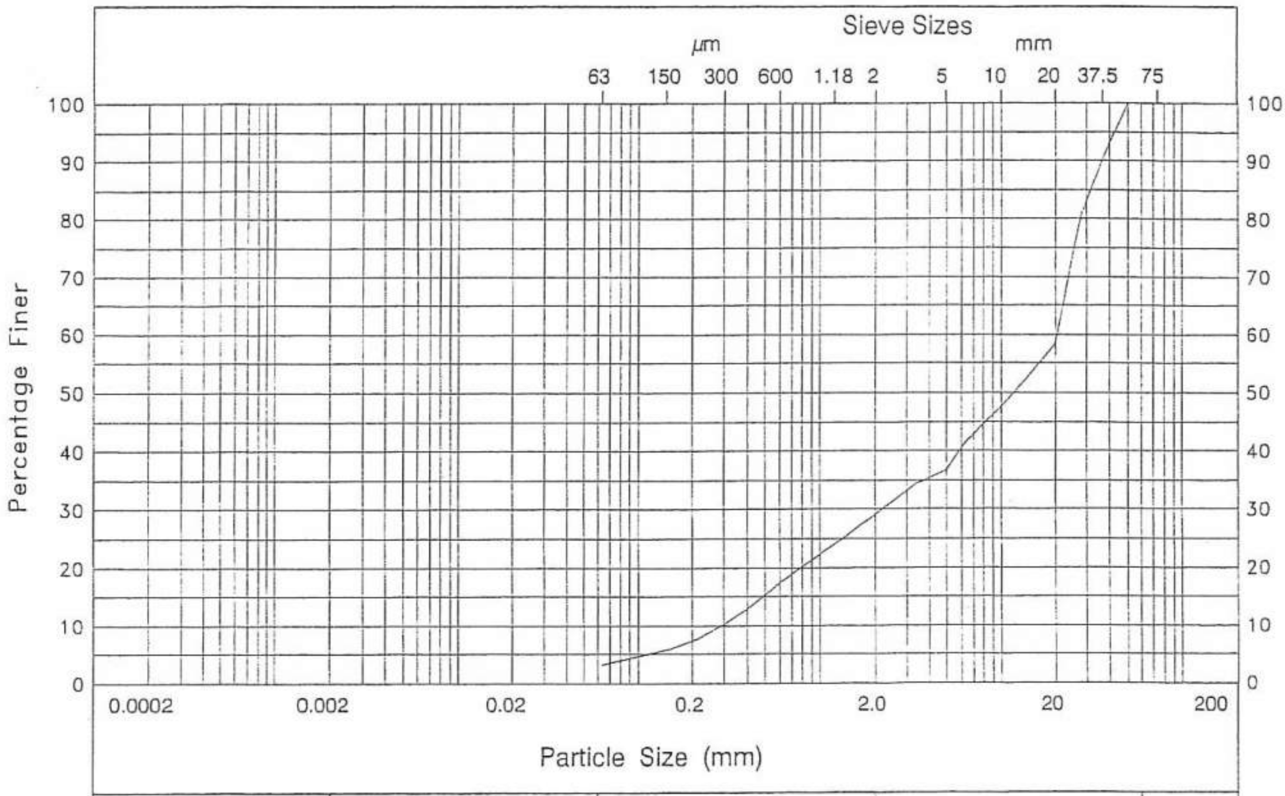


Particle Size	% Passing	Particle Size	% Passing
50 mm	100	425 µm	16
37.5 mm	91	300 µm	13
28 mm	84	212 µm	11
20 mm	71	150 µm	10
14 mm	64	63 µm	8
10 mm	60		
6.3 mm	55		
5 mm	47		
3.35 mm	42		
2 mm	34		
1.18 mm	26		
600 µm	19		

Hole HD2	Description: Silty very sandy GRAVEL
Depth 0.15 -0.20	
Type D	
Test Performed: Wet	Uniformity Coefficient = 65

Form 25/4

Laboratory - Particle Size Plot	**Project** LLANWONNO TIPS Rhondda Cynon Taff	**Contract** 151258
Exploration Associates		**Sheet** P2/9



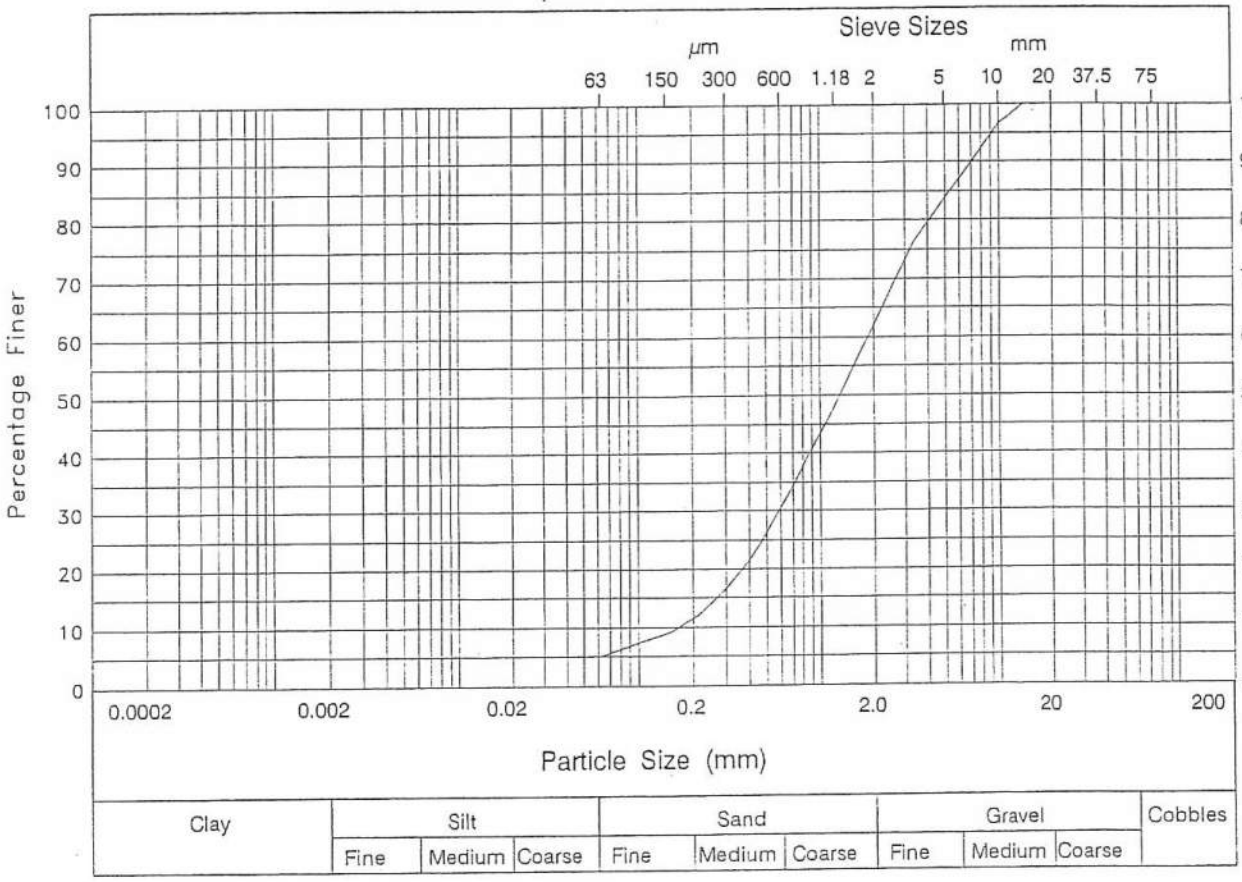
Clay	Silt			Sand			Gravel			Cobbles
	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	

Particle Size	% Passing	Particle Size	% Passing
50 mm	100	425 µm	13
37.5 mm	91	300 µm	10
28 mm	81	212 µm	8
20 mm	59	150 µm	6
14 mm	53	63 µm	3
10 mm	48		
6.3 mm	41		
5 mm	37		
3.35 mm	34		
2 mm	29		
1.18 mm	24		
600 µm	17		

Hole HD2	Description: Slightly silty sandy GRAVEL.
Depth 0.20 -0.25	
Type D	
Test Performed: Wet	Uniformity Coefficient = 70

Form 25/4

Laboratory - Particle Size Plot	**Project** LLANWONNO TIPS Rhondda Cynon Taff	**Contract** 151258
Exploration Associates		**Sheet** P2/10

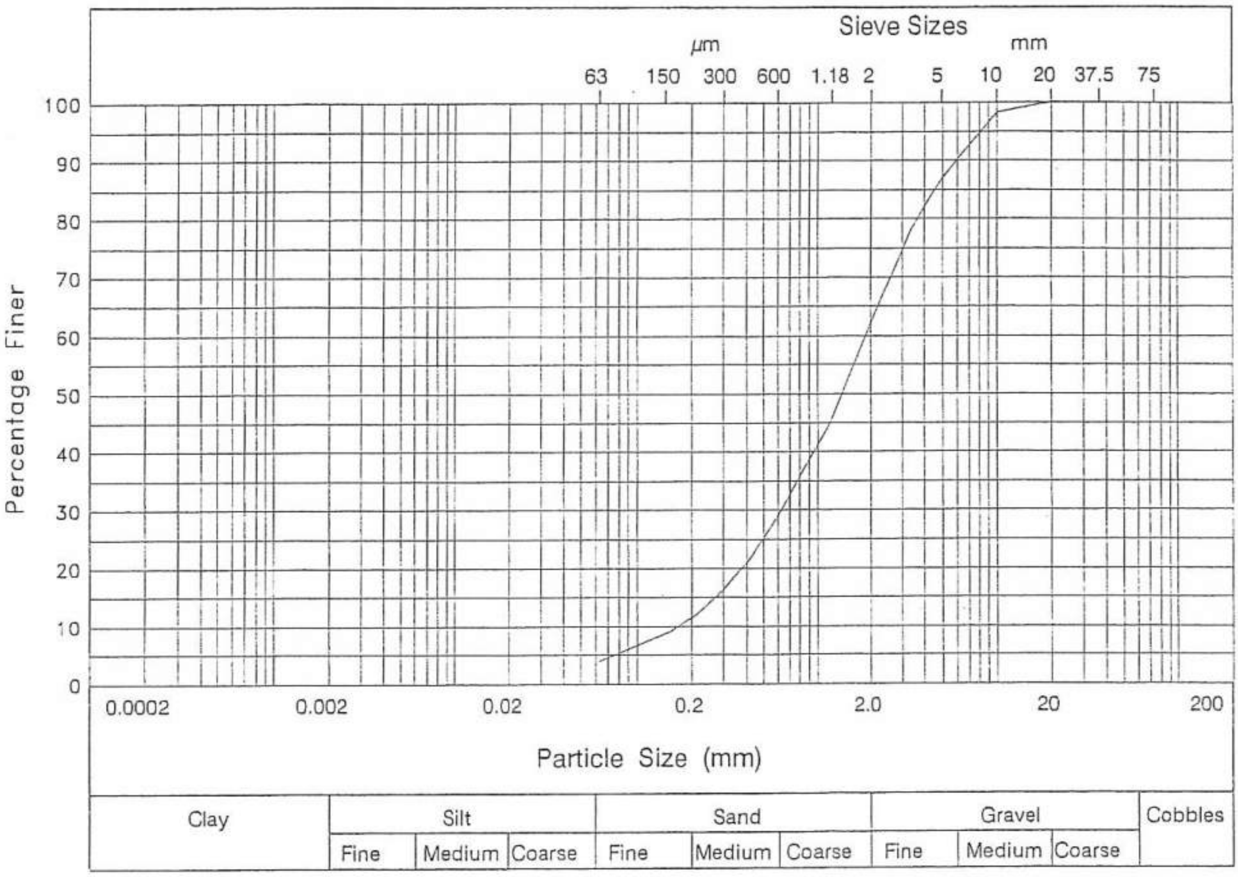


Particle Size	% Passing	Particle Size	% Passing
14 mm	100	63 µm	5
10 mm	97		
6.3 mm	88		
5 mm	84		
3.35 mm	76		
2 mm	62		
1.18 mm	48		
600 µm	31		
425 µm	23		
300 µm	17		
212 µm	12		
150 µm	9		

Hole HD3	Description: Slightly silty gravelly SAND
Depth 0.00 -0.05	
Type D	
Test Performed: Wet	Uniformity Coefficient = 11

Form 25/4

Laboratory - Particle Size Plot	**Project** LLANWONNO TIPS Rhondda Cynon Taff	**Contract** 151258
Exploration Associates		**Sheet** P2/11

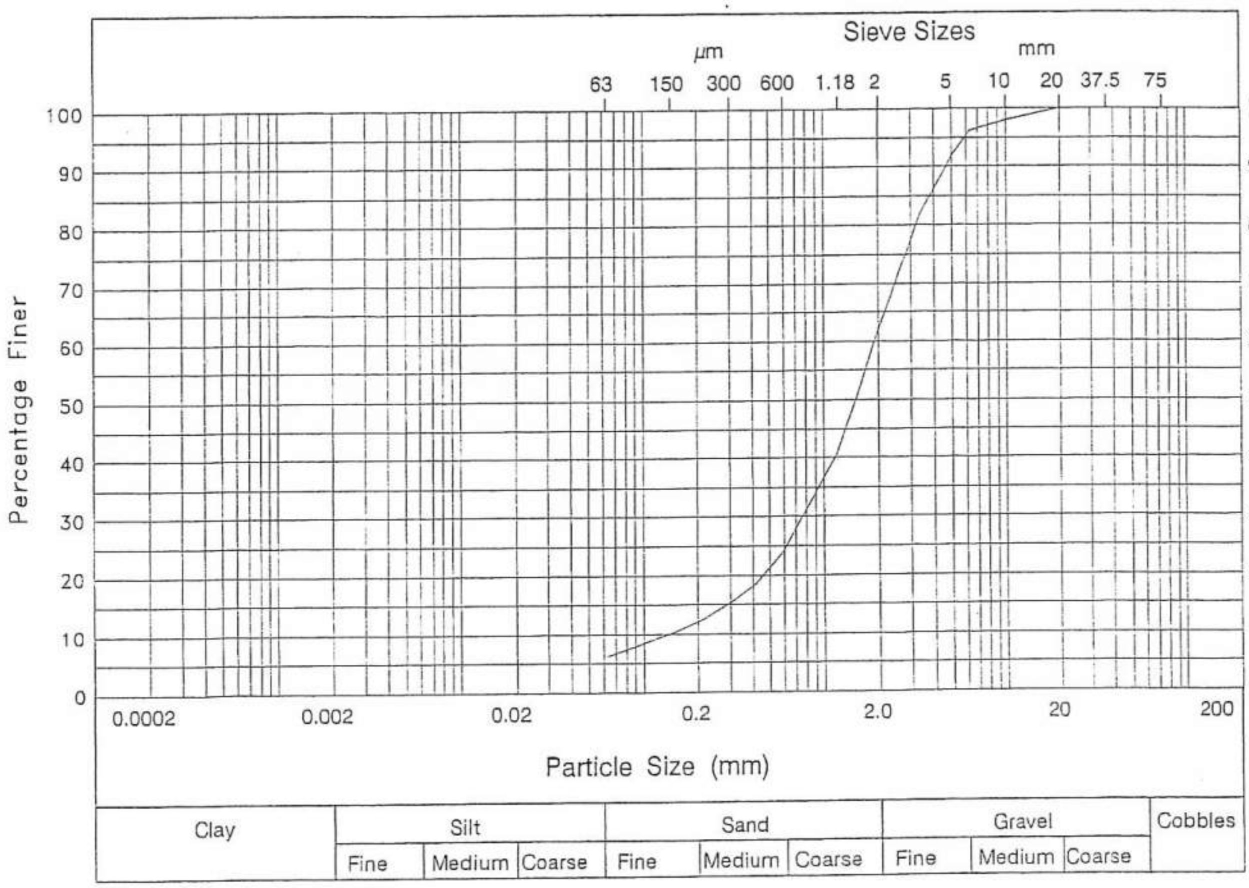


Particle Size	% Passing	Particle Size	% Passing
20 mm	100	150 µm	9
14 mm	99	63 µm	4
10 mm	98		
6.3 mm	91		
5 mm	87		
3.35 mm	78		
2 mm	62		
1.18 mm	45		
600 µm	29		
425 µm	22		
300 µm	16		
212 µm	12		

Hole HD3	Description: Slightly silty gravelly SAND
Depth 0.05 -0.10	
Type D	
Test Performed: Wet	Uniformity Coefficient = 11

Form 25/4

Laboratory - Particle Size Plot	**Project** LLANWONNO TIPS Rhondda Cynon Taff	**Contract** 151258
Exploration Associates		**Sheet** P2/12

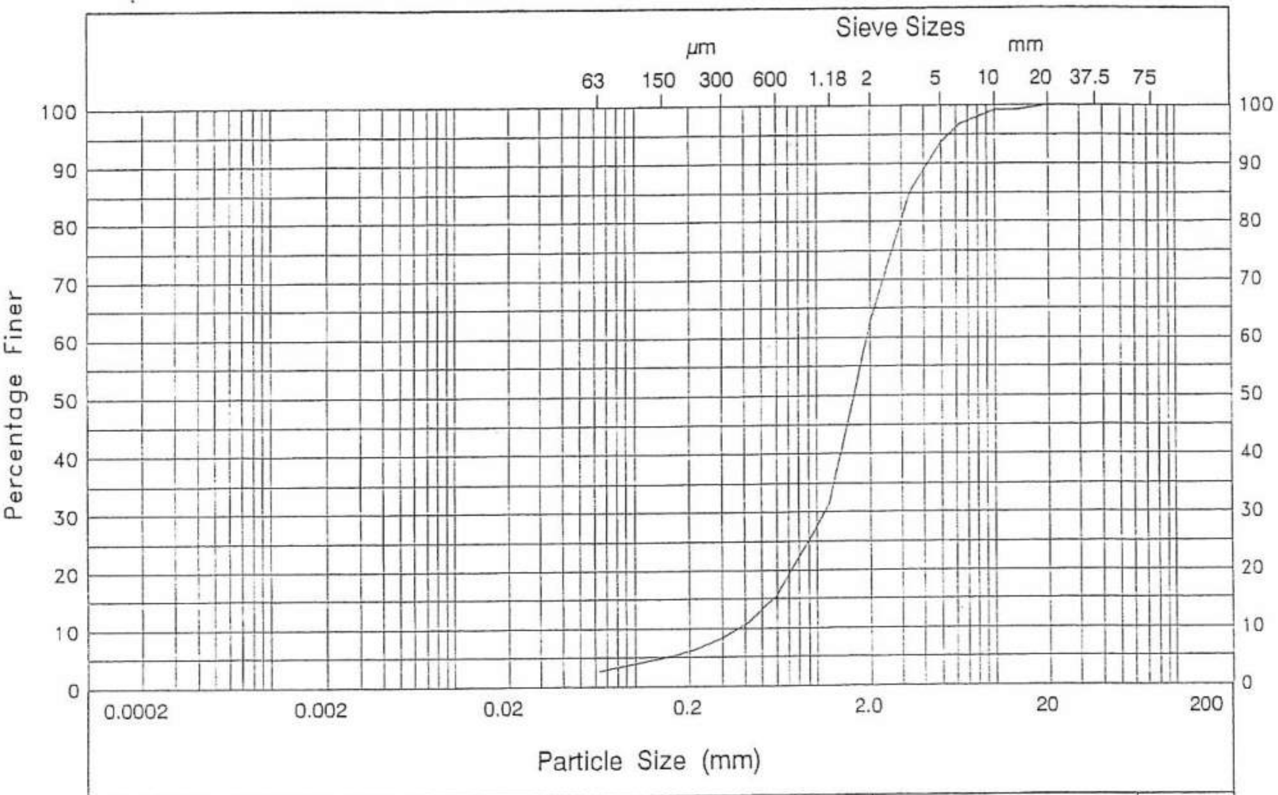


Particle Size	% Passing	Particle Size	% Passing
20 mm	100	150 μm	10
14 mm	99	63 μm	6
10 mm	98		
6.3 mm	96		
5 mm	92		
3.35 mm	82		
2 mm	62		
1.18 mm	41		
600 μm	24		
425 μm	19		
300 μm	15		
212 μm	12		

Hole HD3	Description: Slightly silty very gravelly SAND
Depth 0.10 -0.15	
Type D	
Test Performed: Wet	Uniformity Coefficient = 26

Form 25/4

Laboratory - Particle Size Plot	**Project** LLANWONNO TIPS Rhondda Cynon Taff	**Contract** 151258
Exploration Associates		**Sheet** P2/13



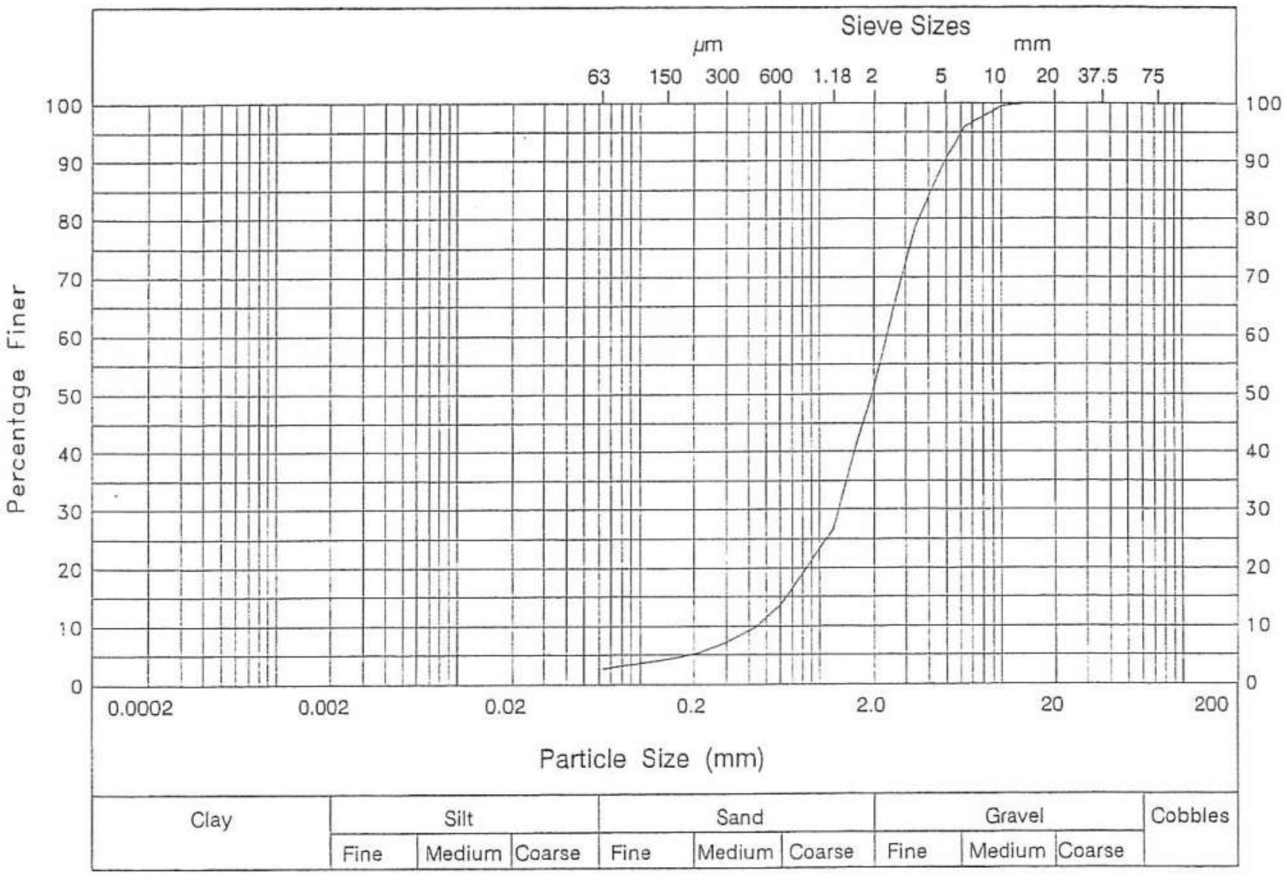
Clay	Silt			Sand			Gravel			Cobbles
	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	

Particle Size	% Passing	Particle Size	% Passing
20 mm	100	150 µm	5
14 mm	99	63 µm	3
10 mm	99		
6.3 mm	97		
5 mm	94		
3.35 mm	85		
2 mm	63		
1.18 mm	32		
600 µm	16		
425 µm	11		
300 µm	8		
212 µm	6		

Hole HD3	Description: Slightly silty very gravelly SAND
Depth 0.15 -0.20	
Type D	
Test Performed: Wet	Uniformity Coefficient = 5.0

Form 25/4

Laboratory - Particle Size Plot	**Project** LLANWONNO TIPS, Rhondda Cynon Taff	**Contract** 151258
Exploration Associates		**Sheet** P2/14



Particle Size	% Passing	Particle Size	% Passing
14 mm	100	63 µm	3
10 mm	99		
6.3 mm	96		
5 mm	91		
3.35 mm	79		
2 mm	51		
1.18 mm	27		
600 µm	14		
425 µm	10		
300 µm	7		
212 µm	5		
150 µm	4		

Hole HD3	Description: Slightly silty very sandy GRAVEL
Depth 0.20 -0.25	
Type D	
Test Performed: Wet	Uniformity Coefficient = 5.6

Form 25/4

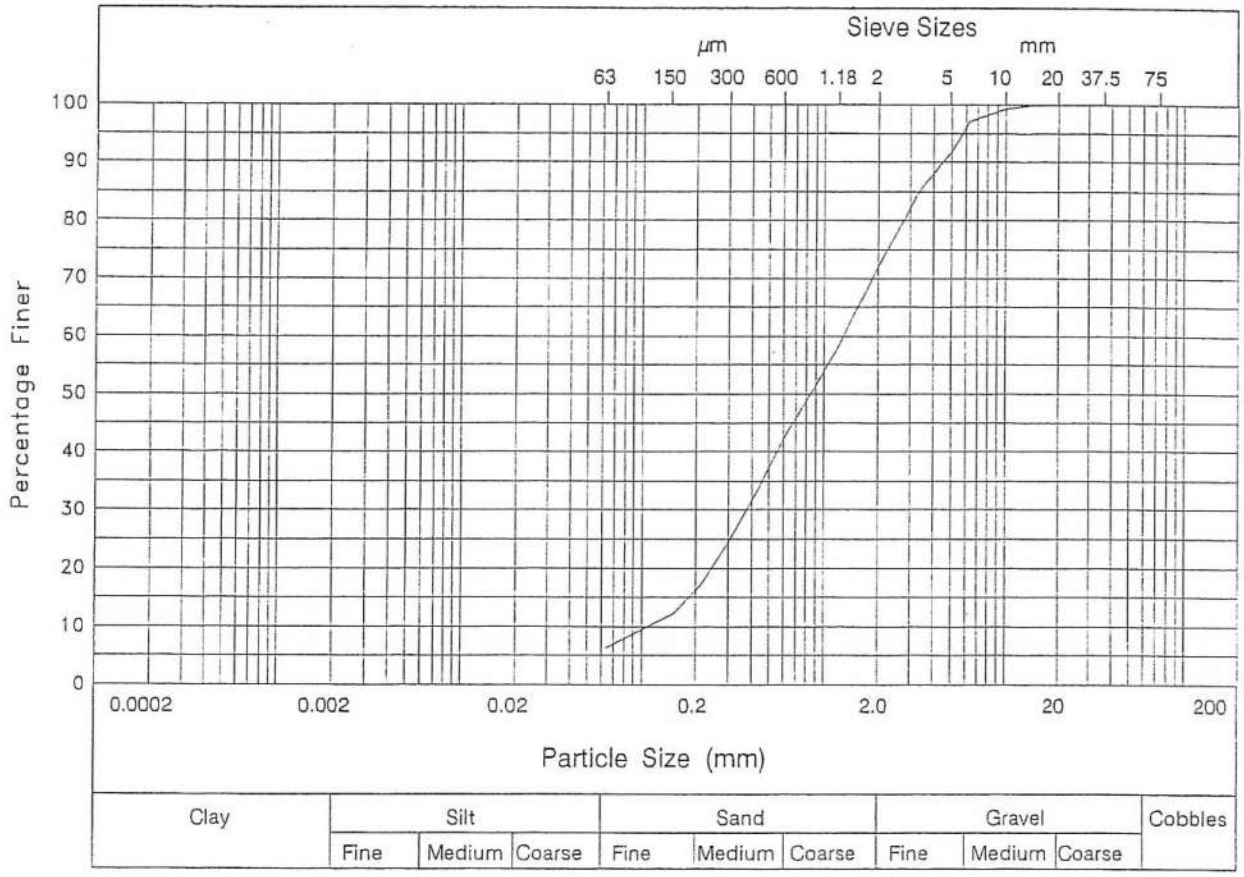
Laboratory - Particle Size Plot

Exploration Associates

Project
LLANWONNO TIPS
Rhondda Cynon Taff

Contract 151258

Sheet P2/15

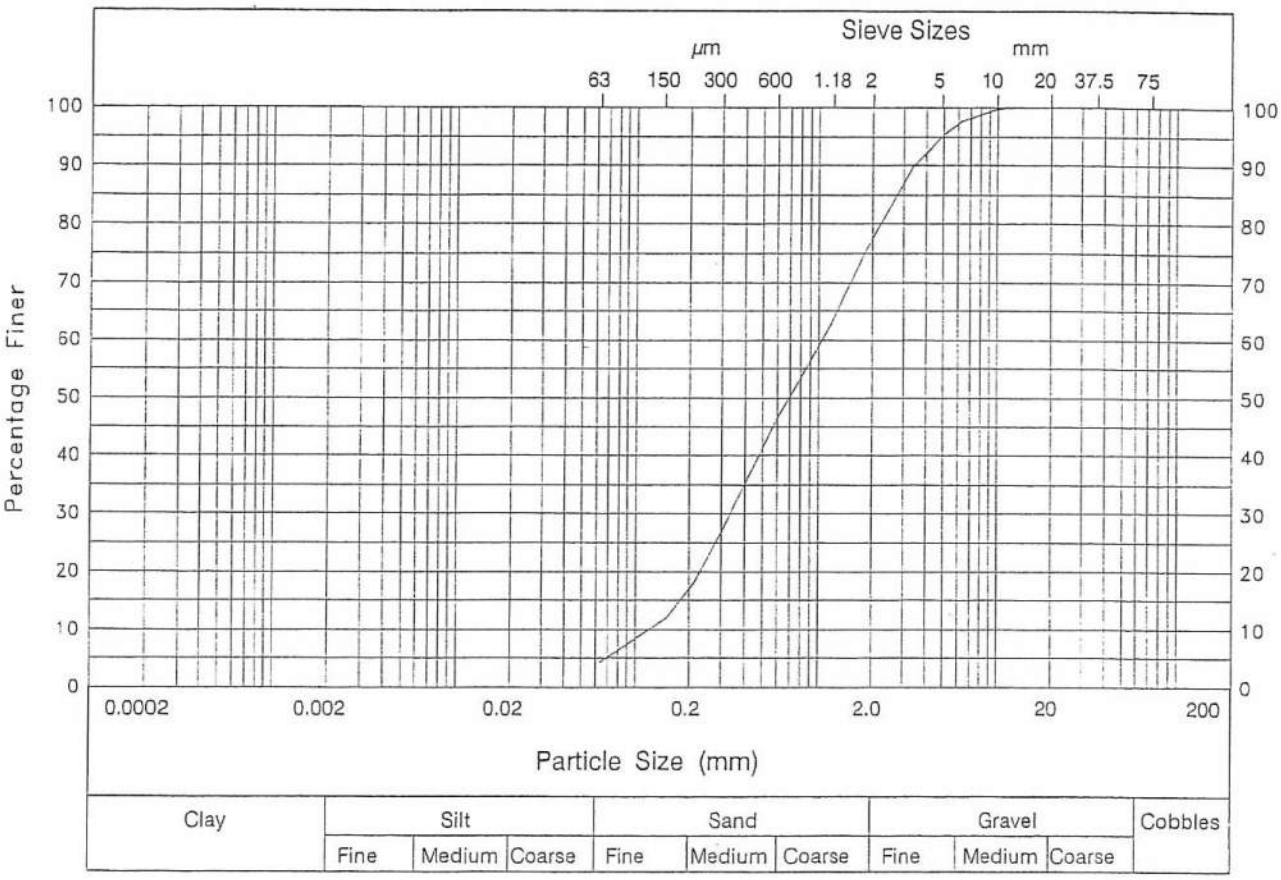


Particle Size	% Passing	Particle Size	% Passing
20 mm	100	150 μm	12
14 mm	100	63 μm	6
10 mm	99		
6.3 mm	97		
5 mm	92		
3.35 mm	85		
2 mm	72		
1.18 mm	58		
600 μm	42		
425 μm	33		
300 μm	24		
212 μm	17		

Hole HD4	Description: Slightly gravelly SAND
Depth 0.00 -0.05	
Type D	
Test Performed: Wet	Uniformity Coefficient = 18

Form 25/4

Laboratory - Particle Size Plot	**Project** LLANWONNO TIPS Rhondda Cynon Taff	**Contract** 151258
Exploration Associates		**Sheet** P2/16

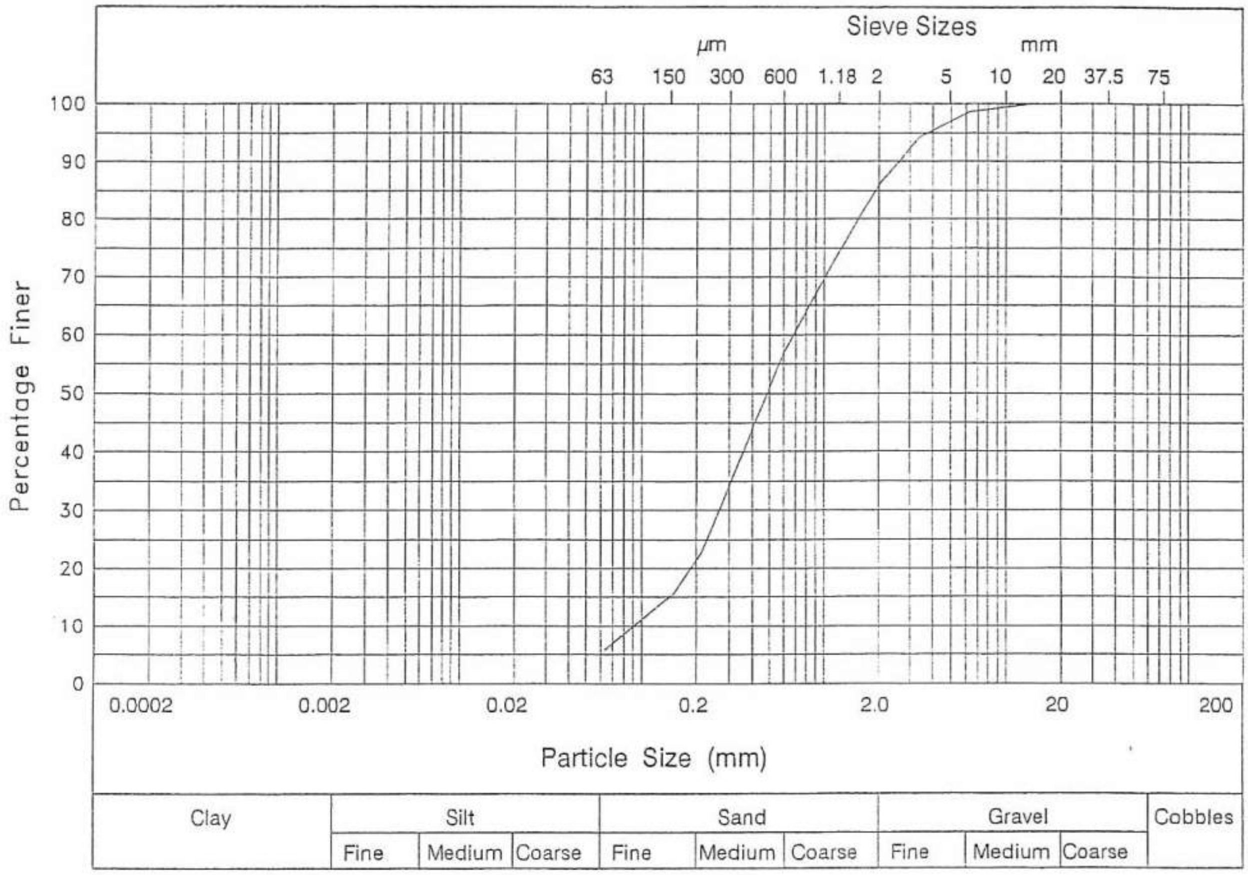


Particle Size	% Passing	Particle Size	% Passing
14 mm	100	63 µm	4
10 mm	100		
6.3 mm	98		
5 mm	95		
3.35 mm	90		
2 mm	78		
1.18 mm	63		
600 µm	47		
425 µm	37		
300 µm	27		
212 µm	18		
150 µm	12		

Hole HD4	Description: Slightly silty very gravelly SAND
Depth 0.05 -0.10	
Type D	
Test Performed: Wet	Uniformity Coefficient = 14

Form 25/4

Laboratory - Particle Size Plot	**Project** LLANWONNO TIPS Rhondda Cynon Taff	**Contract** 151258
Exploration Associates		**Sheet** P2/17

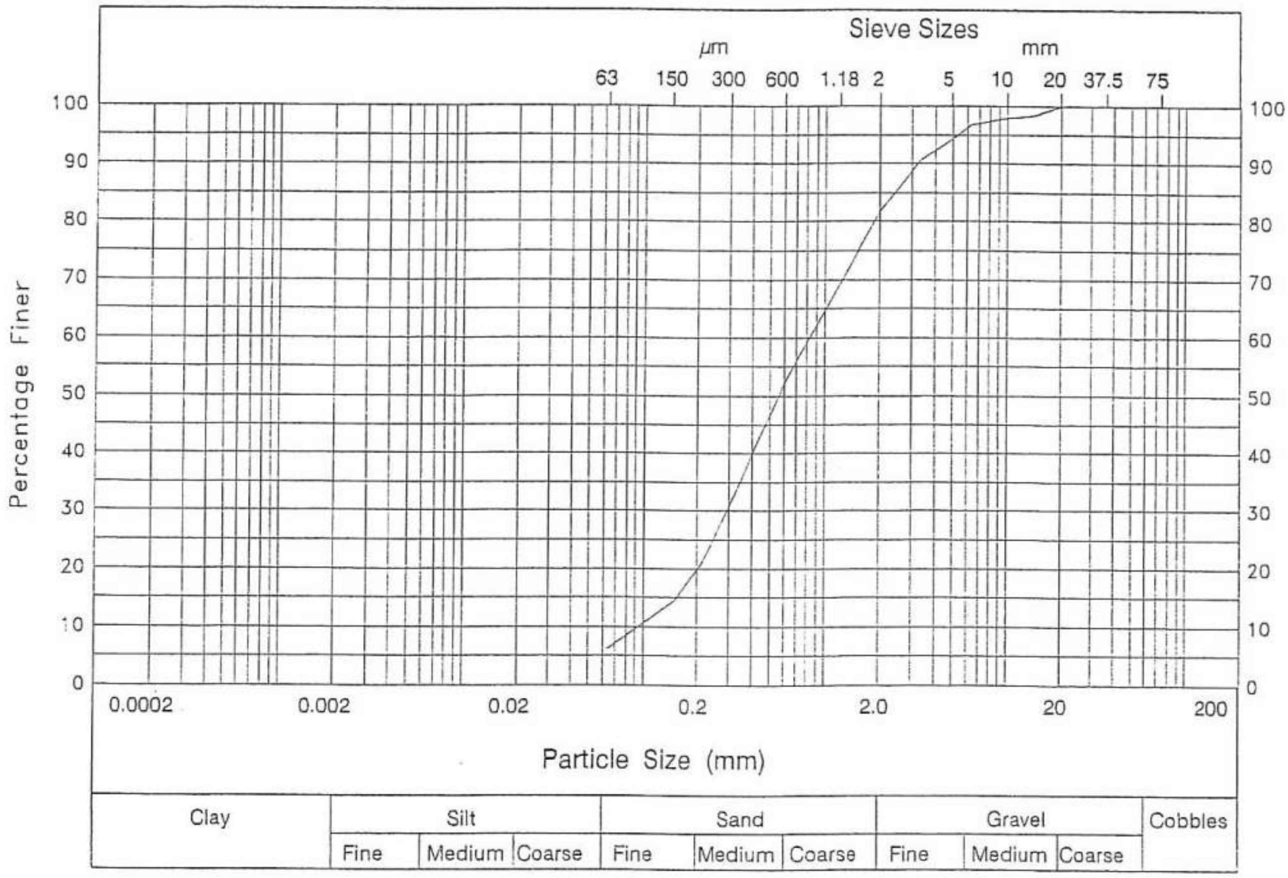


Particle Size	% Passing	Particle Size	% Passing
14 mm	100	63 µm	6
10 mm	99		
6.3 mm	99		
5 mm	97		
3.35 mm	94		
2 mm	86		
1.18 mm	74		
600 µm	57		
425 µm	46		
300 µm	34		
212 µm	23		
150 µm	16		

Hole HD4	Description: Silty very gravelly SAND
Depth 0.10 -0.15	
Type D	
Test Performed: Wet	Uniformity Coefficient = 10.0

Form 25/4

Laboratory - Particle Size Plot	**Project** LLANWONNO TIPS Rhondda Cynon Taff	**Contract** 151258
Exploration Associates		**Sheet** P2/18

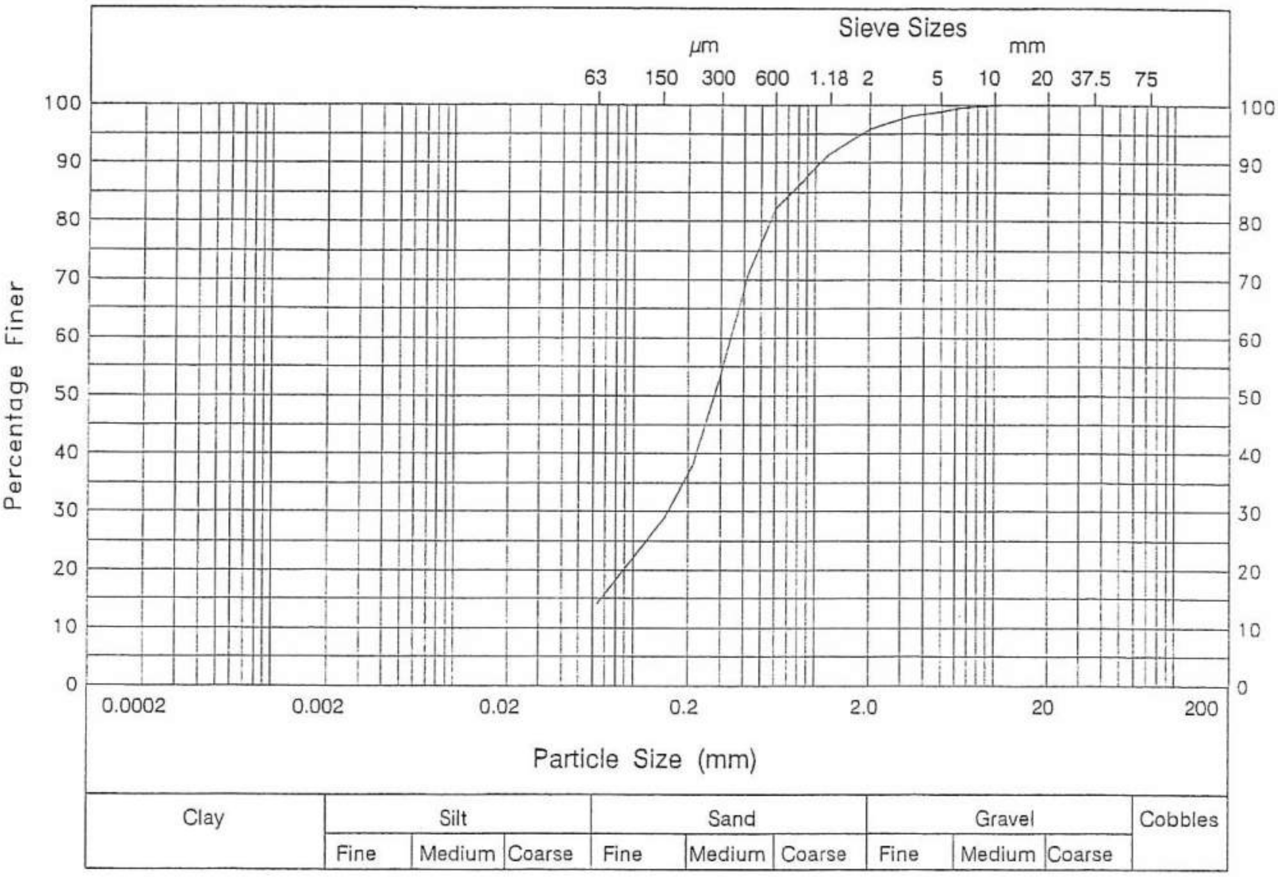


Particle Size	% Passing	Particle Size	% Passing
20 mm	100	150 µm	15
14 mm	98	63 µm	6
10 mm	98		
6.3 mm	97		
5 mm	94		
3.35 mm	91		
2 mm	82		
1.18 mm	69		
600 µm	52		
425 µm	42		
300 µm	31		
212 µm	21		

Hole HD4	Description: Silty gravelly SAND
Depth 0.15 -0.20	
Type D	
Test Performed: Wet	Uniformity Coefficient = 12

Form 25/4

Laboratory - Particle Size Plot	**Project** LLANWONNO TIPS, Rhondda Cynon Taff	**Contract** 151258
Exploration Associates		**Sheet** P2/19

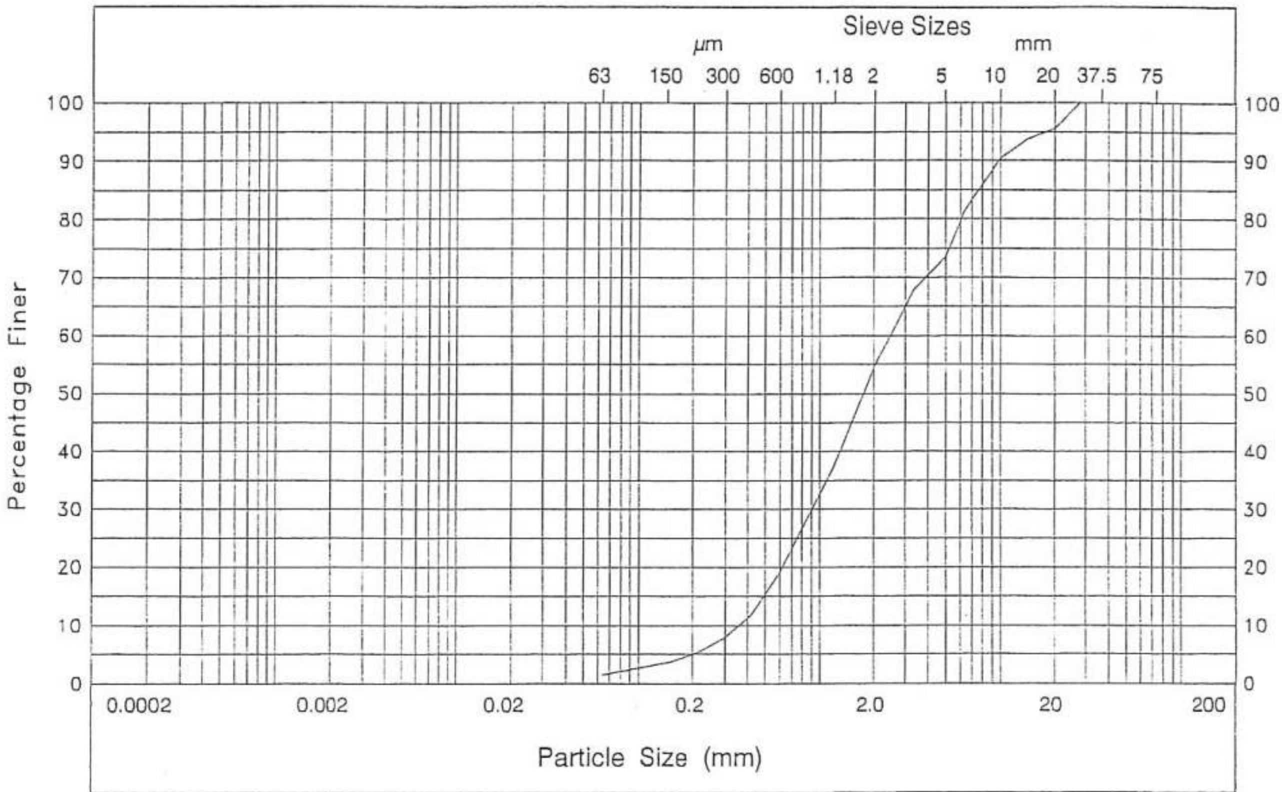


Particle Size	% Passing	Particle Size	% Passing
14 mm	100	63 µm	14
10 mm	100		
6.3 mm	99		
5 mm	99		
3.35 mm	98		
2 mm	96		
1.18 mm	92		
600 µm	82		
425 µm	71		
300 µm	54		
212 µm	38		
150 µm	29		

Hole HD4	Description: Silty slightly gravelly SAND
Depth 0.20 -0.25	
Type D	
Test Performed: Wet	Uniformity Coefficient not applicable.

Form 25/4

Laboratory - Particle Size Plot	**Project** LLANWONNO TIPS, Rhondda Cynon Taff	**Contract** 151258
Exploration Associates		**Sheet** P2/20



Clay	Silt			Sand			Gravel			Cobbles
	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	

Particle Size	% Passing	Particle Size	% Passing
28 mm	100	212 µm	5
20 mm	96	150 µm	4
14 mm	94	63 µm	1
10 mm	90		
6.3 mm	81		
5 mm	74		
3.35 mm	68		
2 mm	55		
1.18 mm	37		
600 µm	19		
425 µm	12		
300 µm	8		

Hole HD5	Description Slightly silty SAND and GRAVEL
Depth 0.00 -0.05	
Type D	
Test Performed Wet	Uniformity Coefficient = 6.8

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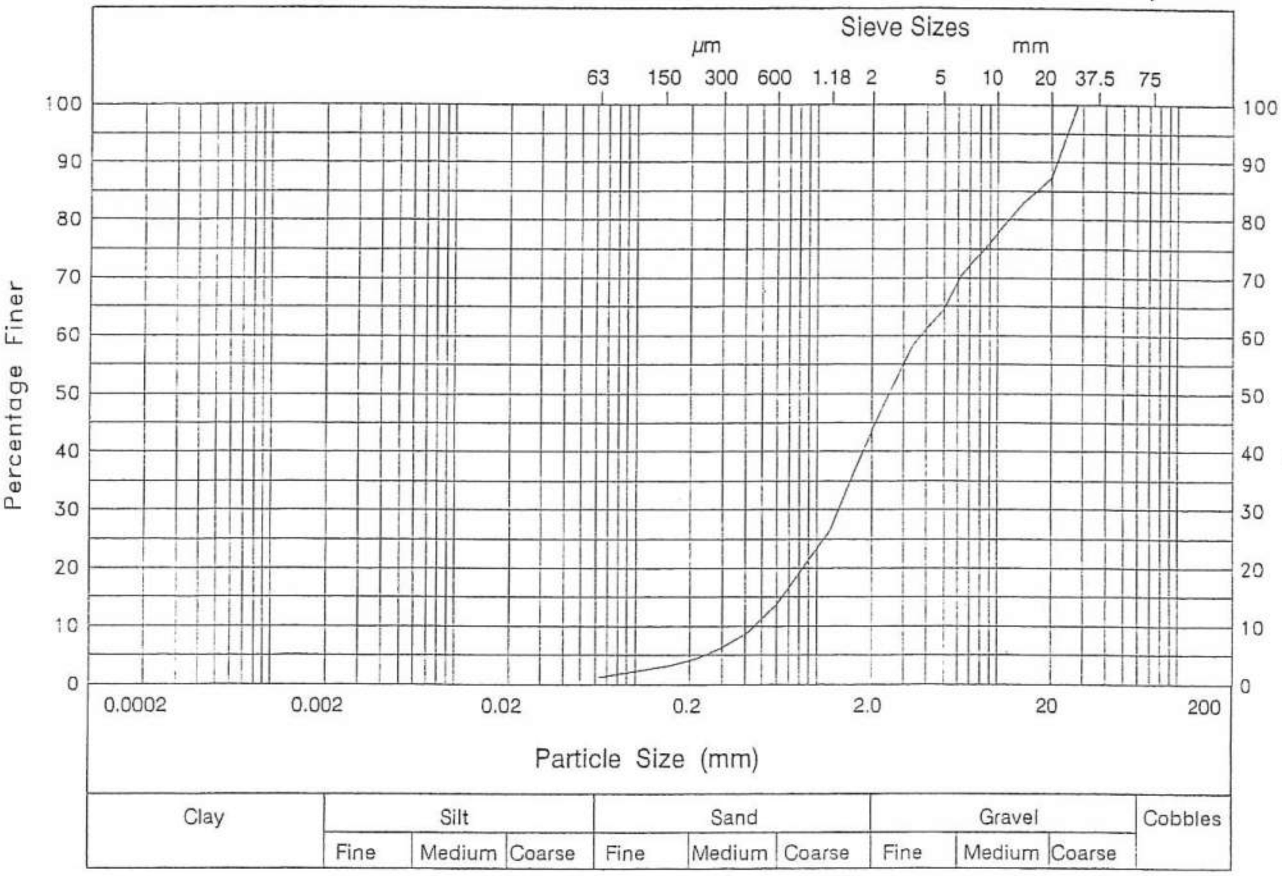
Laboratory - Particle Size Plot	**Project** LLANWONNO TIPS Rhondda Cynon Taff	**Contract** 151258
Exploration Associates		**Sheet** P2/21



Particle Size	% Passing	Particle Size	% Passing
28 mm	100	212 µm	4
20 mm	87	150 µm	3
14 mm	83	63 µm	1
10 mm	78		
6.3 mm	70		
5 mm	65		
3.35 mm	58		
2 mm	44		
1.18 mm	27		
600 µm	14		
425 µm	9		
300 µm	6		

Hole HD5	Description: Slightly silty very sandy GRAVEL
Depth 0.05 -0.10	
Type D	
Test Performed: Wet	Uniformity Coefficient = 8.3

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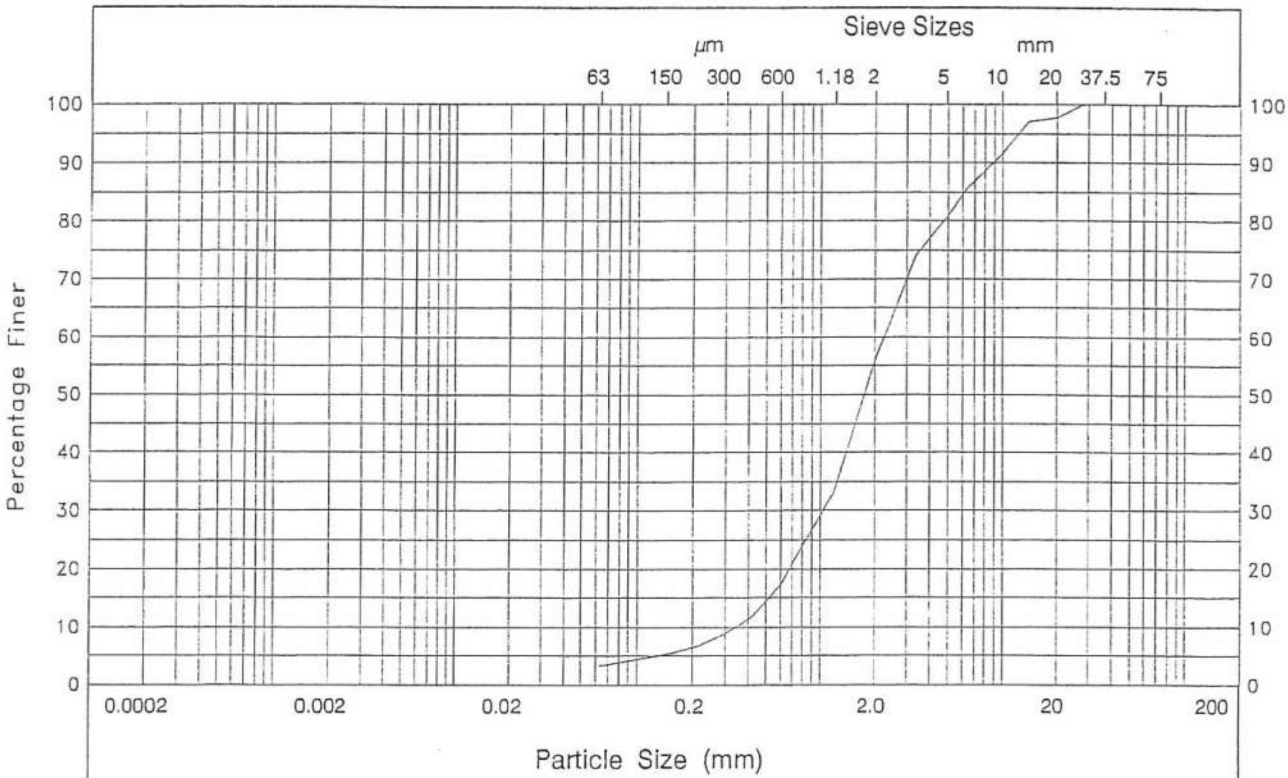
Laboratory - Particle Size Plot	Project: LLANWONNO TIPS, Rhondda Cynon Taff	Contract: 151258
Exploration Associates		Sheet: P2/22



Clay	Silt			Sand			Gravel			Cobbles
	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	

Particle Size	% Passing	Particle Size	% Passing
28 mm	100	212 µm	7
20 mm	98	150 µm	5
14 mm	97	63 µm	3
10 mm	92		
6.3 mm	86		
5 mm	81		
3.35 mm	74		
2 mm	56		
1.18 mm	33		
600 µm	17		
425 µm	12		
300 µm	9		

Hole HD5	Description: Slightly silty SAND and GRAVEL
Depth 0.10 -0.15	
Type D	
Test Performed: Wet	Uniformity Coefficient = 6.6

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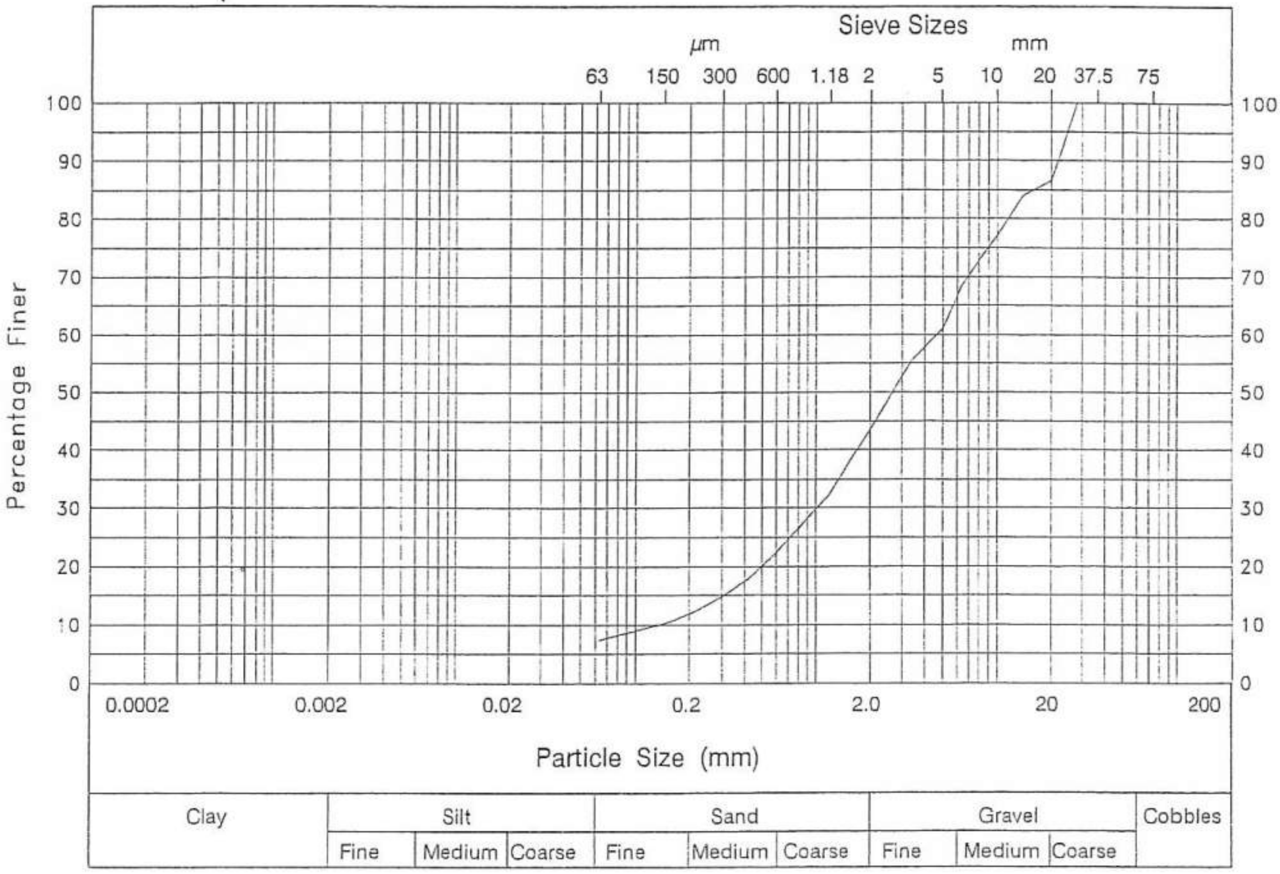
Laboratory - Particle Size Plot	**Project** LLANWONNO TIPS Rhondda Cynon Taff	**Contract** 151258
Exploration Associates		**Sheet** P2/23

Particle Size	% Passing	Particle Size	% Passing
14 mm	100	63 µm	5
10 mm	96		
6.3 mm	90		
5 mm	85		
3.35 mm	77		
2 mm	56		
1.18 mm	34		
600 µm	19		
425 µm	15		
300 µm	12		
212 µm	9		
150 µm	8		

Hole HD5	Description Slightly silty SAND and GRAVEL
Depth 0.15 -0.20	
Type D	
Test Performed Dry	Uniformity Coefficient = 9.1

Form 25/4

Laboratory - Particle Size Plot	**Project** LLANWONNO TIPS Rhondda Cynon Taff	**Contract** 151258
Exploration Associates		**Sheet** P2/24

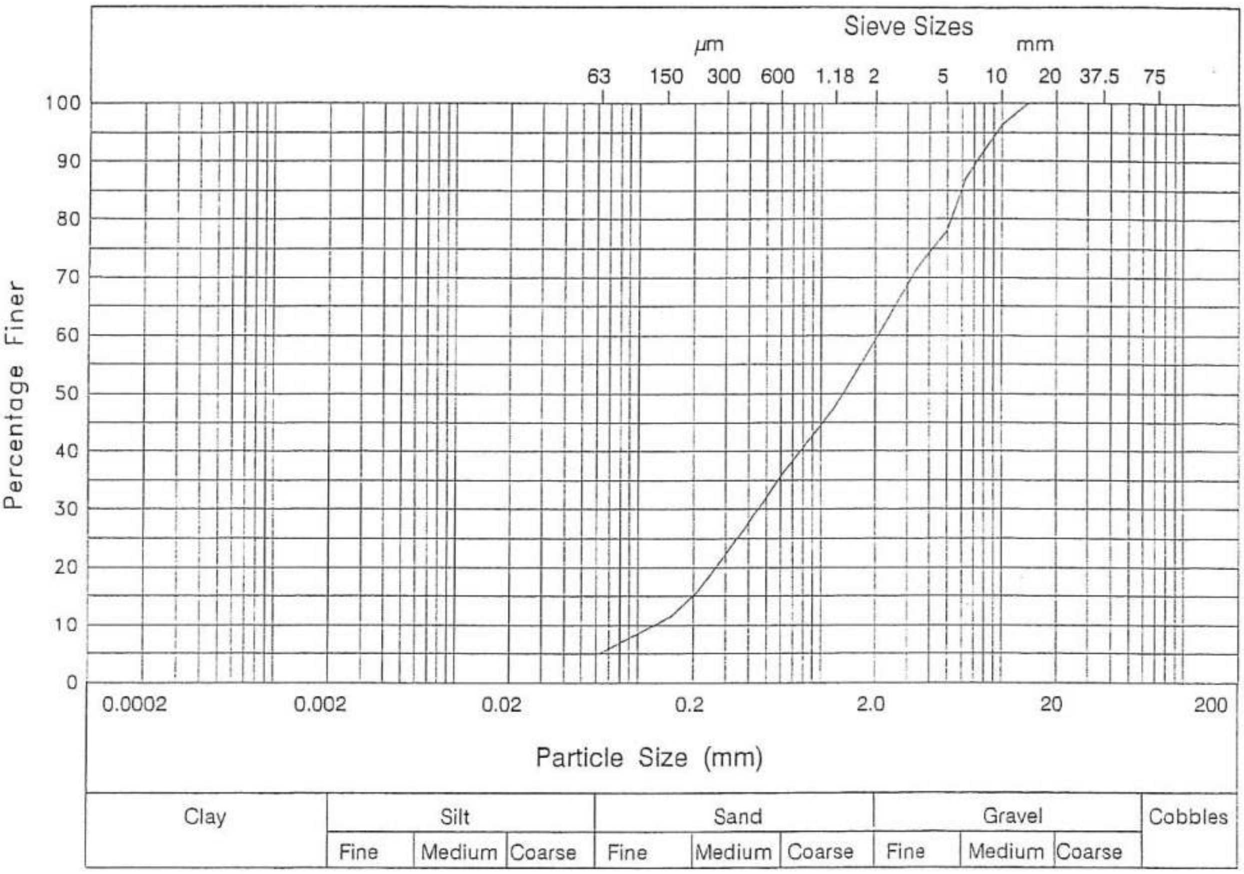


Particle Size	% Passing	Particle Size	% Passing
28 mm	100	212 µm	12
20 mm	87	150 µm	10
14 mm	84	63 µm	7
10 mm	77		
6.3 mm	68		
5 mm	61		
3.35 mm	55		
2 mm	44		
1.18 mm	32		
600 µm	22		
425 µm	18		
300 µm	15		

Hole HD5	Description: Slightly silty very sandy GRAVEL
Depth 0.20 -0.25	
Type D	
Test Performed: Wet	Uniformity Coefficient = 64

Form 25/4

Laboratory - Particle Size Plot	Project: LLANWONNO TIPS, Rhondda Cynon Taff	Contract: 151258
Exploration Associates		Sheet: P2/25

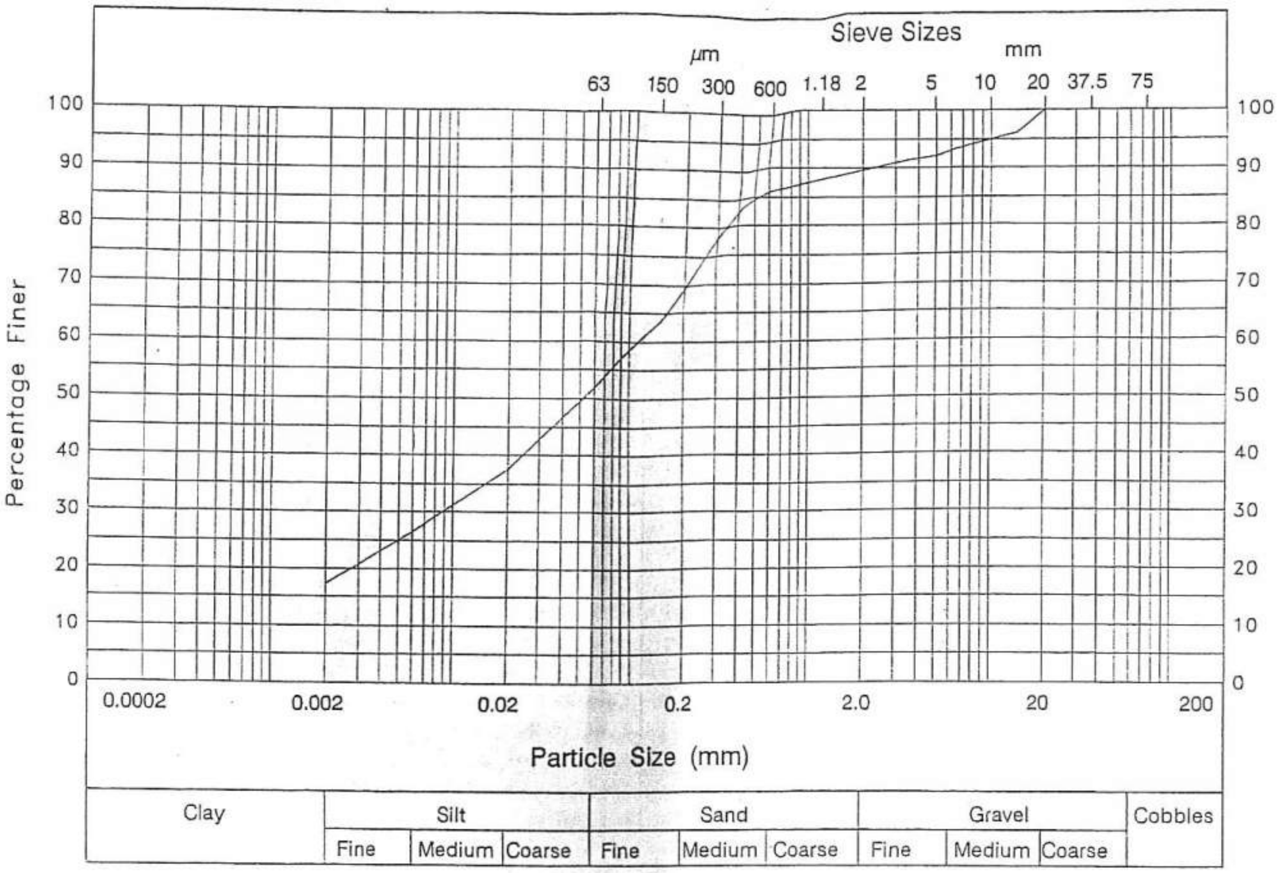


Particle Size	% Passing	Particle Size	% Passing
14 mm	100	63 µm	5
10 mm	96		
6.3 mm	87		
5 mm	78		
3.35 mm	71		
2 mm	59		
1.18 mm	47		
600 µm	36		
425 µm	29		
300 µm	22		
212 µm	16		
150 µm	11		

Hole HD6	Description: Slightly silty very gravelly SAND
Depth 0.00 -0.05	
Type D	
Test Performed: Wet	Uniformity Coefficient = 29

Form 25/4

Laboratory - Particle Size Plot	**Project** LLANWONNO TIPS Rhondda Cynon Taff	**Contract** 151258
Exploration Associates		**Sheet** P2/26



Particle Size	% Passing	Particle Size	% Passing
20 mm	100	150 µm	64
14 mm	96	63 µm	53
10 mm	95	20 µm	38
6.3 mm	93	6 µm	27
5 mm	92	2 µm	17
3.35 mm	91		
2 mm	90		
1.18 mm	88		
600 µm	86		
425 µm	83		
300 µm	78		
212 µm	71		

Hole HD6	Description: sandy slightly gravelly CLAY / SILT
Depth 0.10 -0.15	
Type D	
Test Performed: Wet	Uniformity Coefficient not applicable.

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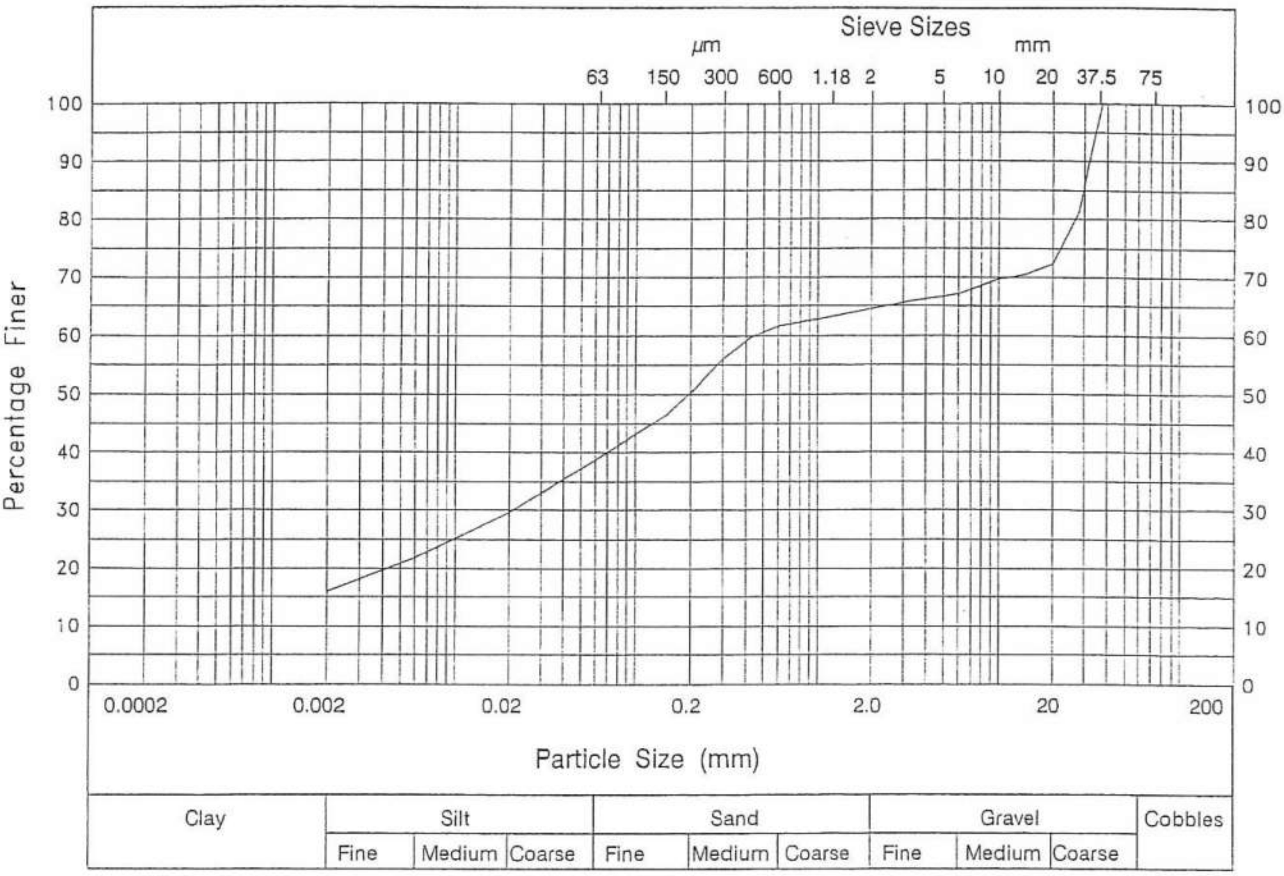
Laboratory - Particle Size Plot	**Project** LLANWONNO TIPS Rhondda Cynon Taff	**Contract** 151258
Exploration Associates		**Sheet** P2/28



Particle Size	% Passing	Particle Size	% Passing
37.5 mm	100	300 µm	56
28 mm	81	212 µm	51
20 mm	72	150 µm	47
14 mm	70	63 µm	39
10 mm	70	20 µm	30
6.3 mm	67	6 µm	22
5 mm	67	2 µm	16
3.35 mm	66		
2 mm	65		
1.18 mm	63		
600 µm	62		
425 µm	60		

Hole HD6	Description: Sandy gravelly CLAY / SILT
Depth 0.15 -0.20	
Type D	
Test Performed: Wet	Uniformity Coefficient not applicable.

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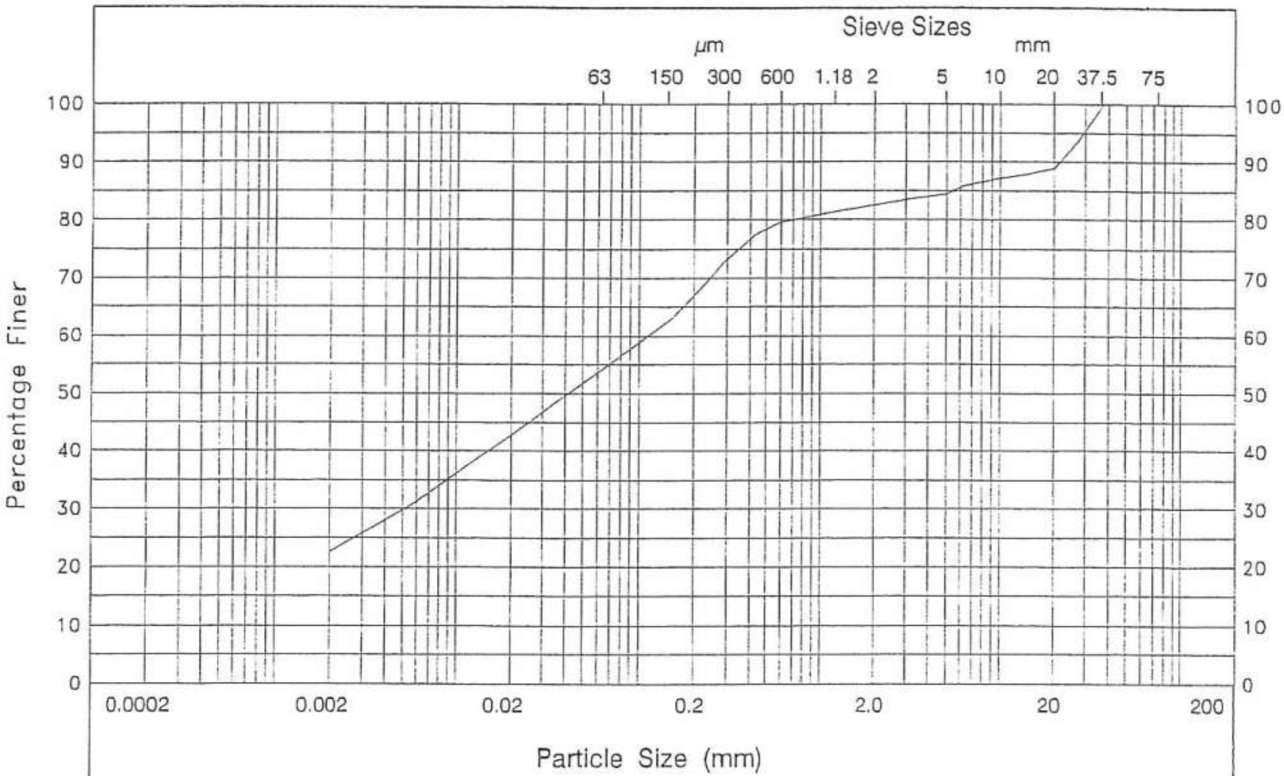
Laboratory - Particle Size Plot	**Project** LLANWONNO TIPS Rhondda Cynon Taff	**Contract** 151258
Exploration Associates		**Sheet** P2/29



Clay	Silt			Sand			Gravel			Cobbles
	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	

Particle Size	% Passing	Particle Size	% Passing
37.5 mm	100	300 µm	73
28 mm	94	212 µm	68
20 mm	89	150 µm	63
14 mm	88	63 µm	54
10 mm	87	20 µm	43
6.3 mm	86	6 µm	31
5 mm	84	2 µm	23
3.35 mm	84		
2 mm	82		
1.18 mm	81		
600 µm	80		
425 µm	77		

Hole HD6	Description: sandy slightly gravelly CLAY / SILT
Depth 0.20 -0.25	
Type D	
Test Performed: Wet	Uniformity Coefficient not applicable.

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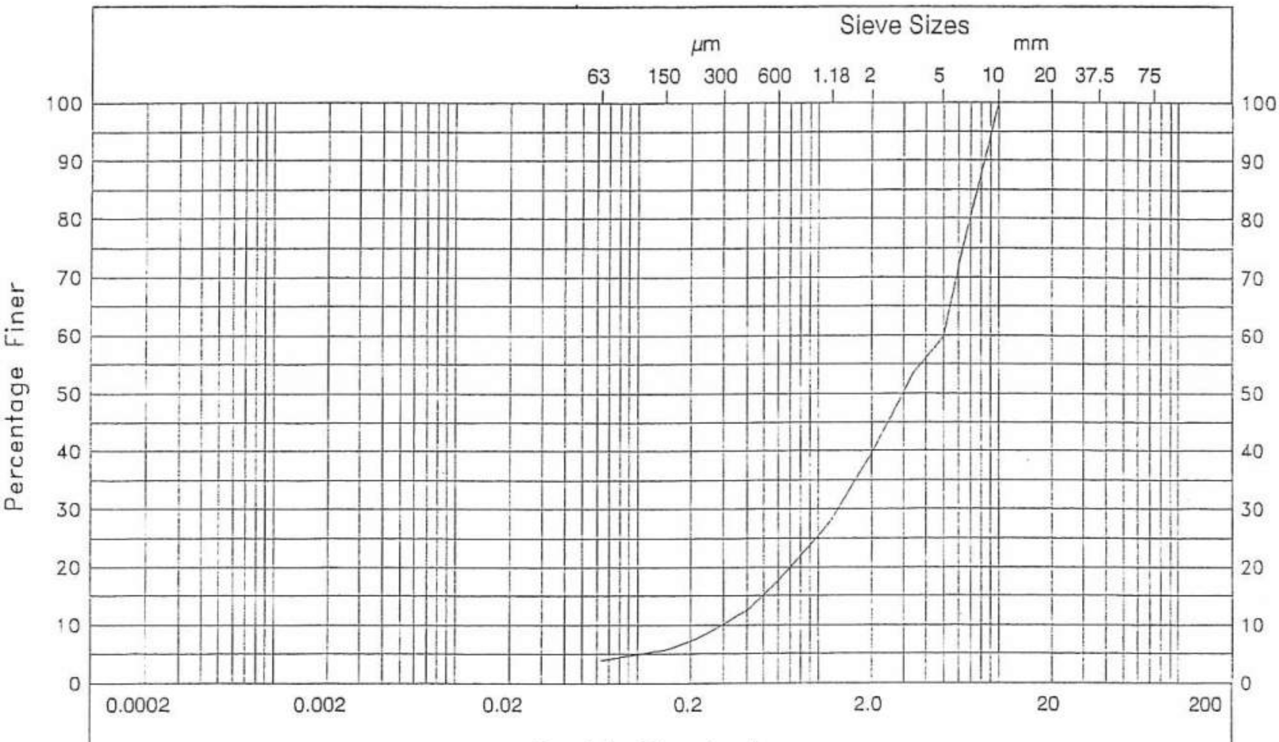
Laboratory - Particle Size Plot	**Project** LLANWONNO TIPS Rhondda Cynon Taff	**Contract** 151258
Exploration Associates		**Sheet** P2/30



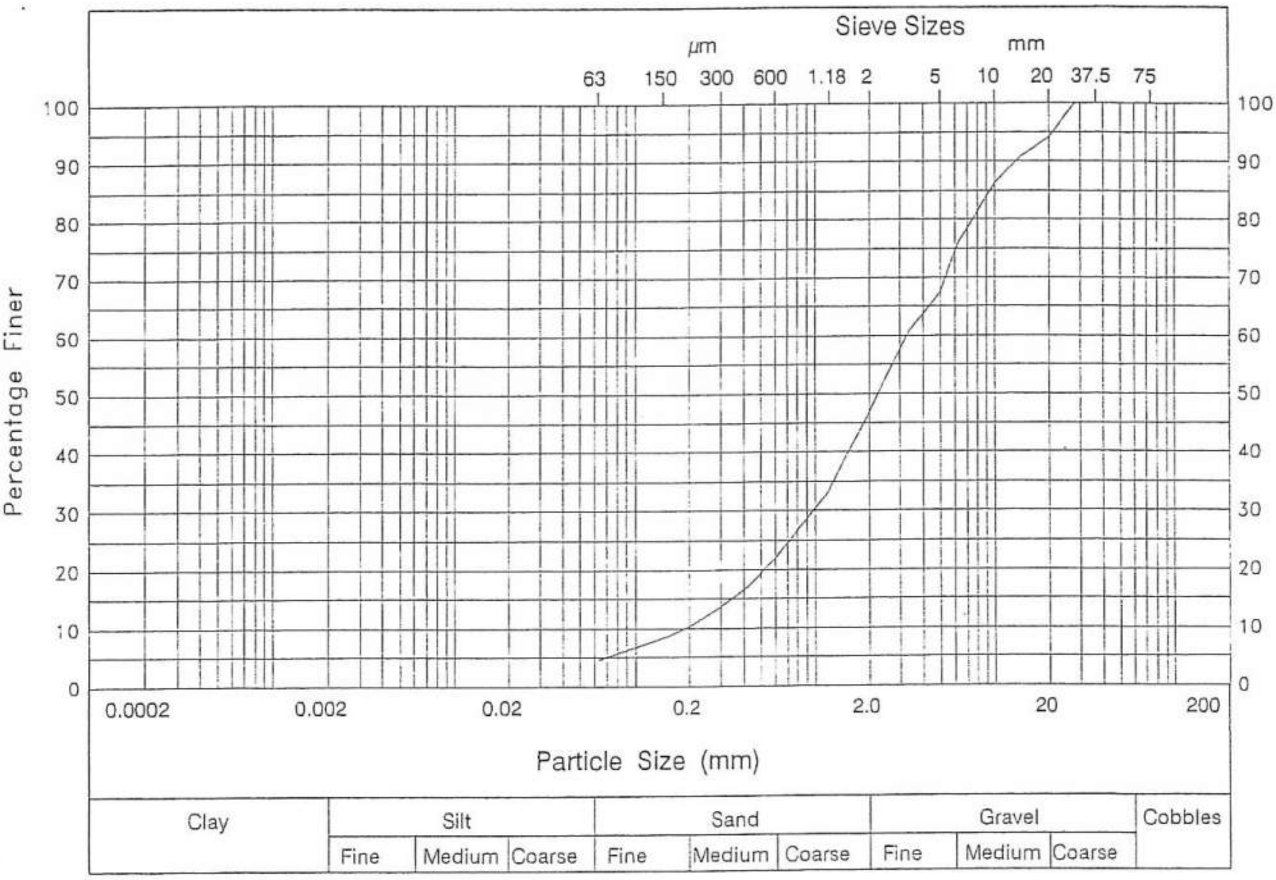
Clay	Silt			Sand			Gravel			Cobbles
	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	

Particle Size	% Passing	Particle Size	% Passing
10 mm	100		
6.3 mm	75		
5 mm	60		
3.35 mm	53		
2 mm	40		
1.18 mm	28		
600 µm	18		
425 µm	13		
300 µm	10		
212 µm	8		
150 µm	6		
63 µm	4		

Hole HD7	Description Slightly silty very sandy GRAVEL
Depth 0.00 -0.05	
Type D	
Test Performed Wet	Uniformity Coefficient = 17

Form 25/4

Laboratory - Particle Size Plot	**Project** LLANWONNO TIPS Rhondda Cynon Taff	**Contract** 151258
Exploration Associates		**Sheet** P2/31



Particle Size	% Passing	Particle Size	% Passing
28 mm	100	212 µm	11
20 mm	94	150 µm	9
14 mm	91	63 µm	5
10 mm	86		
6.3 mm	76		
5 mm	67		
3.35 mm	61		
2 mm	47		
1.18 mm	33		
600 µm	22		
425 µm	17		
300 µm	14		

Hole HD7	Description: Slightly silty very sandy GRAVEL
Depth 0.05 -0.10	
Type D	
Test Performed: Wet	Uniformity Coefficient = 18

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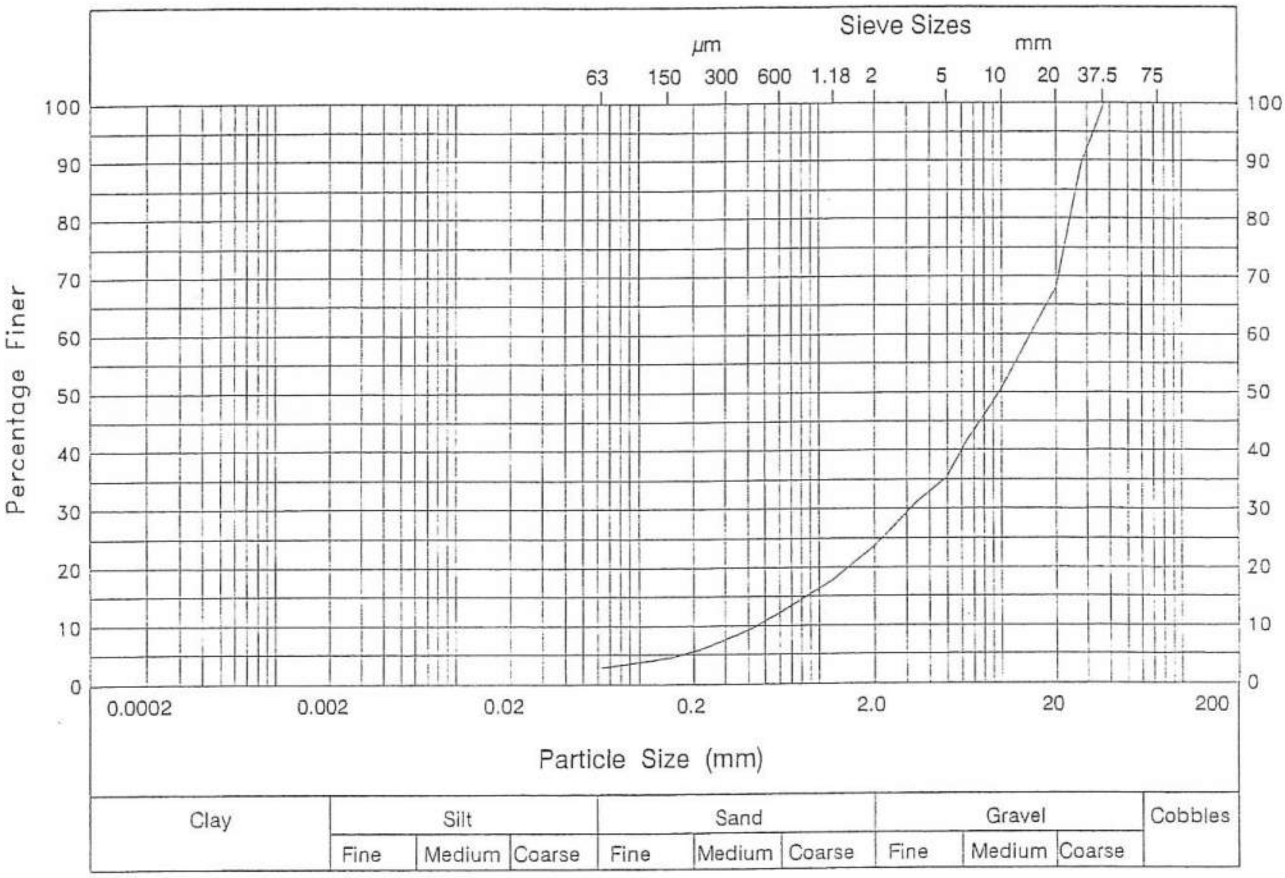
Laboratory - Particle Size Plot	**Project** LLANWONNO TIPS Rhondda Cynon Taff	**Contract** 151258
Exploration Associates		**Sheet** P2/32

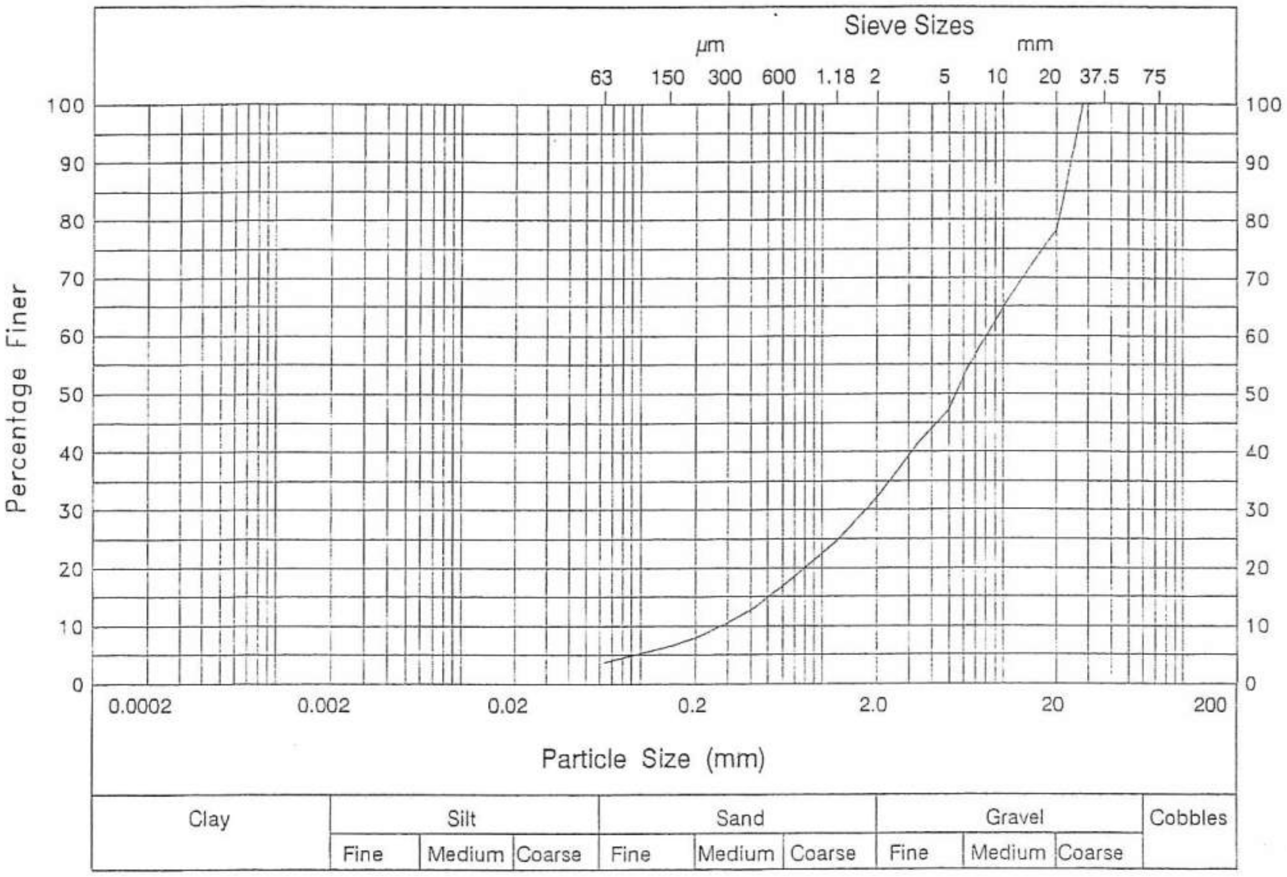


Particle Size	% Passing	Particle Size	% Passing
37.5 mm	100	300 µm	8
28 mm	90	212 µm	6
20 mm	68	150 µm	5
14 mm	59	63 µm	3
10 mm	51		
6.3 mm	41		
5 mm	35		
3.35 mm	31		
2 mm	24		
1.18 mm	18		
600 µm	12		
425 µm	10		

Hole HD7	Description Slightly silty sandy GRAVEL
Depth 0.10 -0.15	
Type D	
Test Performed Wet	Uniformity Coefficient = 34

Form 25/4

Laboratory - Particle Size Plot	**Project** LLANWONNO TIPS Rhondda Cynon Taff	**Contract** 151258
Exploration Associates		**Sheet** P2/33

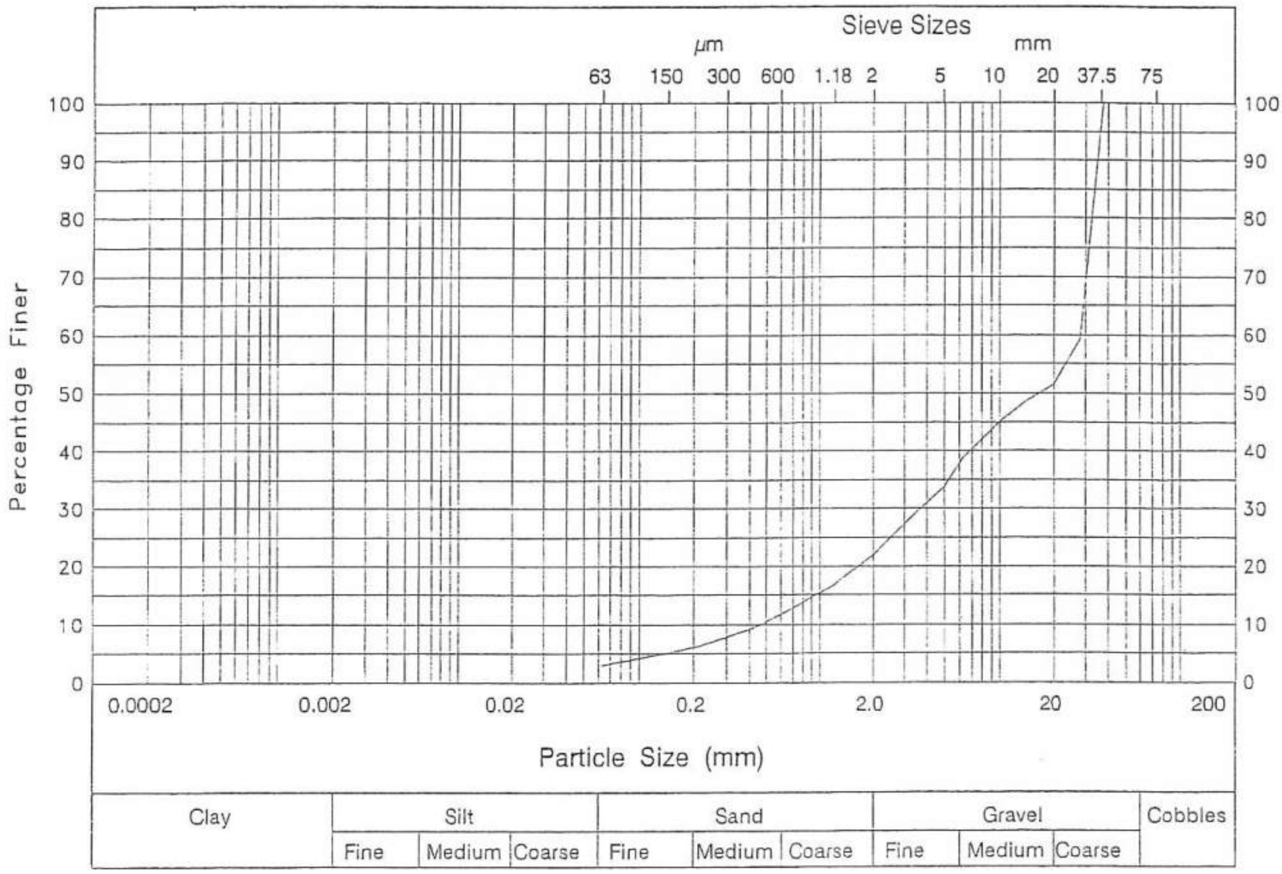


Particle Size	% Passing	Particle Size	% Passing
28 mm	100	212 µm	8
20 mm	78	150 µm	7
14 mm	72	63 µm	4
10 mm	65		
6.3 mm	54		
5 mm	47		
3.35 mm	41		
2 mm	32		
1.18 mm	24		
600 µm	17		
425 µm	13		
300 µm	11		

Hole HD7	Description: Slightly silty sandy GRAVEL
Depth 0.15 -0.20	
Type D	
Test Performed: Wet	Uniformity Coefficient = 29

Form 25/4

Laboratory - Particle Size Plot	**Project** LLANWONNO TIPS Rhondda Cynon Taff	**Contract** 151258
Exploration Associates		**Sheet** P2/34

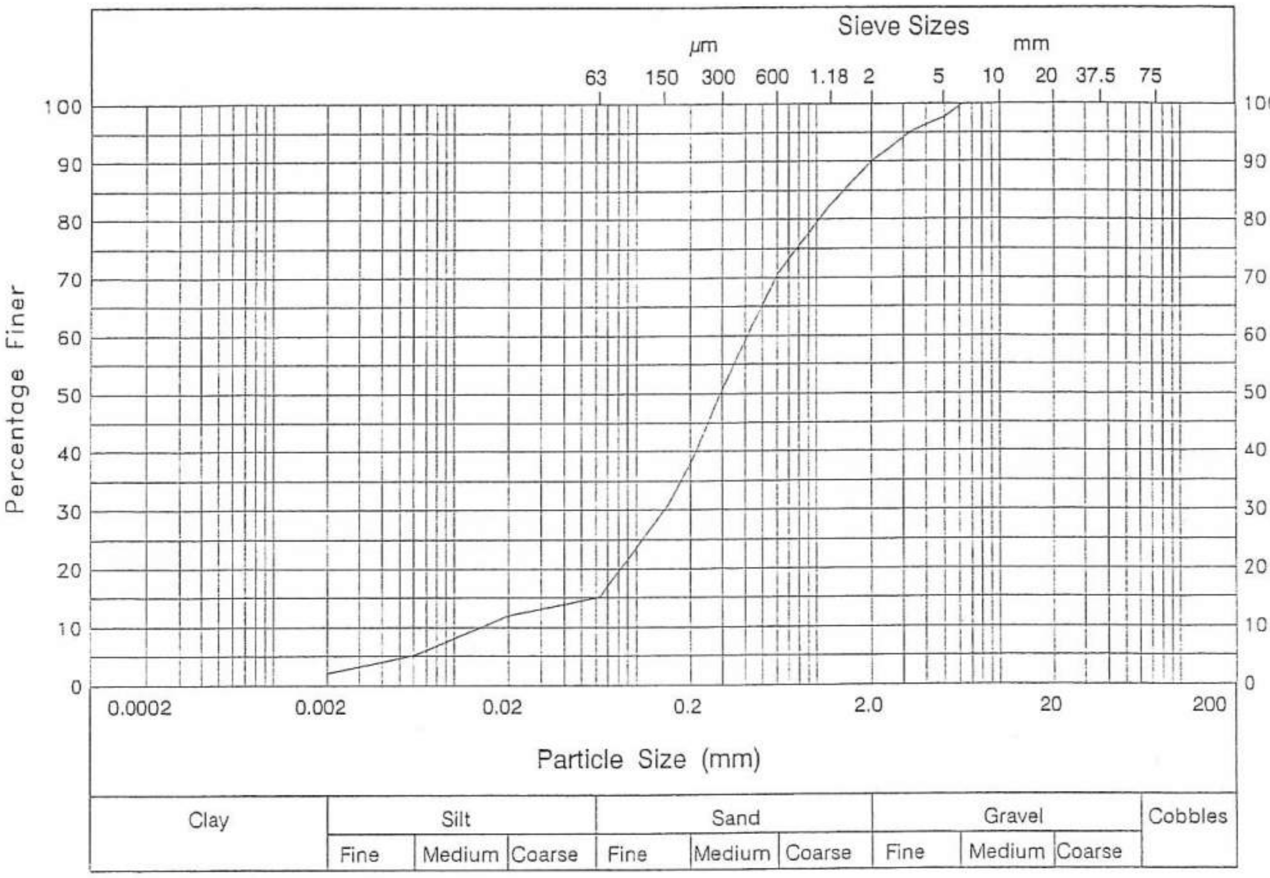


Particle Size	% Passing	Particle Size	% Passing
37.5 mm	100	300 μm	8
28 mm	59	212 μm	6
20 mm	52	150 μm	5
14 mm	49	63 μm	3
10 mm	45		
6.3 mm	39		
5 mm	34		
3.35 mm	29		
2 mm	22		
1.18 mm	17		
600 μm	12		
425 μm	9		

Hole HD7	Description Slightly silty sandy GRAVEL
Depth 0.20 -0.25	
Type D	
Test Performed Wet	Uniformity Coefficient = 59

Form 25/4

Laboratory - Particle Size Plot	Project LLANWONNO TIPS Rhondda Cynon Taff	Contract 151258
Exploration Associates		Sheet P2/35

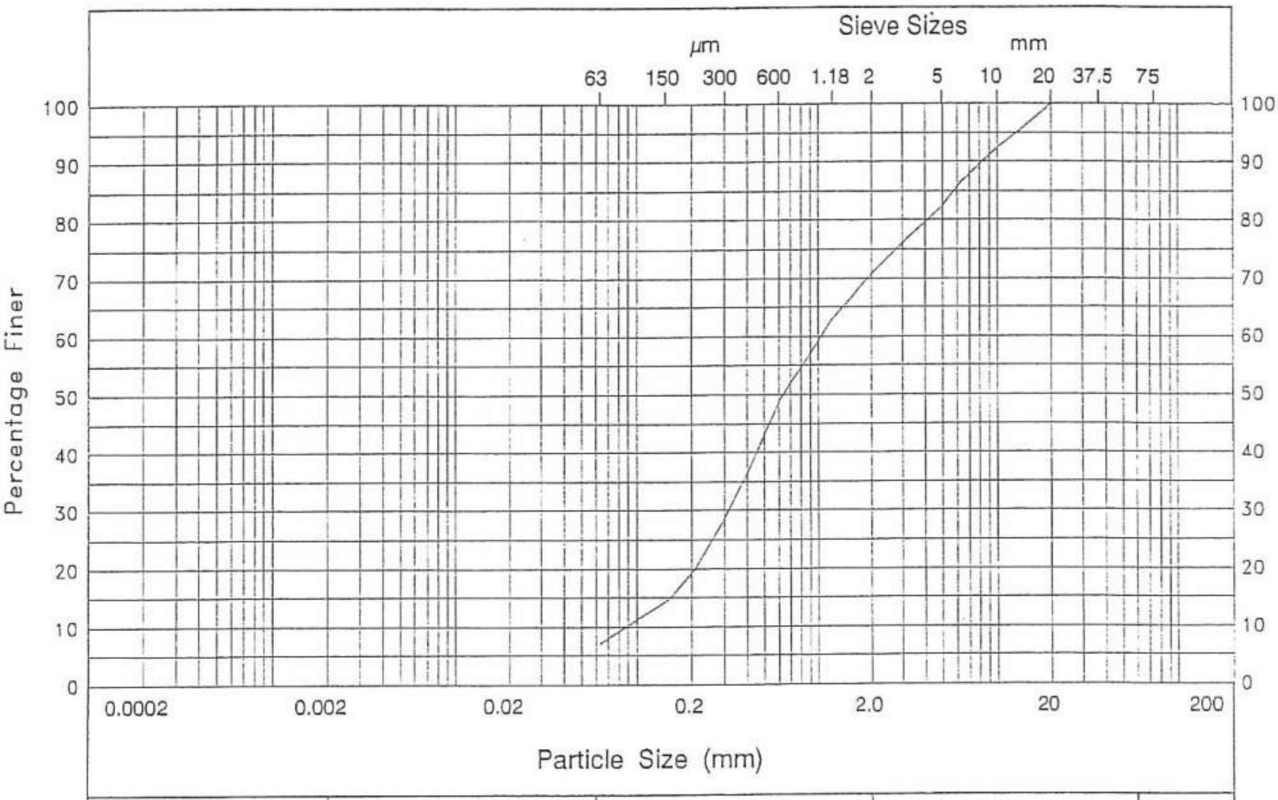


Particle Size	% Passing	Particle Size	% Passing
6.3 mm	100	6 μm	5
5 mm	98	2 μm	2
3.35 mm	95		
2 mm	90		
1.18 mm	82		
600 μm	71		
425 μm	61		
300 μm	51		
212 μm	40		
150 μm	31		
63 μm	15		
20 μm	12		

Hole HD8	Description: Very silty gravelly SAND
Depth 0.00 -0.05	
Type D	
Test Performed: Wet	Uniformity Coefficient = 29

Form 25/4

Laboratory - Particle Size Plot	**Project** LLANWONNO TIPS Rhondda Cynon Taff	**Contract** 151258
Exploration Associates		**Sheet** P2/36



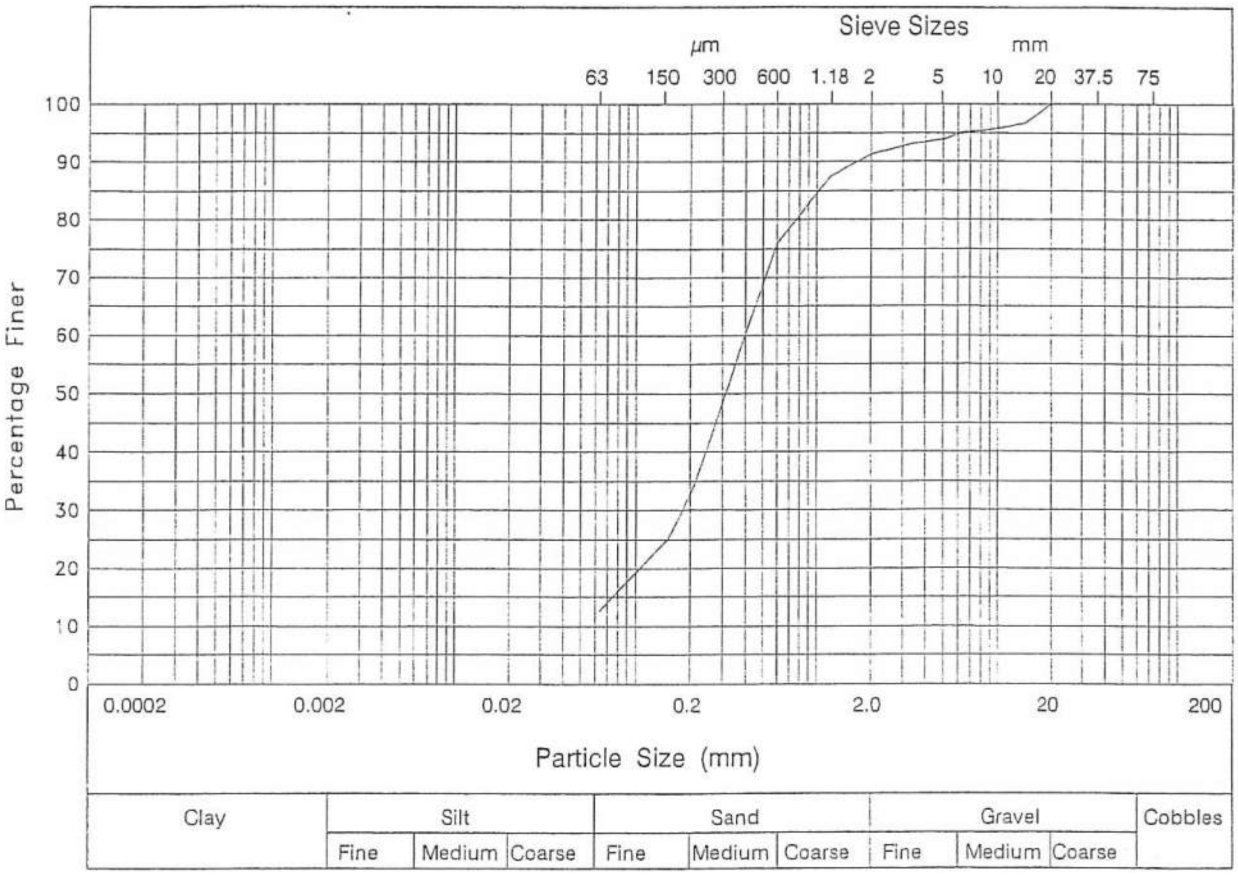
Clay	Silt			Sand			Gravel			Cobbles
	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	

Particle Size	% Passing	Particle Size	% Passing
20 mm	100	150 µm	15
14 mm	96	63 µm	7
10 mm	92		
6.3 mm	86		
5 mm	82		
3.35 mm	78		
2 mm	71		
1.18 mm	63		
600 µm	49		
425 µm	38		
300 µm	29		
212 µm	20		

Hole HD8	Description Slightly silty gravelly SAND
Depth 0.05 -0.10	
Type D	
Test Performed Wet	Uniformity Coefficient = 15

Form 25/4

Laboratory - Particle Size Plot	**Project** LLANWONNO TIPS Rhondda Cynon Taff	**Contract** 151258
Exploration Associates		**Sheet** P2/37

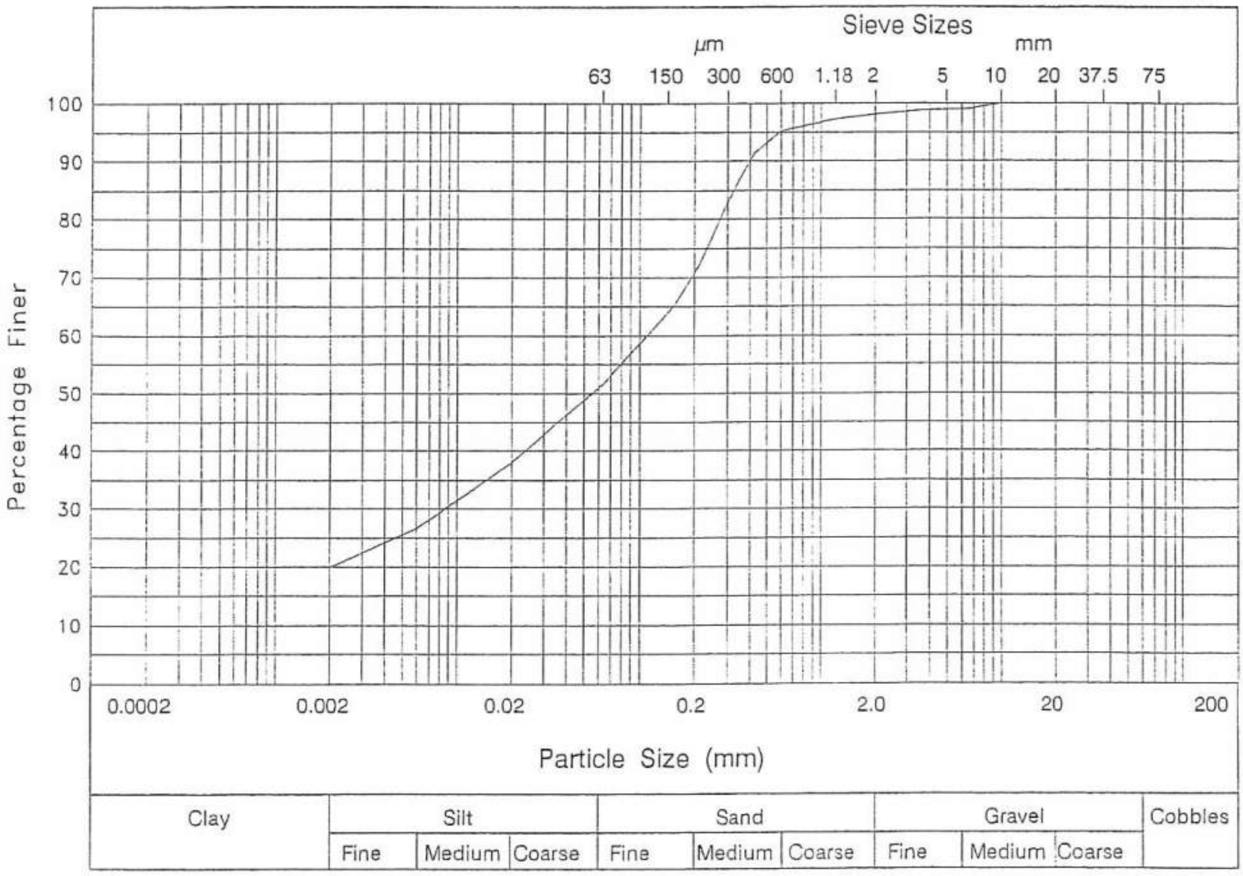


Particle Size	% Passing	Particle Size	% Passing
20 mm	100	150 µm	25
14 mm	97	63 µm	13
10 mm	96		
6.3 mm	95		
5 mm	94		
3.35 mm	93		
2 mm	91		
1.18 mm	87		
600 µm	76		
425 µm	63		
300 µm	48		
212 µm	35		

Hole HD8	Description Silty gravelly SAND
Depth 0.10 -0.15	
Type D	
Test Performed Wet	Uniformity Coefficient not applicable.

Form 25/4

Laboratory - Particle Size Plot	Project LLANWONNO TIPS Rhondda Cynon Taff	Contract 151258
Exploration Associates		Sheet P2/38

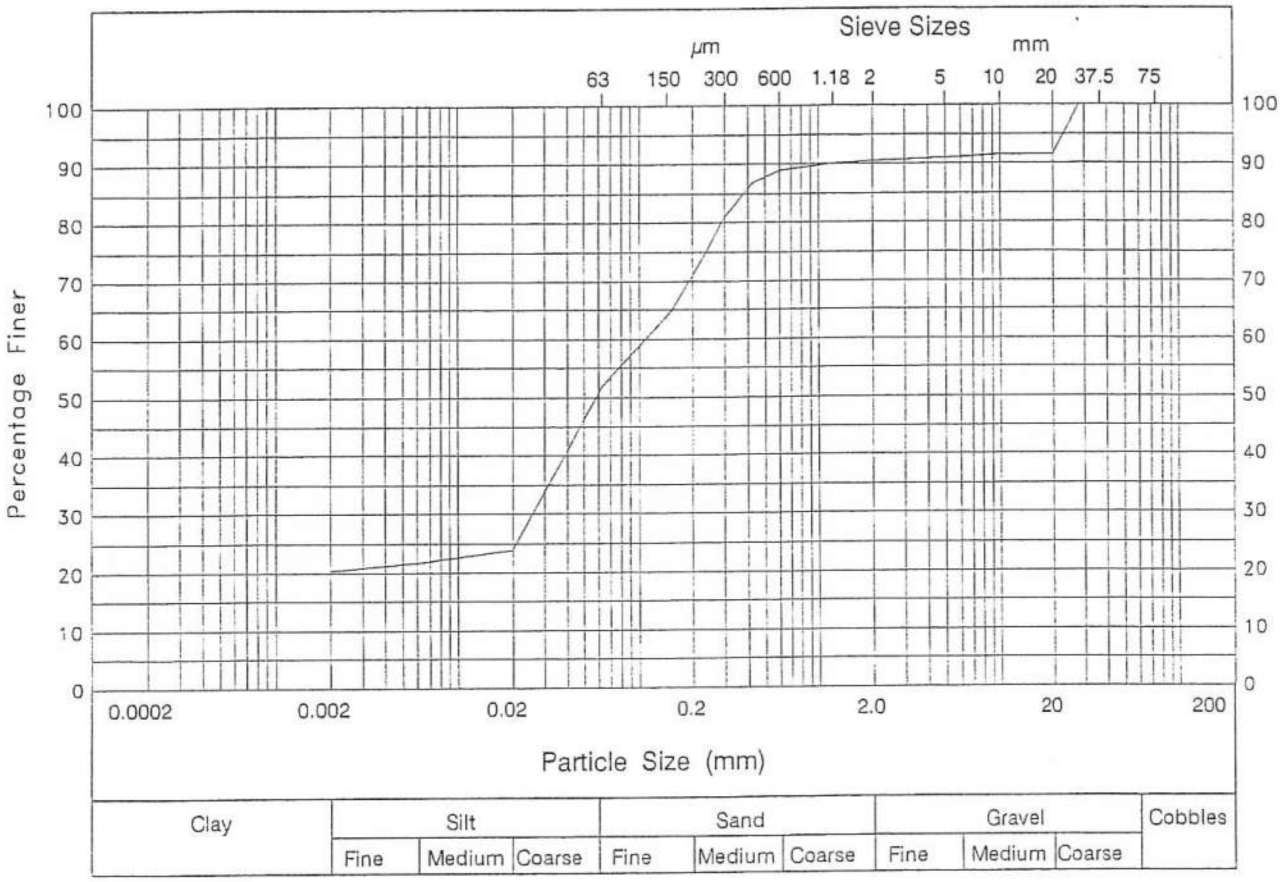


Particle Size	% Passing	Particle Size	% Passing
10 mm	100	20 µm	38
6.3 mm	99	6 µm	27
5 mm	99	2 µm	20
3.35 mm	99		
2 mm	98		
1.18 mm	97		
600 µm	95		
425 µm	91		
300 µm	83		
212 µm	72		
150 µm	65		
63 µm	52		

Hole HD8	Description: Sandy slightly gravelly CLAY / SILT
Depth 0.15 -0.20	
Type D	
Test Performed: Wet	Uniformity Coefficient not applicable.

Form 25/4

Laboratory - Particle Size Plot	**Project** LLANWONNO TIPS Rhondda Cynon Taff	**Contract** 151258
Exploration Associates		**Sheet** P2/39

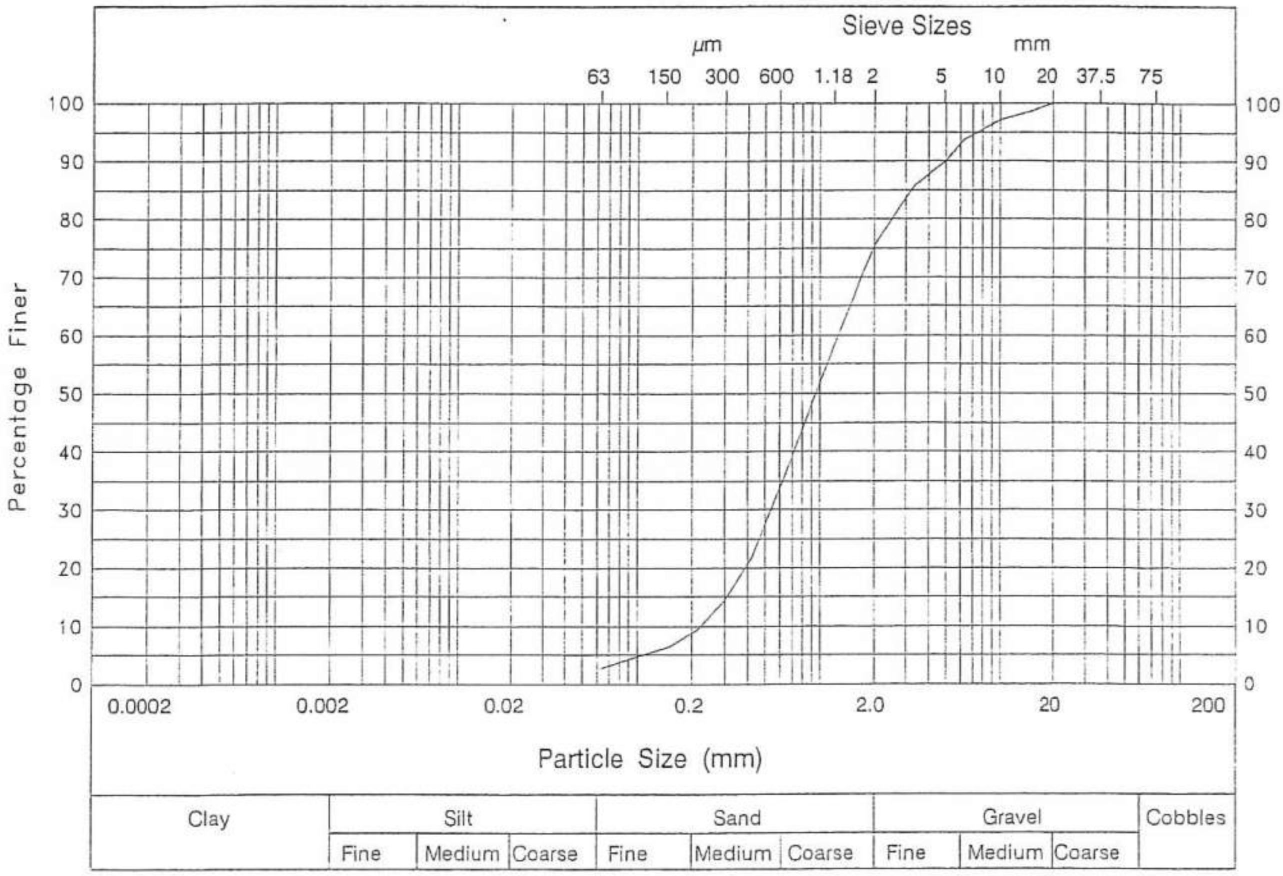


Particle Size	% Passing	Particle Size	% Passing
28 mm	100	212 µm	72
20 mm	92	150 µm	65
14 mm	92	63 µm	52
10 mm	92	20 µm	24
6.3 mm	91	6 µm	22
5 mm	91	2 µm	20
3.35 mm	91		
2 mm	91		
1.18 mm	90		
600 µm	89		
425 µm	87		
300 µm	81		

Hole HD8	Description: Very sandy gravelly CLAY / SILT
Depth 0.20 -0.25	
Type D	
Test Performed: Wet	Uniformity Coefficient not applicable.

Form 25/4

Laboratory - Particle Size Plot	**Project** LLANWONNO TIPS Rhondda Cynon Taff	**Contract** 151258
Exploration Associates		**Sheet** P2/40



Particle Size	% Passing	Particle Size	% Passing
20 mm	100	150 µm	6
14 mm	98	63 µm	3
10 mm	97		
6.3 mm	94		
5 mm	90		
3.35 mm	86		
2 mm	75		
1.18 mm	58		
600 µm	34		
425 µm	22		
300 µm	14		
212 µm	9		

Hole HD9

Depth 0.00 -0.05

Type D

Description: Slightly silty gravelly SAND

Test Performed: Wet

Uniformity Coefficient = 5.5

Form 25/4

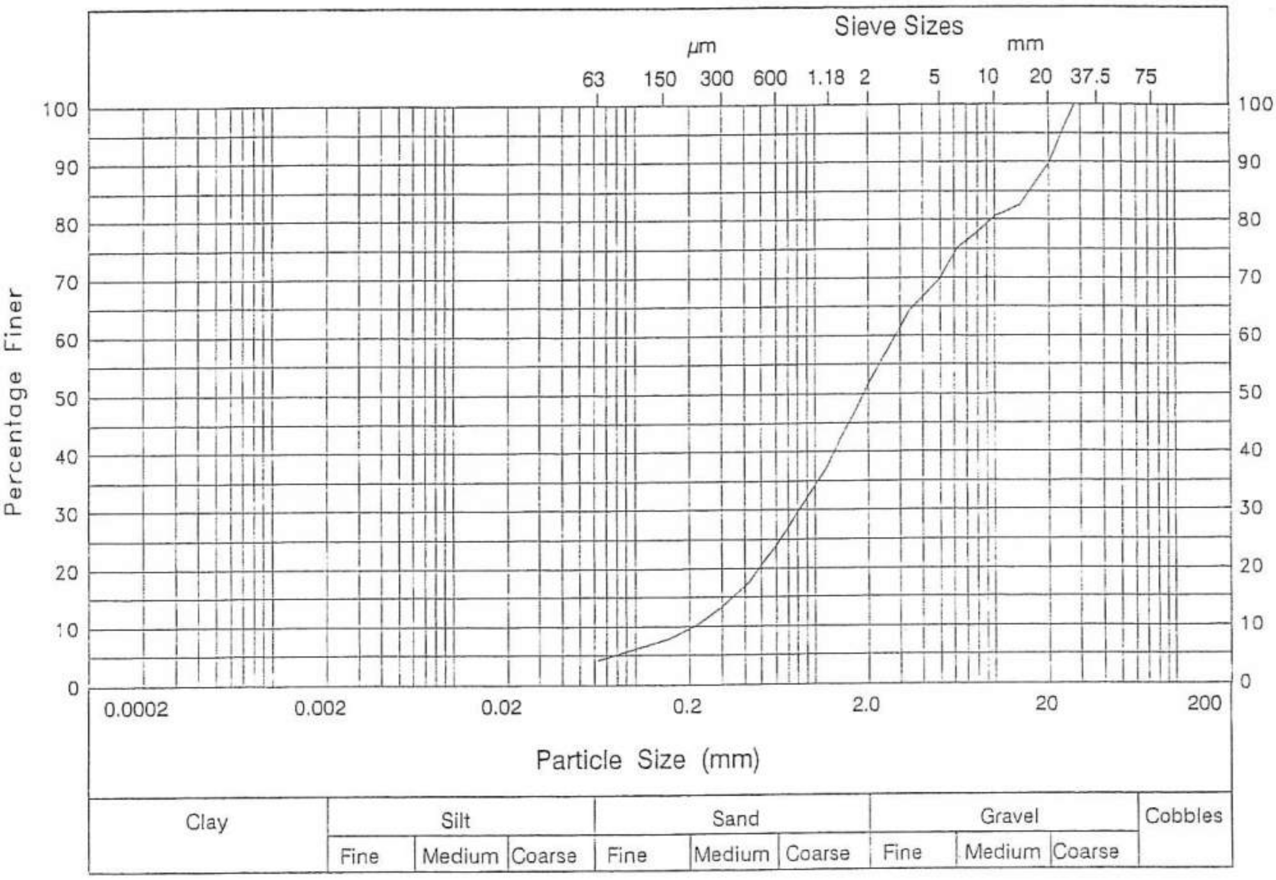
Laboratory - Particle Size Plot

Exploration Associates

Project LLANWONNO TIPS Rhondda Cynon Taff

Contract 151258

Sheet P2/41

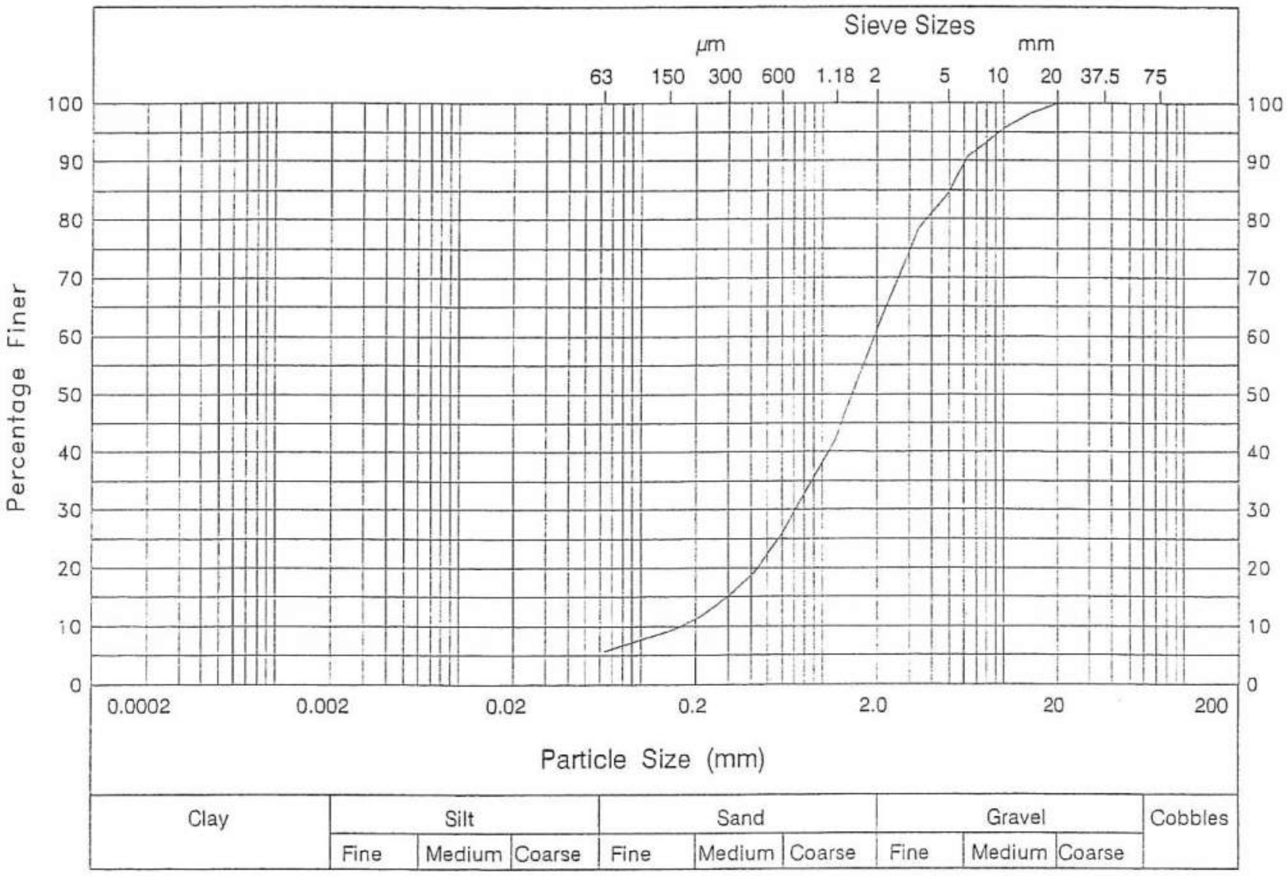


Particle Size	% Passing	Particle Size	% Passing
28 mm	100	212 µm	10
20 mm	90	150 µm	8
14 mm	83	63 µm	4
10 mm	81		
6.3 mm	75		
5 mm	70		
3.35 mm	64		
2 mm	52		
1.18 mm	38		
600 µm	24		
425 µm	18		
300 µm	13		

Hole HD9	Description: Slightly silty SAND and GRAVEL
Depth 0.05 -0.10	
Type D	
Test Performed: Wet	Uniformity Coefficient = 13

Form 25/4

Laboratory - Particle Size Plot	**Project** LLANWONNO TIPS Rhondda Cynon Taff	**Contract** 151258
Exploration Associates		**Sheet** P2/42

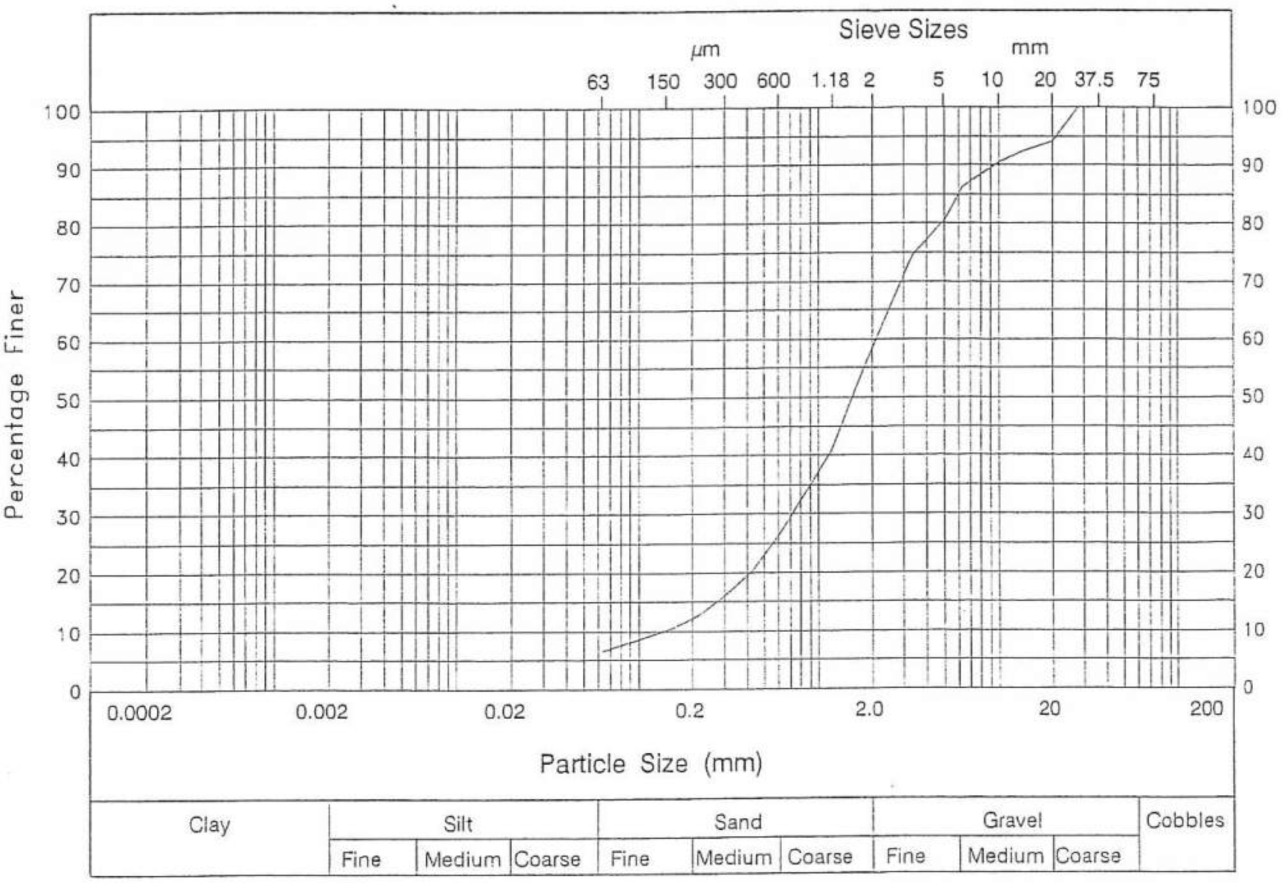


Particle Size	% Passing	Particle Size	% Passing
20 mm	100	150 µm	9
14 mm	98	63 µm	6
10 mm	96		
6.3 mm	91		
5 mm	85		
3.35 mm	78		
2 mm	61		
1.18 mm	42		
600 µm	26		
425 µm	19		
300 µm	15		
212 µm	12		

Hole HD9	Description: Silty SAND and GRAVEL
Depth 0.10 -0.15	
Type D	
Test Performed: Wet	Uniformity Coefficient = 11

Form 25/4

Laboratory - Particle Size Plot	**Project** LLANWONNO TIPS Rhondda Cynon Taff	**Contract** 151258
Exploration Associates		**Sheet** P2/43

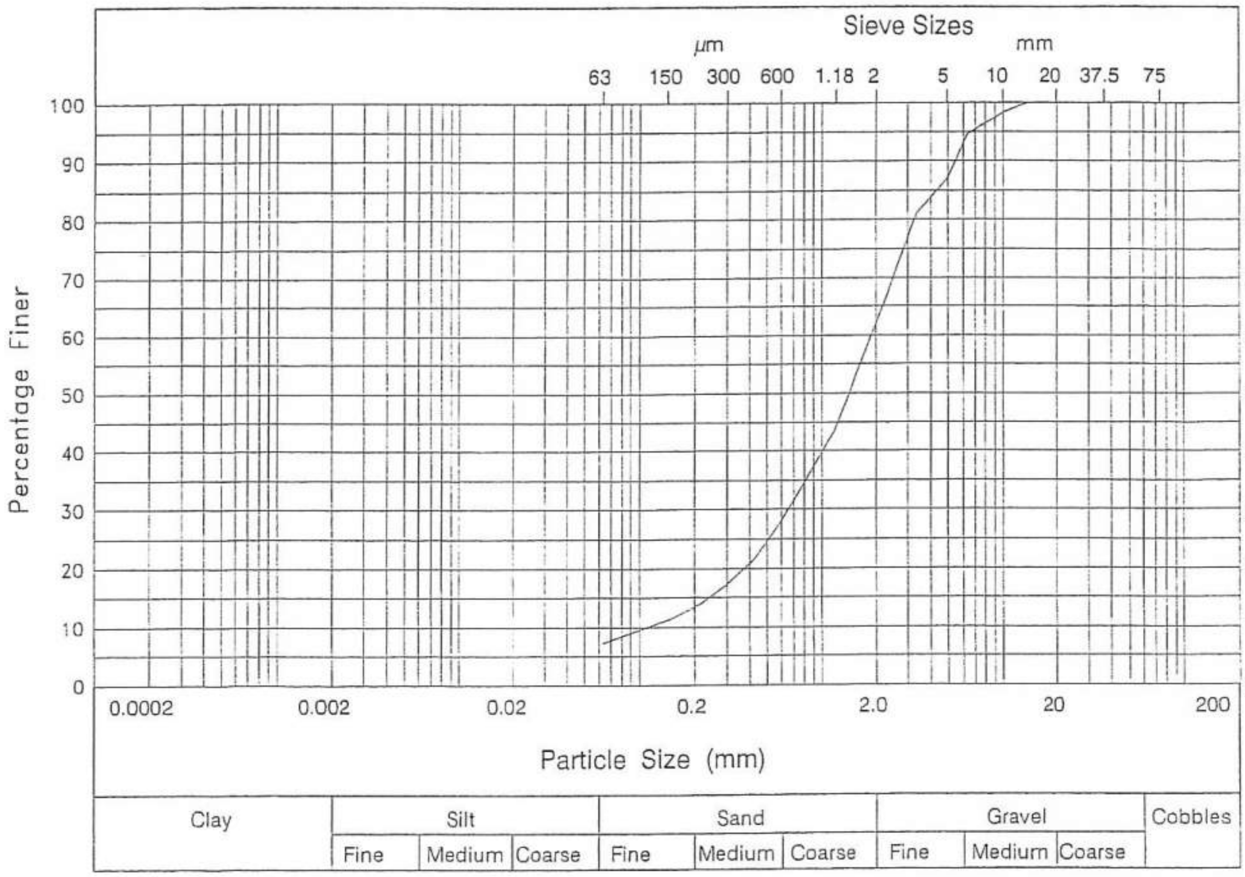


Particle Size	% Passing	Particle Size	% Passing
28 mm	100	212 µm	13
20 mm	94	150 µm	10
14 mm	92	63 µm	7
10 mm	90		
6.3 mm	86		
5 mm	80		
3.35 mm	75		
2 mm	59		
1.18 mm	41		
600 µm	26		
425 µm	20		
300 µm	16		

Hole HD9	Description: Silty SAND and GRAVEL
Depth 0.15 -0.20	
Type D	
Test Performed: Wet	Uniformity Coefficient = 28

Form 25/4

Laboratory - Particle Size Plot	Project: LLANWONNO TIPS, Rhondda Cynon Taff	Contract: 151258
Exploration Associates		Sheet: P2/44

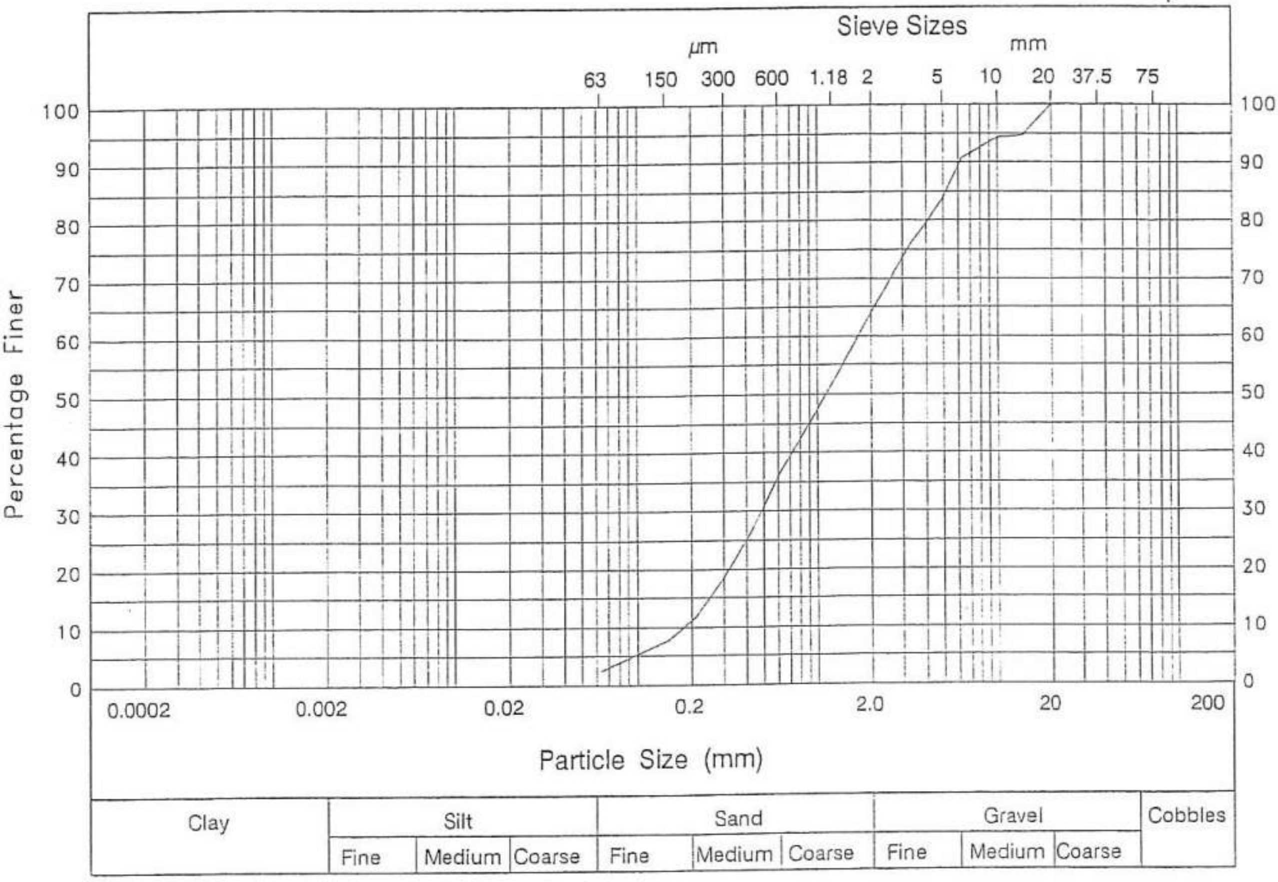


Particle Size	% Passing	Particle Size	% Passing
14 mm	100	63 µm	7
10 mm	98		
6.3 mm	95		
5 mm	87		
3.35 mm	81		
2 mm	62		
1.18 mm	44		
600 µm	28		
425 µm	22		
300 µm	17		
212 µm	14		
150 µm	11		

Hole HD9	Description: Silty gravelly SAND
Depth 0.20 -0.25	
Type D	
Test Performed: Wet	Uniformity Coefficient = 27

Form 25/4

Laboratory - Particle Size Plot	Project: LLANWONNO TIPS, Rhondda Cynon Taff	Contract: 151258
Exploration Associates		Sheet: P2/45

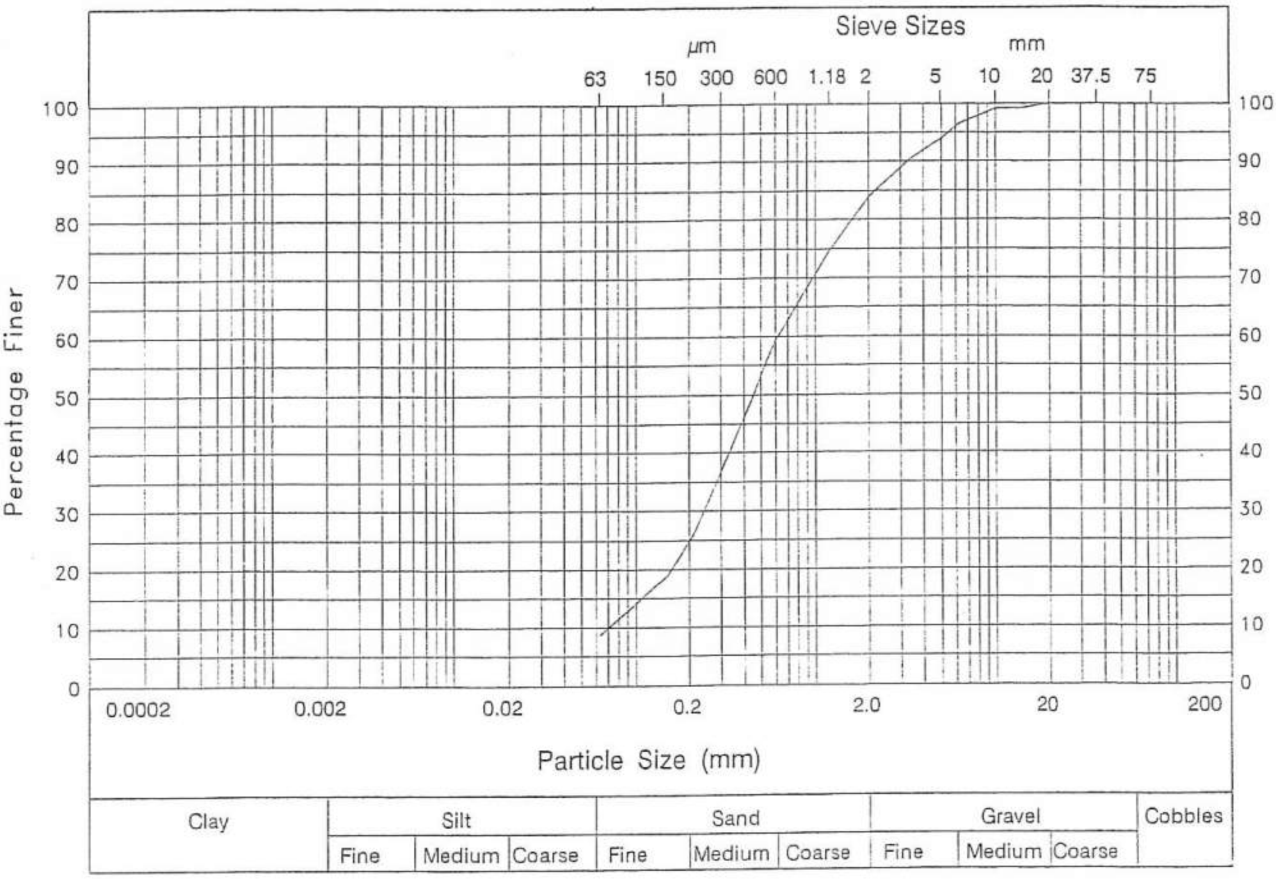


Particle Size	% Passing	Particle Size	% Passing
20 mm	100	150 µm	8
14 mm	95	63 µm	2
10 mm	94		
6.3 mm	91		
5 mm	84		
3.35 mm	76		
2 mm	64		
1.18 mm	51		
600 µm	36		
425 µm	26		
300 µm	18		
212 µm	12		

Hole HD10	Description: Slightly silty very gravelly SAND
Depth 0.00 -0.05	
Type D	
Test Performed: Wet	Uniformity Coefficient = 9.4

Form 25/4

Laboratory - Particle Size Plot	**Project** LLANWONNO TIPS Rhondda Cynon Taff	**Contract** 151258
Exploration Associates		**Sheet** P2/46

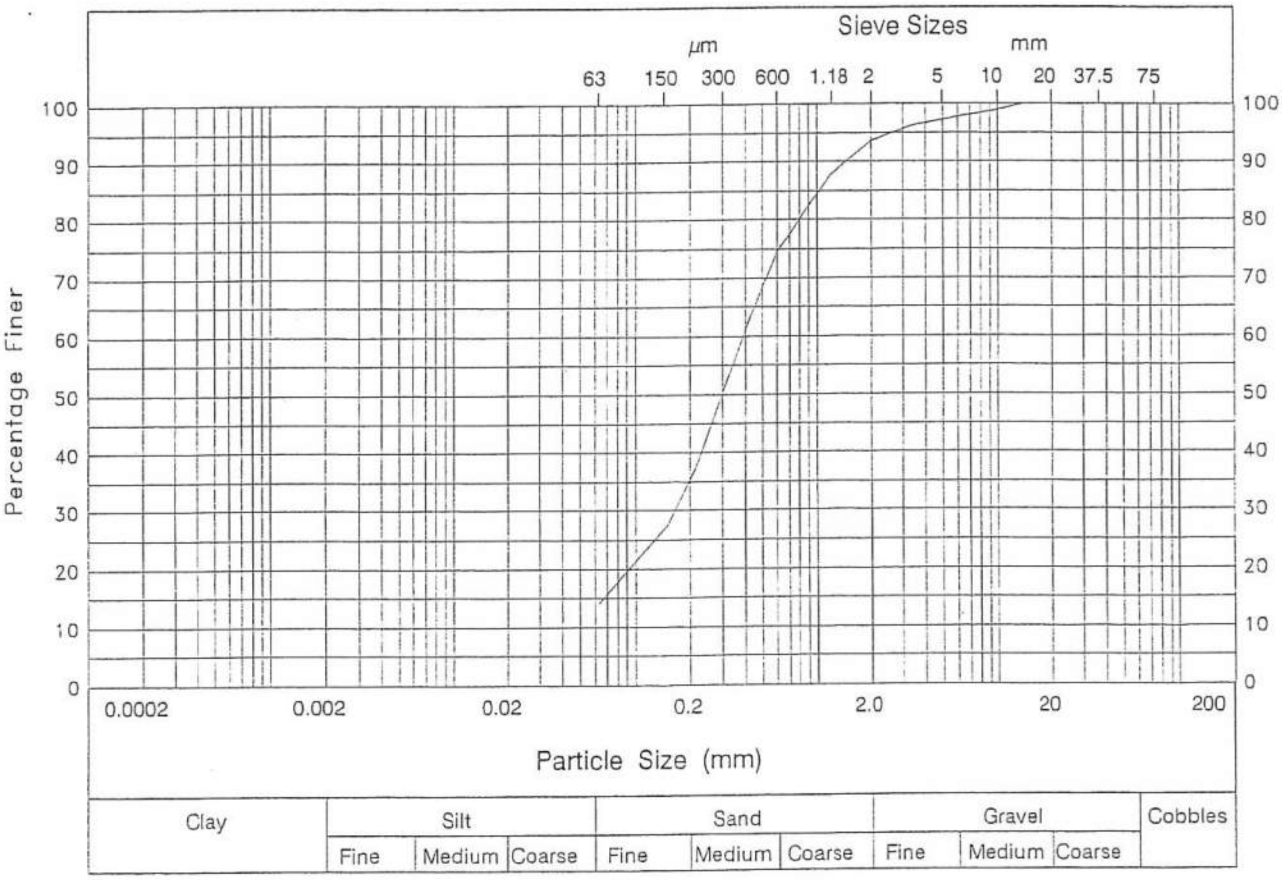


Particle Size	% Passing	Particle Size	% Passing
20 mm	100	150 µm	19
14 mm	99	63 µm	9
10 mm	99		
6.3 mm	97		
5 mm	94		
3.35 mm	90		
2 mm	84		
1.18 mm	74		
600 µm	59		
425 µm	48		
300 µm	37		
212 µm	26		

Hole HD10	Description: Silty gravelly SAND
Depth 0.05 -0.10	
Type D	
Test Performed: Wet	Uniformity Coefficient = 9.8

Form 25/4

Laboratory - Particle Size Plot	Project: LLANWONNO TIPS, Rhondda Cynon Taff	Contract: 151258
Exploration Associates		Sheet: P2/47

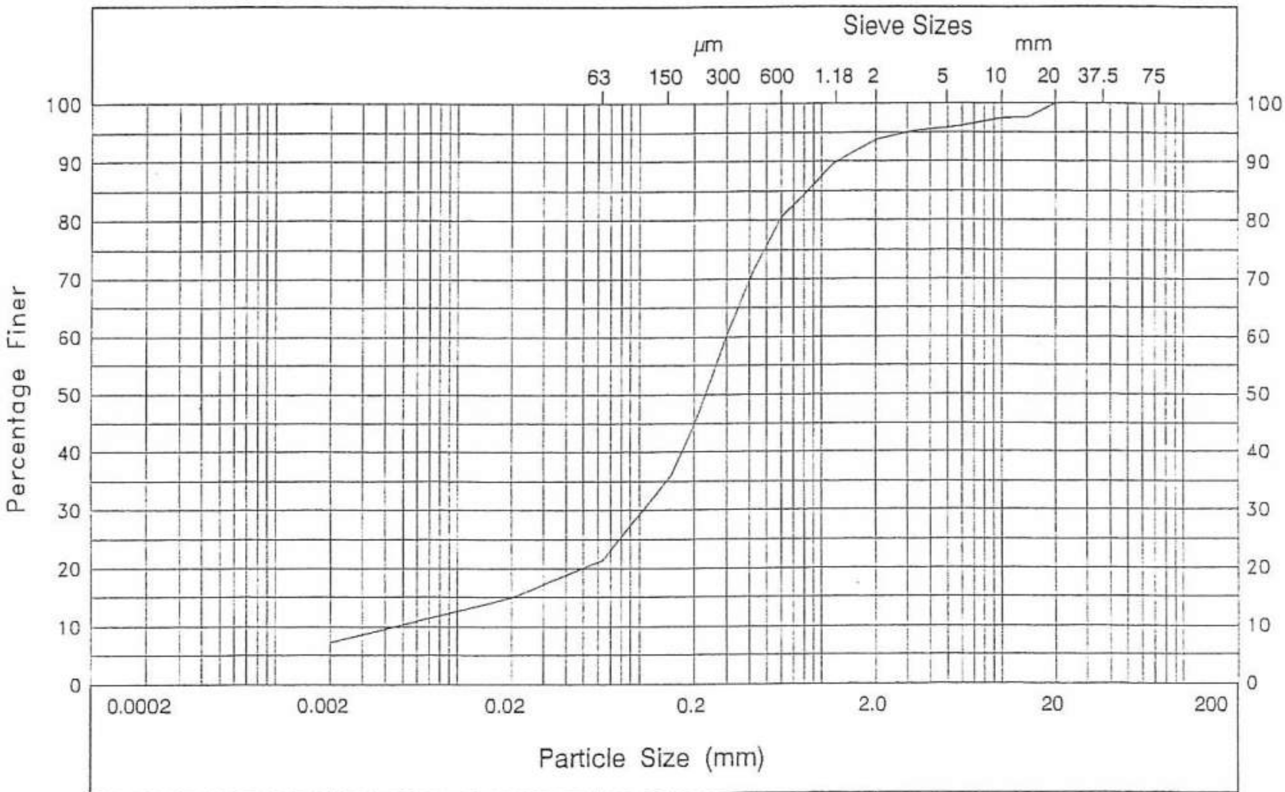


Particle Size	% Passing	Particle Size	% Passing
14 mm	100	63 µm	14
10 mm	99		
6.3 mm	98		
5 mm	97		
3.35 mm	96		
2 mm	94		
1.18 mm	88		
600 µm	75		
425 µm	63		
300 µm	50		
212 µm	37		
150 µm	28		

Hole HD10	Description: Silty slightly gravelly SAND
Depth 0.10 -0.15	
Type D	
Test Performed: Wet	Uniformity Coefficient not applicable.

Form 25/4

Laboratory - Particle Size Plot	**Project** LLANWONNO TIPS, Rhondda Cynon Taff	**Contract** 151258
Exploration Associates		**Sheet** P2/48



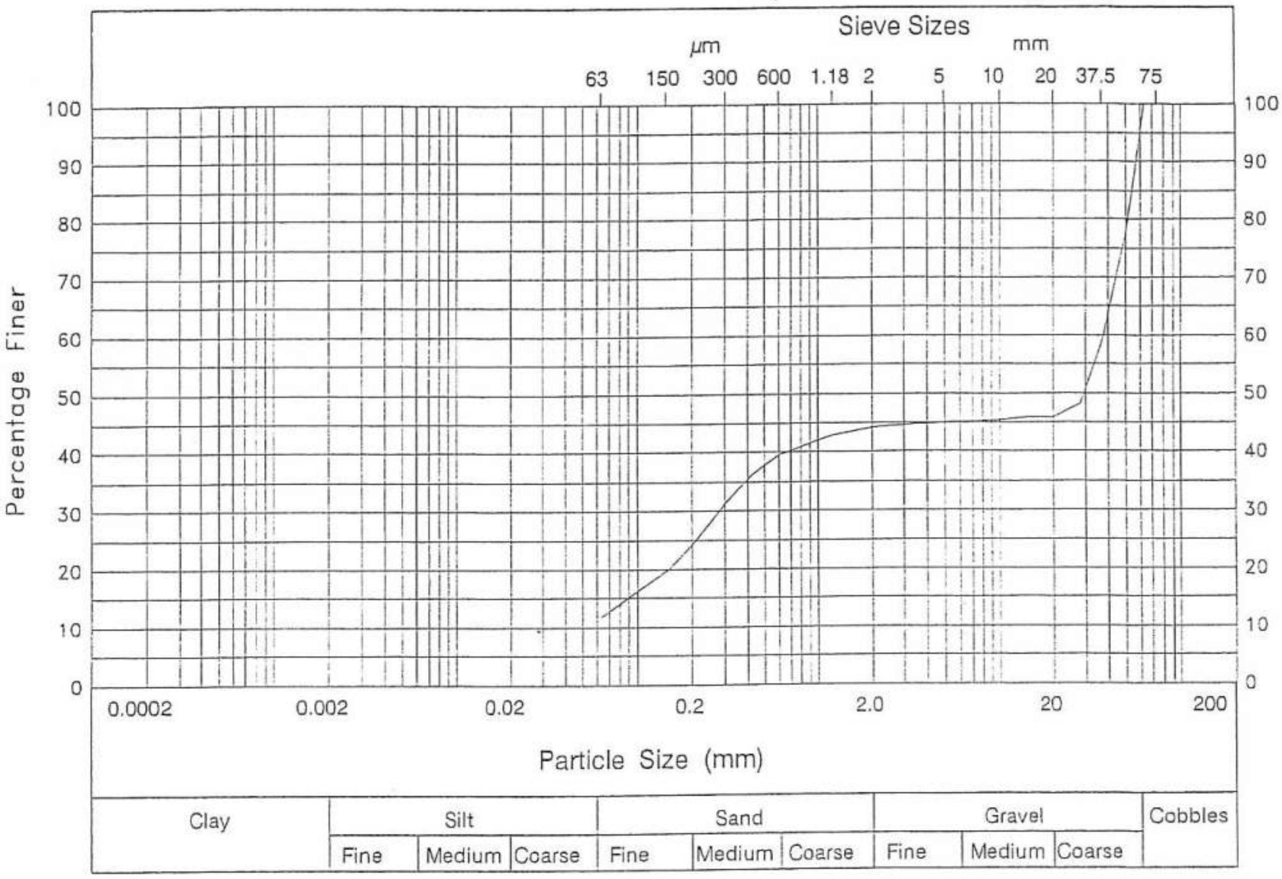
Clay	Silt			Sand			Gravel			Cobbles
	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	

Particle Size	% Passing	Particle Size	% Passing
20 mm	100	150 µm	36
14 mm	97	63 µm	21
10 mm	97	20 µm	15
6.3 mm	96	6 µm	11
5 mm	96	2 µm	7
3.35 mm	95		
2 mm	94		
1.18 mm	90		
600 µm	81		
425 µm	72		
300 µm	60		
212 µm	47		

Hole HD10	Description: Very silty gravelly SAND
Depth 0.15 -0.20	
Type D	
Test Performed: Wet	Uniformity Coefficient = 65

Form 25/4

Laboratory - Particle Size Plot	**Project** LLANWONNO TIPS Rhondda Cynon Taff	**Contract** 151258
Exploration Associates		**Sheet** P2/49

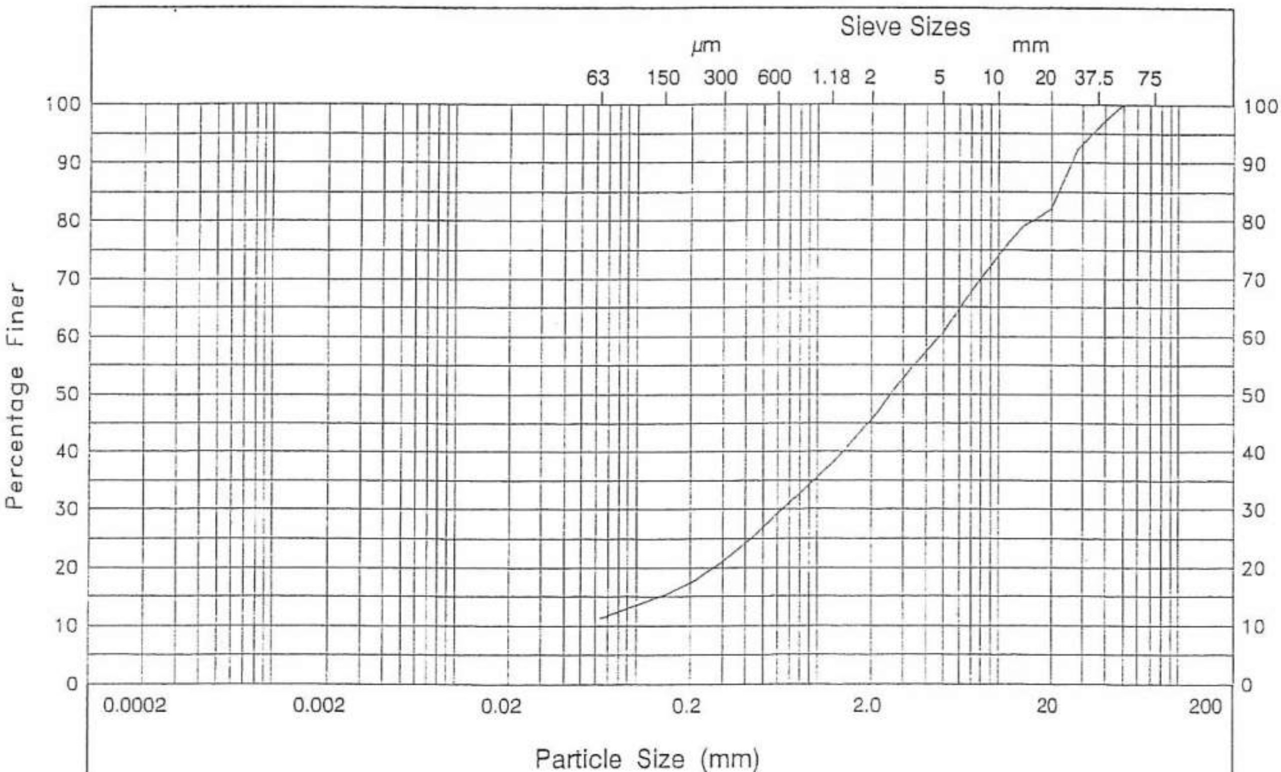


Particle Size	% Passing	Particle Size	% Passing
63 mm	100	600 µm	40
50 mm	77	425 µm	36
37.5 mm	60	300 µm	31
28 mm	48	212 µm	25
20 mm	46	150 µm	20
14 mm	46	63 µm	12
10 mm	45		
6.3 mm	45		
5 mm	45		
3.35 mm	45		
2 mm	44		
1.18 mm	43		

Hole HD10	**Description** Silty sandy GRAVEL
Depth 0.20 -0.25	
Type D	
Test Performed Wet	Uniformity Coefficient not applicable.

Form 25/4

Laboratory - Particle Size Plot	**Project** LLANWONNO TIPS Rhondda Cynon Taff	**Contract** 151258
Exploration Associates		**Sheet** P2/50



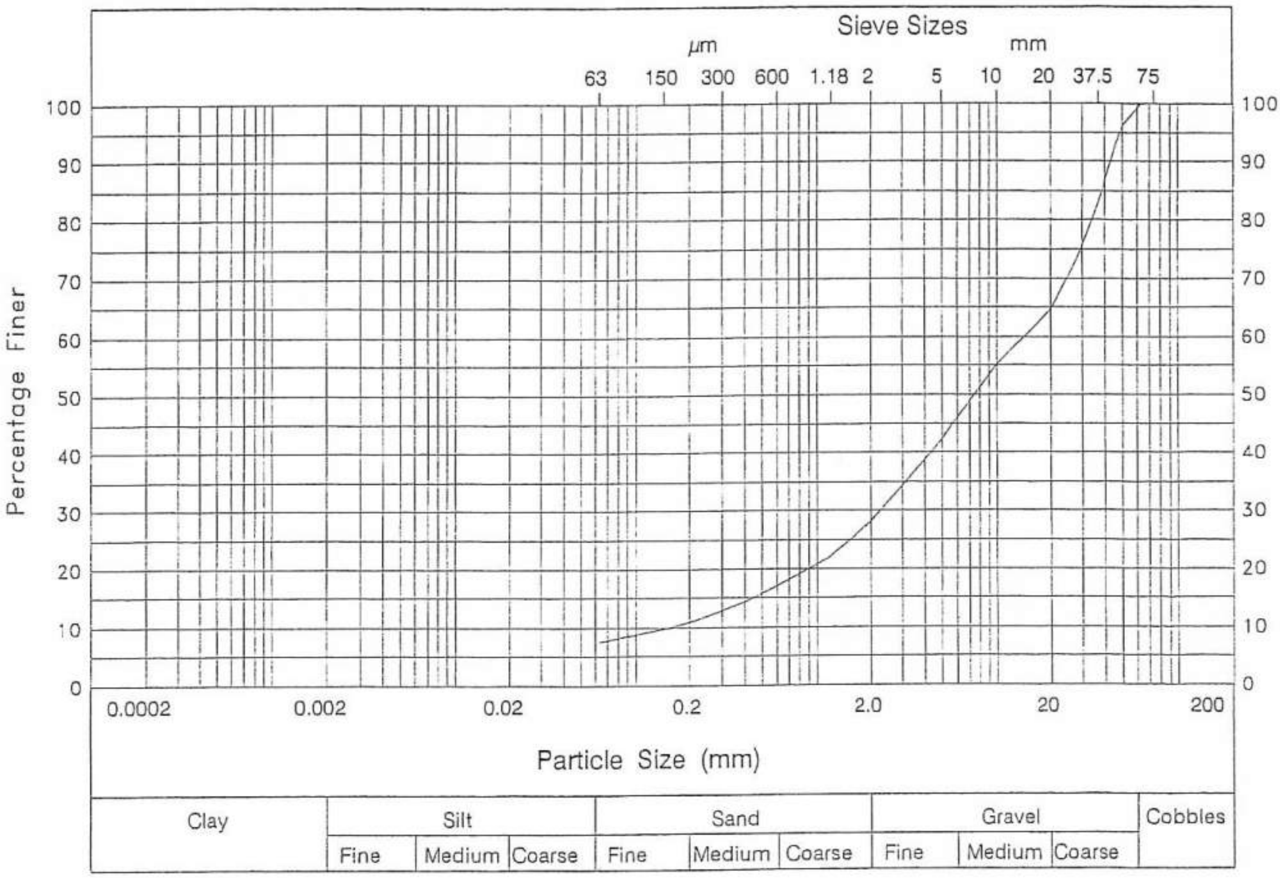
Clay	Silt			Sand			Gravel			Cobbles
	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	

Particle Size	% Passing	Particle Size	% Passing
50 mm	100	425 µm	25
37.5 mm	96	300 µm	21
28 mm	92	212 µm	18
20 mm	82	150 µm	16
14 mm	79	63 µm	11
10 mm	74		
6.3 mm	66		
5 mm	61		
3.35 mm	55		
2 mm	46		
1.18 mm	38		
600 µm	29		

Hole LWT2	Description: MADE GROUND: loose dark grey and black slightly clayey very sandy angular fine to coarse GRAVEL of mudstone and coal.
Depth 3.00 -3.45	
Type B	
Test Performed Wet	Uniformity Coefficient not applicable.

Form 25/4

Laboratory - Particle Size Plot	Project: LLANWONNO TIPS, Rhondda Cynon Taff	Contract: 151258
Exploration Associates		Sheet: P2/51

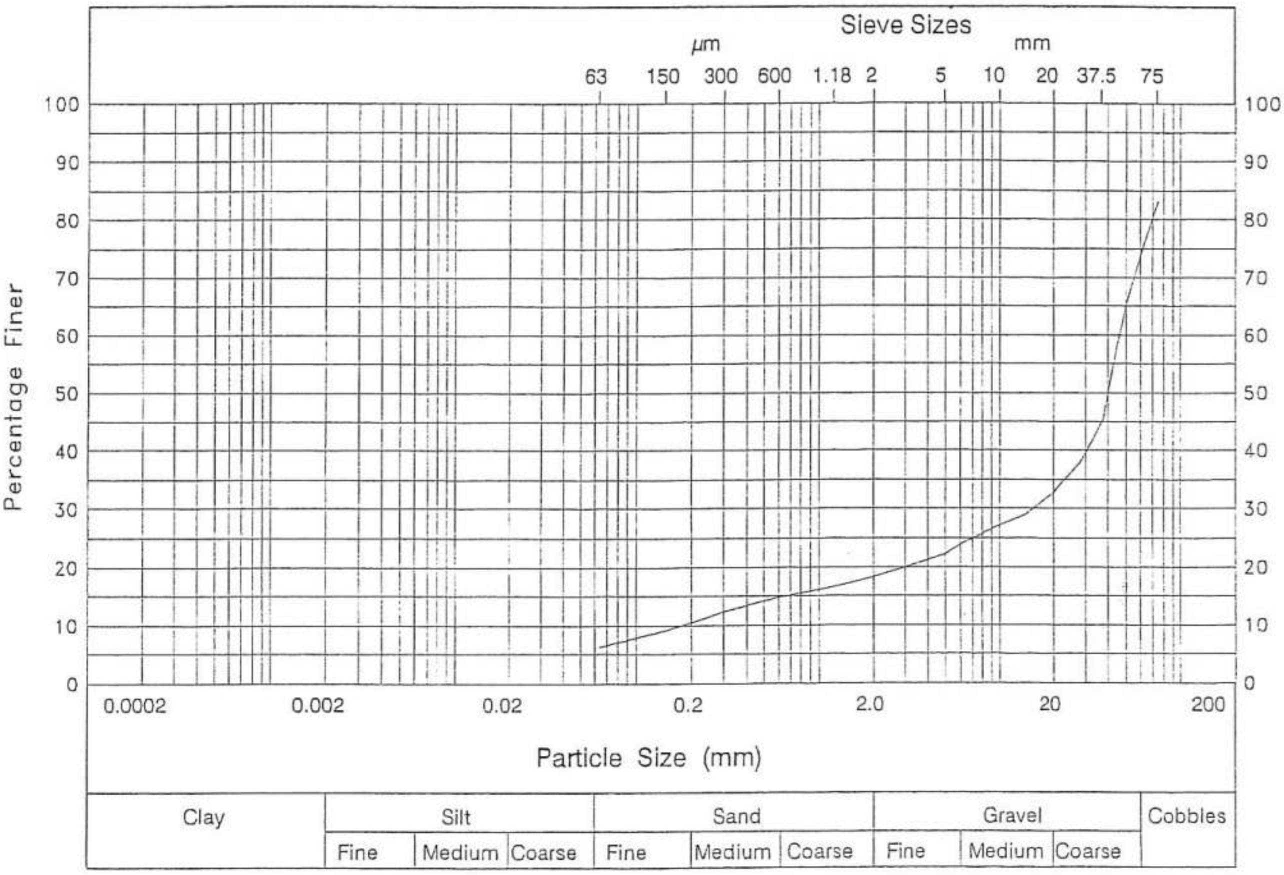


Particle Size	% Passing	Particle Size	% Passing
63 mm	100	600 µm	17
50 mm	96	425 µm	15
37.5 mm	84	300 µm	13
28 mm	73	212 µm	11
20 mm	65	150 µm	10
14 mm	60	63 µm	8
10 mm	55		
6.3 mm	47		
5 mm	42		
3.35 mm	36		
2 mm	28		
1.18 mm	22		

Hole LWT2	Description MADE GROUND: loose dark grey and black slightly clayey very sandy angular fine to coarse GRAVEL of mudstone and coal.
Depth 5.00 -5.45	
Type B	
Test Performed Wet	Uniformity Coefficient = 93

Form 25/4

Laboratory - Particle Size Plot	Project LLANWONNO TIPS Rhondda Cynon Taff	Contract 151258
Exploration Associates		Sheet P2/52

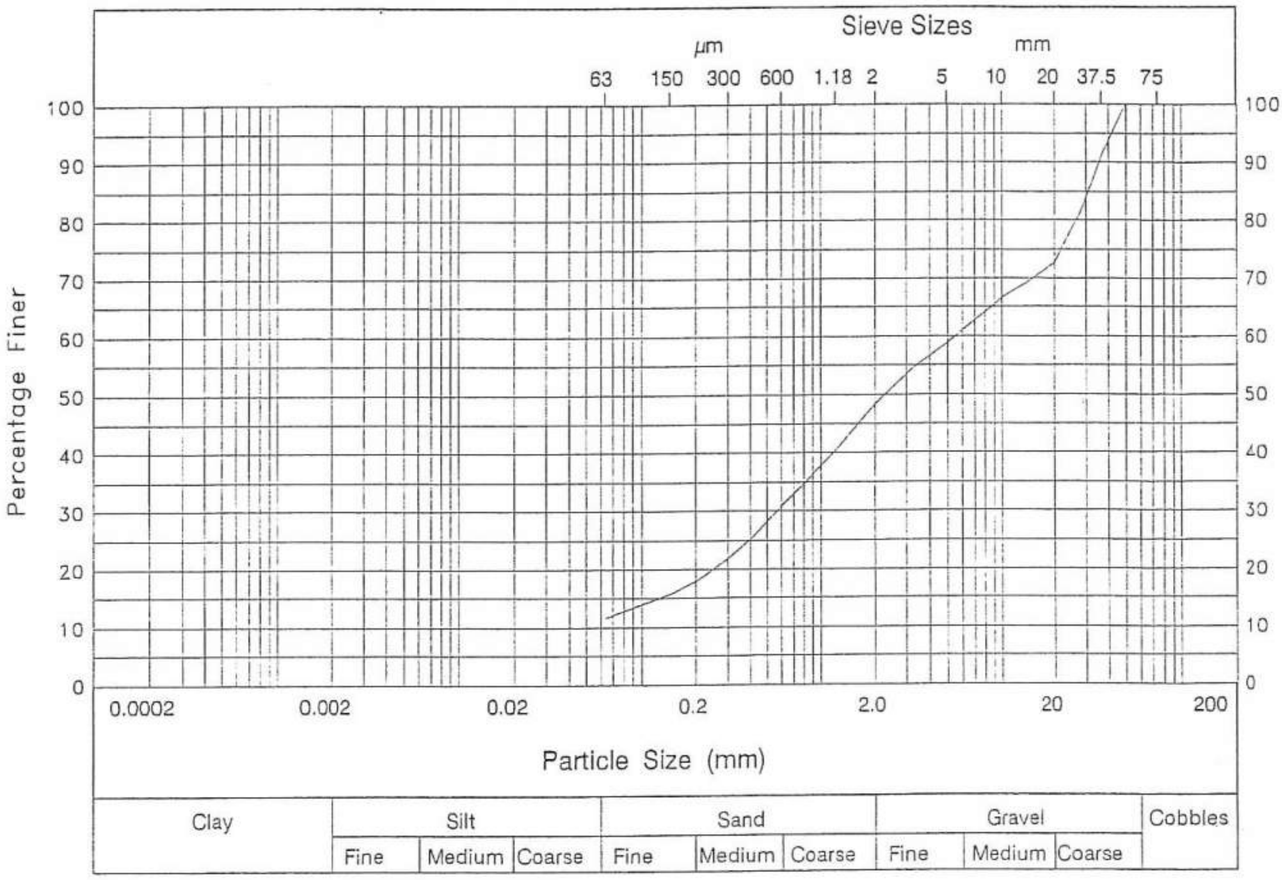


Particle Size	% Passing	Particle Size	% Passing
75 mm	83	1.18 mm	17
63 mm	76	600 µm	15
50 mm	65	425 µm	14
37.5 mm	45	300 µm	12
28 mm	38	212 µm	11
20 mm	33	150 µm	9
14 mm	29	63 µm	6
10 mm	27		
6.3 mm	24		
5 mm	22		
3.35 mm	20		
2 mm	18		

Hole LWT2	Description: Medium dense becoming dense dark orange brown slightly clayey sandy angular dominantly coarse GRAVEL with occasional subangular cobbles of siltstone and sandstone.
Depth 8.00 -8.45	
Type B	
Test Performed: Wet	Uniformity Coefficient = 254

Form 25/4

Laboratory - Particle Size Plot	**Project** LLANWONNO TIPS, Rhondda Cynon Taff	**Contract** 151258
Exploration Associates		**Sheet** P2/53

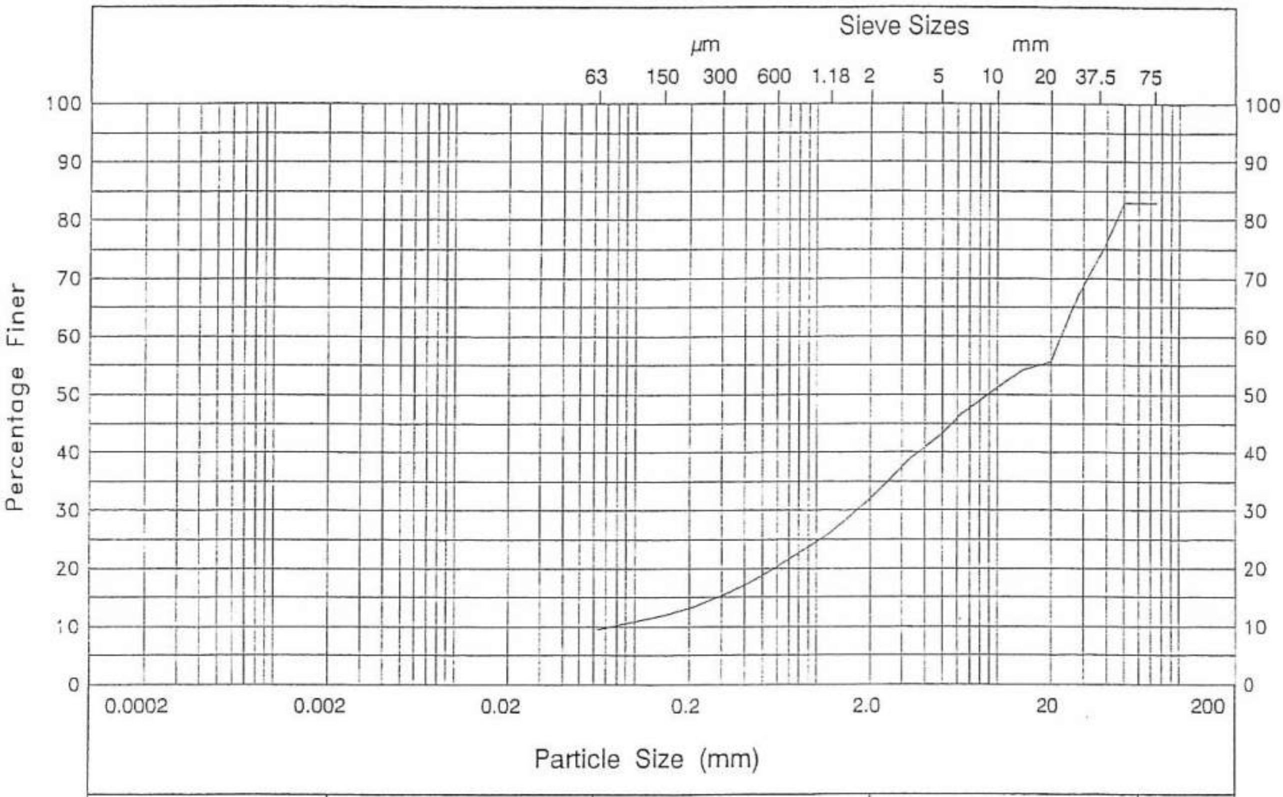


Particle Size	% Passing	Particle Size	% Passing
50 mm	100	425 μm	26
37.5 mm	92	300 μm	22
28 mm	82	212 μm	18
20 mm	73	150 μm	16
14 mm	69	63 μm	12
10 mm	67		
6.3 mm	62		
5 mm	59		
3.35 mm	55		
2 mm	48		
1.18 mm	40		
600 μm	31		

Hole LWT3	Description: MADE GROUND: medium dense dark grey and black clayey sandy angular fine to coarse GRAVEL with occasional subangular cobbles of mudstone and coal.
Depth 3.00 -3.45	
Type B	
Test Performed: Wet	Uniformity Coefficient not applicable.

Form 25/4

Laboratory - Particle Size Plot	**Project** LLANWONNO TIPS Rhondda Cynon Taff	**Contract** 151258
Exploration Associates		**Sheet** P2/54



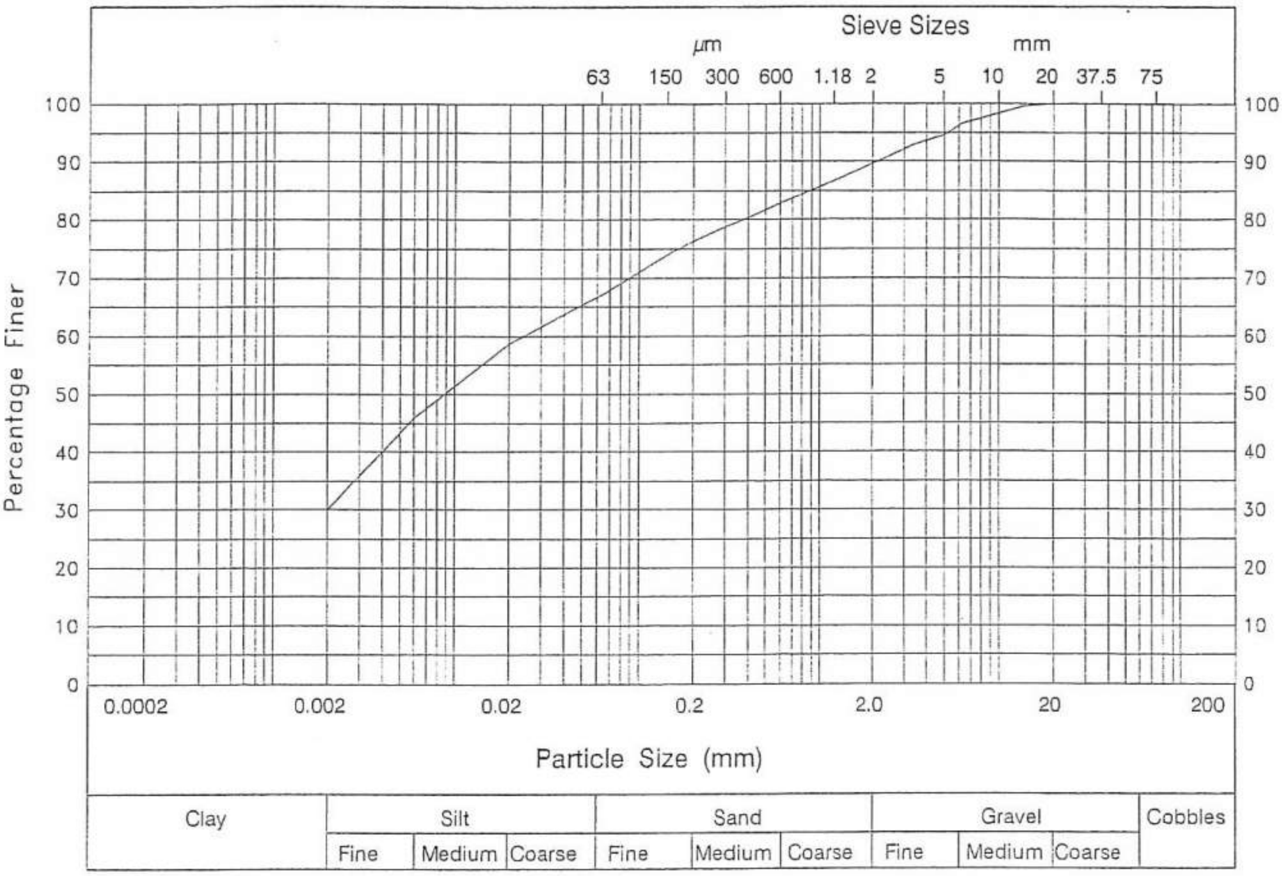
Clay	Silt			Sand			Gravel			Cobbles
	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	

Particle Size	% Passing	Particle Size	% Passing
75 mm	83	1.18 mm	26
63 mm	83	600 µm	20
50 mm	83	425 µm	17
37.5 mm	74	300 µm	15
28 mm	67	212 µm	13
20 mm	56	150 µm	12
14 mm	54	63 µm	10
10 mm	51		
6.3 mm	47		
5 mm	43		
3.35 mm	39		
2 mm	32		

Hole LWT3	Description MADE GROUND: Medium dense dark grey and black clayey sandy angular fine to coarse GRAVEL with occasional subangular cobbles of mudstone and coal.
Depth 7.75 -8.20	
Type B	
Test Performed Wet	Uniformity Coefficient = 359

Form 25/4

Laboratory - Particle Size Plot	**Project** LLANWONNO TIPS Rhondda Cynon Taff	**Contract** 151258
Exploration Associates		**Sheet** P2/55

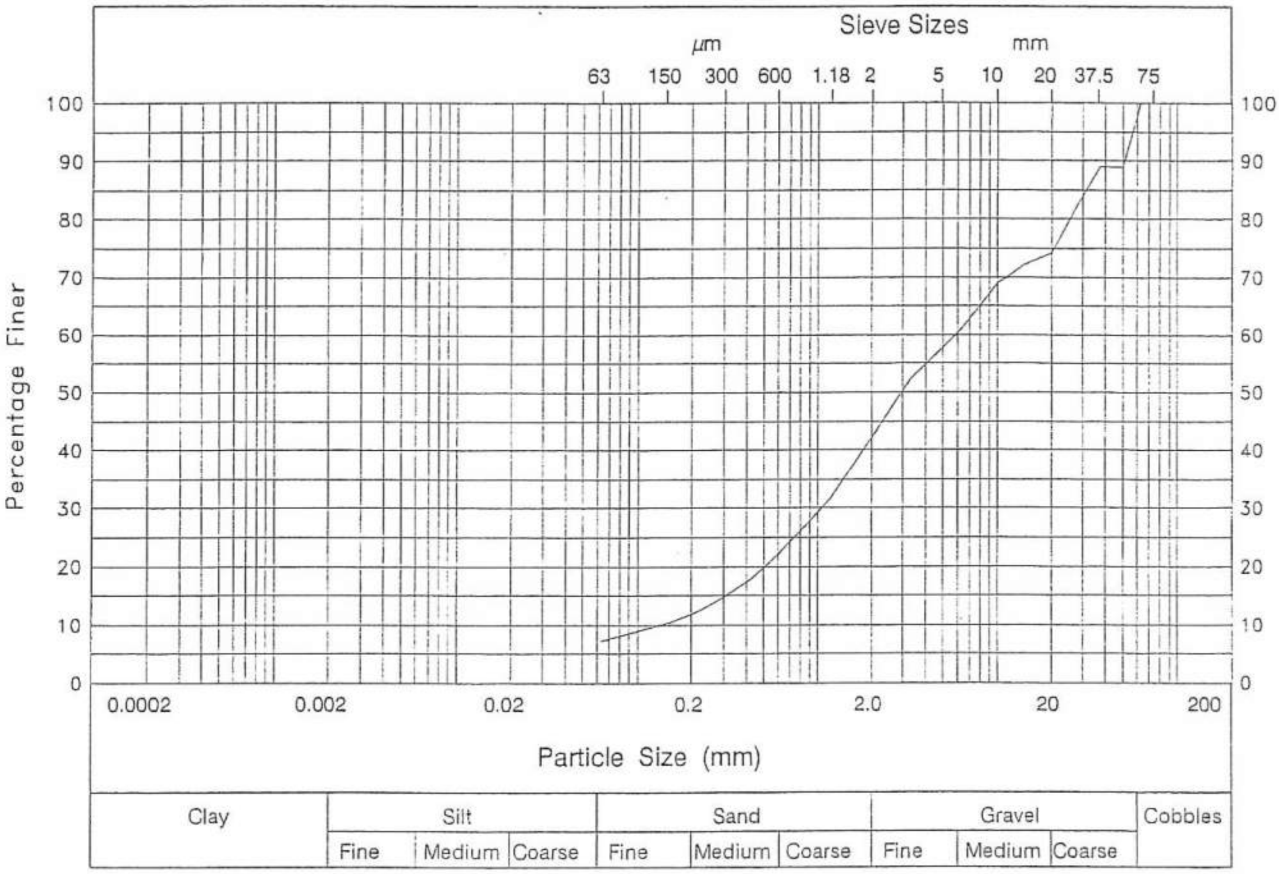


Particle Size	% Passing	Particle Size	% Passing
20 mm	100	150 µm	74
14 mm	100	63 µm	67
10 mm	98	20 µm	59
6.3 mm	97	6 µm	46
5 mm	95	2 µm	30
3.35 mm	93		
2 mm	90		
1.18 mm	87		
600 µm	83		
425 µm	81		
300 µm	79		
212 µm	77		

Hole LWT3	Description: Very stiff slightly sandy slightly gravelly SILT. Sand is fine to coarse gravel is angular to subangular fine to coarse of siltstone and sandstone.
Depth 10.80-11.00	
Type B	
Test Performed: Wet	Uniformity Coefficient not applicable.

Form 25/4

Laboratory - Particle Size Plot	**Project** LLANWONNO TIPS, Rhondda Cynon Taff	**Contract** 151258
Exploration Associates		**Sheet** P2/56

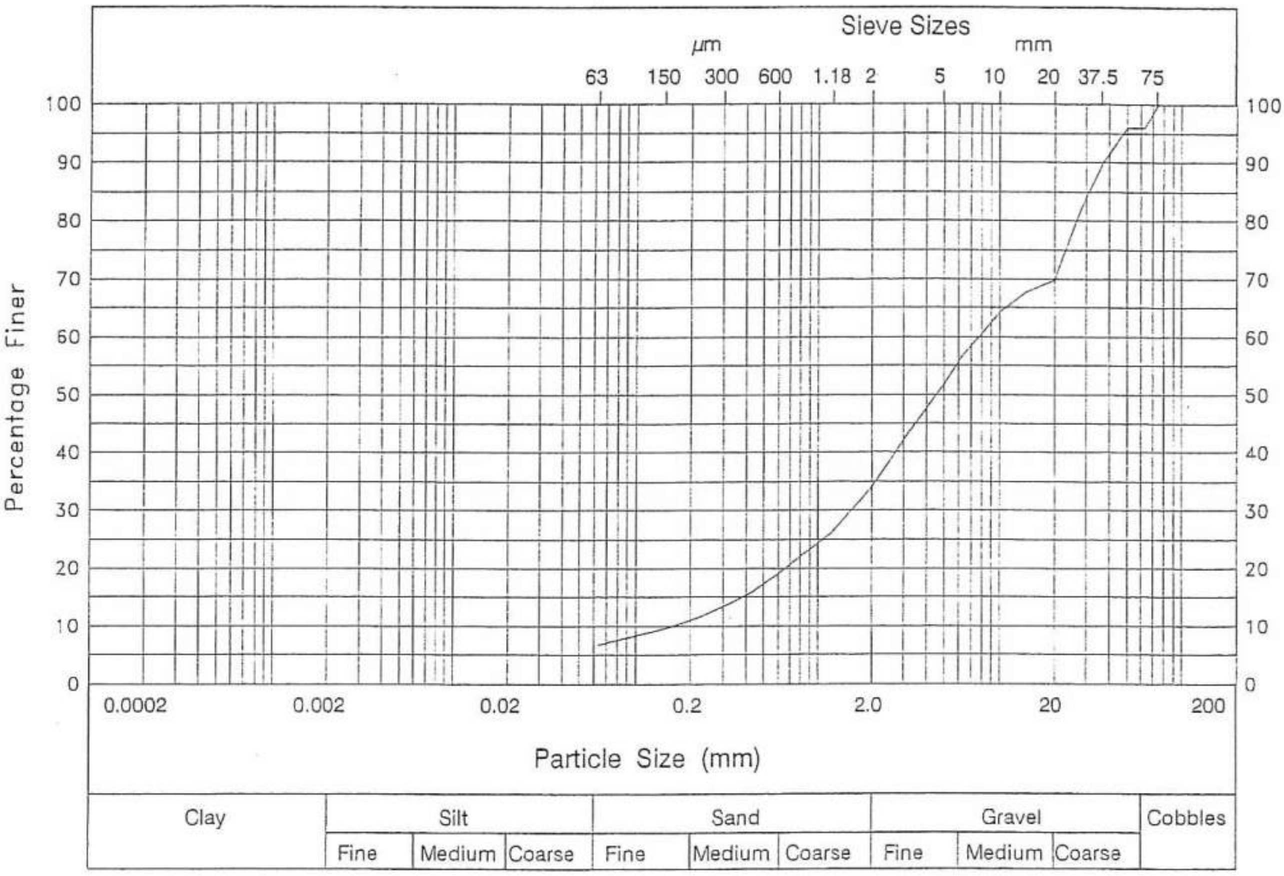


Particle Size	% Passing	Particle Size	% Passing
63 mm	100	600 µm	22
50 mm	89	425 µm	18
37.5 mm	89	300 µm	15
28 mm	82	212 µm	12
20 mm	74	150 µm	10
14 mm	72	63 µm	7
10 mm	69		
6.3 mm	61		
5 mm	58		
3.35 mm	52		
2 mm	42		
1.18 mm	32		

Hole LWT4	Description Medium dense dark grey slightly silty very sandy angular fine to coarse GRAVEL of mudstone and coal.
Depth 2.75 -3.25	
Type U	
Test Performed Wet	Uniformity Coefficient = 80

Form 25/4

Laboratory - Particle Size Plot	**Project** LLANWONNO TIPS Rhondda Cynon Taff	**Contract** 151258
Exploration Associates		**Sheet** P2/57

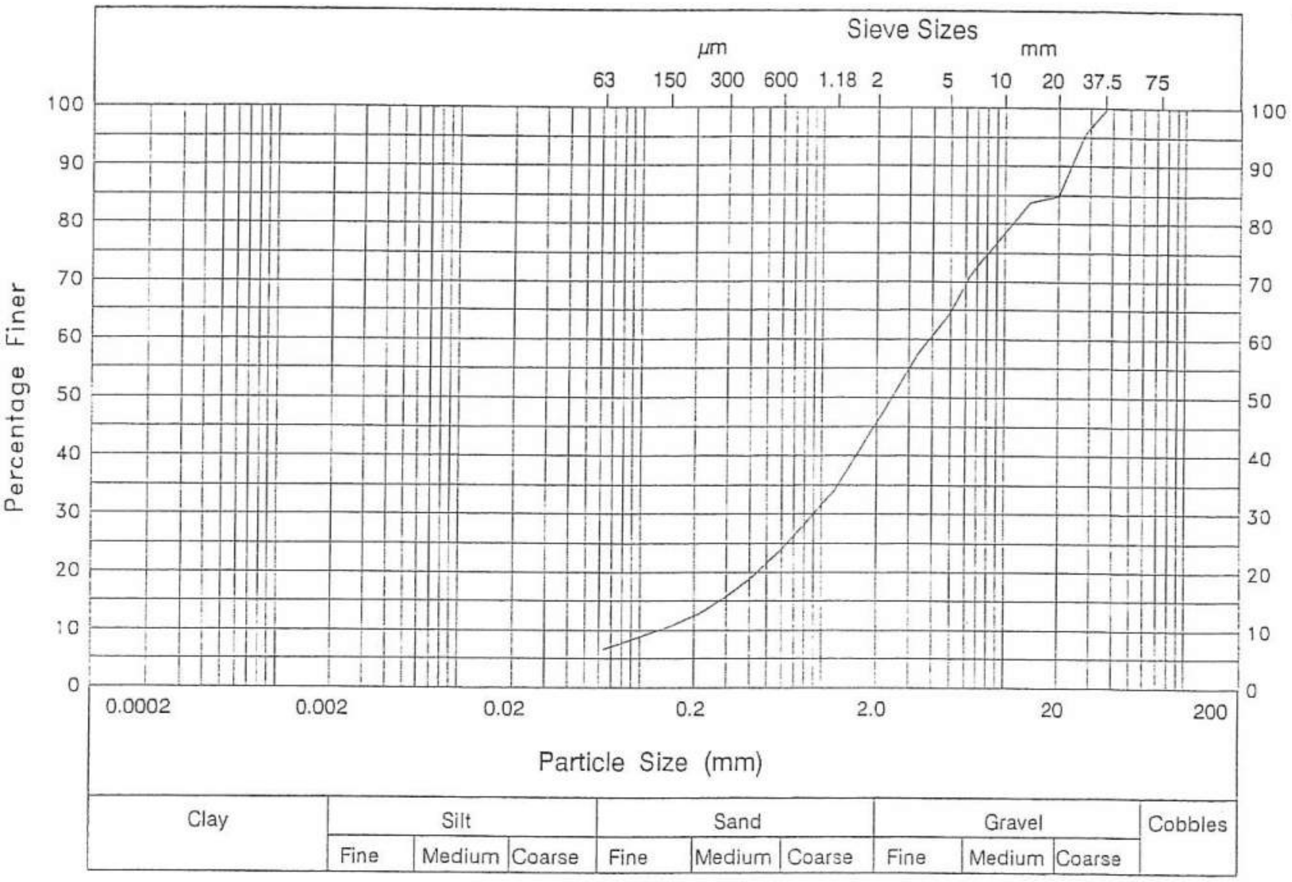


Particle Size	% Passing	Particle Size	% Passing
75 mm	100	1.18 mm	26
63 mm	96	600 μm	19
50 mm	96	425 μm	16
37.5 mm	90	300 μm	13
28 mm	82	212 μm	11
20 mm	70	150 μm	10
14 mm	68	63 μm	7
10 mm	64		
6.3 mm	57		
5 mm	52		
3.35 mm	44		
2 mm	34		

Hole LWT4	Description: Medium dense dark grey slightly silty sandy angular fine to coarse GRAVEL of mudstone and coal.
Depth 6.50 -6.95	
Type B	
Test Performed: Wet	Uniformity Coefficient = 51

Form 25/4

Laboratory - Particle Size Plot	**Project** LLANWONNO TIPS Rhondda Cynon Taff	**Contract** 151258
Exploration Associates		**Sheet** P2/58



Particle Size	% Passing	Particle Size	% Passing
37.5 mm	100	300 µm	16
28 mm	96	212 µm	13
20 mm	85	150 µm	11
14 mm	84	63 µm	7
10 mm	78		
6.3 mm	71		
5 mm	65		
3.35 mm	58		
2 mm	46		
1.18 mm	34		
600 µm	24		
425 µm	19		

Hole
LWT4

Depth
7.25 -7.75

Type
U

Description
Medium dense dark grey slightly silty sandy angular fine to coarse GRAVEL of mudstone and coal.

Test Performed
Wet

Uniformity Coefficient = 52

Form 25/4

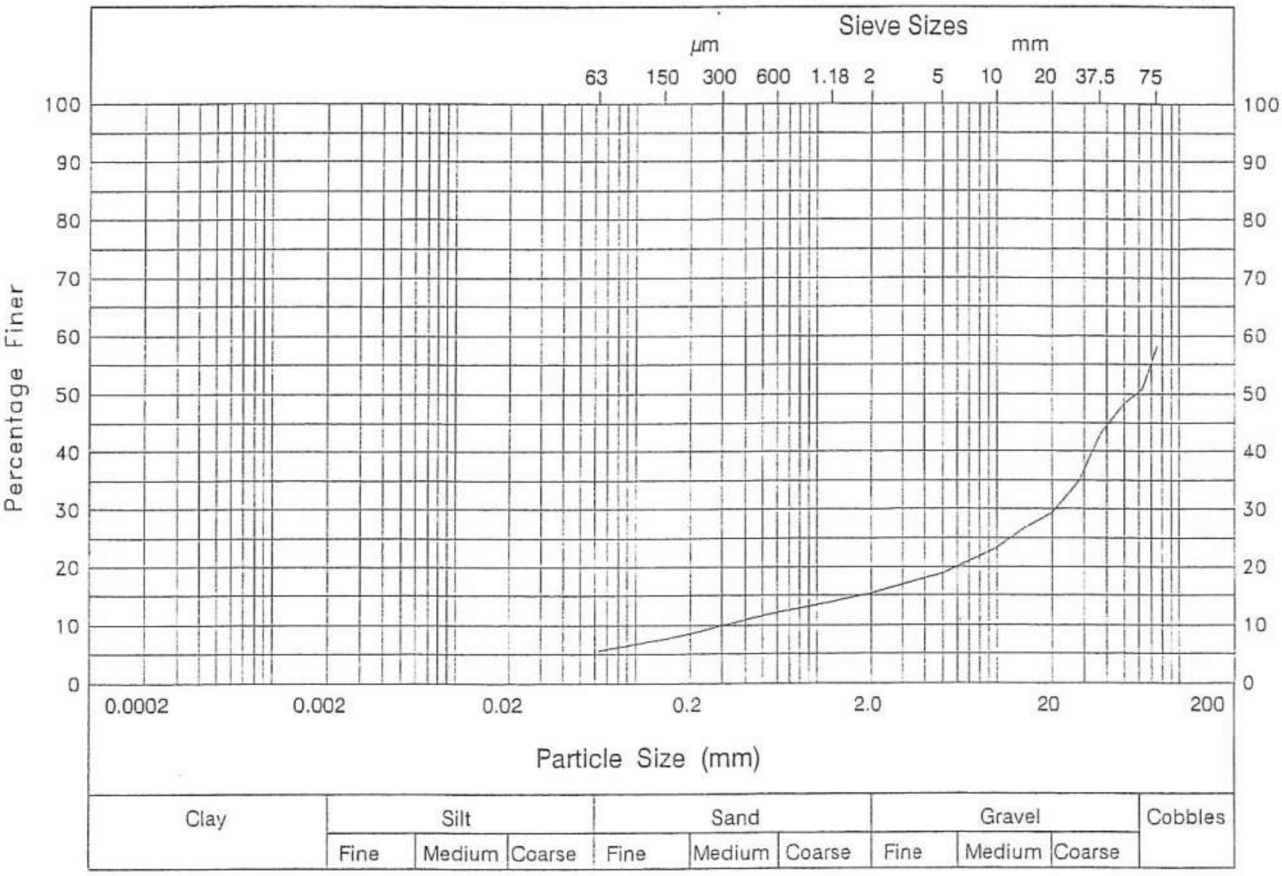
Laboratory - Particle Size Plot

Exploration Associates

Project
LLANWONNO TIPS
Rhondda Cynon Taff

Contract
151258

Sheet
P2/59

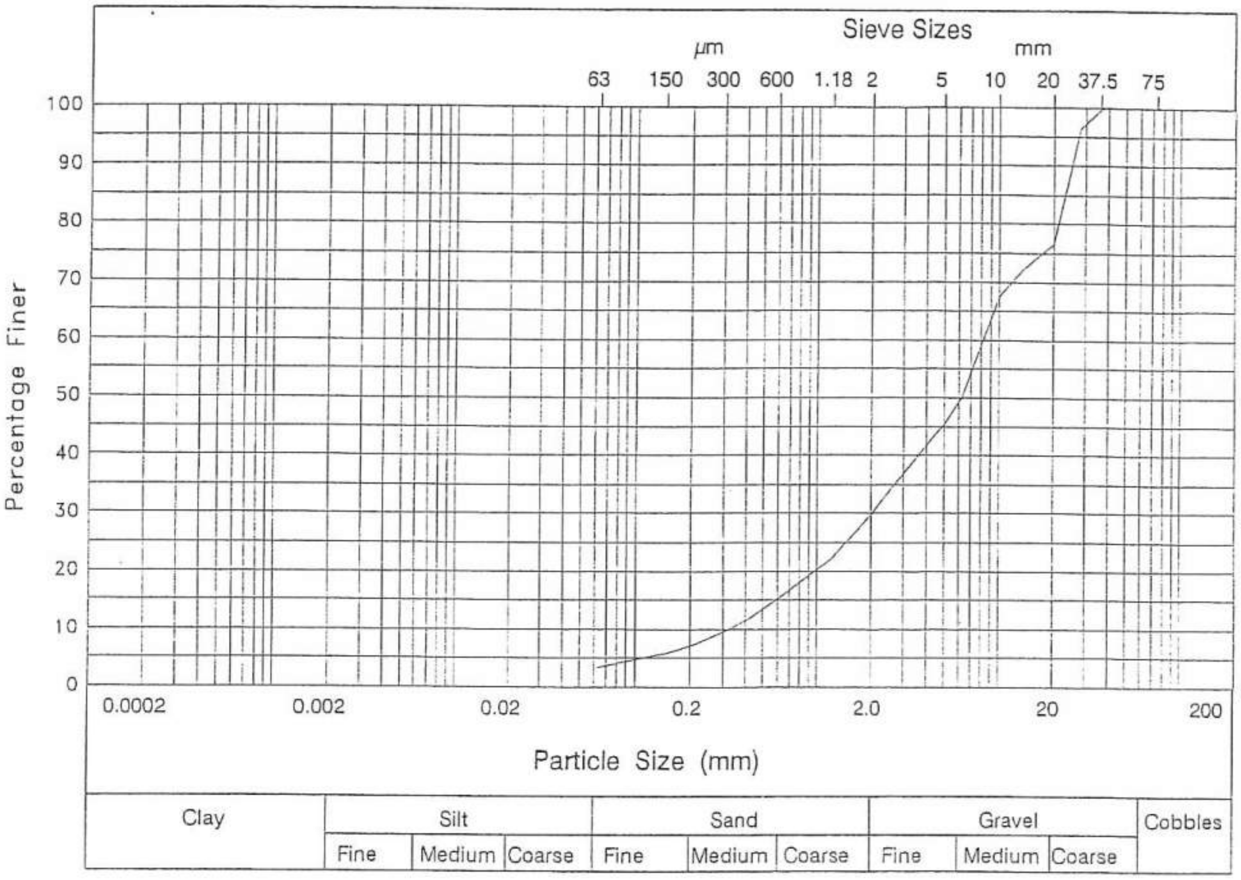


Particle Size	% Passing	Particle Size	% Passing
75 mm	58	1.18 mm	14
63 mm	51	600 µm	12
50 mm	48	425 µm	11
37.5 mm	43	300 µm	10
28 mm	35	212 µm	9
20 mm	29	150 µm	8
14 mm	27	63 µm	6
10 mm	23		
6.3 mm	20		
5 mm	19		
3.35 mm	17		
2 mm	15		

Hole LWT4	Description: Medium dense orange brown slightly silty sandy angular fine to coarse GRAVEL of siltstone and sandstone.
Depth 8.75 -9.20	
Type B	
Test Performed Wet	Uniformity Coefficient = 252

Form 25/4

Laboratory - Particle Size Plot	Project: LLANWONNO TIPS, Rhondda Cynon Taff	Contract: 151258
Exploration Associates		Sheet: P2/60

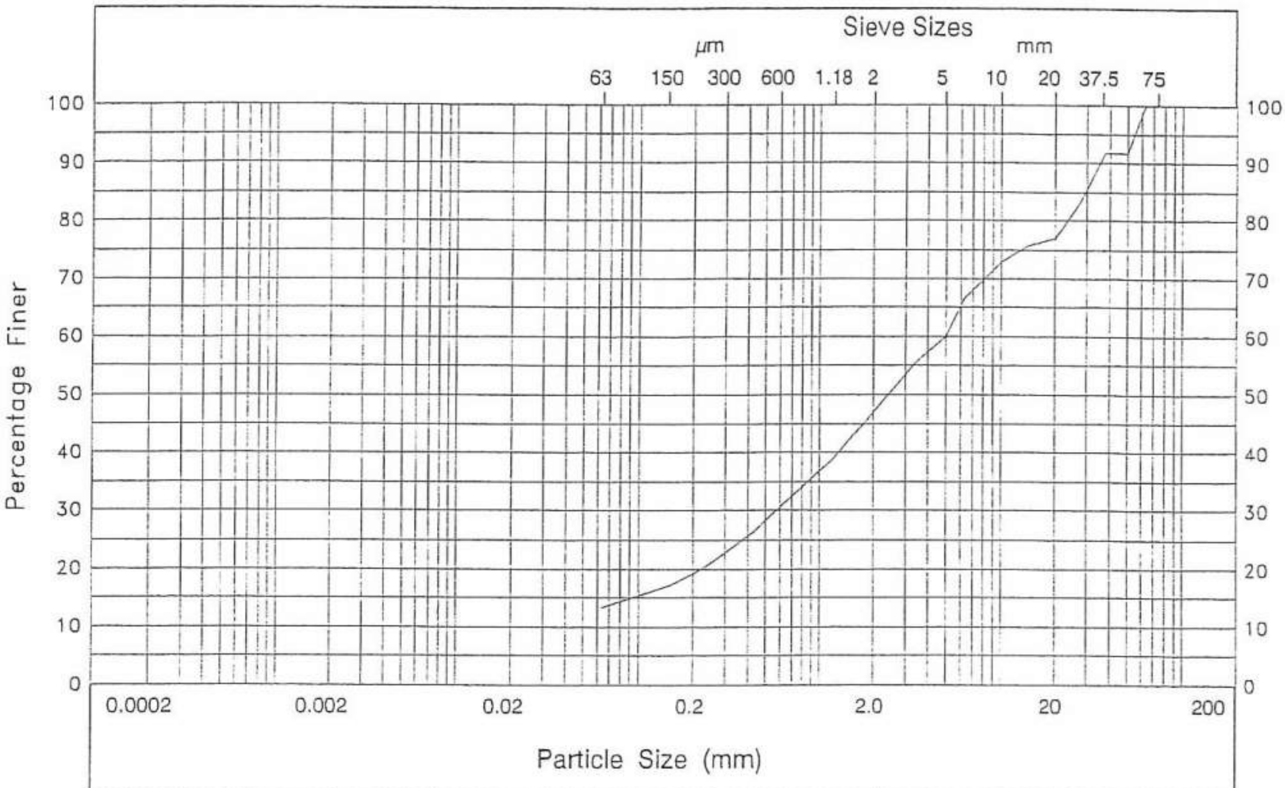


Particle Size	% Passing	Particle Size	% Passing
37.5 mm	100	300 µm	10
28 mm	96	212 µm	7
20 mm	77	150 µm	6
14 mm	72	63 µm	3
10 mm	67		
6.3 mm	50		
5 mm	45		
3.35 mm	39		
2 mm	30		
1.18 mm	22		
600 µm	15		
425 µm	12		

Hole LWT5	Description MADE GROUND: medium dense light and dark orange brown very silty very sandy GRAVEL. Sand is fine to coarse, gravel is subangular to subrounded of mudstone siltstone sandstone and ironstone
Depth 10.50-11.00	
Type U	
Test Performed Wet	Uniformity Coefficient = 27

Form 25/4

Laboratory - Particle Size Plot	**Project** LLANWONNO TIPS Rhondda Cynon Taff	**Contract** 151258
Exploration Associates		**Sheet** P2/61



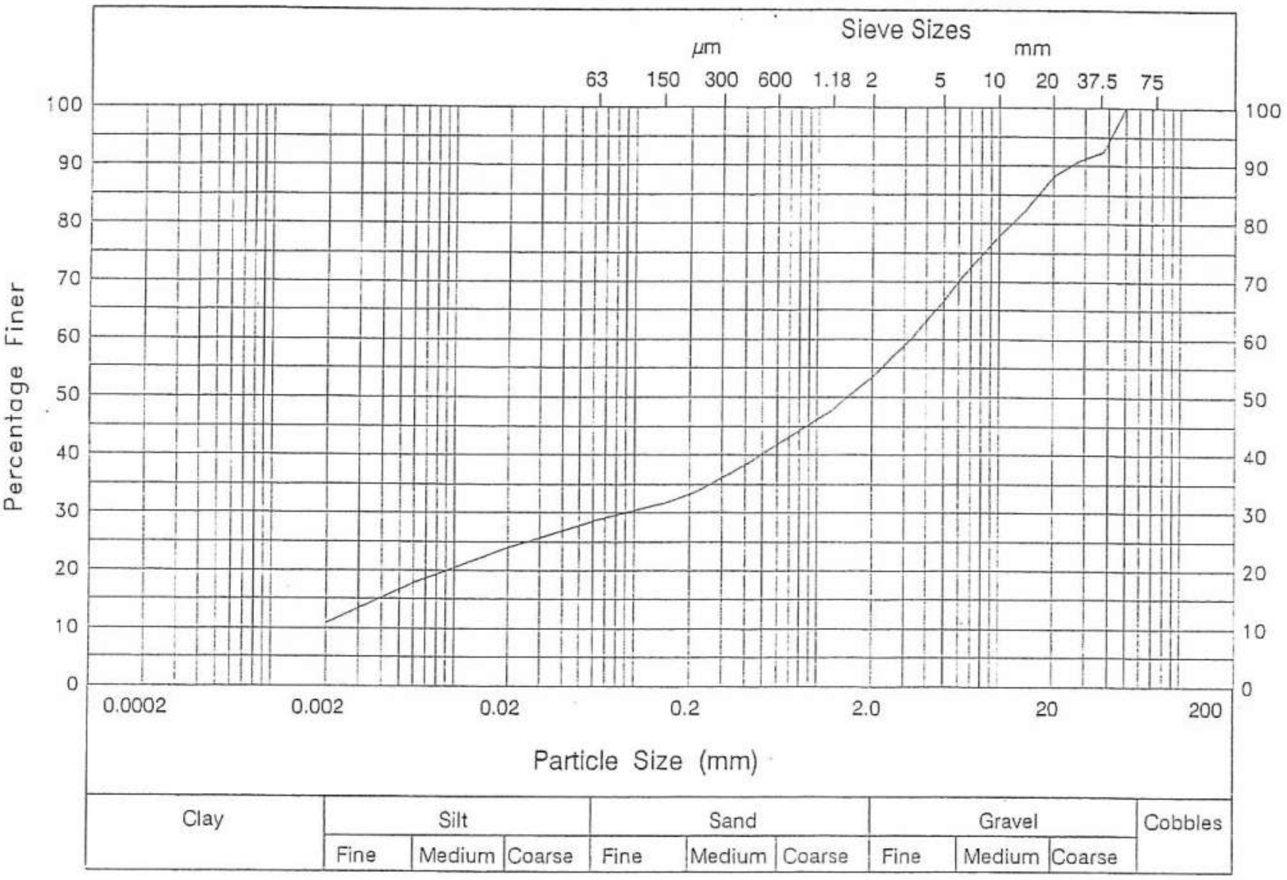
Clay	Silt			Sand			Gravel			Cobbles
	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	

Particle Size	% Passing	Particle Size	% Passing
63 mm	100	600 μm	31
50 mm	92	425 μm	26
37.5 mm	92	300 μm	23
28 mm	84	212 μm	20
20 mm	77	150 μm	17
14 mm	76	63 μm	13
10 mm	73		
6.3 mm	67		
5 mm	60		
3.35 mm	55		
2 mm	47		
1.18 mm	39		

Hole LWT5	Description Medium dense gravelly very sandy SILT, very silty SAND.
Depth 11.20-11.65	
Type B	
Test Performed Wet	Uniformity Coefficient not applicable.

Form 25/4

Laboratory - Particle Size Plot	Project LLANWONNO TIPS Rhondda Cynon Taff	Contract 151258
Exploration Associates		Sheet P2/62

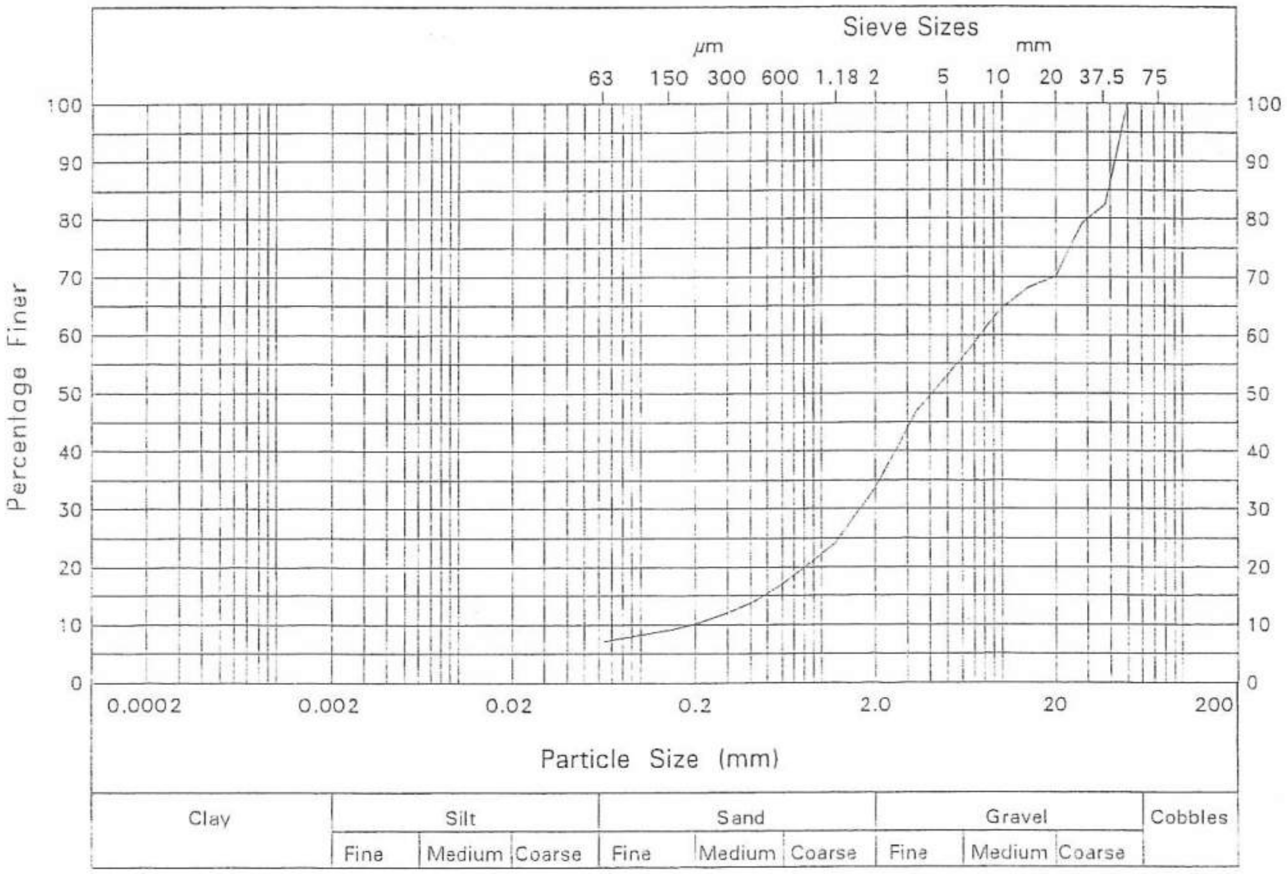


Particle Size	% Passing	Particle Size	% Passing
50 mm	100	425 µm	39
37.5 mm	92	300 µm	36
28 mm	91	212 µm	34
20 mm	88	150 µm	32
14 mm	82	63 µm	29
10 mm	78	20 µm	24
6.3 mm	71	6 µm	18
5 mm	67	2 µm	11
3.35 mm	61		
2 mm	53		
1.18 mm	48		
600 µm	42		

Hole LWT5	Description Firm orange brown mottled grey slightly sandy slightly gravelly CLAY. Sand is fine to coarse, gravel is angular fine to coarse of siltstone and sandstone.
Depth 13.50-14.00	
Type U	
Test Performed Wet	Uniformity Coefficient not applicable.

Form 25/4

Laboratory - Particle Size Plot	Project LLANWONNO TIPS Rhondda Cynon Taff	Contract 151258
Exploration Associates		Sheet P2/63

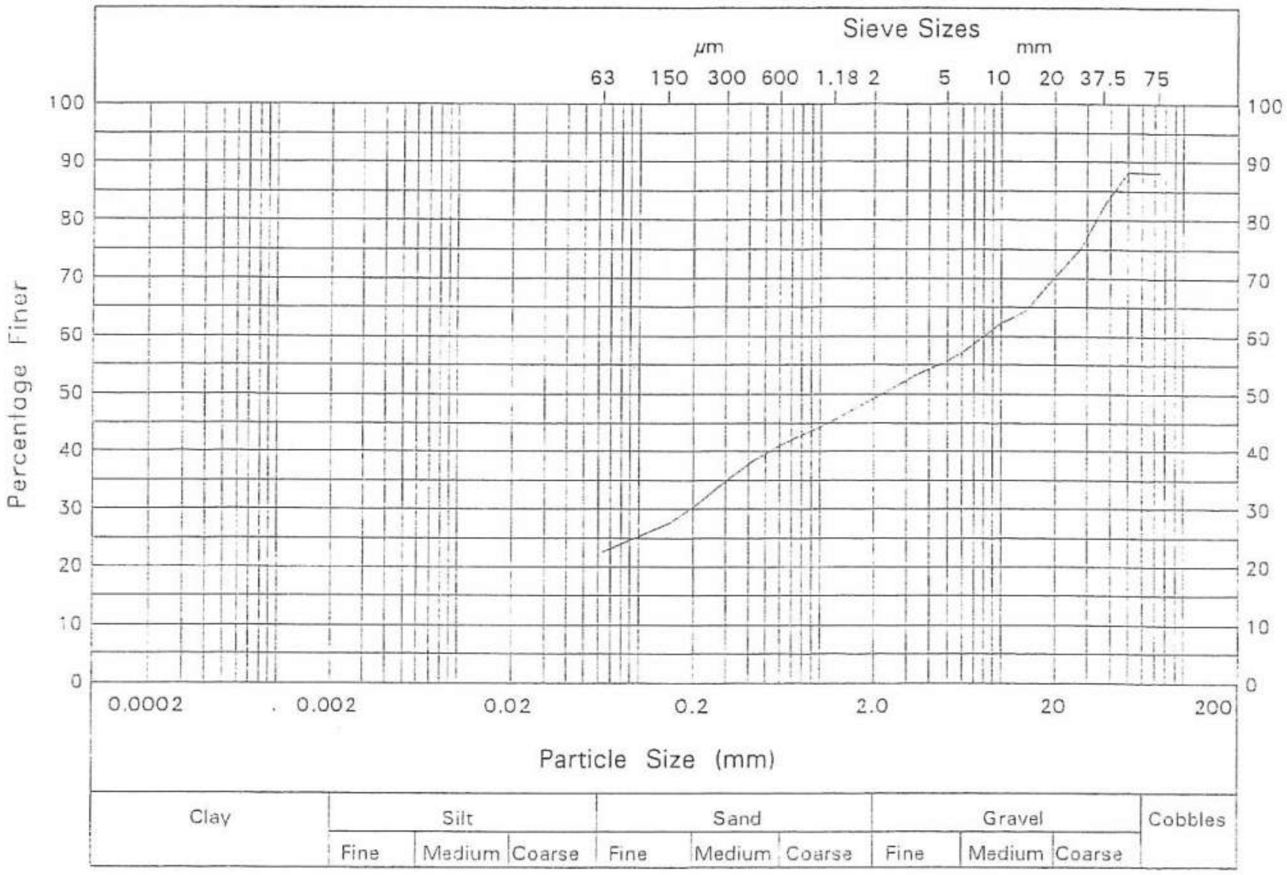


Particle Size	% Passing	Particle Size	% Passing
50 mm	100	425 µm	14
37.5 mm	82	300 µm	12
28 mm	79	212 µm	10
20 mm	70	150 µm	9
14 mm	68	63 µm	7
10 mm	65		
6.3 mm	57		
5 mm	53		
3.35 mm	47		
2 mm	34		
1.18 mm	24		
600 µm	17		

Hole LWT6 Depth 1.75 -2.25 Type U	Description MADE GROUND: very loose dark grey and black slightly silty very sandy angular fine to coarse gravel of mudstone and coal.
Test Performed Wet	Uniformity Coefficient = 39

Form 25/4

Laboratory - Particle Size Plot	Project LLANWONNO TIPS Rhondda Cynon Taff	Contract 151258
Exploration Associates		Sheet P2/64

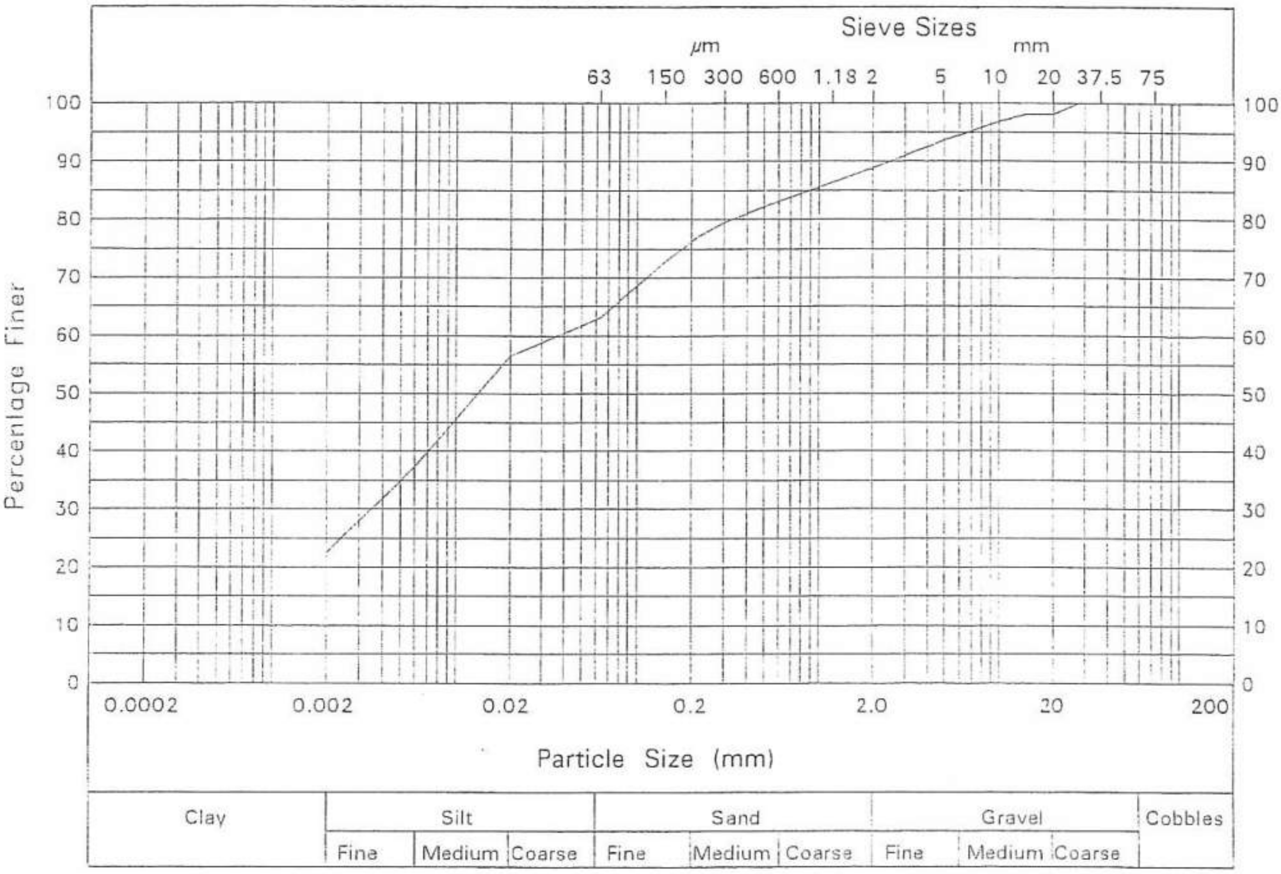


Particle Size	% Passing	Particle Size	% Passing
75 mm	88	1.18 mm	45
63 mm	88	600 μm	41
50 mm	88	425 μm	38
37.5 mm	83	300 μm	35
28 mm	75	212 μm	31
20 mm	70	150 μm	28
14 mm	65	63 μm	23
10 mm	62		
6.3 mm	58		
5 mm	56		
3.35 mm	53		
2 mm	49		

Hole LWT6 Depth 8.50 -9.00 Type U	Description Stiff grey mottled brown slightly sandy gravelly CLAY. Sand is fine to coarse gravel is angular fine to coarse of mudstone siltstone and sandstone.
Test Performed Wet	Uniformity Coefficient not applicable.

Form 25/4

Laboratory - Particle Size Plot	Project LLANWONNO TIPS Rhondda Cynon Taff	Contract 151258
Exploration Associates		Sheet P2/65

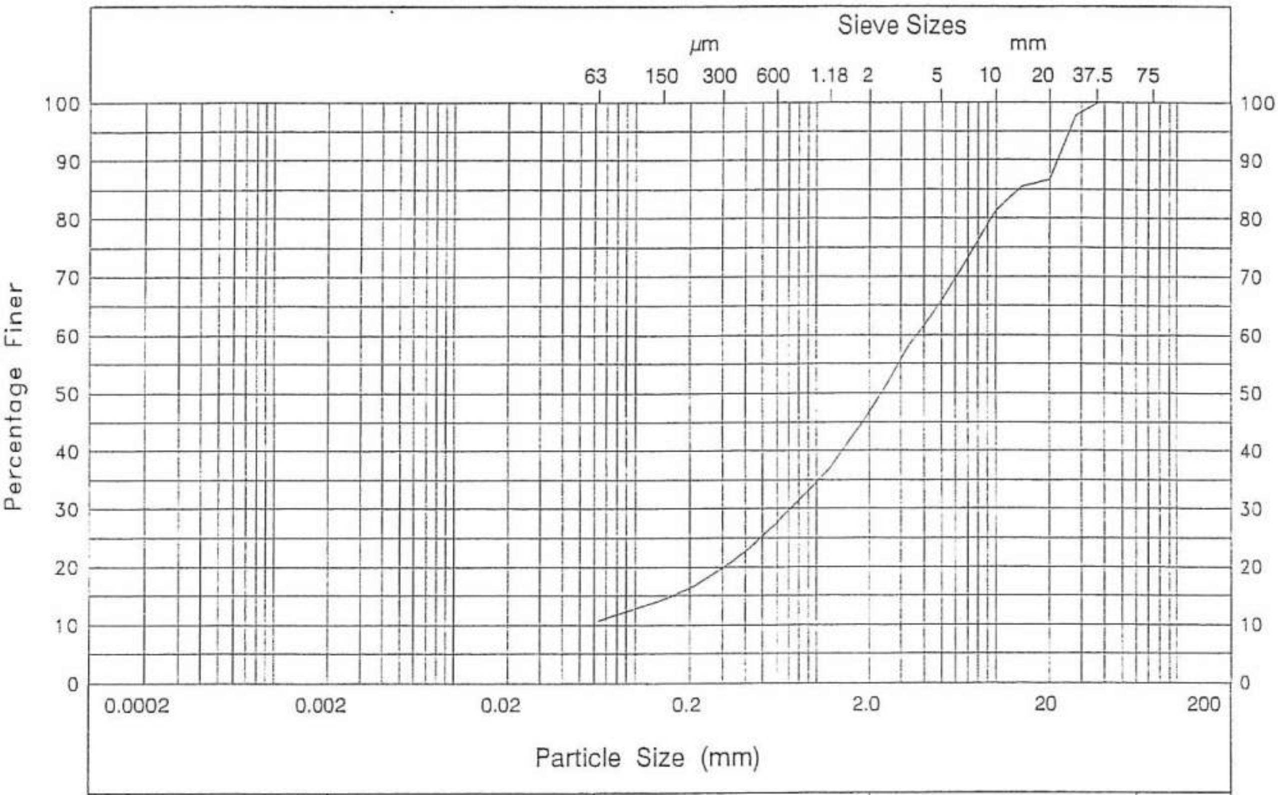


Particle Size	% Passing	Particle Size	% Passing
28 mm	100	212 µm	77
20 mm	98	150 µm	73
14 mm	98	63 µm	63
10 mm	97	20 µm	56
6.3 mm	95	6 µm	37
5 mm	94	2 µm	22
3.35 mm	92		
2 mm	89		
1.18 mm	86		
600 µm	83		
425 µm	81		
300 µm	79		

Hole LWT6 Depth 10.50-11.00 Type U	Description Stiff light and dark orange brown slightly sandy slightly gravelly SILT sand is fine to coarse gravel is rounded to subangular of siltstone and sandstone.
Test Performed Wet	Uniformity Coefficient not applicable.

Form 25/4

Laboratory - Particle Size Plot	Project LLANWONNO TIPS Rhondda Cynon Taff	Contract 151258
Exploration Associates		Sheet P2/66



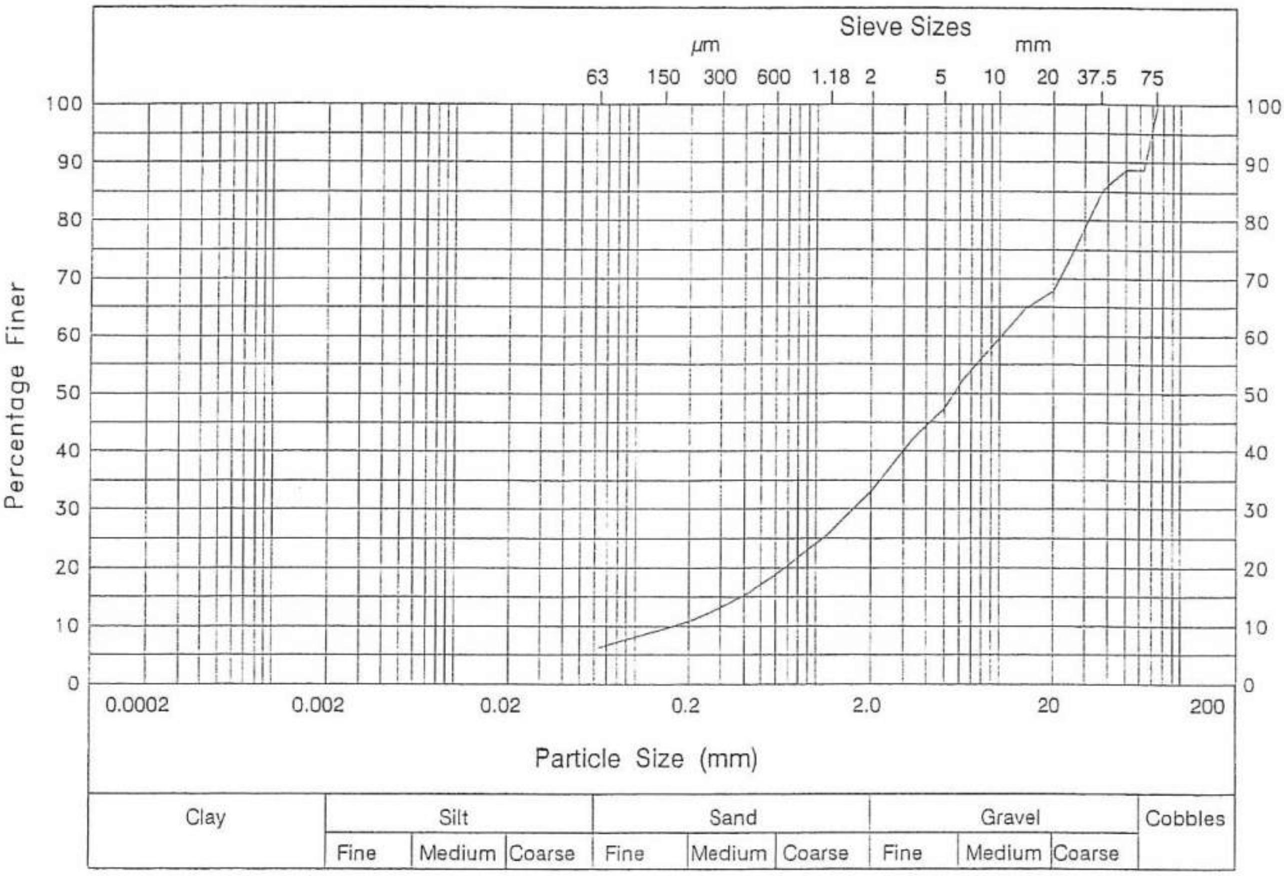
Clay	Silt			Sand			Gravel			Cobbles
	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	

Particle Size	% Passing	Particle Size	% Passing
37.5 mm	100	300 µm	20
28 mm	98	212 µm	17
20 mm	87	150 µm	15
14 mm	85	63 µm	11
10 mm	81		
6.3 mm	71		
5 mm	66		
3.35 mm	58		
2 mm	47		
1.18 mm	37		
600 µm	28		
425 µm	23		

Hole LWT7	Description
Depth 2.00 -2.45	Loose becoming medium dense dark grey and black slightly silty sandy angular fine to coarse GRAVEL of ash coal and sandstone.
Type B	
Test Performed Wet	Uniformity Coefficient not applicable.

Form 25/4

Laboratory - Particle Size Plot	**Project** LLANWONNO TIPS Rhondda Cynon Taff	**Contract** 151258
Exploration Associates		**Sheet** P2/67

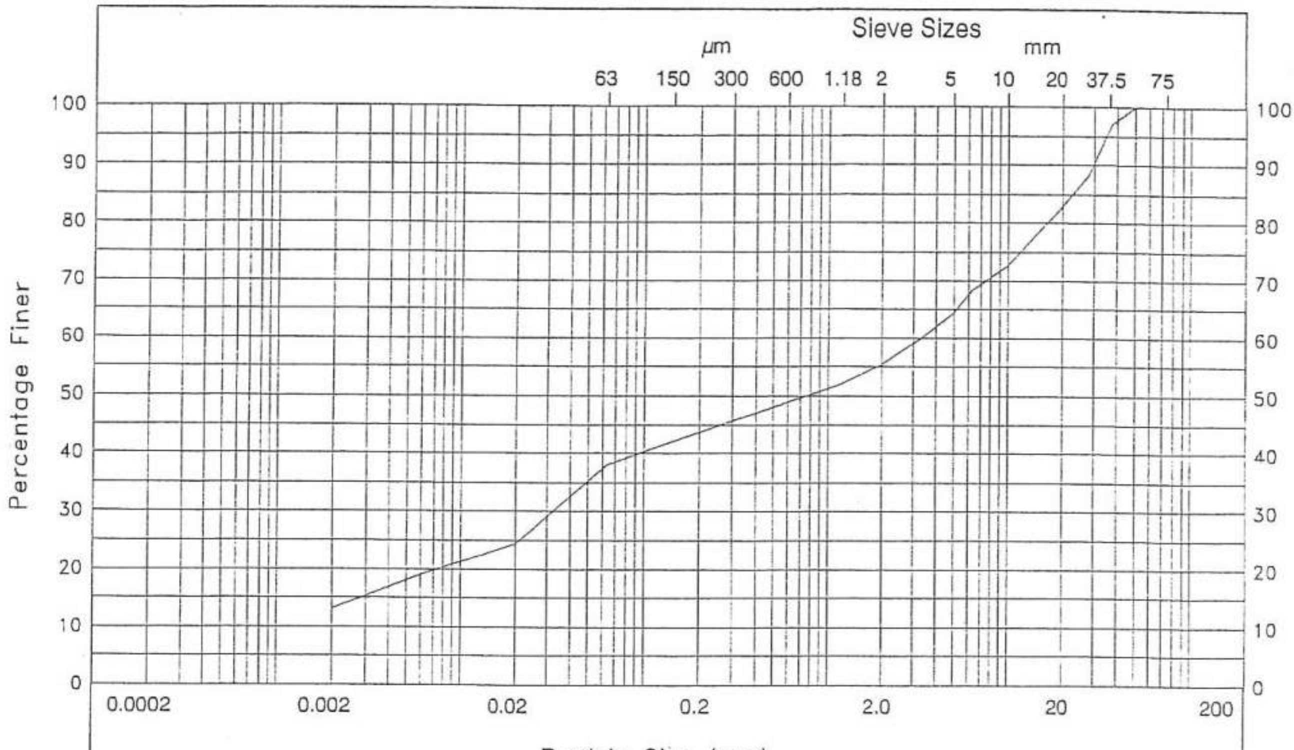


Particle Size	% Passing	Particle Size	% Passing
75 mm	100	1.18 mm	26
63 mm	89	600 μm	19
50 mm	89	425 μm	16
37.5 mm	85	300 μm	13
28 mm	77	212 μm	11
20 mm	68	150 μm	10
14 mm	65	63 μm	6
10 mm	60		
6.3 mm	52		
5 mm	47		
3.35 mm	42		
2 mm	33		

Hole: LWT7	Description: Loose becoming medium dense dark grey and black slightly clayey sandy angular fine to coarse GRAVEL of ash coal and sandstone.
Depth: 5.00 -5.45	
Type: B	
Test Performed: Wet	Uniformity Coefficient = 67

Form 25/4

Laboratory - Particle Size Plot	Project: LLANWONNO TIPS, Rhondda Cynon Taff	Contract: 151258
Exploration Associates		Sheet: P2/68



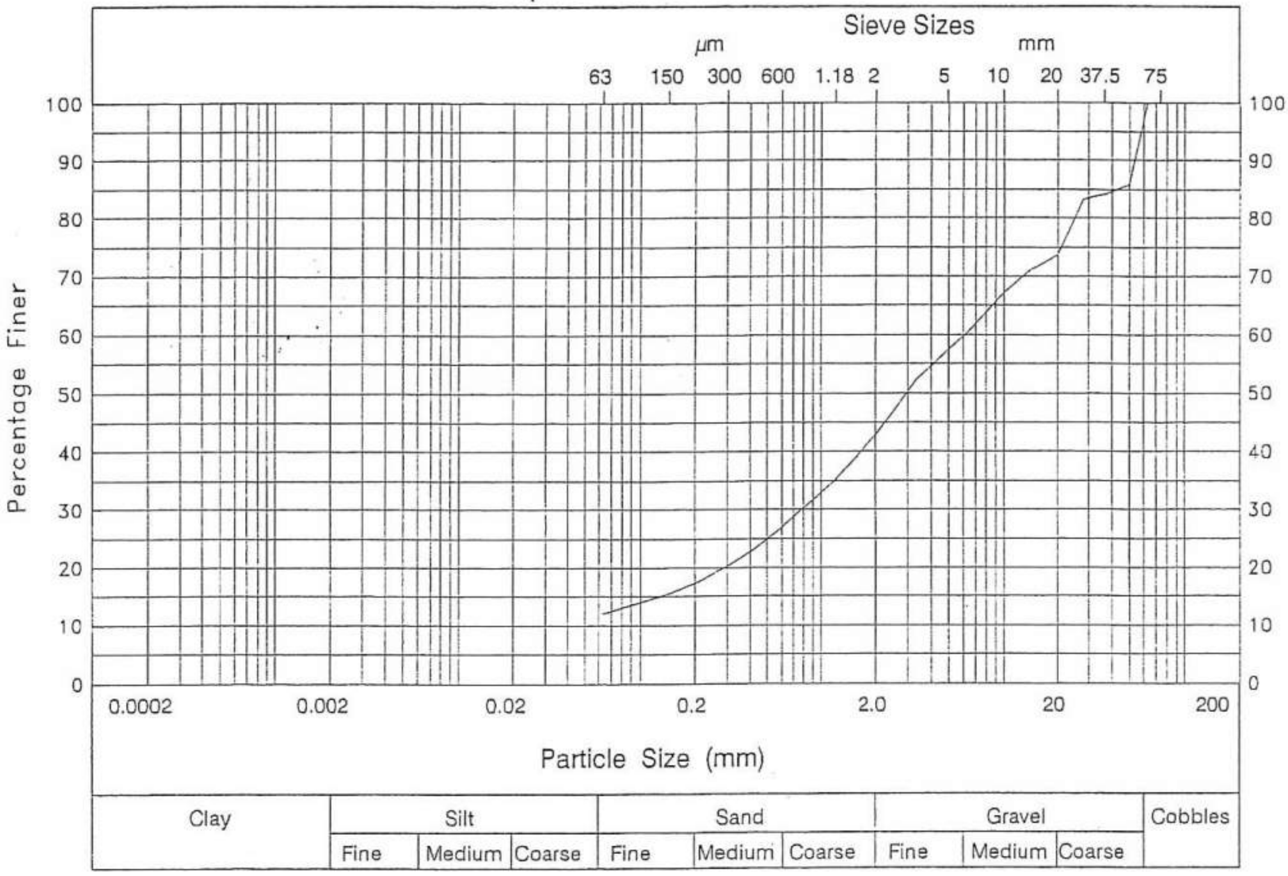
Clay	Silt			Sand			Gravel			Cobbles
	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	

Particle Size	% Passing	Particle Size	% Passing
50 mm	100	425 µm	47
37.5 mm	97	300 µm	46
28 mm	88	212 µm	44
20 mm	83	150 µm	42
14 mm	78	63 µm	38
10 mm	73	20 µm	24
6.3 mm	68	6 µm	19
5 mm	64	2 µm	13
3.35 mm	60		
2 mm	55		
1.18 mm	52		
600 µm	49		

Hole LWT7	Description: Firm to stiff orange mottled grey slightly sandy gravelly CLAY. gravel is angular fine to coarse of sandstone
Depth 9.00 -9.45	
Type B	
Test Performed: Wet	Uniformity Coefficient not applicable.

Form 25/4

Laboratory - Particle Size Plot	**Project** LLANWONNO TIPS Rhondda Cynon Taff	**Contract** 151258
Exploration Associates		**Sheet** P2/69

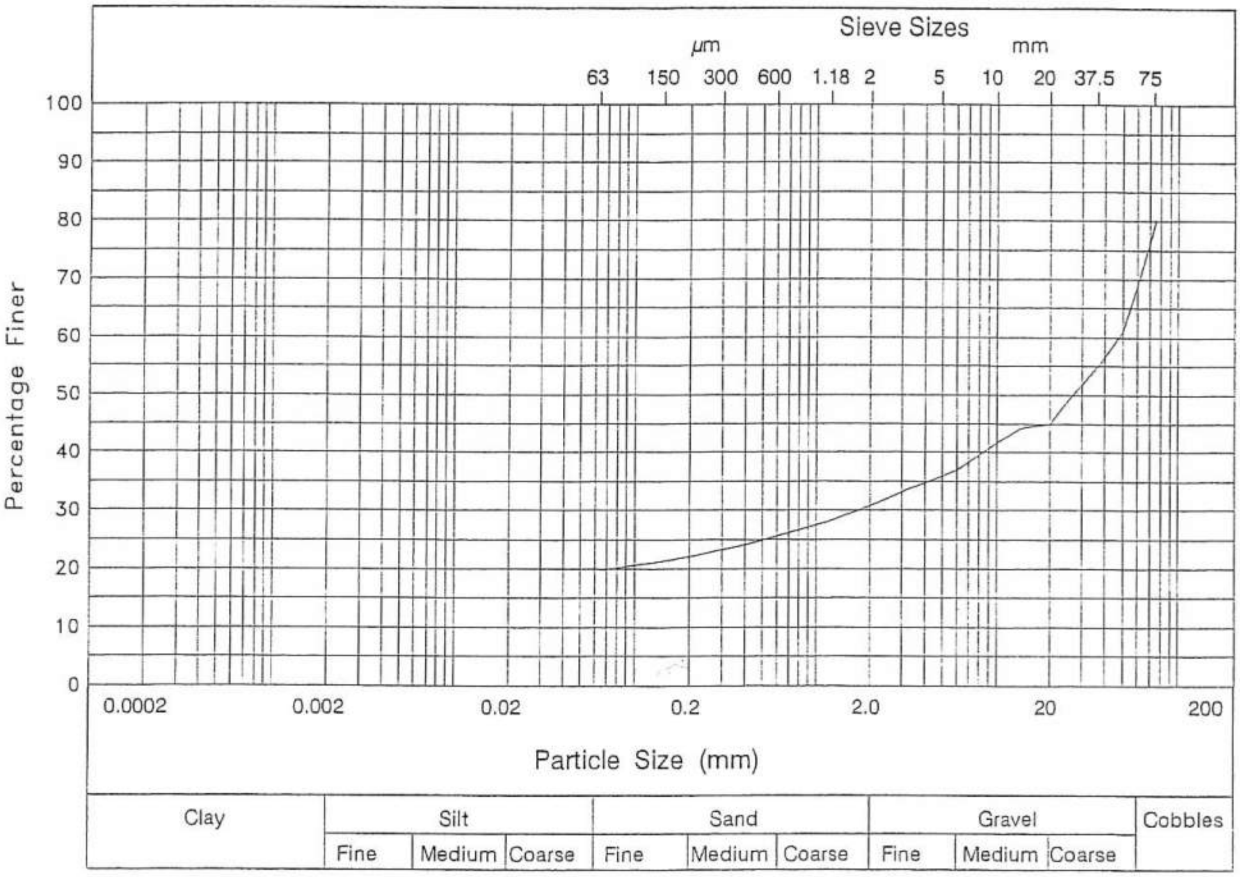


Particle Size	% Passing	Particle Size	% Passing
63 mm	100	600 µm	27
50 mm	86	425 µm	23
37.5 mm	84	300 µm	20
28 mm	83	212 µm	18
20 mm	74	150 µm	16
14 mm	71	63 µm	12
10 mm	67		
6.3 mm	60		
5 mm	58		
3.35 mm	52		
2 mm	43		
1.18 mm	35		

Hole LWT8	Description MADE GROUND: Medium dense dark grey and black silty slightly sandy angular fine to coarse GRAVEL of mudstone sandstone and siltstone and coal.
Depth 6.75 -7.00	
Type B	
Test Performed Wet	Uniformity Coefficient not applicable.

Form 25/4

Laboratory - Particle Size Plot	**Project** LLANWONNO TIPS Rhondda Cynon Taff	**Contract** 151258
Exploration Associates		**Sheet** P2/70



Particle Size	% Passing	Particle Size	% Passing
75 mm	80	1.18 mm	28
63 mm	71	600 µm	26
50 mm	61	425 µm	24
37.5 mm	55	300 µm	23
28 mm	51	212 µm	22
20 mm	45	150 µm	21
14 mm	44	63 µm	20
10 mm	42		
6.3 mm	37		
5 mm	36		
3.35 mm	34		
2 mm	31		

Hole LWT8 **Depth** 15.75-16.00 **Type** B	Description MADE GROUND: medium dense dark grey and black silty slightly sandy angular fine to coarse GRAVEL of sandstone siltstone and coal.
Test Performed Wet	Uniformity Coefficient not applicable.

Form 25/4

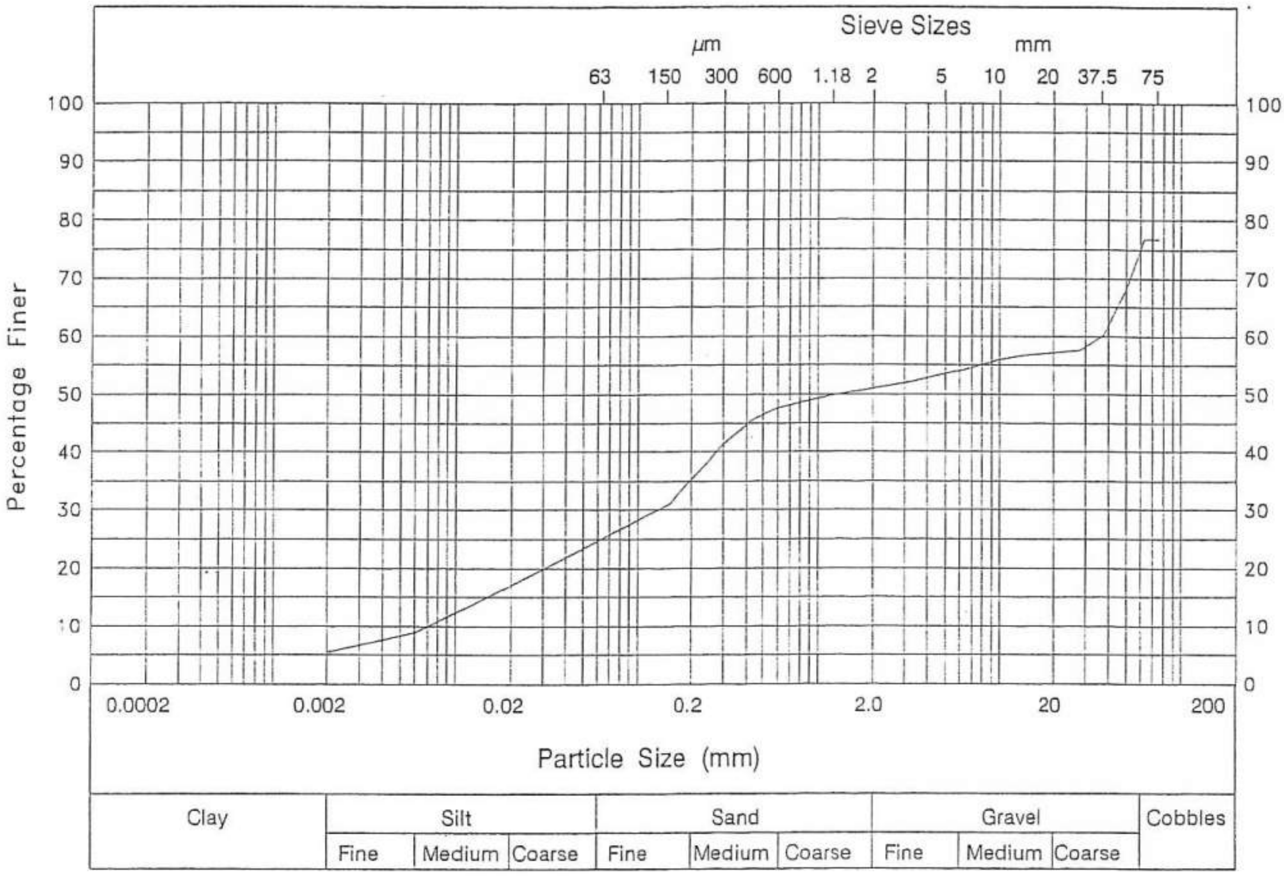
Laboratory - Particle Size Plot

Exploration Associates

Project LLANWONNO TIPS Rhondda Cynon Taff

Contract 151258

Sheet P2/71

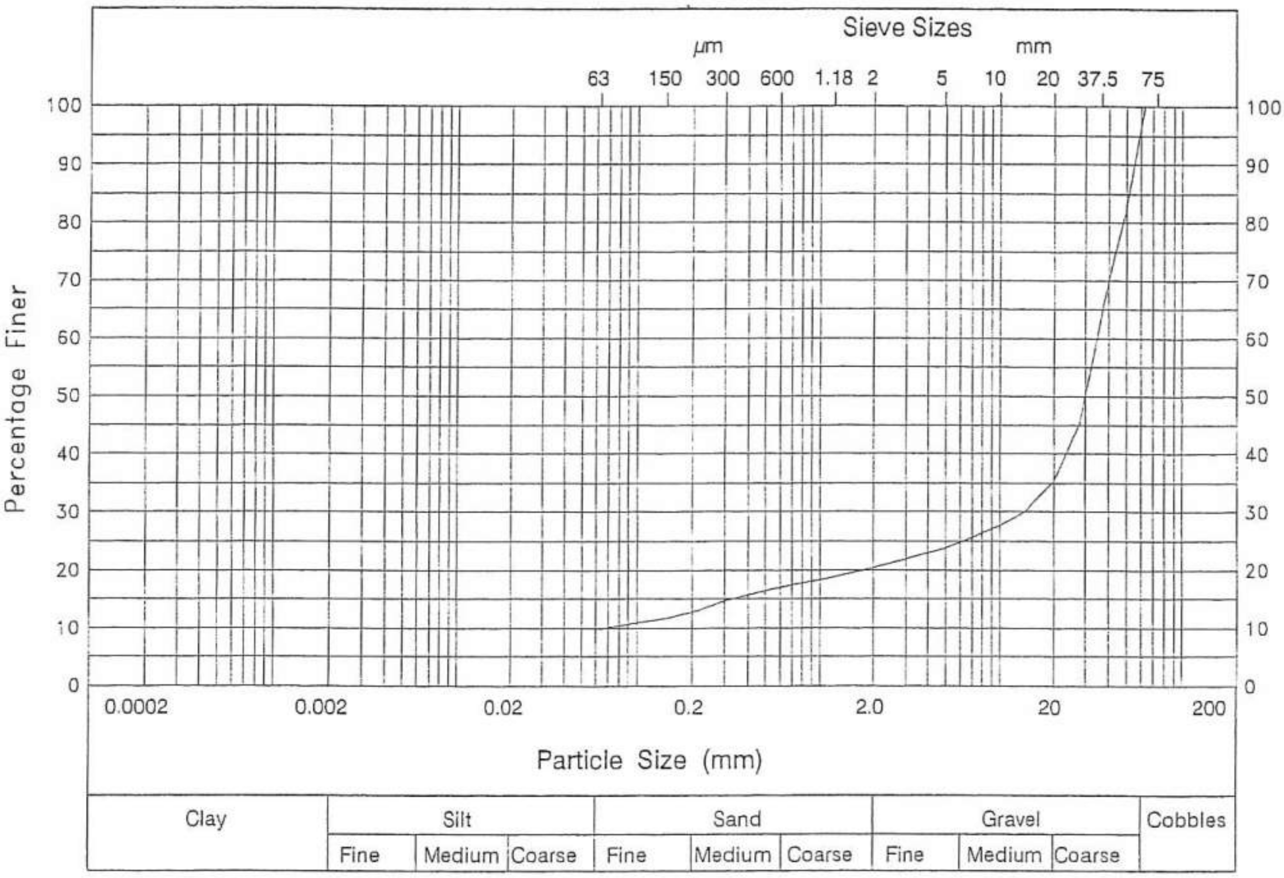


Particle Size	% Passing	Particle Size	% Passing
75 mm	77	1.18 mm	50
63 mm	77	600 µm	48
50 mm	68	425 µm	45
37.5 mm	60	300 µm	41
28 mm	58	212 µm	36
20 mm	57	150 µm	31
14 mm	57	63 µm	25
10 mm	56	20 µm	17
6.3 mm	54	6 µm	9
5 mm	54	2 µm	5
3.35 mm	52		
2 mm	51		

Hole LWT8	Description Grey brown slightly gravelly slightly sandy CLAY with occasional orange brown sand partings
Depth 21.70-22.20	
Type U	
Test Performed Wet	Uniformity Coefficient = 5271

Form 25/4

Laboratory - Particle Size Plot	**Project** LLANWONNO TIPS Rhondda Cynon Taff	**Contract** 151258
Exploration Associates		**Sheet** P2/72

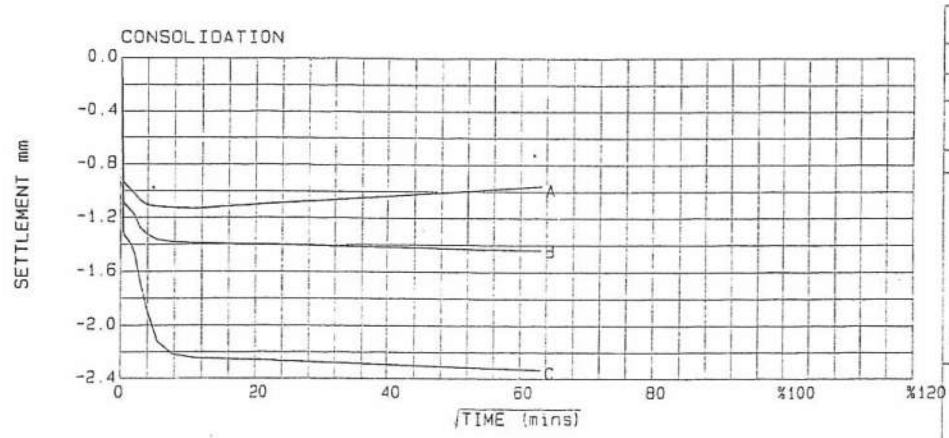


Particle Size	% Passing	Particle Size	% Passing
63 mm	100	600 µm	17
50 mm	83	425 µm	16
37.5 mm	66	300 µm	15
28 mm	45	212 µm	13
20 mm	35	150 µm	12
14 mm	30	63 µm	10
10 mm	28		
6.3 mm	25		
5 mm	24		
3.35 mm	22		
2 mm	20		
1.18 mm	19		

Hole LWT8	Description: Very dense brown very clayey slightly sandy angular fine to coarse GRAVEL, with some cobbles of sandstone
Depth 25.50-26.50	
Type B	
Test Performed: Wet	Uniformity Coefficient = 546

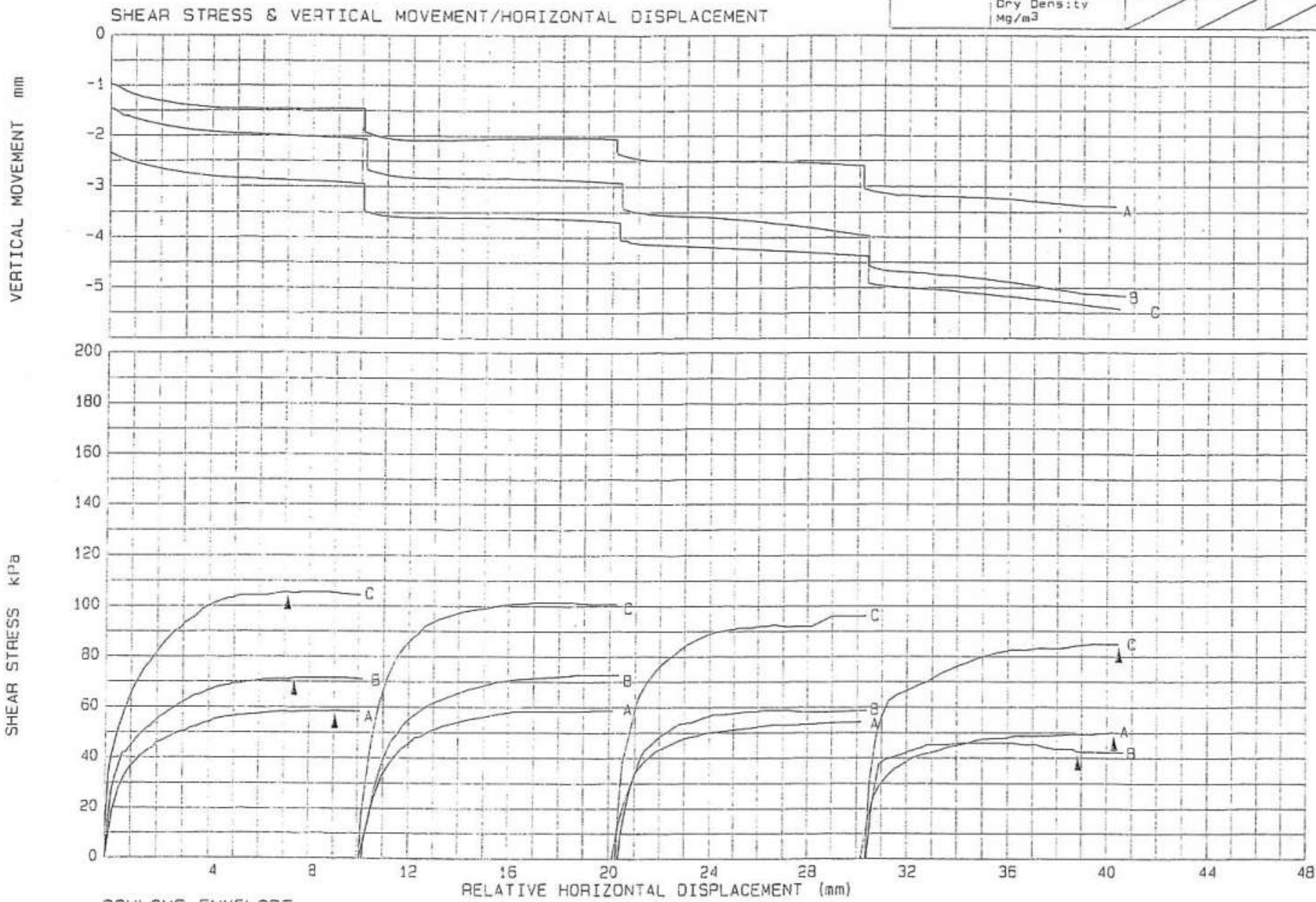
Form 25/4

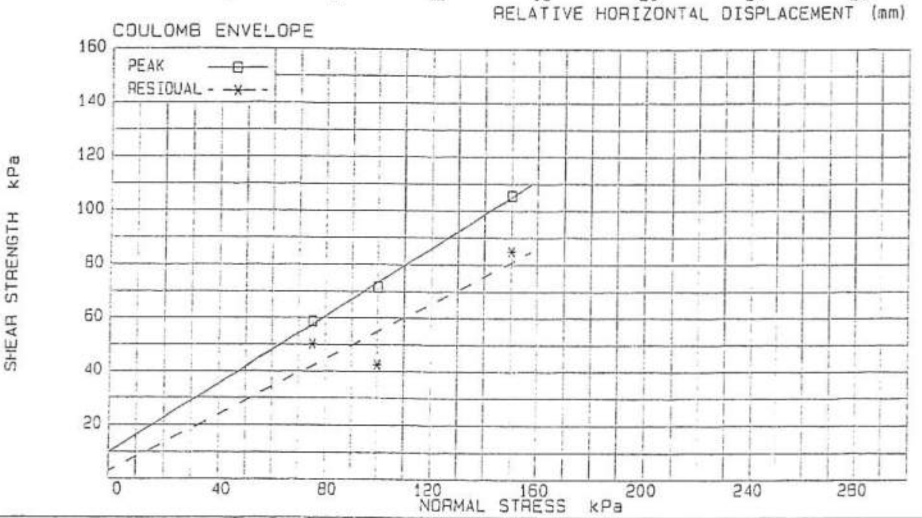
Laboratory - Particle Size Plot	**Project** LLANWONNO TIPS Rhondda Cynon Taff	**Contract** 151258
Exploration Associates		**Sheet** P2/73



SOIL DESCRIPTION	Medium dense black fine to coarse sand and fine to medium gravel sized COLLIERY SPOIL with some crushed siltstone		
PREPARATION	Material crushed to -2mm Recompacted to 1.80Mg/m3 bulk density at as received moisture content. Test carried out in submerged condition		

SPECIMEN		A	B	C
INITIAL	Bulk density Mg/m3	1.80	1.80	1.80
	Moisture %	8.4	8.4	8.4
	Dry density Mg/m3	1.66	1.66	1.66
Particle density	Void Ratio	0.596	0.596	0.596
2.65 Mg/m3 assumed	Saturation %	37	37	37
AFTER TEST	Bulk density Mg/m3			
	Moisture %	15	14	13
	Dry Density Mg/m3			





CONSOLIDATION PRESSURE / NORMAL STRESS kPa		75	100	150
RATES OF DISPLACE -MENT	Peak mm/min	0.0054	0.0054	0.0054
	Post peak / Residual mm/min	0.011	0.011	0.011
PEAK VALUES	Relative Displacement mm	9.00	7.35	7.06
	Shear Strength kPa	58.7	71.6	106
RESIDUAL VALUES	Number of Reversals	3	3	3
	Relative Displacement mm	40.1	38.7	40.3
	Shear Strength kPa	50.3	42.5	85.0

SHEAR STRENGTH PARA-METERS			Linear regression	Re-assessed	
	PEAK	C'	10		kPa
		Ø'	32½		Degrees
	RESIDUAL	C'R	3		kPa
		Ø'R	27½		Degrees

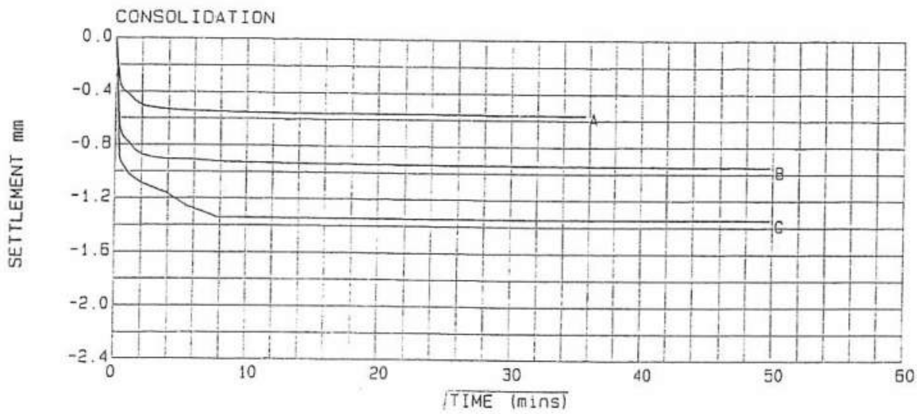
CONSOLIDATED DRAINED DIRECT SHEAR TEST

BS1377: Part 7: 1990, method 4 in 60mm square x 20mm deep box

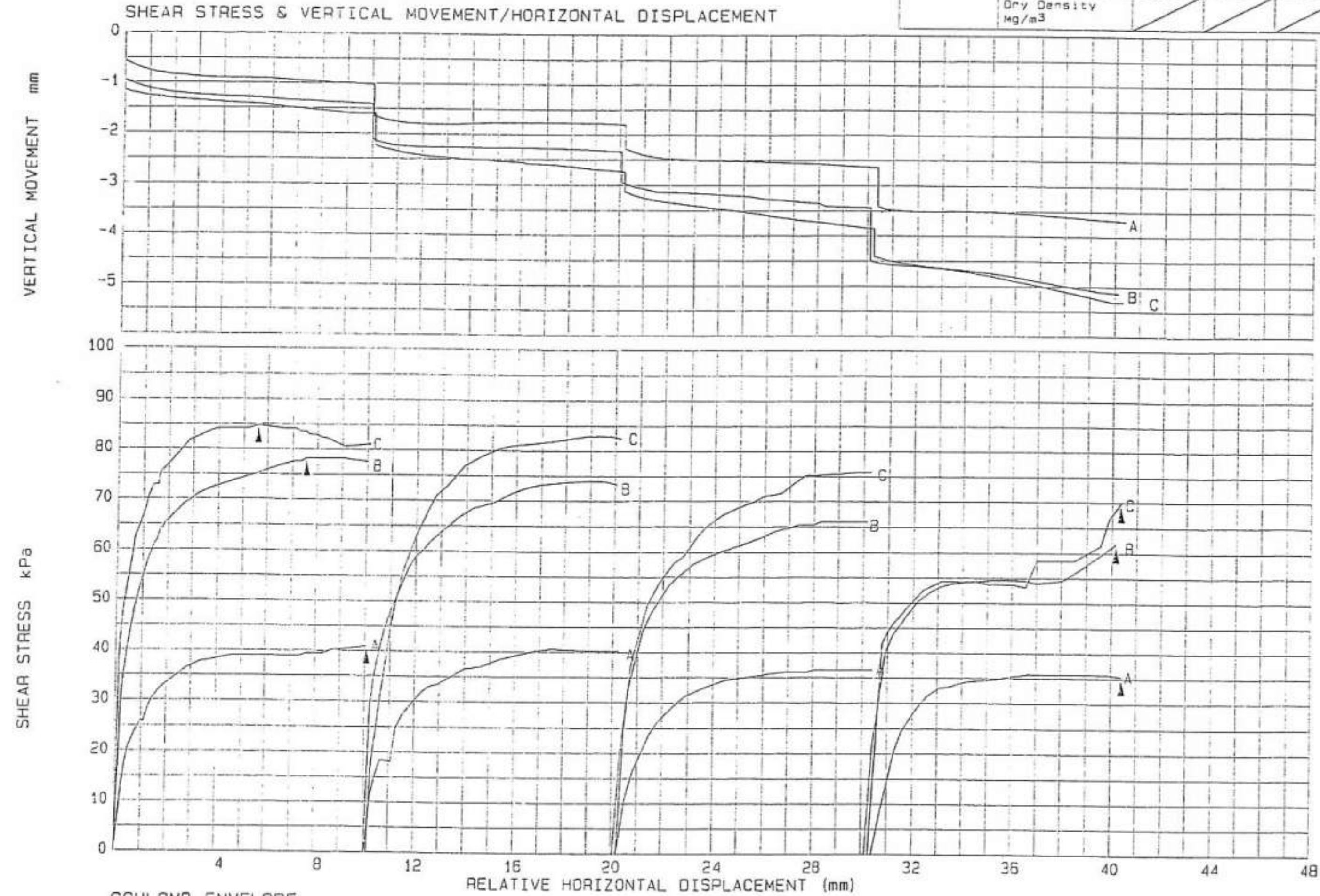
Borehole No. LWT2 Depth 5.00m

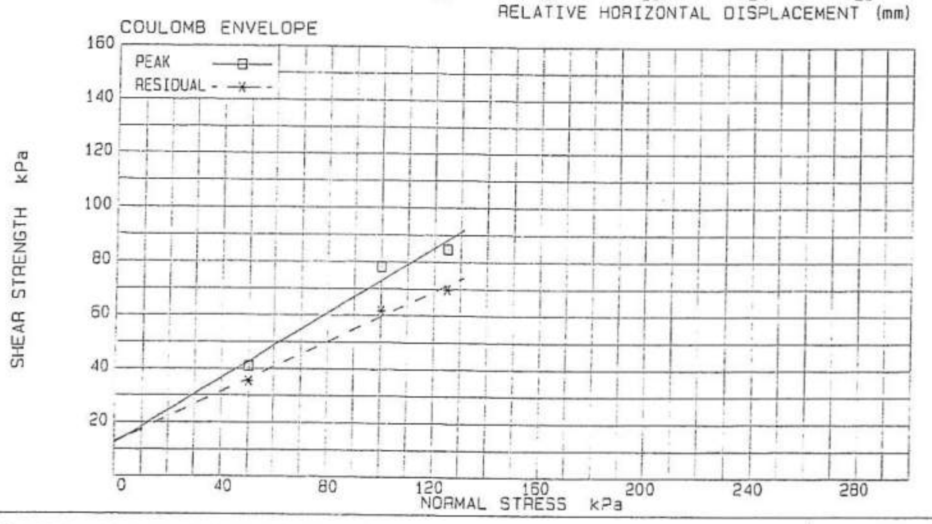
Sample No.

SLR 7.4	Soil Mechanics	Location: LLANWONNO TIPS	Loc. No. 151258	Fig. P3/1



SOIL DESCRIPTION	Dense dark grey friable fine to coarse weak MUDSTONE with a little colliery spoil.			
PREPARATION	Material crushed to -2mm. Recompacted to 1.80Mg/m3 bulk density at as received moisture content. Test carried out in submerged condition			
SPECIMEN		A	B	C
INITIAL	Bulk density Mg/m3	1.80	1.80	1.80
	Moisture %	6.5	6.5	6.5
	Dry density Mg/m3	1.69	1.69	1.69
Particle density 2.65 Mg/m3 assumed	Void Ratio	0.567	0.568	0.569
	Saturation %	30	30	30
AFTER TEST	Bulk density Mg/m3			
	Moisture %	15	14	14
	Dry Density Mg/m3			





CONSOLIDATION PRESSURE / NORMAL STRESS kPa		50	100	125
RATES OF DISPLACE-MENT	Peak mm/min	0.015	0.015	0.015
	Post peak / Residual mm/min	0.030	0.030	0.030
PEAK VALUES	Relative Displacement mm	10.0	7.53	5.57
	Shear Strength kPa	41.0	78.2	84.8
RESIDUAL VALUES	Number of Reversals	3	3	3
	Relative Displacement mm	40.3	40.0	40.2
	Shear Strength kPa	35.4	61.8	69.8

			Linear regression	Re-assessed	
SHEAR STRENGTH PARA-METERS	PEAK	C'	12		kPa
		Ø'	31½		Degrees
	RESIDUAL	C'r	13		kPa
		Ø'r	25		Degrees

CONSOLIDATED DRAINED DIRECT SHEAR TEST

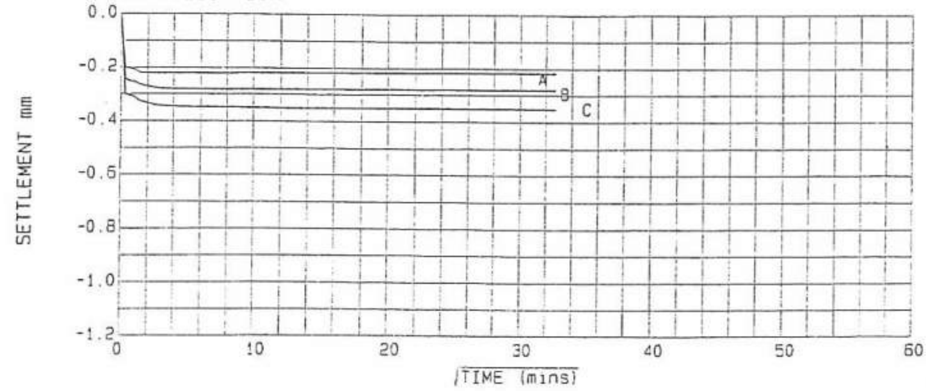
BS1377: Part 7: 1990, method 4 in 60mm square x 20mm deep box

Borehole No. LWT3 Depth 2.00-2.50m

Sample No.

SLR 7.4	Soil Mechanics	Location LLANWONNO TIPS	Loc. No. 151258	Fig. P3/2

CONSOLIDATION

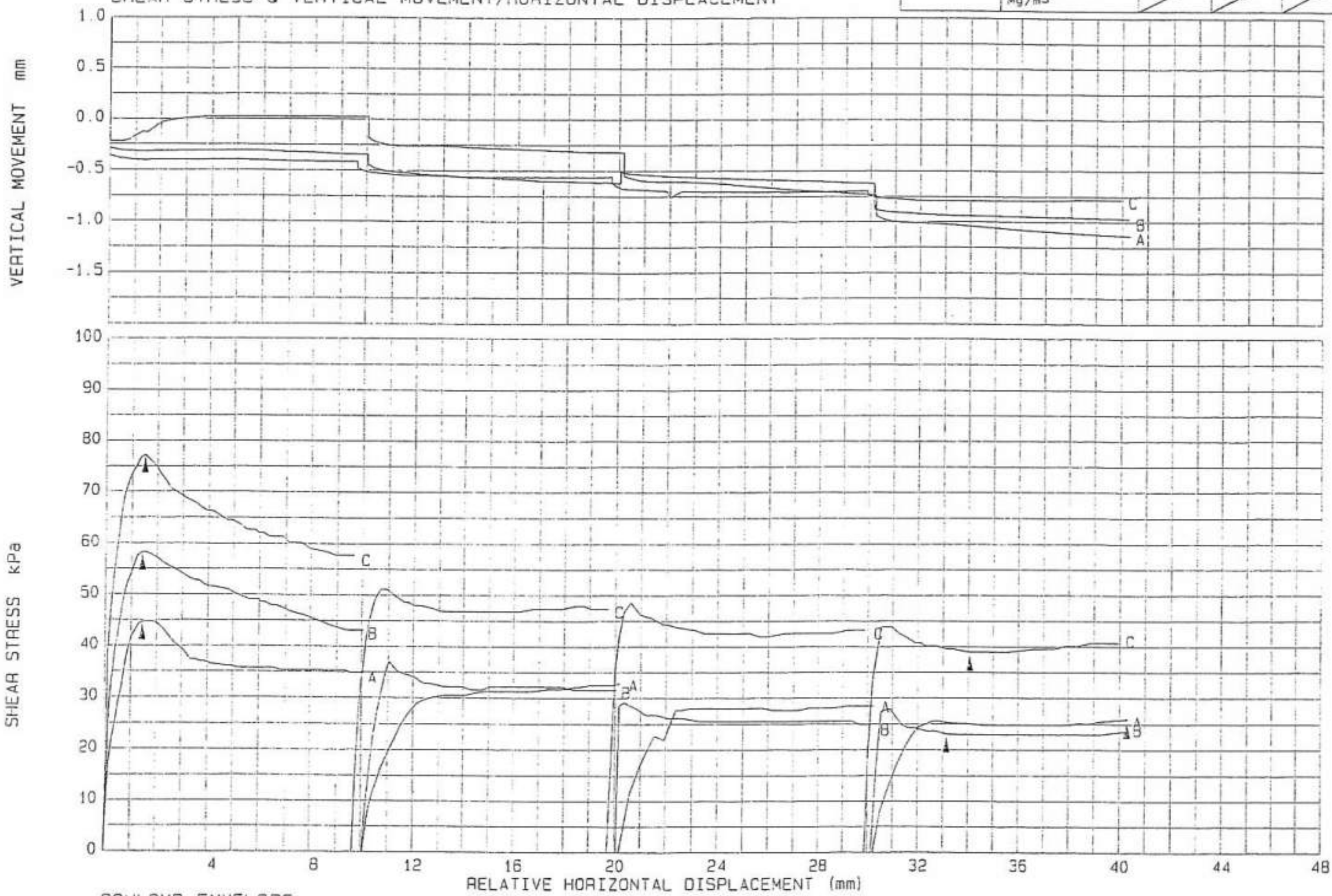


SOIL DESCRIPTION	Firm light brown silty CLAY with rare coarse sand to fine gravel sized siltstone.	
PREPARATION	Undisturbed	

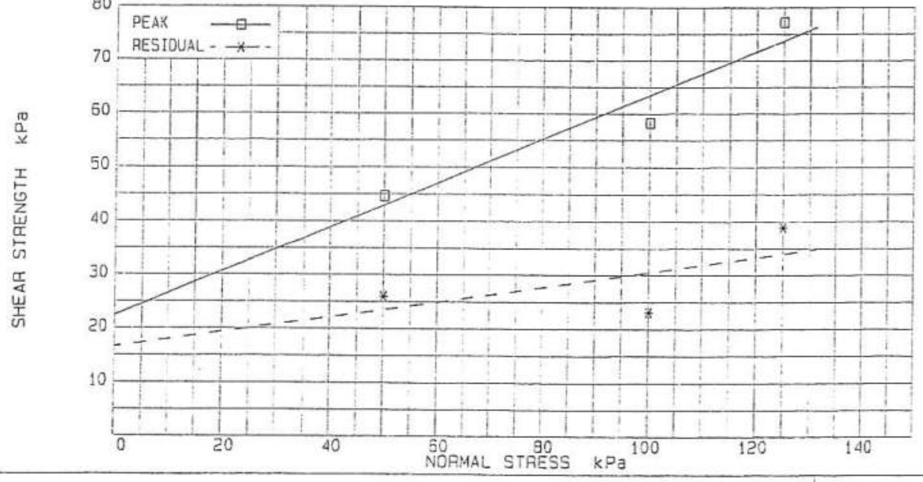
Test carried out in submerged condition

SPECIMEN		A	B	C
INITIAL	Bulk density Mg/m3	2.11	2.05	2.03
	Moisture %	17	22	21
	Dry density Mg/m3	1.80	1.67	1.68
Particle density 2.65 Mg/m3 assumed	Void Ratio	0.475	0.584	0.582
	Saturation %	97	101	97
AFTER TEST	Bulk density Mg/m3			
	Moisture %	21	24	23
	Dry Density Mg/m3			

SHEAR STRESS & VERTICAL MOVEMENT/HORIZONTAL DISPLACEMENT



COULOMB ENVELOPE



CONSOLIDATION PRESSURE / NORMAL STRESS kPa		50	100	125
RATES OF DISPLACE -MENT	Peak mm/min	0.0094	0.0094	0.0094
	Post peak / Residual mm/min	0.019	0.019	0.189
PEAK VALUES	Relative Displacement mm	1.42	1.40	1.47
	Shear Strength kPa	44.7	58.3	77.2
RESIDUAL VALUES	Number of Reversals	3	3	3
	Relative Displacement mm	40.1	33.0	33.9
	Shear Strength kPa	26.0	23.1	38.9

			Linear regression	Re-assessed	
SHEAR STRENGTH PARA-METERS	PEAK	C'	22		kPa
		Ø'	22½		Degrees
	RESIDUAL	C'R	17		kPa
		Ø'R	8		Degrees

CONSOLIDATED DRAINED DIRECT SHEAR TEST

BS1377: Part 7: 1990, method 4 in 60mm square x 20mm deep box

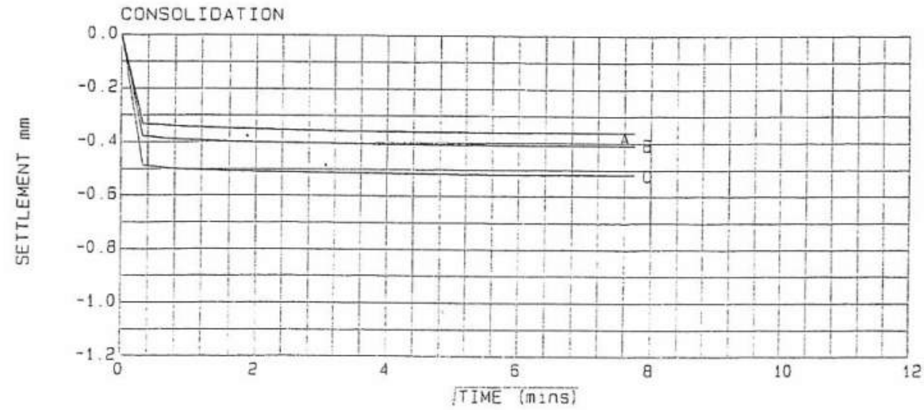
Borehole No. LWT3A Depth 11.00-11.50m

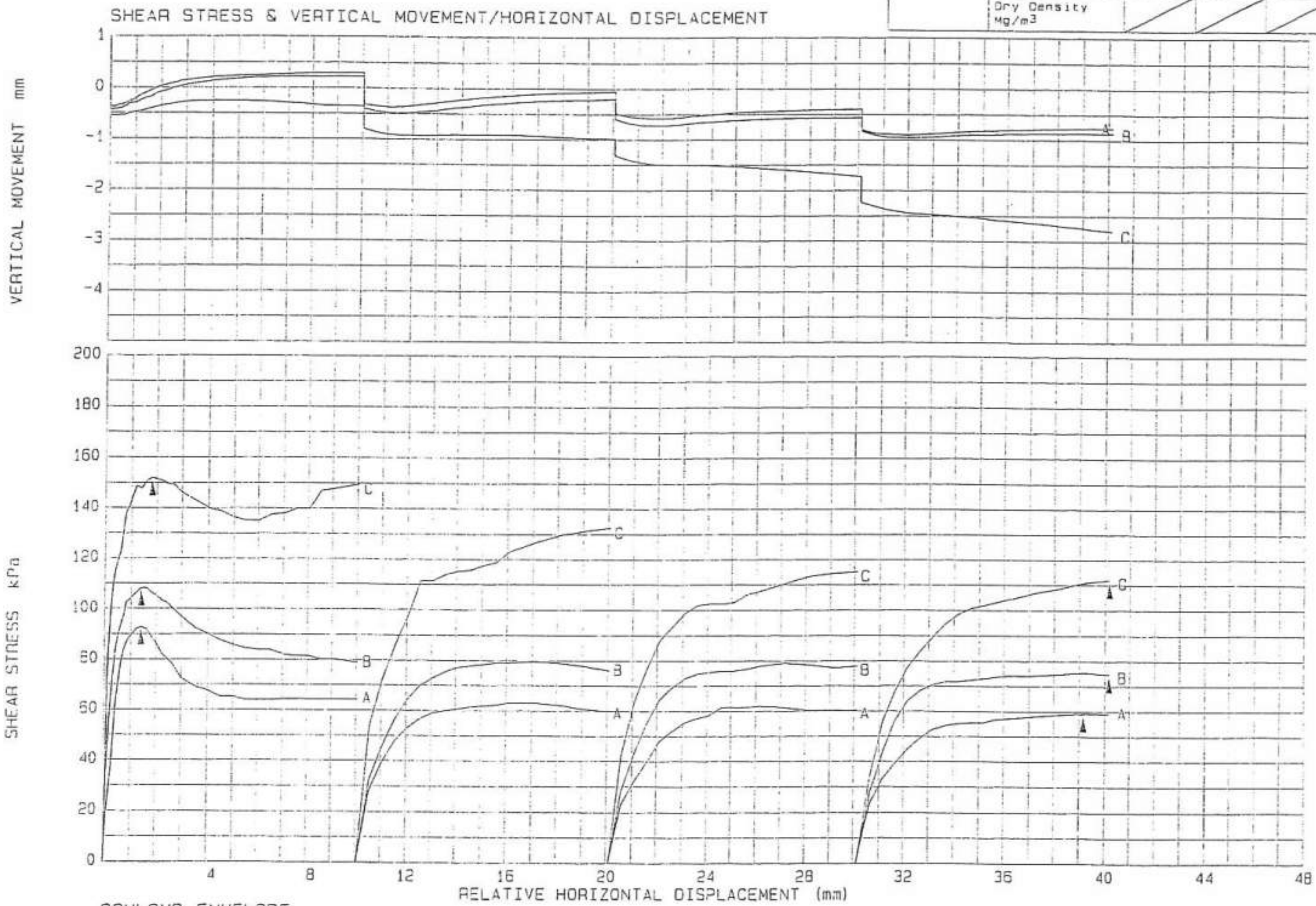
Sample No.

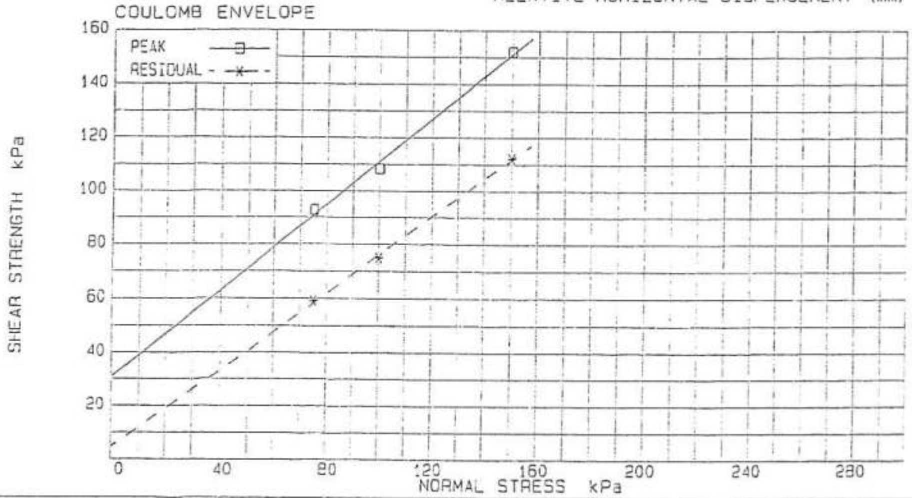
SLR 7.4	Soil Mechanics	Location LLANWONNO TIPS	Loc. No. 151258	Fig. P3/3

SOIL DESCRIPTION	Loose dark grey fine to coarse sand and fine to medium gravel sized COLLIERY SPOIL.		
PREPARATION	Material crushed to -2mm. Recompacted to 1.80Mg/m3 bulk density at as received moisture content. Test carried out in submerged condition		

SPECIMEN		A	B	C
INITIAL	Bulk density Mg/m3	1.80	1.80	1.80
	Moisture %	17	17	17
	Dry density Mg/m3	1.54	1.54	1.54
Particle density 2.65 Mg/m3 assumed	Void Ratio	0.726	0.726	0.726
	Saturation %	63	63	63
AFTER TEST	Bulk density Mg/m3			
	Moisture %	20	19	19
	Dry Density Mg/m3			







CONSOLIDATION PRESSURE / NORMAL STRESS kPa		75	100	150
RATES OF DISPLACE -MENT	Peak mm/min	0.600	0.600	0.600
	Post peak / Residual mm/min	0.600	0.600	0.600
PEAK VALUES	Relative Displacement mm	1.40	1.40	1.80
	Shear Strength kPa	92.9	108	152
RESIDUAL VALUES	Number of Reversals	3	3	3
	Relative Displacement mm	39.0	40.0	40.0
	Shear Strength kPa	59.1	74.8	112

SHEAR STRENGTH PARA-METERS			Linear regression	Re-assessed	
	PEAK	C'	31		kPa
		Ø'	38½		Degrees
	RESIDUAL	C'R	5		kPa
		Ø'R	35½		Degrees

CONSOLIDATED DRAINED DIRECT SHEAR TEST

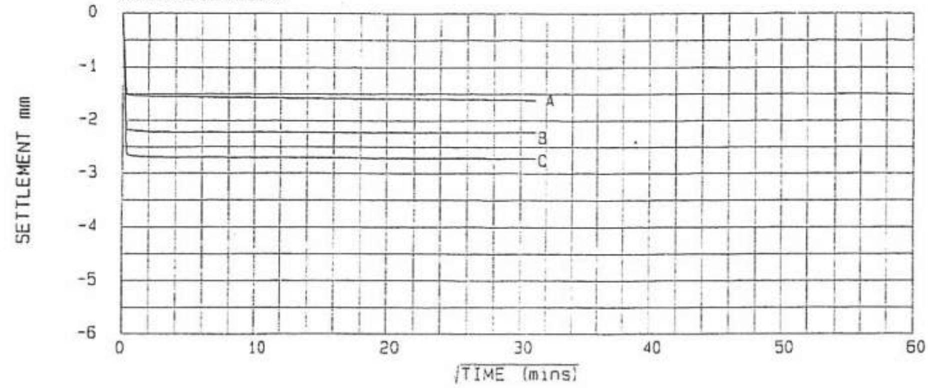
BS1377: Part 7: 1990, method 4 in 60mm square x 20mm deep box

Borehole No. LWT4 Depth 2.75-3.25m

Sample No.

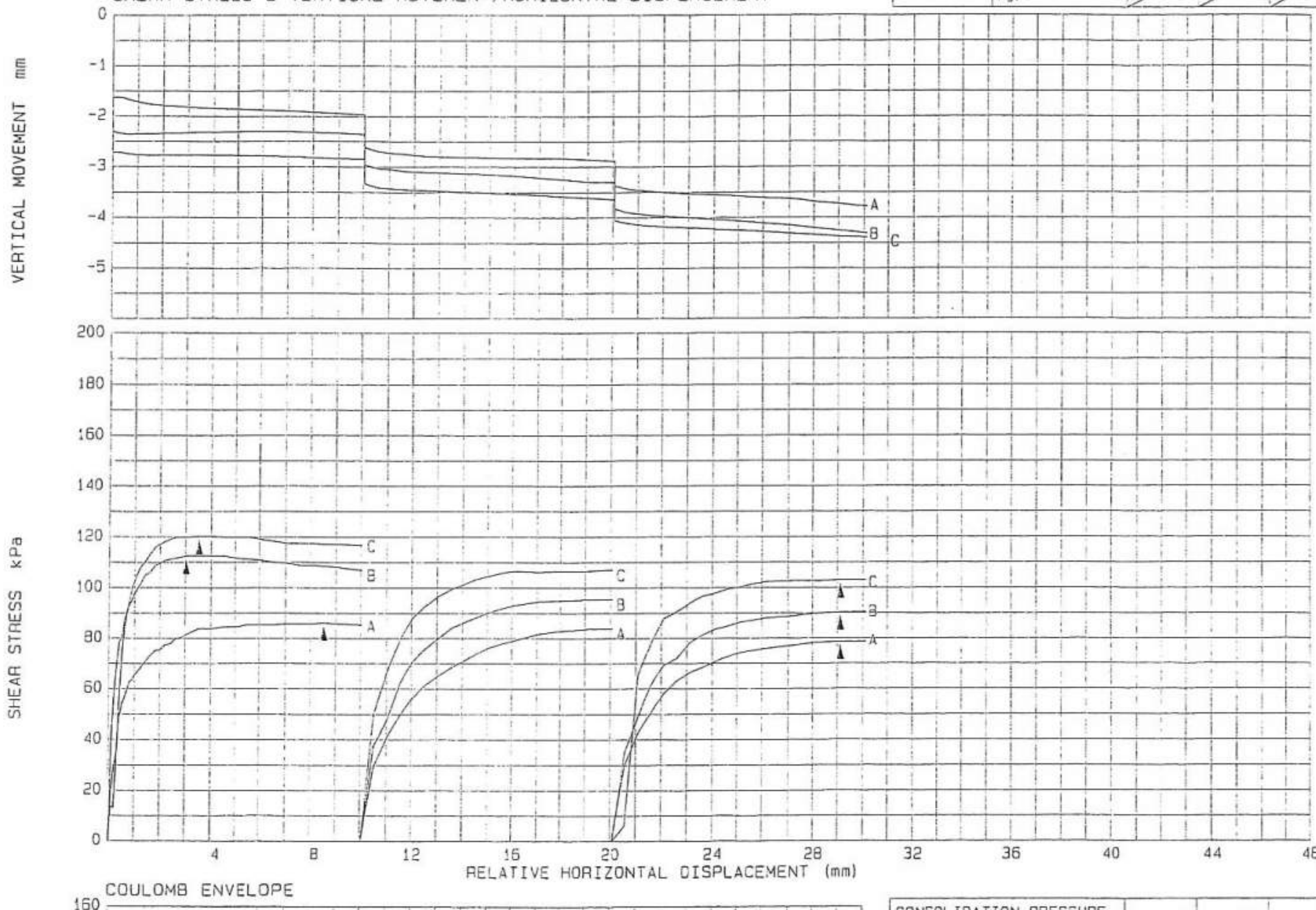
SLR 7.4	Soil Mechanics	Location LLANWONNO TIPS	Loc No 151258	Fig. P3/4

CONSOLIDATION

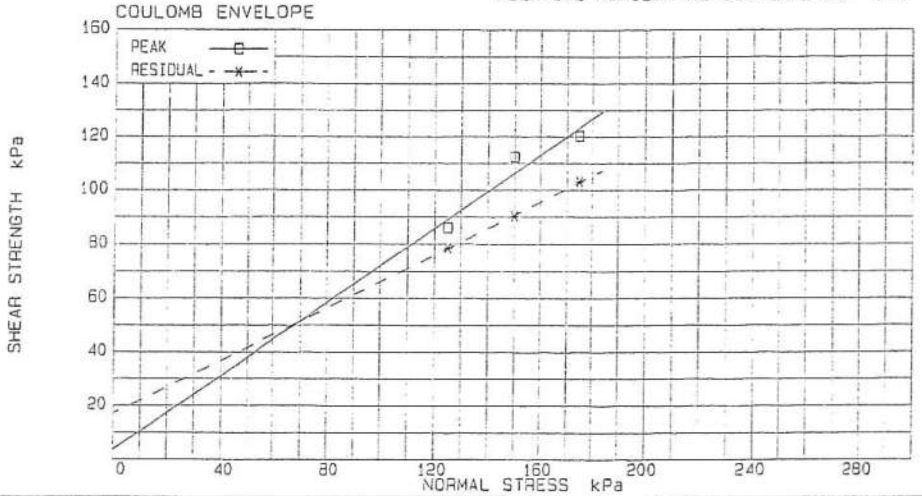


SOIL DESCRIPTION	Dense dark grey fine to coarse sand and gravel sized COLLIERY SPOIL with little weak fine to medium mudstone			
PREPARATION	Material crushed to -2mm Recompacted to 1.96Mg/m3 bulk density at 9.7% moisture content. Test carried out in submerged condition			
SPECIMEN		A	B	C
INITIAL	Bulk density Mg/m3	1.96	1.96	1.96
	Moisture %	9.9	9.9	9.9
	Dry density Mg/m3	1.78	1.78	1.78
Particle density 2.65 Mg/m3 assumed	Void Ratio	0.487	0.485	0.486
	Saturation %	54	54	54
AFTER TEST	Bulk density Mg/m3			
	Moisture %	16	16	15
	Dry Density Mg/m3			

SHEAR STRESS & VERTICAL MOVEMENT/HORIZONTAL DISPLACEMENT



COULOMB ENVELOPE



CONSOLIDATION PRESSURE / NORMAL STRESS kPa		125	150	175
RATES OF DISPLACE-MENT	Peak mm/min	0.600	0.600	0.600
	Post peak / Residual mm/min	0.600	0.600	0.600
PEAK VALUES	Relative Displacement mm	8.50	3.00	3.50
	Shear Strength kPa	86.1	113	120
RESIDUAL VALUES	Number of Reversals	2	2	2
	Relative Displacement mm	29.0	29.0	29.0
	Shear Strength kPa	78.6	90.3	103

			Linear regression	Re-assessed	
SHEAR STRENGTH PARA-METERS	PEAK	C'	4		kPa
		Ø'	$34\frac{1}{2}$		Degrees
	RESIDUAL	C'r	17		kPa
		Ø'r	25		Degrees

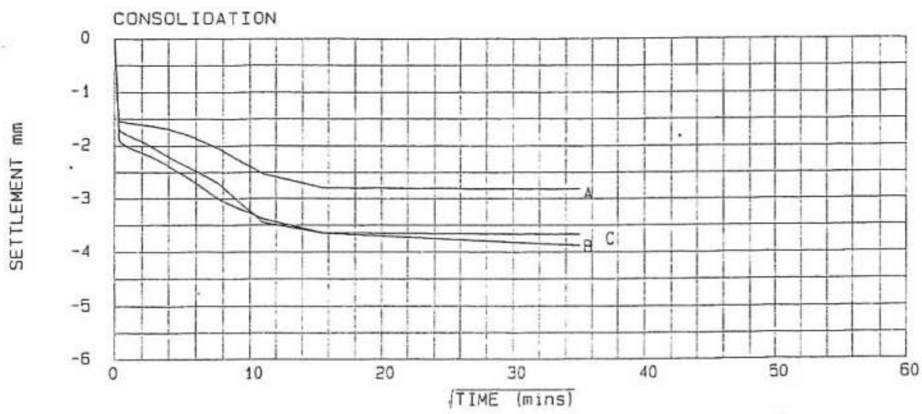
CONSOLIDATED DRAINED DIRECT SHEAR TEST

BS1377: Part 7: 1990, method 4 in 60mm square x 20mm deep box

Borehole No. LWT5 Depth 11.20-11.65m

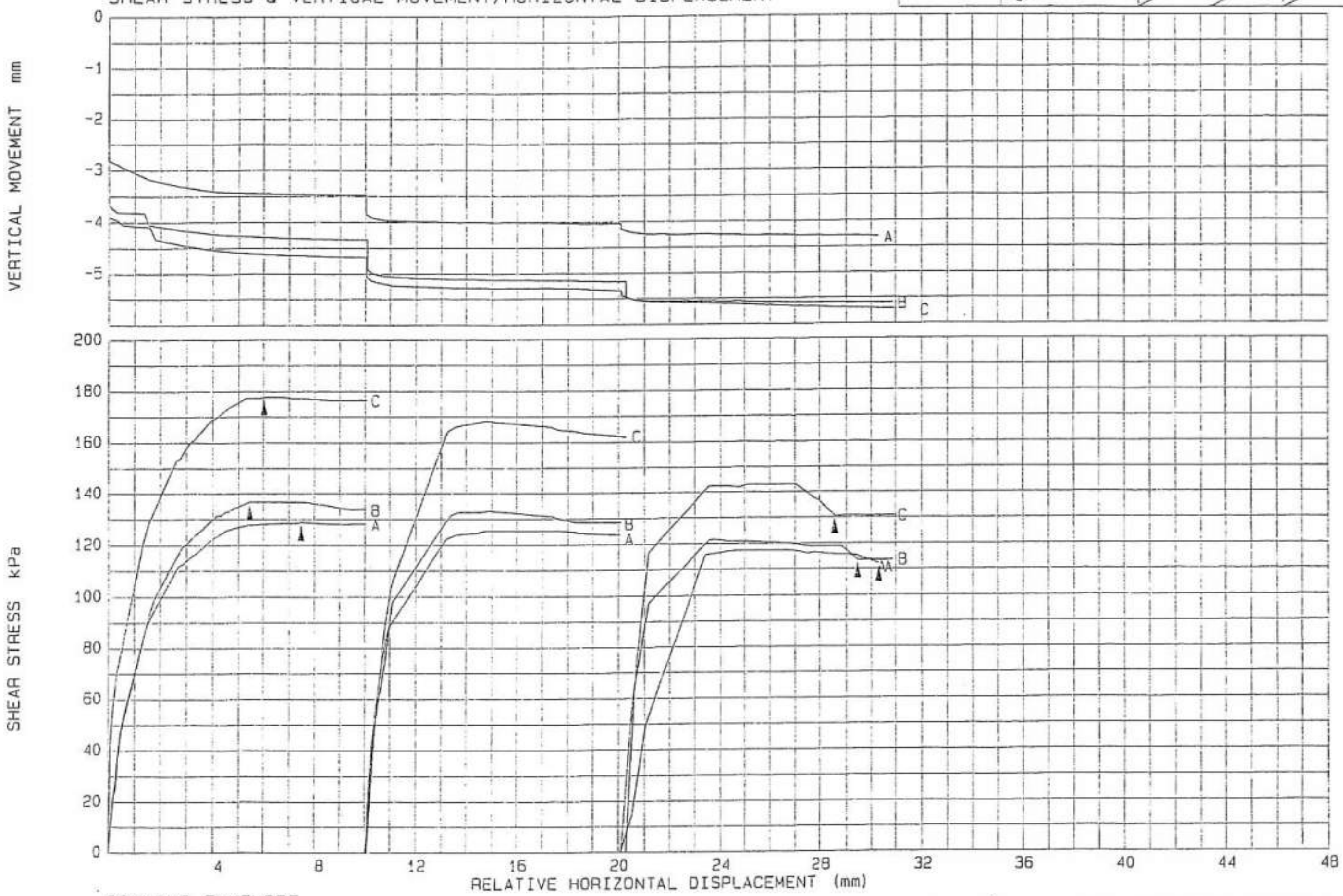
Sample No. 1

SLR 7.4	Soil Mechanics	Location: LLANWONNO TIPS	Loc. No. 151258	Fig. P3/5

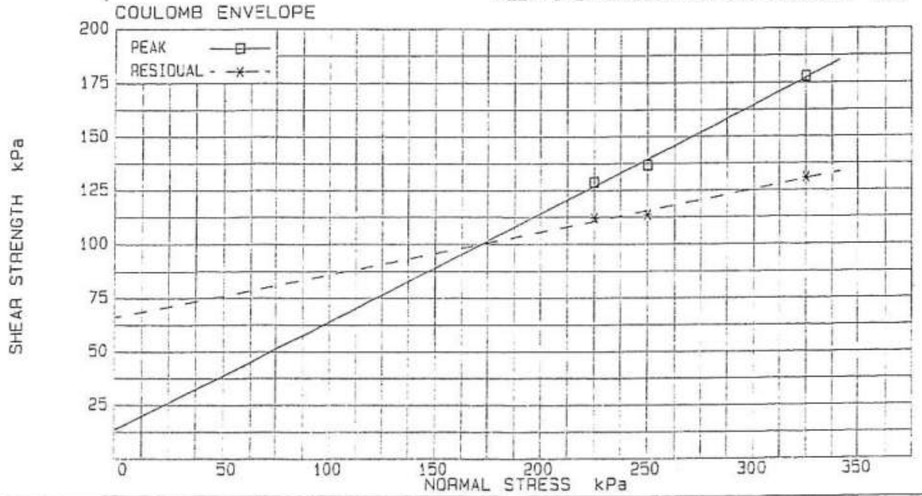


SOIL DESCRIPTION	Firm light brown and black silty CLAY with some fine to medium siltstone and mudstone.			
PREPARATION	Material crushed to -2mm. Recompacted to 1.80Mg/m3 bulk density at as received moisture content. Test carried out in submerged condition			
SPECIMEN		A	B	C
INITIAL	Bulk density Mg/m3	1.80	1.80	1.80
	Moisture %	14	14	14
	Dry density Mg/m3	1.57	1.57	1.57
Particle density	Void Ratio	0.685	0.683	0.684
2.65 Mg/m^3 assumed	Saturation %	56	56	56
AFTER TEST	Bulk density Mg/m3			
	Moisture %	18	16	18
	Dry Density Mg/m3			

SHEAR STRESS & VERTICAL MOVEMENT/HORIZONTAL DISPLACEMENT



COULOMB ENVELOPE



CONSOLIDATION PRESSURE / NORMAL STRESS kPa		225	250	325
RATES OF DISPLACE -MENT	Peak mm/min	0.0014	0.0014	0.0014
	Post peak / Residual mm/min	0.0028	0.0028	0.0028
PEAK VALUES	Relative Displacement mm	7.43	5.43	6.00
	Shear Strength kPa	129	137	178
RESIDUAL VALUES	Number of Reversals	2	2	2
	Relative Displacement mm	30.2	29.3	28.4
	Shear Strength kPa	112	114	131

			Linear regression	Re-assessed	
SHEAR STRENGTH PARA-METERS	PEAK	C'	14		kPa
		Ø'	26½		Degrees
	RESIDUAL	C'R	66		kPa
		Ø'R	11		Degrees

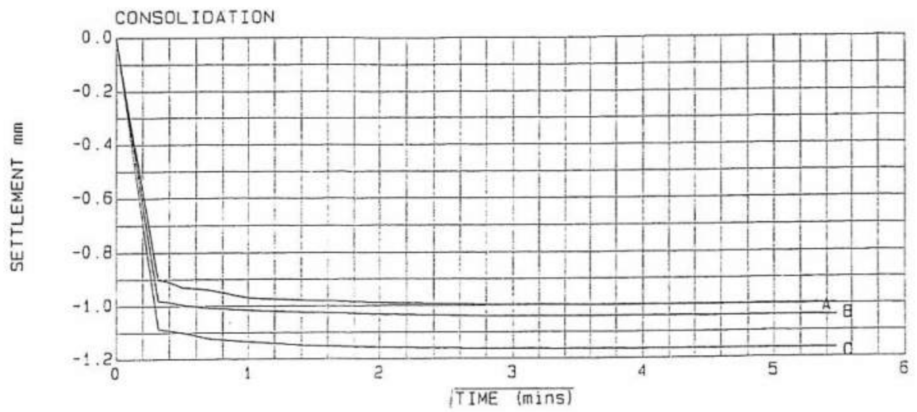
CONSOLIDATED DRAINED DIRECT SHEAR TEST

BS1377: Part 7: 1990, method 4 in 60mm square x 20mm deep box

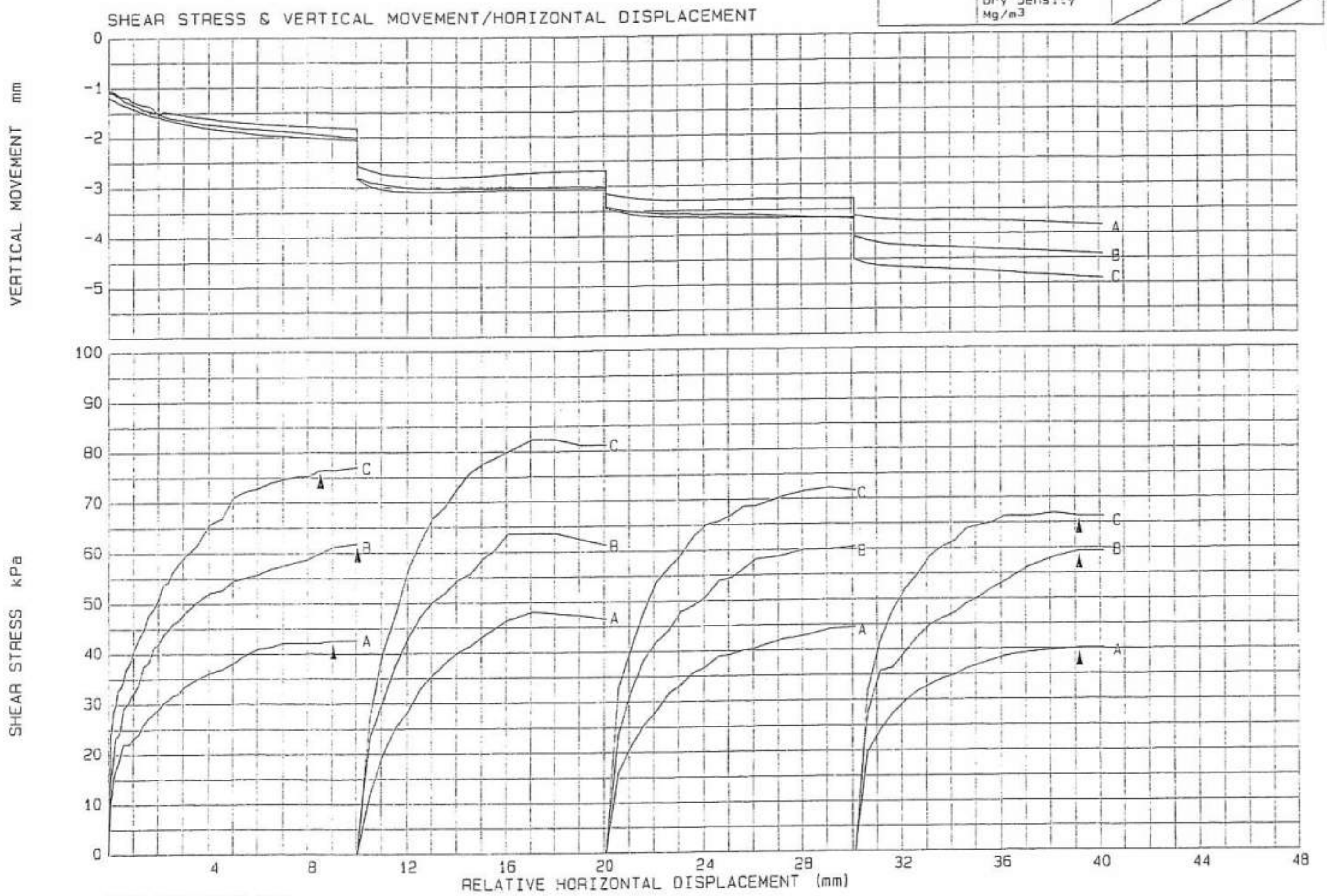
Borehole No. LWT5 Depth 13.50-14.00m

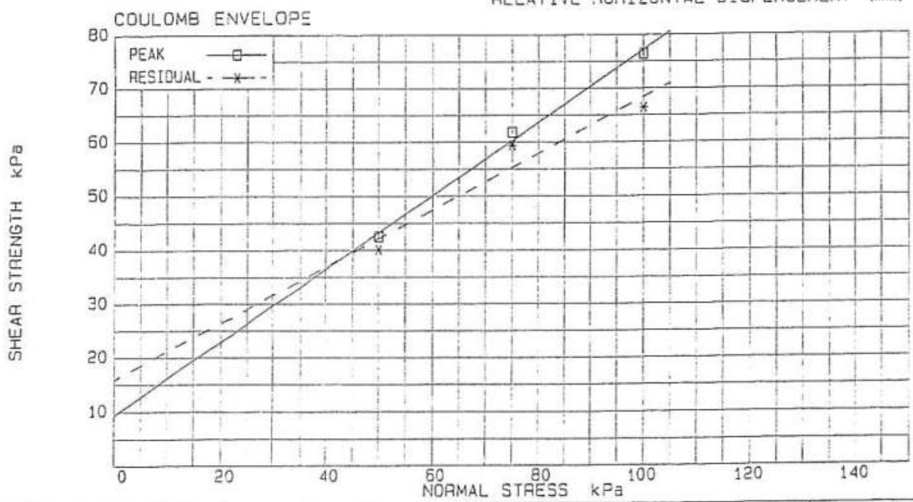
Sample No.

SLR 7.4	Soil Mechanics	Location: LLANWONNO TIPS	Loc. No. 151258	Fig. P3/6



SOIL DESCRIPTION	Dense dark grey fine to coarse sand and fine to medium gravel sized COLLIERY SPOIL.			
PREPARATION	Material crushed to -2mm. Recompacted to 1.80Mg/m3 bulk density at as received moisture content. Test carried out in submerged condition			
SPECIMEN		A	B	C
INITIAL	Bulk density Mg/m3	1.80	1.80	1.80
	Moisture %	6.2	6.2	6.2
	Dry density Mg/m3	1.70	1.69	1.69
Particle density 2.65 Mg/m3 assumed	Void Ratio	0.563	0.564	0.564
	Saturation %	29	29	29
AFTER TEST	Bulk density Mg/m3			
	Moisture %	15	15	14
	Dry Density Mg/m3			





CONSOLIDATION PRESSURE / NORMAL STRESS kPa		50	75	100
RATES OF DISPLACE -MENT	Peak mm/min	0.600	0.600	0.600
	Post peak / Residual mm/min	0.600	0.600	0.600
PEAK VALUES	Relative Displacement mm	9.00	10.0	8.50
	Shear Strength kPa	42.5	61.8	76.4
RESIDUAL VALUES	Number of Reversals	3	3	3
	Relative Displacement mm	39.0	39.0	39.0
	Shear Strength kPa	40.1	59.4	66.3

SHEAR STRENGTH PARA-METERS			Linear regression	Re-assessed	
	PEAK	C'	9		kPa
		Ø'	34		Degrees
	RESIDUAL	C'a	16		kPa
		Ø'a	27½		Degrees

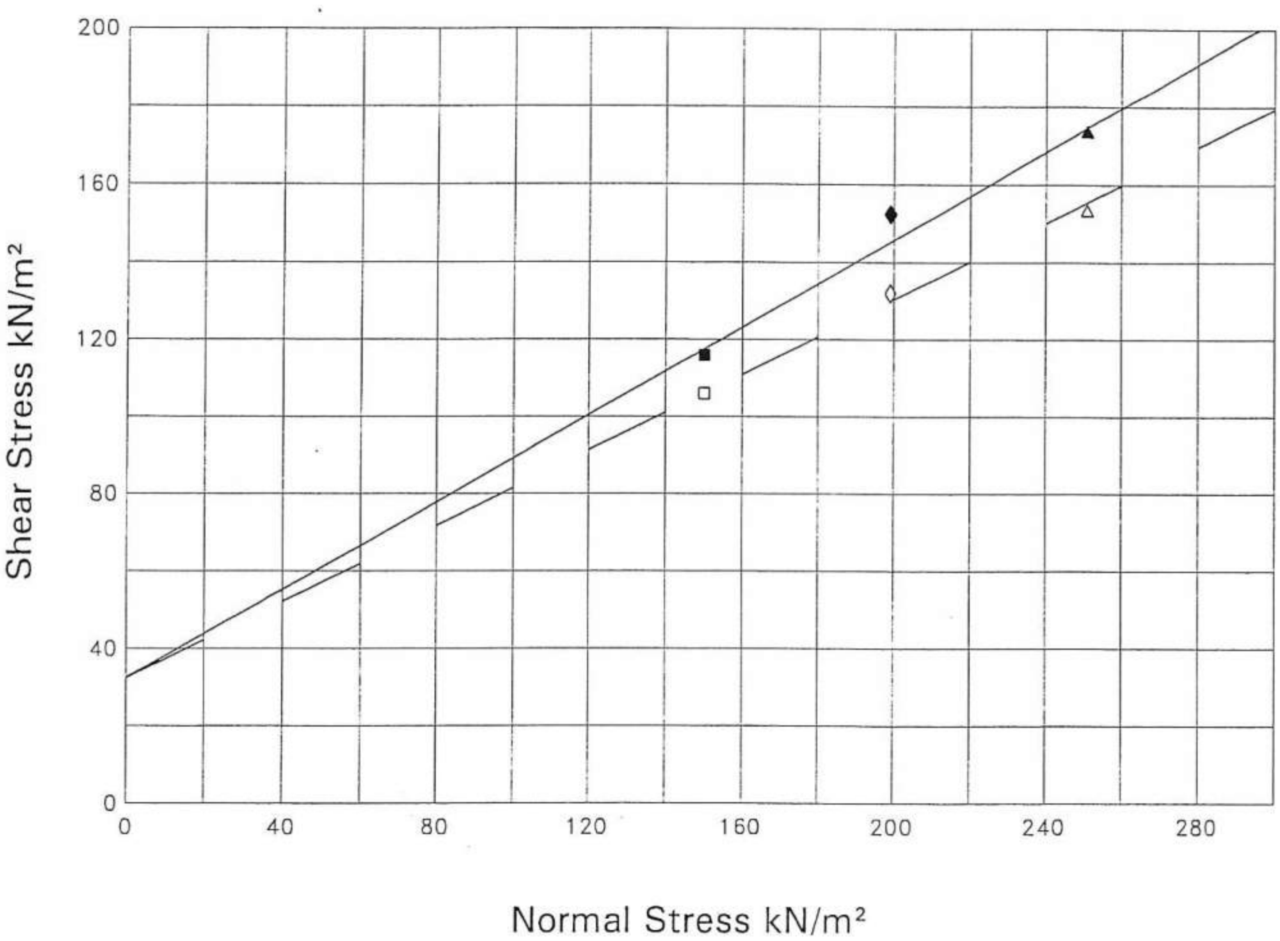
CONSOLIDATED DRAINED DIRECT SHEAR TEST

BS1377: Part 7: 1990, method 4 in 60mm square x 20mm deep box

Borehole No. LWT6 Depth 1.75-2.25m

Sample No.

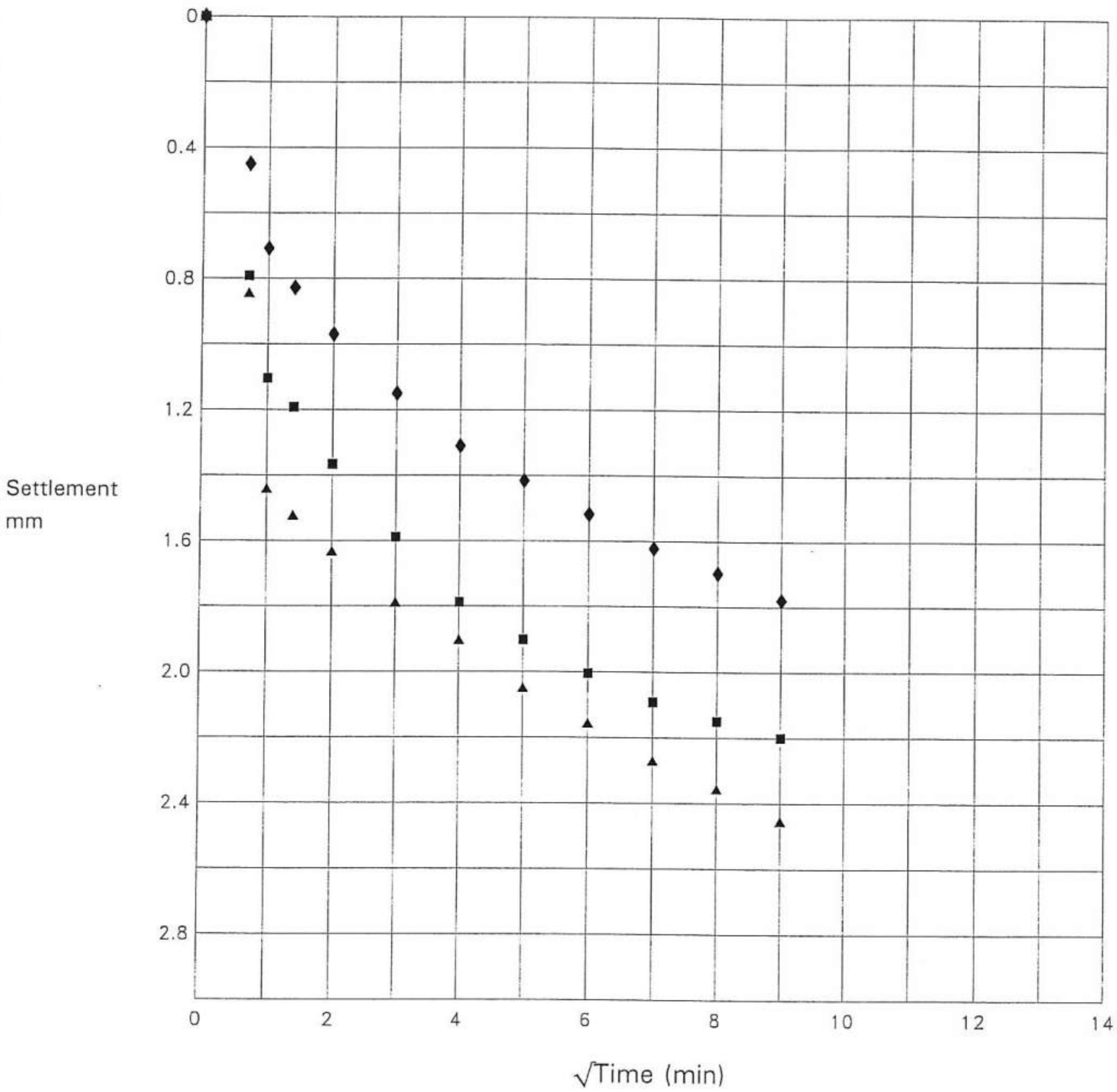
SLR 7.4	Soil Mechanics	Location LLANWONNO TIPS	Loc. No. 151258	Fig. P3/7



Normal Stress	kN/m²	150.0	199.1	251.0	
Peak Shear Stress	kN/m²	116.0	152.5	173.5	
Residual Shear Stress	kN/m²	106.0	132.0	153.5	
Rate of Strain	mm/min	.02400	.02400	.02400	
Strain at Peak Shear Stress	%	10.01	14.17	10.01	
Method of Residual Shear Stress Determination		Reversal			
Sample Preparation		REMOULDED			

Shear Box Drained	Description Dark brown/black very gravelly slightly sandy CLAY	C' 32.5 C'r 32.5 kN/m² Ø' 29.5 Ø'r 26 Degrees
	Shear Stress/Normal Stress	Depth 7.00 - 7.50 m Borehole LWT3
Remarks		
Laboratory - Effective Stress	**Project** Llanwunno Tips Rhondda Cynon Taff	**Contract** 151258
Exploration Associates		**Figure** P3/8

■ p'o = 150.0 kN/m² ♦ p'o = 199.1 kN/m² ▲ p'o = 251.0 kN/m² ▼ p'o = kN/m²



p'o kN/m²	t_{100} mins	C_v m²/year	M_v m²/MN	k m/sec	Voids Ratio Initial	Voids Ratio After Consolidation	Voids Ratio After Shearing	Initial Saturation %
150.0	3.97	14.94	.61	2.82×10^{-9}	.577	.433	.215	32.31
199.1	6.32	9.38	.37	1.08×10^{-9}	.577	.460	.169	33.69
251.0	2.90	20.45	.41	2.60×10^{-9}	.568	.407	.149	31.82

Shear Box Settlement/√Time

Remarks

Depth 7.00 - 7.50 m
Borehole LWT3

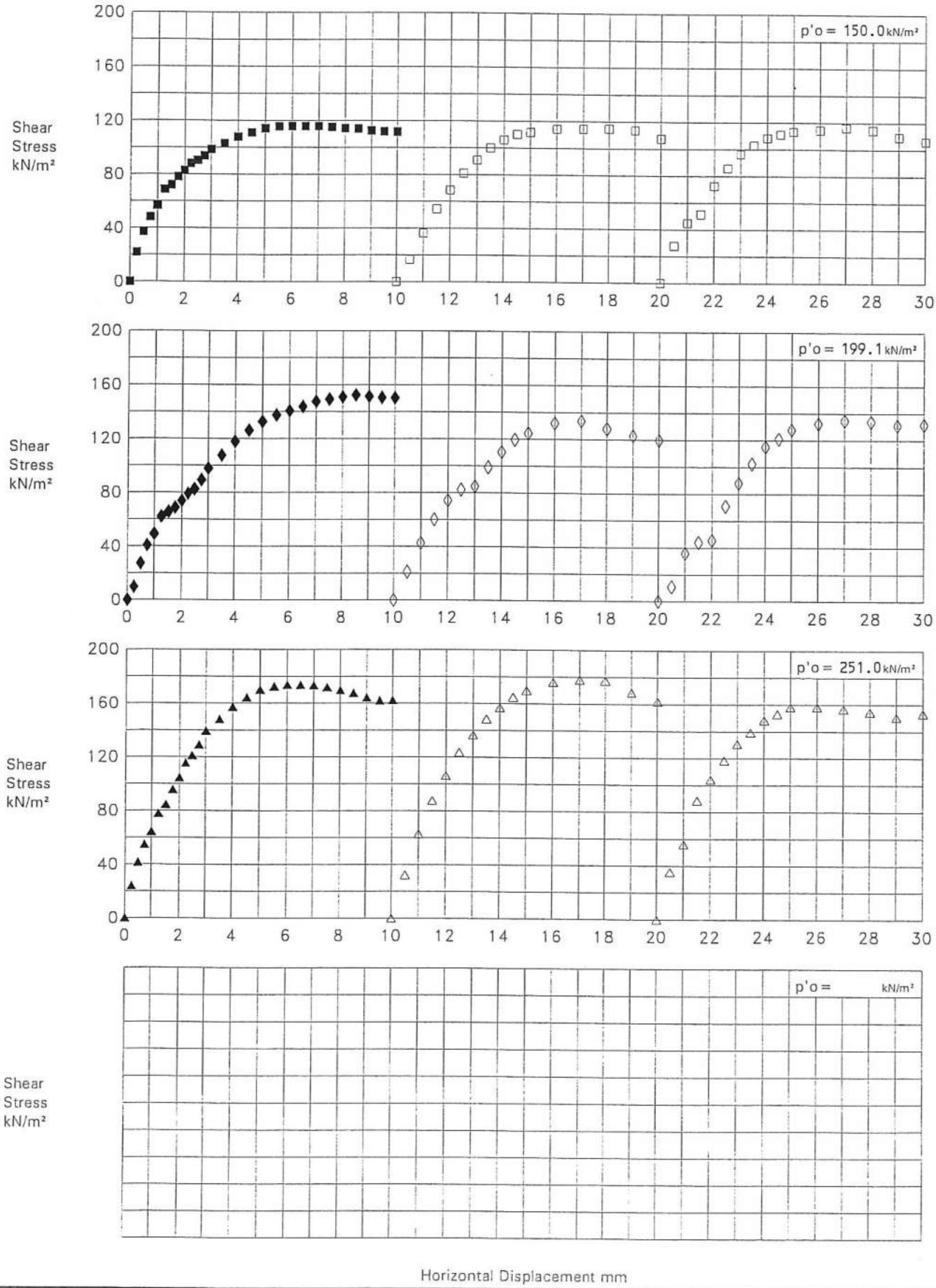
Laboratory - Effective Stress

Project
Llanwunno Tips
Rhondda Cynon Taff

Contract 151258

Exploration Associates

Figure P3/9



Shear Box Shear Stress / Displacement

Depth 7.00 - 7.50 m
Borehole LWT3

Remarks ■ ♦ ▲ ▼ Peak Shear
□ ◇ △ ▽ Residual Shear

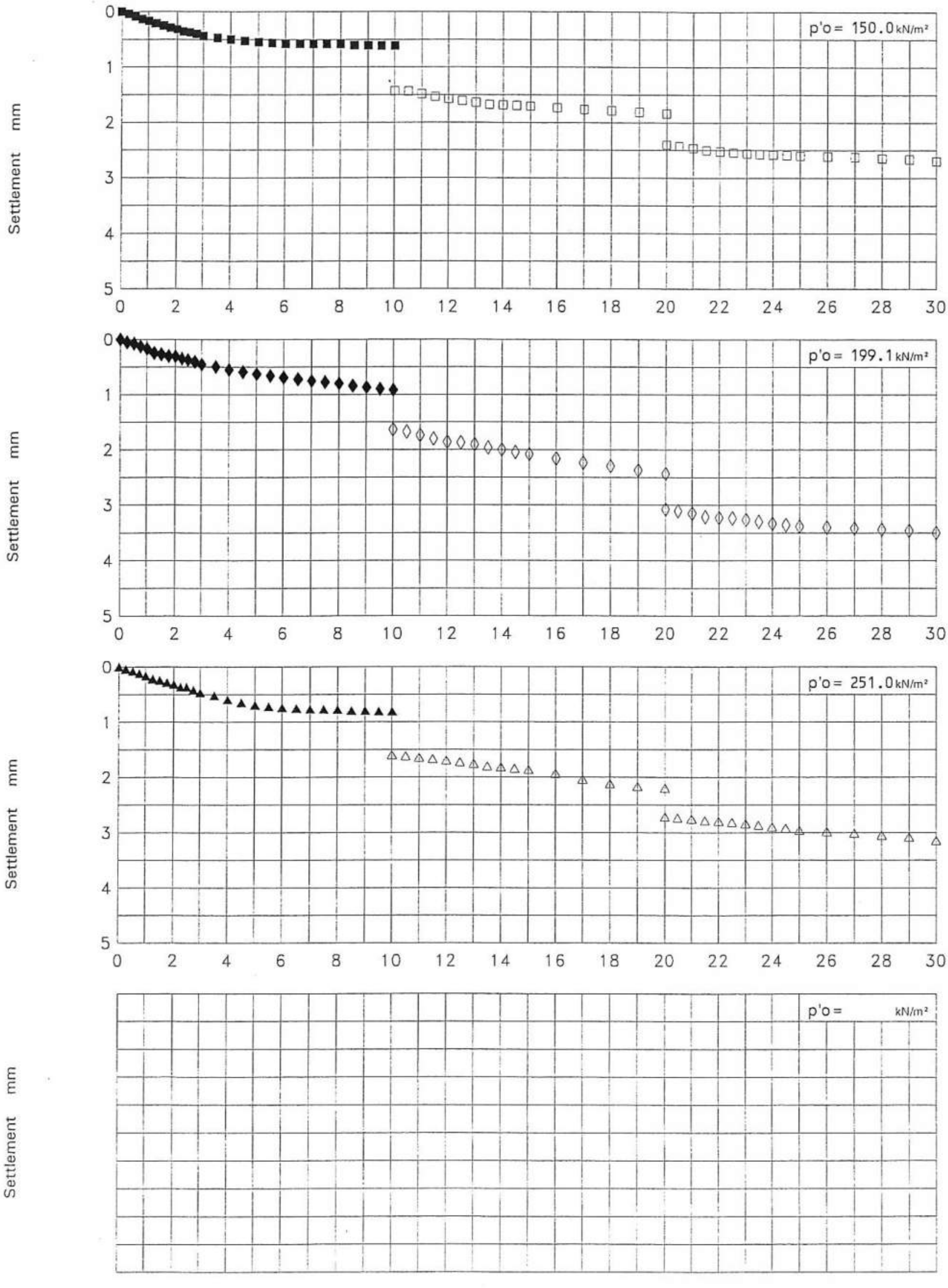
Laboratory - Effective Stress

Project
Llanwunno Tips
Rhondda Cynon Taff

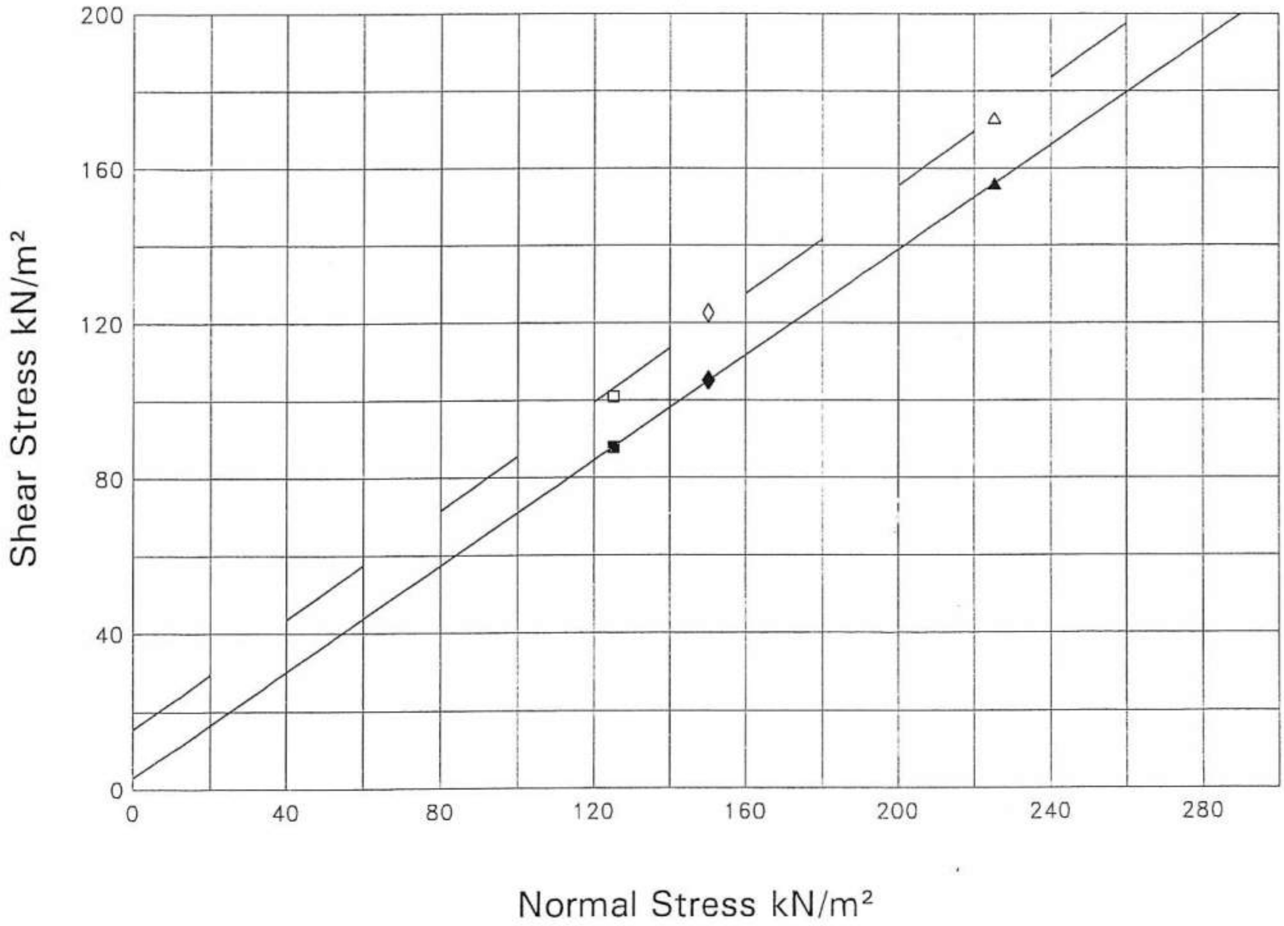
Contract 151258

Figure P2 /10

Exploration Associates

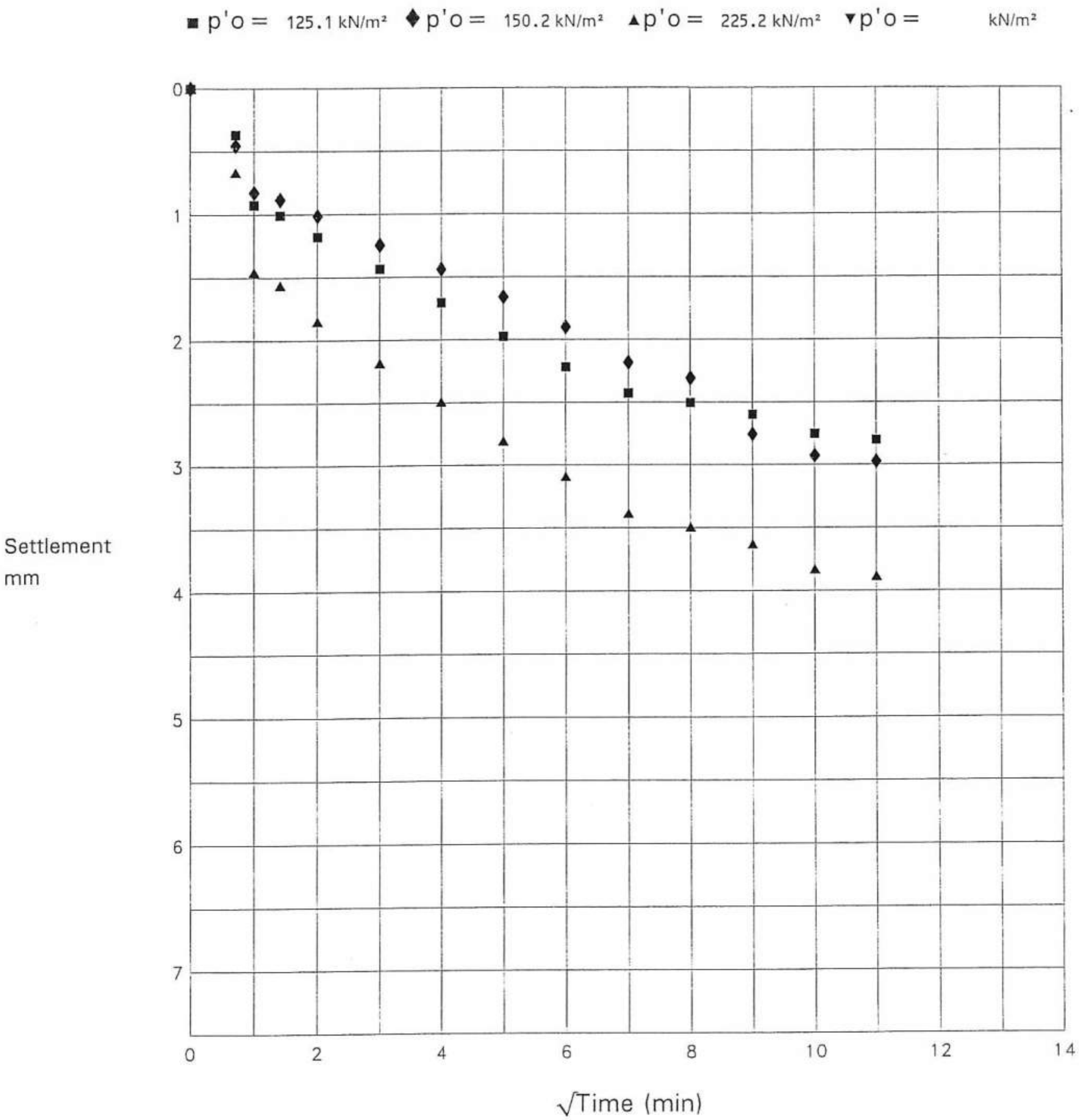


Shear Box Settlement / Displacement	Depth 7.00 - 7.50 m Borehole LWT3
Remarks ■ ◆ ▲ ▼ Peak Settlement □ ◇ △ ▽ Residual Settlement	
Laboratory - Effective Stress Exploration Associates	**Project** Llanwunno Tips Rhondda Cynon Taff
Contract 151258	**Figure** D2/4



Normal Stress	kN/m²	125.1	150.2	225.2	
Peak Shear Stress	kN/m²	88.0	105.0	156.0	
Residual Shear Stress	kN/m²	101.0	122.5	173.0	
Rate of Strain	mm/min	.02400	.02400	.02400	
Strain at Peak Shear Stress	%	16.68	11.67	12.51	
Method of Residual Shear Stress Determination		Reversal			
Sample Preparation		REMOULDED			

Shear Box Drained	Description Very stiff grey brown gravelly CLAY	C' 3 C'r 15.5 kN/m² Ø' 34 Ø'r 35 Degrees
	Shear Stress/Normal Stress	Depth 8.50 - 9.00 m Borehole LWT6
Remarks		
Laboratory - Effective Stress	**Project** Llanwunno Tips Rhondda Cynon Taff	**Contract** 151258
Exploration Associates		**Figure** D3 / 17



p'o kN/m²	t_{100} mins	C_v m²/year	M_v m²/MN	k m/sec	Voids Ratio Initial	Voids Ratio After Consolidation	Voids Ratio After Shearing	Initial Saturation %
125.1	15.45	3.84	.94	1.12×10^{-9}	.606	.418	.211	39.31
150.2	23.56	2.52	.83	6.48×10^{-10}	.596	.398	.179	38.92
225.2	12.37	4.79	.72	1.07×10^{-9}	.606	.346	.095	39.70

Shear Box Settlement/√Time

Remarks

Depth 8.50 - 9.00 m
Borehole LWT6

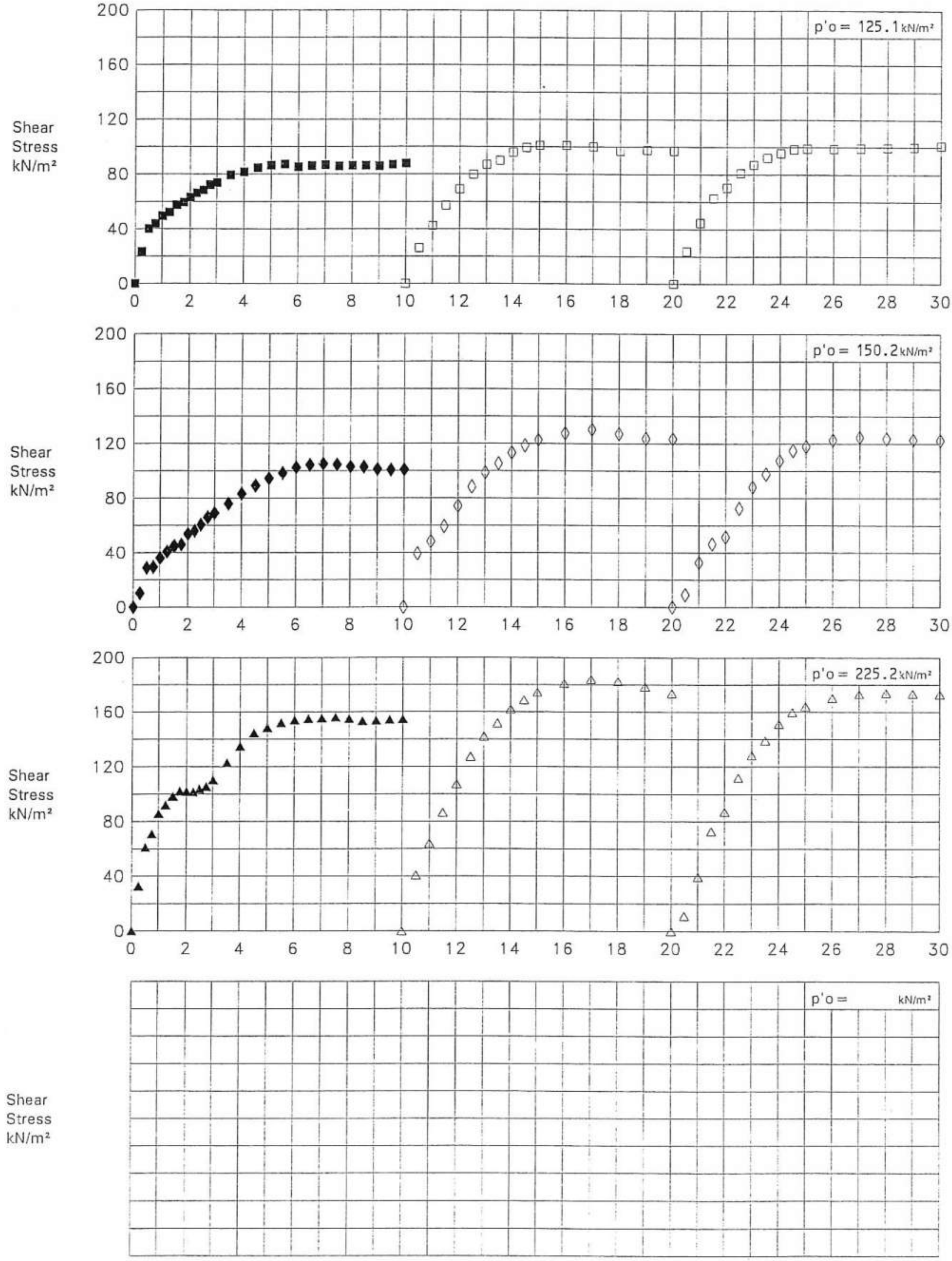
Laboratory - Effective Stress

Project
Llanwunno Tips
Rhondda Cynon Taff

Contract 151258

Figure P3/13

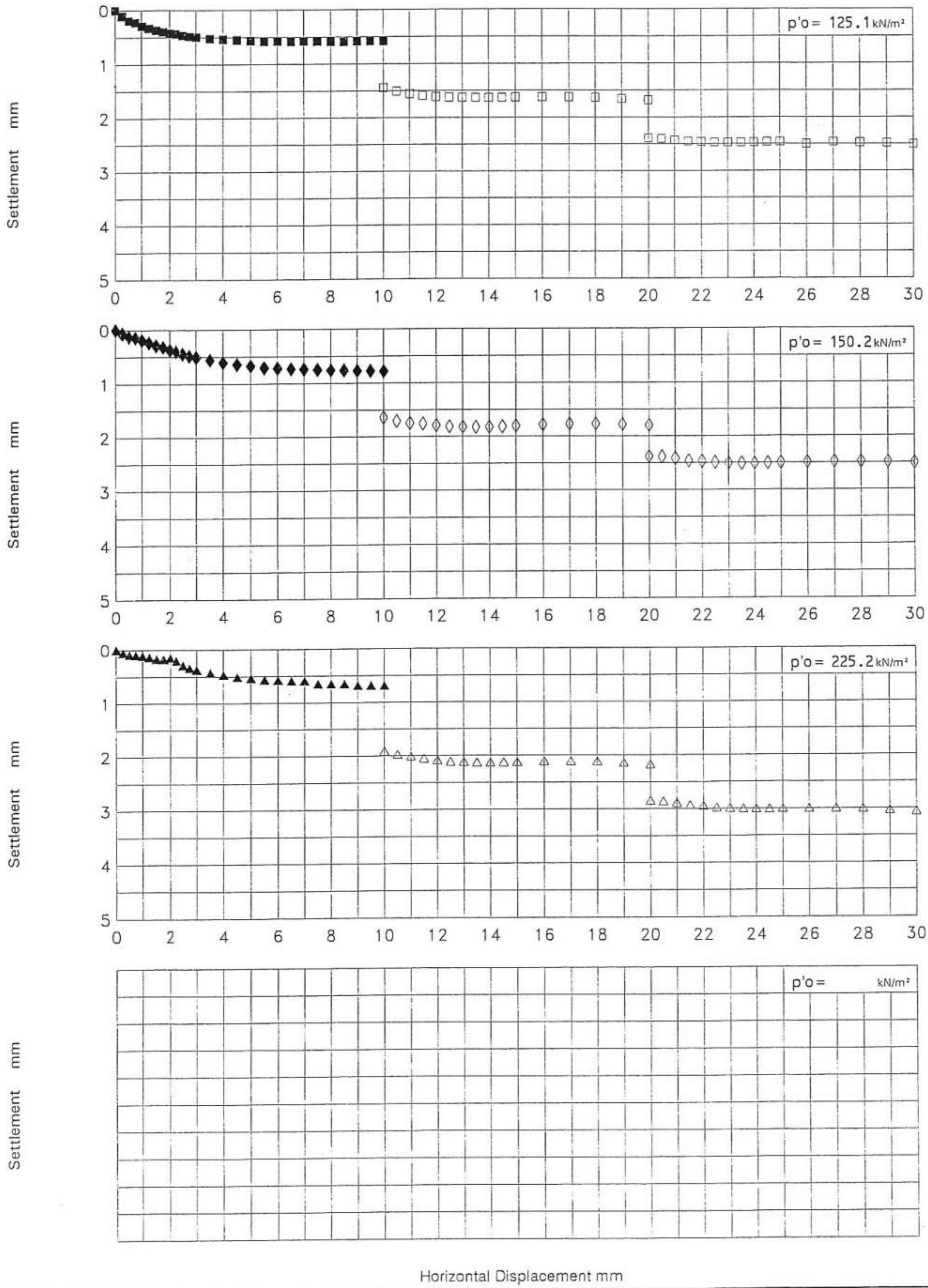
Exploration Associates



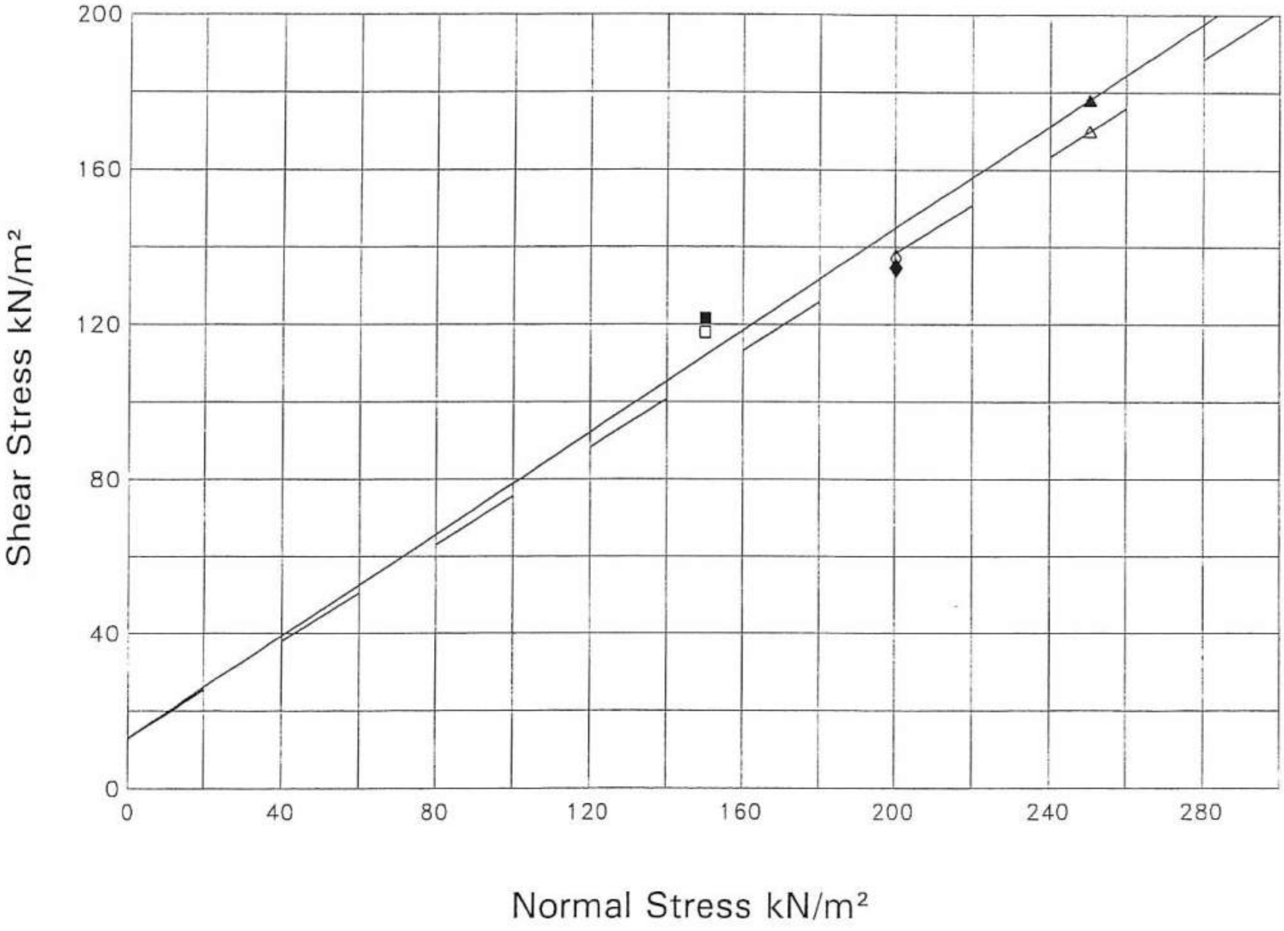
Shear Box Shear Stress / Displacement	Depth 8.50 - 9.00 m Borehole LWT6

Remarks ■ ♦ ▲ ▼ Peak Shear
□ ◇ △ ▽ Residual Shear

Laboratory - Effective Stress	**Project** Llanwunno Tips Rhondda Cynon Taff	**Contract** 151258
Exploration Associates		**Figure** P2/11

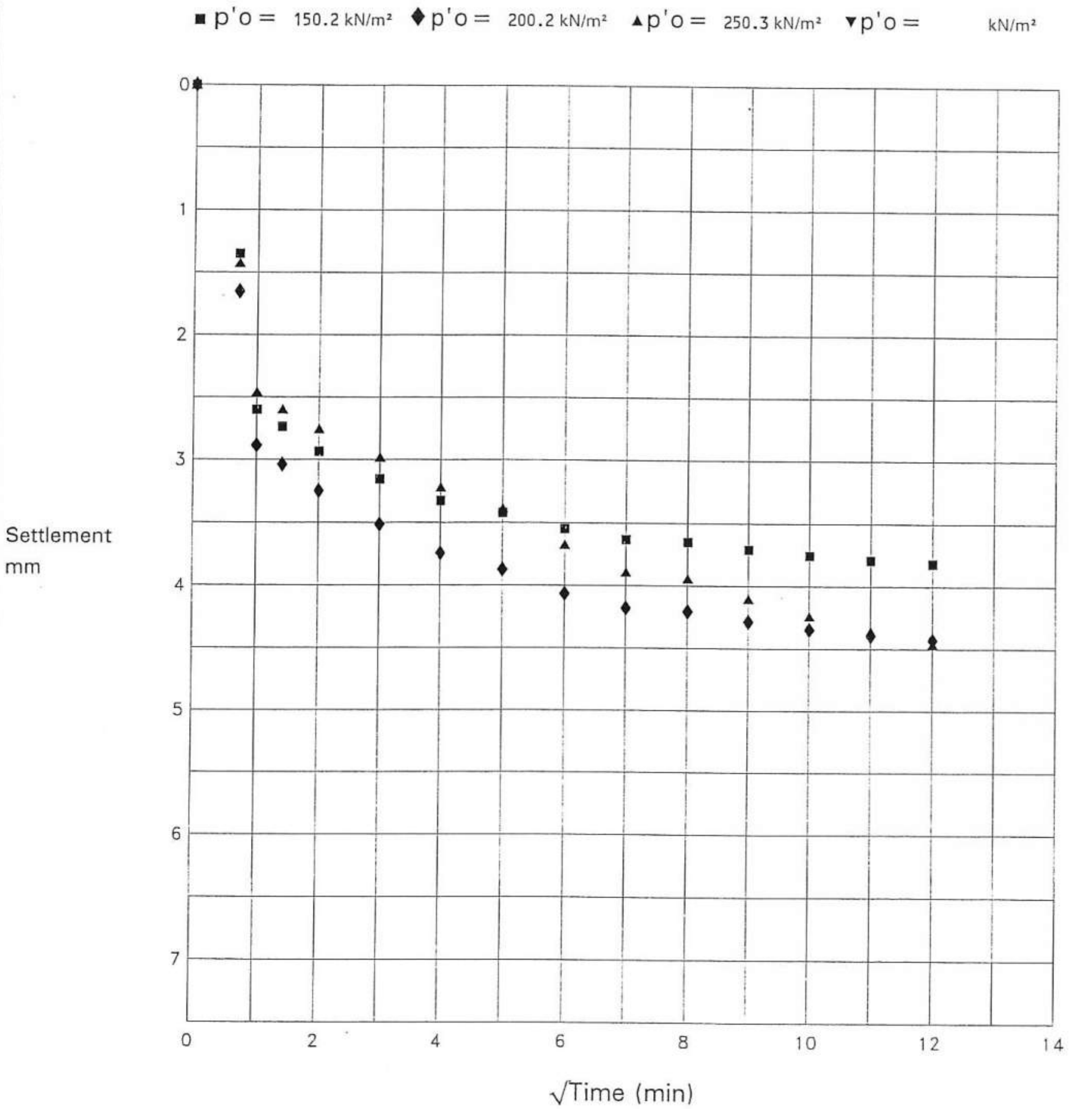


Shear Box Settlement / Displacement		Depth 8.50 - 9.00 m Borehole LWT6
Remarks ■ ♦ ▲ ▼ Peak Settlement □ ◇ △ ▽ Residual Settlement		
Laboratory - Effective Stress	**Project** Llanwunno Tips Rhondda Cynon Taff	**Contract** 151258
Exploration Associates		**Figure** P3/15



Normal Stress	kN/m²	150.2	200.2	250.3	
Peak Shear Stress	kN/m²	121.5	134.5	178.0	
Residual Shear Stress	kN/m²	118.0	137.0	170.0	
Rate of Strain	mm/min	.12000	.12000	.12000	
Strain at Peak Shear Stress	%	10.84	10.01	11.67	
Method of Residual Shear Stress Determination		Reversal			
Sample Preparation		REMOULDED			

Shear Box Drained	Description Stiff yellow brown slightly sandy slightly gravelly CLAY	C' 13 C'r 13 kN/m² Ø' 33.5 Ø'r 32 Degrees
	Shear Stress/Normal Stress	Depth 10.50 - 11.00 m Borehole LWT6
Remarks		
Laboratory - Effective Stress	**Project** Llanwunno Tips Rhondda Cynon Taff	**Contract** 151258
Exploration Associates		**Figure** 02/16



p'o kN/m²	t_{100} mins	C_v m²/year	M_v m²/MN	k m/sec	Voids Ratio Initial	Voids Ratio After Consolidation	Voids Ratio After Shearing	Initial Saturation %
150.2	2.16	27.45	1.06	9.02×10^{-9}	.677	.410	.177	54.74
200.2	2.36	25.13	.92	7.17×10^{-9}	.667	.358	.124	56.25
250.3	3.29	18.02	.74	4.13×10^{-9}	.677	.365	.168	55.53

Shear Box Settlement/√Time

Remarks

Depth 10.50 - 11.00 m
Borehole LWT6

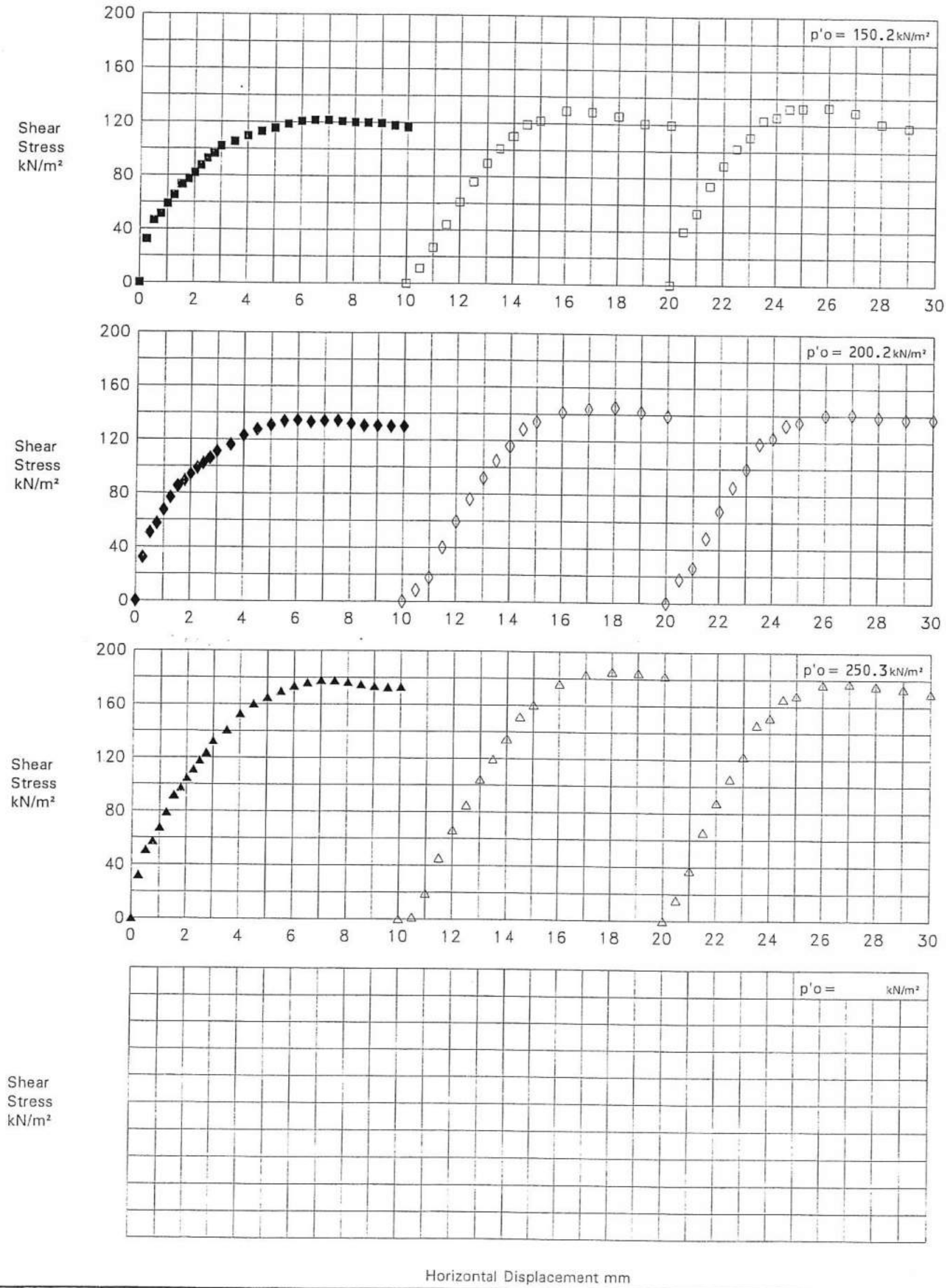
Laboratory - Effective Stress

Project
Llanwunno Tips
Rhondda Cynon Taff

Contract 151258

Exploration Associates

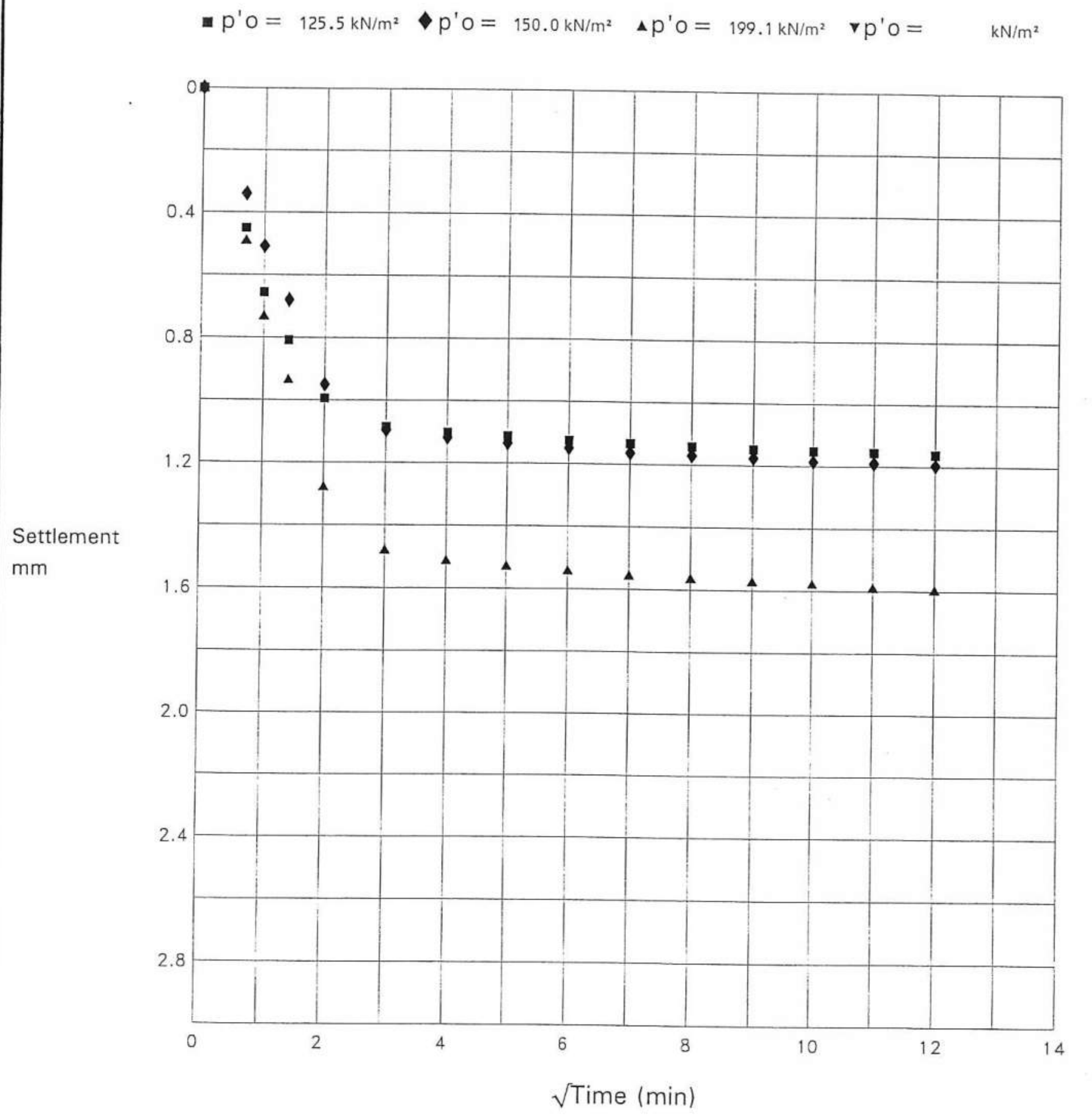
Figure P3/17



Shear Box Shear Stress / Displacement	Depth 10.50 - 11.00 m Borehole LWT6

Remarks ■ ◆ ▲ ▼ Peak Shear
□ ◇ △ ▽ Residual Shear

Laboratory - Effective Stress	**Project** Llanwunno Tips Rhondda Cynon Taff	**Contract** 151258
Exploration Associates		**Figure** D2/18



p'o kN/m²	t_{100} mins	C_v m²/year	M_v m²/MN	k m/sec	Voids Ratio Initial	Voids Ratio After Consolidation	Voids Ratio After Shearing	Initial Saturation %
125.5	4.47	13.27	.39	1.60×10^{-9}	.550	.475	.222	24.20
150.0	6.19	9.58	.33	9.80×10^{-10}	.550	.472	.196	25.89
199.1	6.09	9.74	.33	9.96×10^{-10}	.541	.438	.129	23.53

Shear Box Settlement/√Time

Remarks

Depth 5.75 - 6.25 m
Borehole LWT7

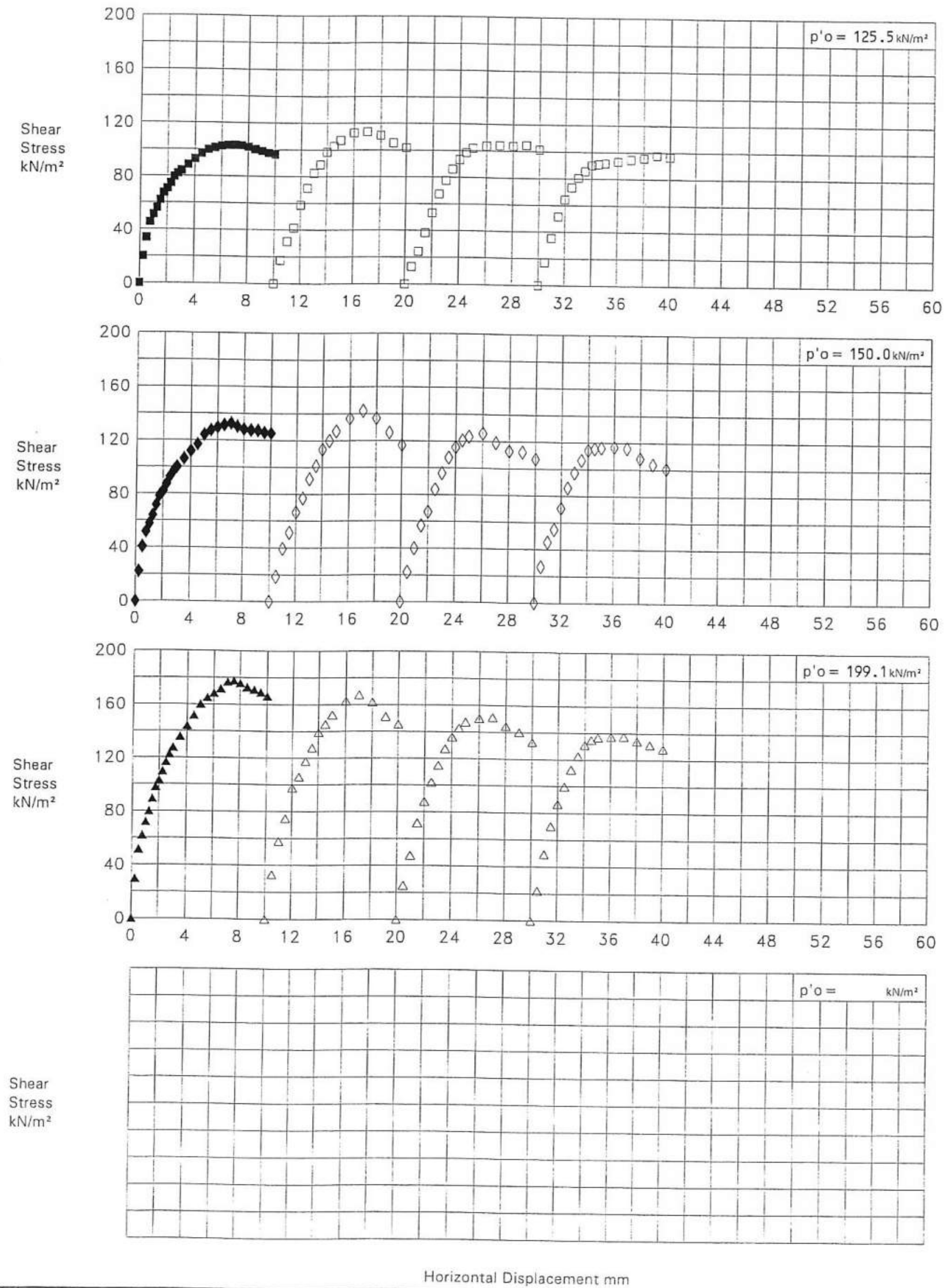
Laboratory - Effective Stress

Project
Llanwunno Tips
Rhondda Cynon Taff

Contract 151258

Exploration Associates

Figure 02 /07

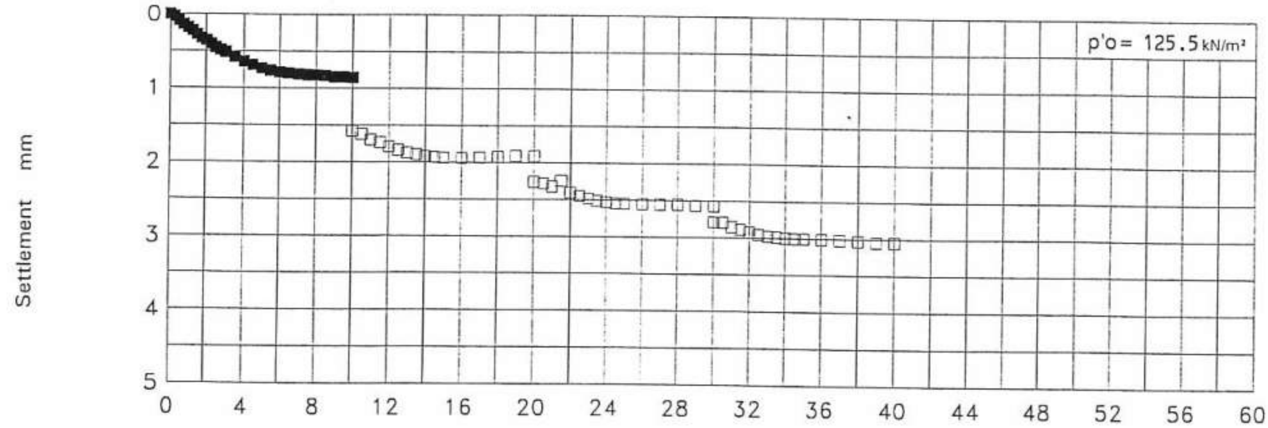


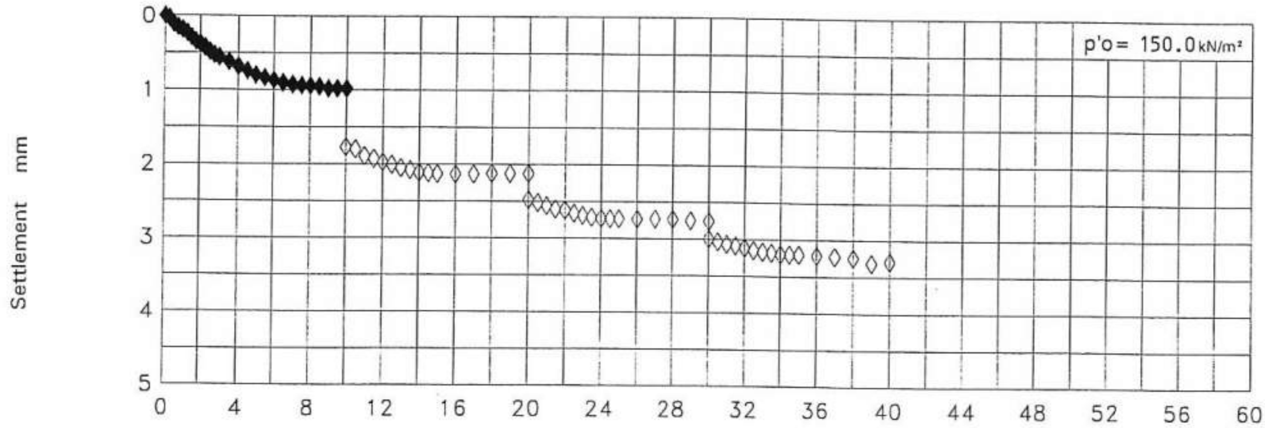
Shear Box Shear Stress / Displacement	Depth 5.75 - 6.25 m Borehole LWT7

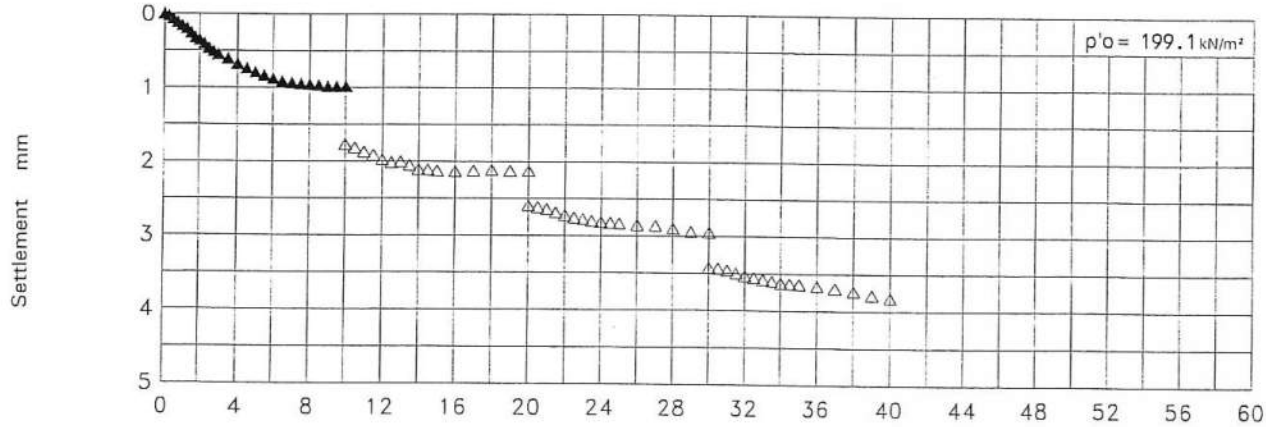
Remarks ■ ◆ ▲ ▼ Peak Shear
□ ◇ △ ▽ Residual Shear

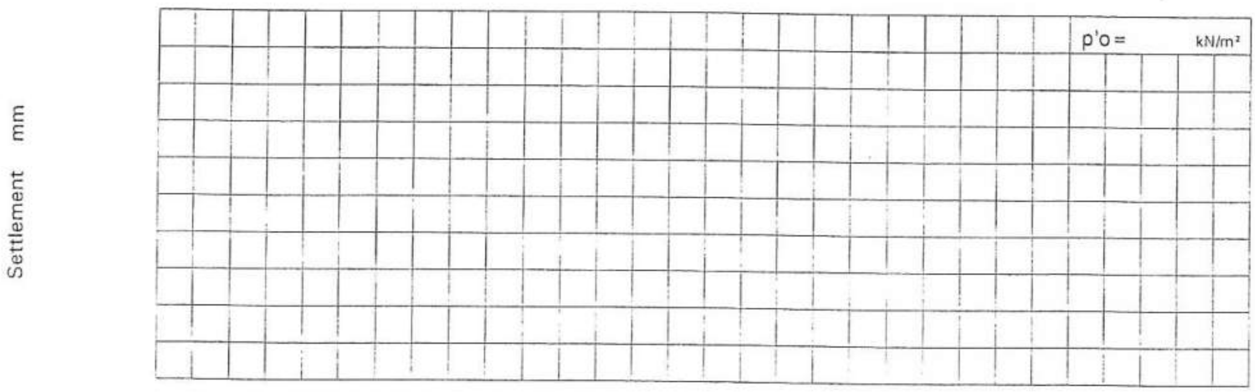
Laboratory - Effective Stress	**Project** Llanwunno Tips Rhondda Cynon Taff	**Contract** 151258 **Figure**

Exploration Associates





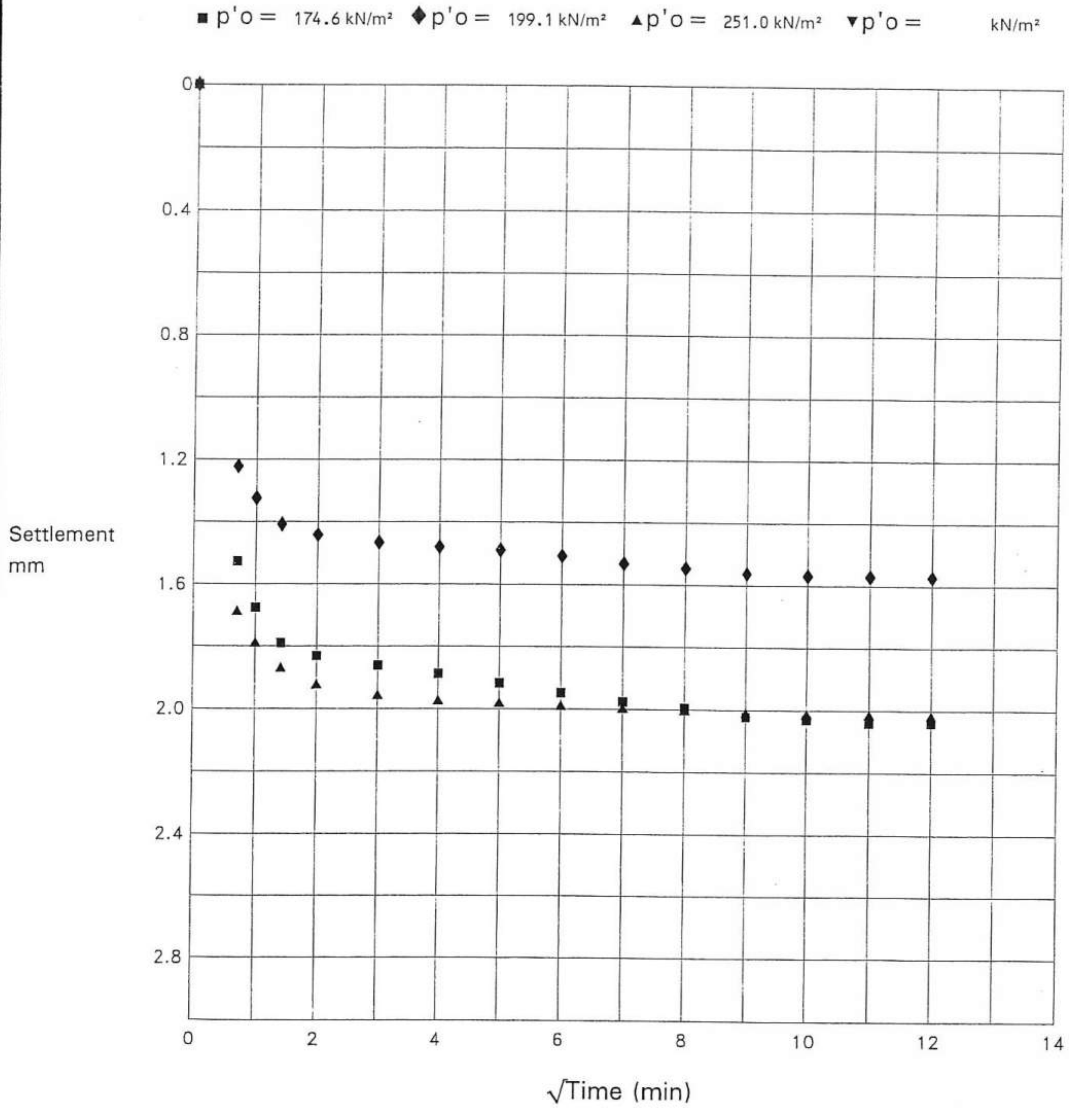




Horizontal Displacement mm

Shear Box Settlement / Displacement	Depth 5.75 - 6.25 m Borehole LWT7
Remarks ■ ◆ ▲ ▼ Peak Settlement □ ◇ △ ▽ Residual Settlement	
Laboratory - Effective Stress	Project Llanwunno Tips Rhondda Cynon Taff
Contract 151258	Figure 03/27

Exploration Associates



p'o kN/m²	t_{100} mins	C_v m²/year	M_v m²/MN	k m/sec	Voids Ratio Initial	Voids Ratio After Consolidation	Voids Ratio After Shearing	Initial Saturation %
174.6	2.93	20.24	.49	3.07×10^{-9}	.803	.649	.370	72.79
199.1	2.93	20.24	.33	2.07×10^{-9}	.803	.684	.386	74.05
251.0	2.74	21.64	.34	2.28×10^{-9}	.791	.640	.325	72.94

Shear Box Settlement/√Time

Remarks

Depth 8.50 - 9.00 m
Borehole LWT7

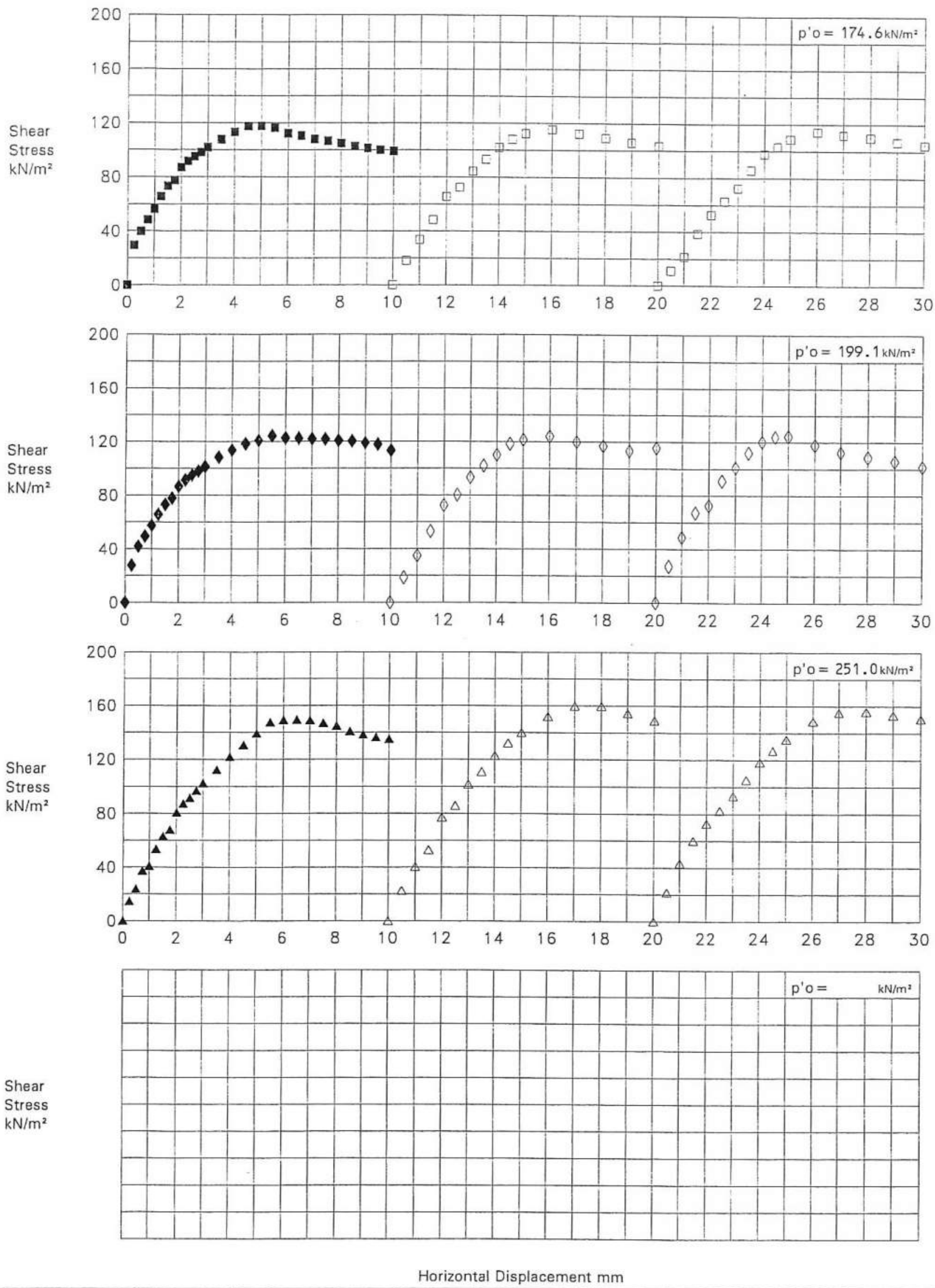
Laboratory - Effective Stress

Project
Llanwunno Tips
Rhondda Cynon Taff

Contract 151258

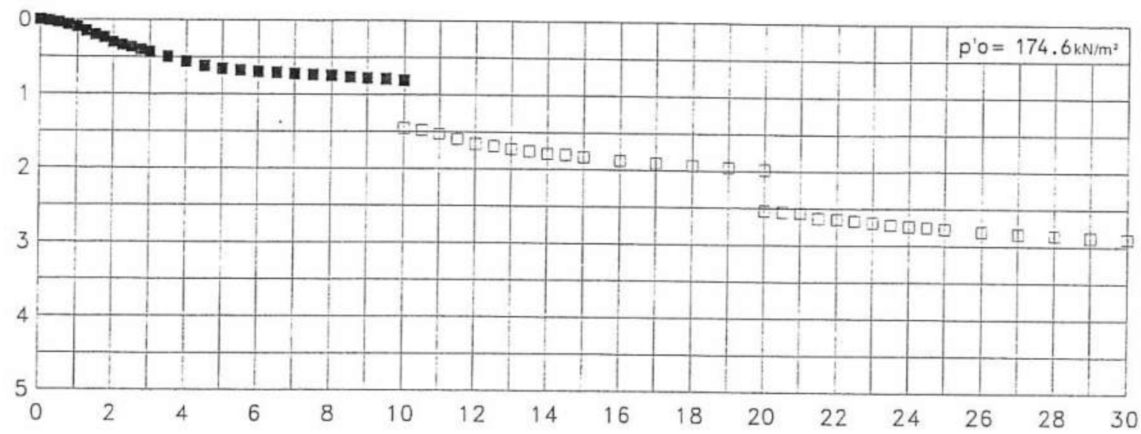
Exploration Associates

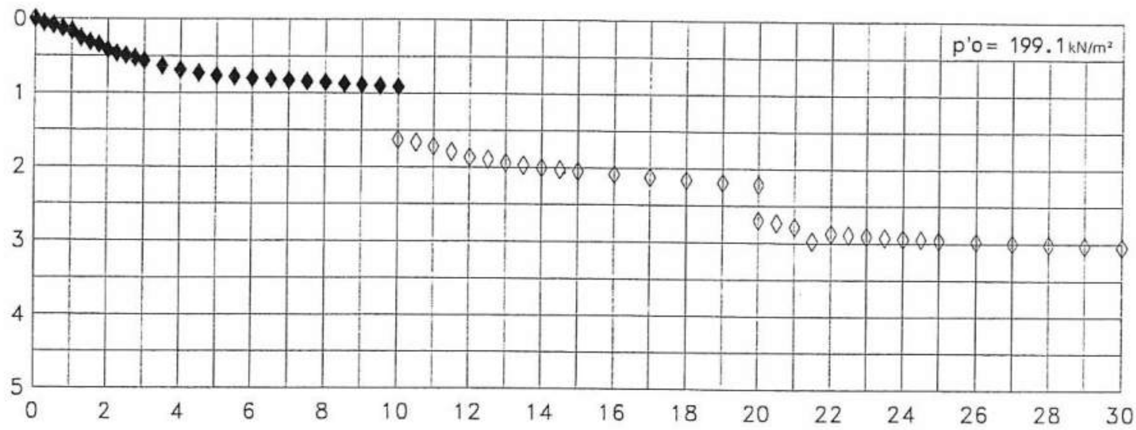
Figure 93/29

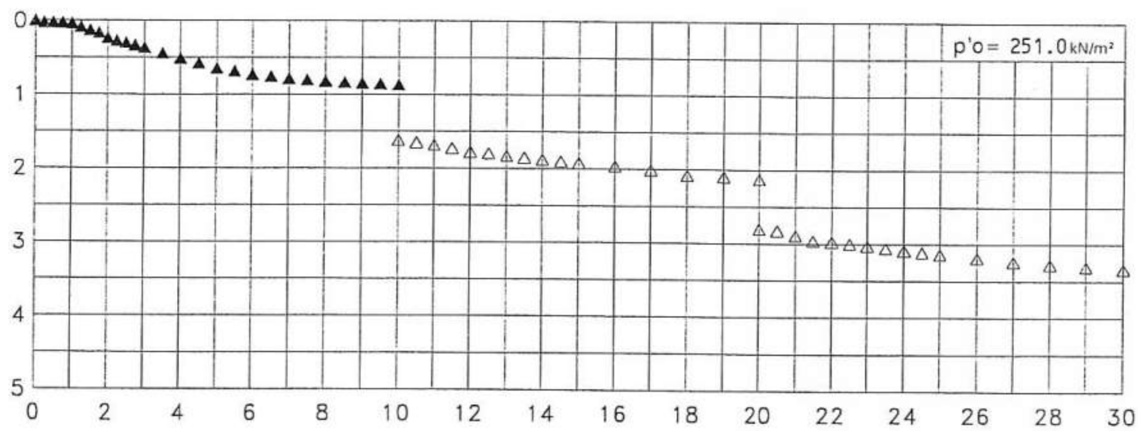


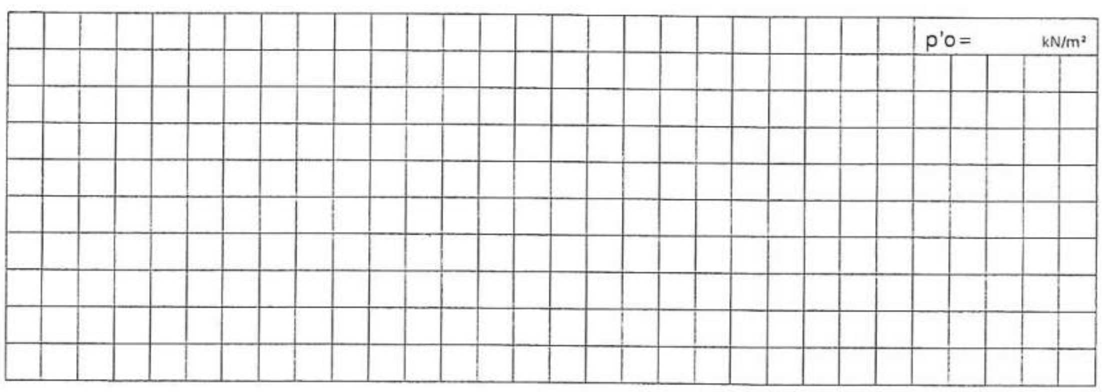
Shear Box Shear Stress / Displacement	Depth 8.50 - 9.00 m Borehole LWT7
Remarks ■ ◆ ▲ ▼ Peak Shear □ ◇ △ ▽ Residual Shear	
Laboratory - Effective Stress	**Project** Llanwunno Tips, Rhondda Cynon Taff
Contract 151258	**Figure** P3/30

Exploration Associates







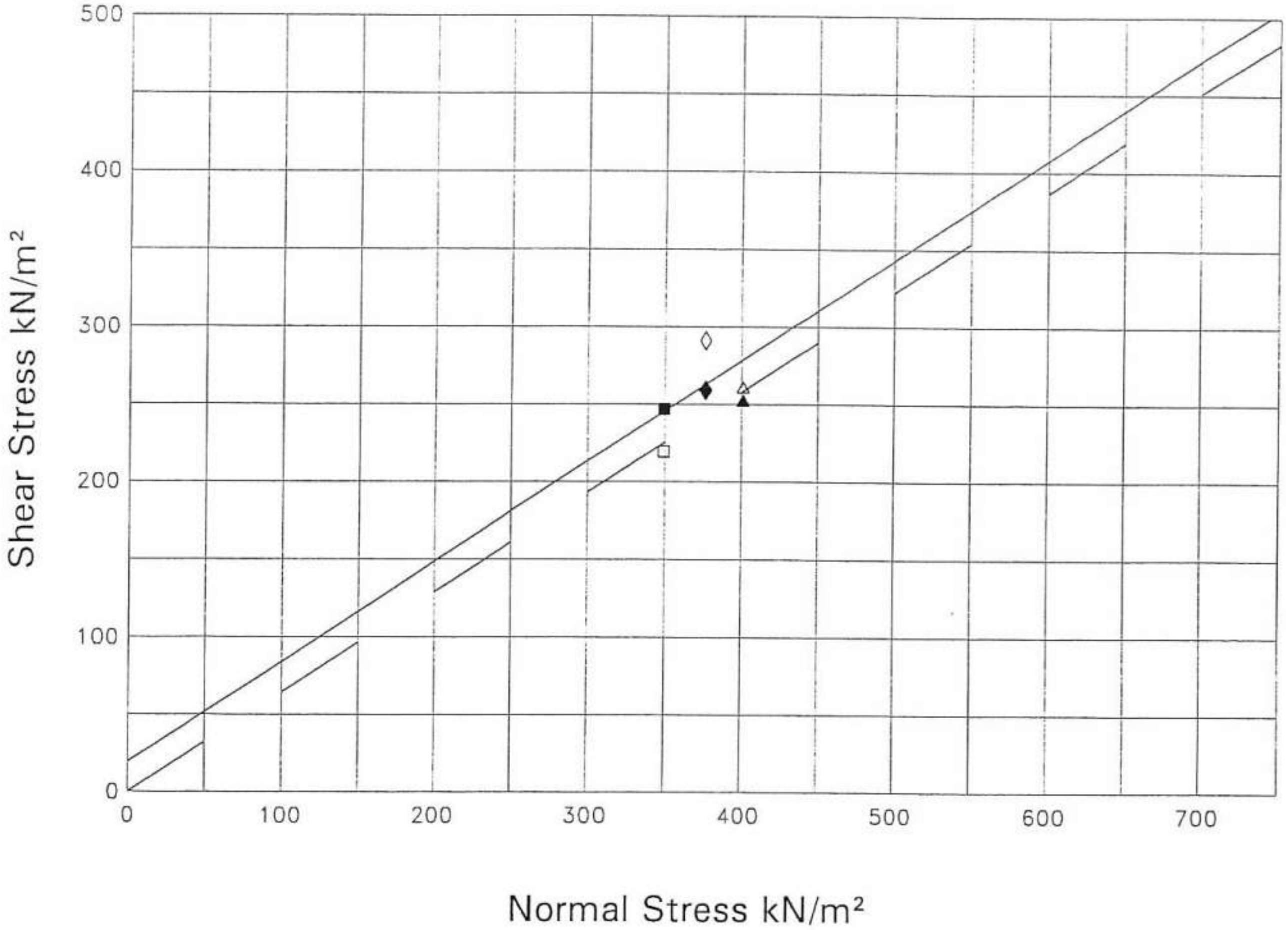


Horizontal Displacement mm

Shear Box Settlement / Displacement	Depth 8.50 - 9.00 m Borehole LWT7

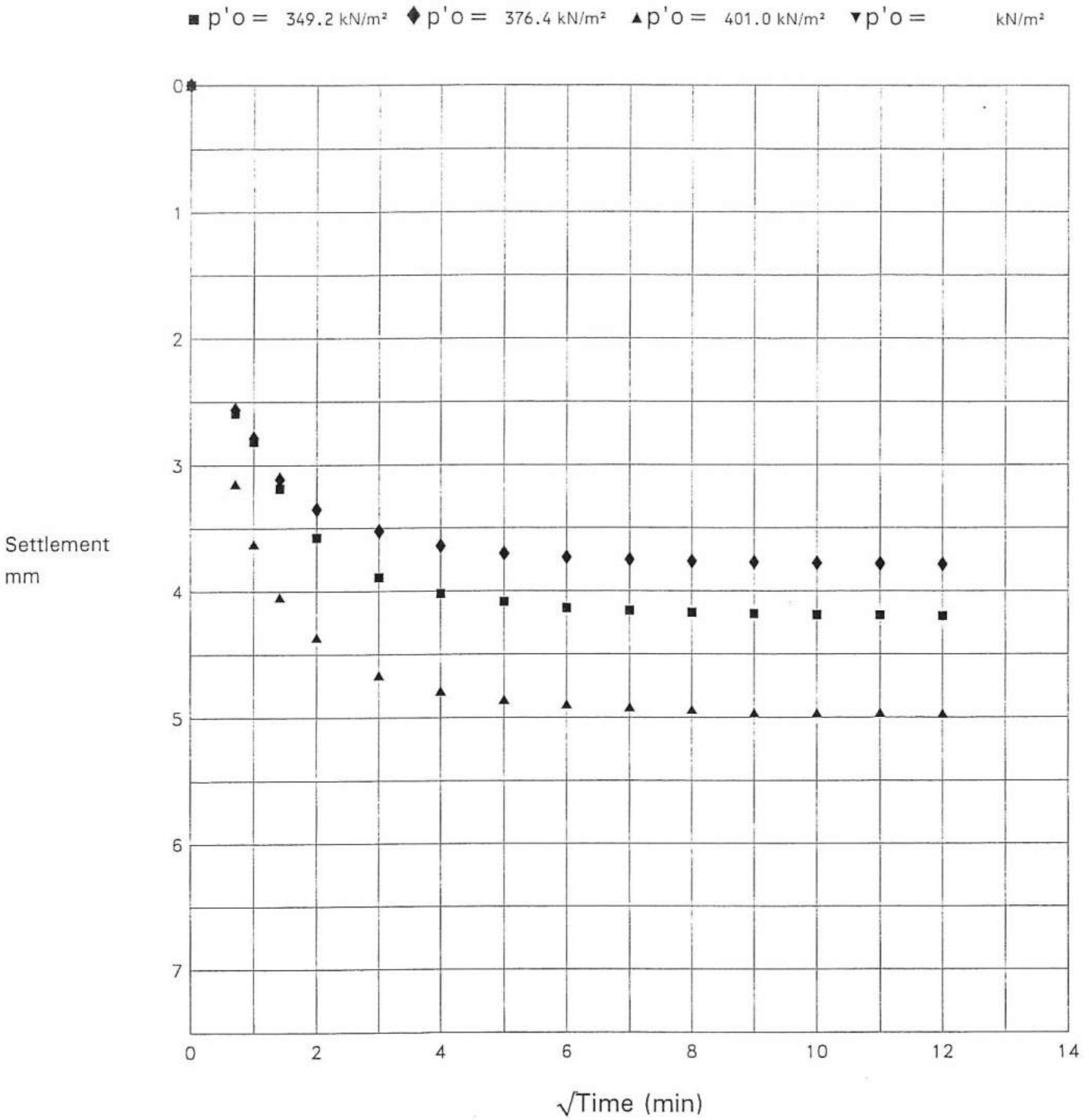
Remarks ■ ♦ ▲ ▼ Peak Settlement
□ ◇ △ ▽ Residual Settlement

Laboratory - Effective Stress	**Project** Llanwunno Tips Rhondda Cynon Taff	**Contract** 151258
Exploration Associates		**Figure** P3/31



Normal Stress	kN/m²	349.2	376.4	401.0	
Peak Shear Stress	kN/m²	247.0	259.0	252.5	
Residual Shear Stress	kN/m²	219.5	291.0	261.0	
Rate of Strain	mm/min	.03600	.03600	.03600	
Strain at Peak Shear Stress	%	11.67	11.67	14.17	
Method of Residual Shear Stress Determination		Reversal			
Sample Preparation		REMOULDED			

Shear Box Drained	Description Grey brown slightly gravelly slightly sandy CLAY with occasional orange brown sand partings	C' 19.5 C'r 0 kN/m² Ø' 33 Ø'r 33 Degrees
	Shear Stress/Normal Stress	Depth 21.70 - 22.20 m Borehole LWT8
Remarks		
Laboratory - Effective Stress	**Project** Llanwunno Tips Rhondda Cynon Taff	**Contract** 151258
Exploration Associates		**Figure** P3/32



p'o kN/m²	t_{100} mins	C_v m²/year	M_v m²/MN	k m/sec	Voids Ratio Initial	Voids Ratio After Consolidation	Voids Ratio After Shearing	Initial Saturation %
349.2	6.84	8.67	.50	1.34×10^{-9}	.815	.497	.149	74.84
376.4	5.21	11.38	.42	1.48×10^{-9}	.803	.518	.220	74.71
401.0	4.58	12.95	.52	2.09×10^{-9}	.815	.439	.107	76.11

Shear Box Settlement/√Time

Remarks

Depth 21.70 - 22.20 m
Borehole LWT8

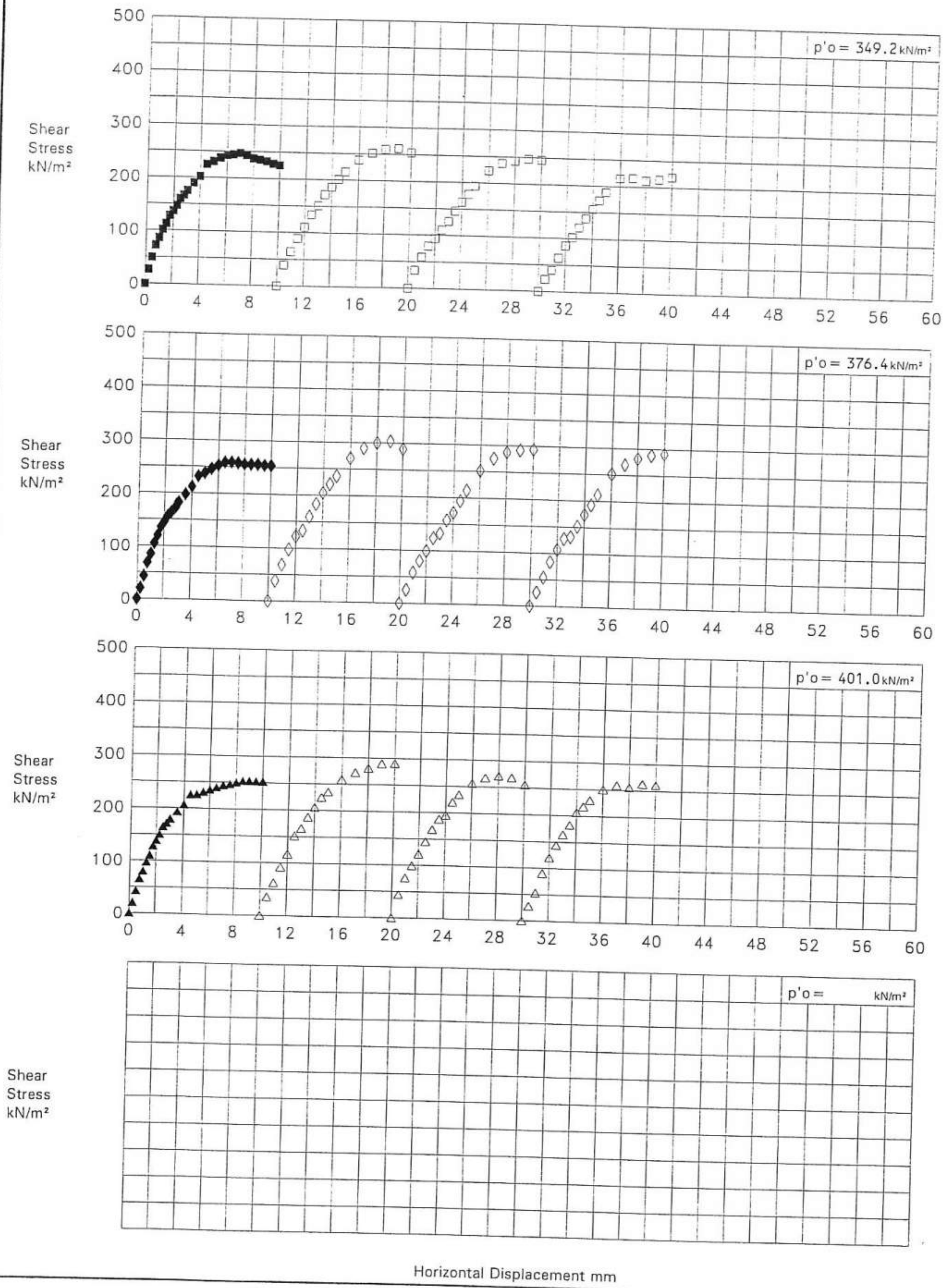
Laboratory - Effective Stress

Project
Llanwunno Tips
Rhondda Cynon Taff

Contract 151258

Exploration Associates

Figure P3/33



Shear Box Shear Stress / Displacement

Depth 21.70 - 22.20 m
Borehole LWT8

Remarks ■ ♦ ▲ ▼ Peak Shear
□ ◇ △ ▽ Residual Shear

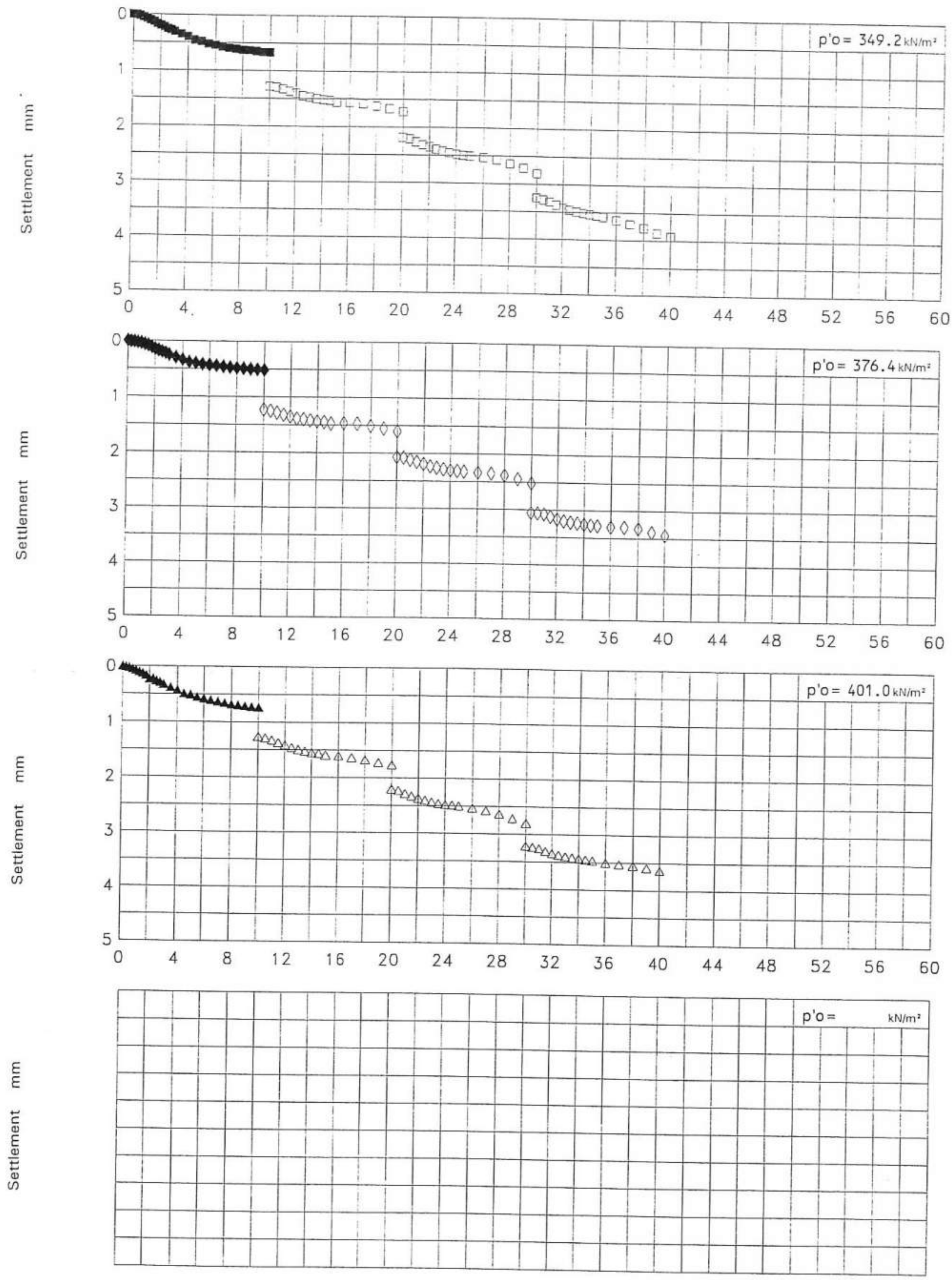
Laboratory - Effective Stress

Project
Llanwunno Tips
Rhondda Cynon Taff

Contract 151258

Exploration Associates

Figure P3/34



Shear Box Settlement / Displacement

Depth 21.70 - 22.20 m

Borehole LWT8

Remarks ■ ♦ ▲ ▼ Peak Settlement

□ ◇ △ ▽ Residual Settlement

Laboratory - Effective Stress

Project

Llanwunno Tips

Rhondda Cynon Taff

Contract 151258

Exploration Associates

Figure P3/35

TEST REPORT

SOIL SAMPLE ANALYSIS

Amended Report
TES Report No. EFS/020214

Site: Llanwonno Tip

Exploration Associates
Unit 13
Crosby Yard
Wildmill
Bridgend
Mid Glamorgan
CF31 1JZ

The 20 samples described in this report were scheduled for analysis by TES Bretby on Monday, 21 January 2002. This is an amended report which replaces the original version issued 01/02/02. The analysis was completed by Monday, 4 February 2002.

The following tables are contained in this report:

Table 1 Main Analysis Results
Table of Report Notes (1 Pages)

On behalf of
TES Bretby : J. Hannah
J Hannah Project Co-ordinator

Date of Issue: 04/02/02

	Units :	j/kg	j/kg	/kg	/kg	mg/kg	mg/l	mg/l	mg/l	%	mg/l	%
	Method Codes :	FIANH3S	ICP/MAJ	ICPMAJ	ICPMAJ	ICPMAJ	SSAL1	SSAL1	SSAL1	SSL	WSLM60	
	Detection Limits :	0.5	1	3	1	30		1	1	0.1	0.1	
TES ID Number CL/	Client Sample Description	Ammoniacal Nitrogen.	Calcium	Magnesium	Potassium	Tot.Phosphorus (PO4)	Available Calcium	Available Magnesium	Available Potassium	Organic Matter %	Available Phosphorus	^Total Nitrogen %
0201455	TP7A	30.9	640	617	2060	2710	I.S	I.S	I.S	66	15.8	1.01
0201456	TP7B	11.4	418	548	1750	846	81	101	303	23	4.7	0.74
0201457	TP7C	11.4	803	1120	2070	1240	223	168	346	23	16.8	0.58
0201458	TP7D	10.4	1210	760	1460	958	407	253	254	29	14.2	0.89
0201459	TP7E	8.3	1060	584	1600	933	314	206	250	59	2.2	0.83
0201460	TP8A	13.7	1280	574	1100	2190	862	255	540	51	19.3	1.31
0201461	TP8B	6.8	395	401	973	2540	129	60	410	49	32.3	1.29
0201462	TP8C	3.8	605	537	832	2830	177	47	219	40	86.1	0.72
0201463	TP8D	11.9	179	1190	1630	1470	46	27	218	8.4	25	0.40
0201464	TP8E	12.5	87	876	969	788	34	30	267	4.5	13.0	0.31
0201465	TP9A	29.4	1110	1840	2450	1350	630	518	628	19	<2.0	0.69
0201466	TP9B	16.6	1600	2490	1680	1360	506	468	450	16	<2.0	0.52
0201467	TP9C	14.7	1170	1400	1970	1390	503	545	435	17	<2.0	0.53
0201468	TP9D	13.0	877	1210	2070	824	549	655	409	16	<2.0	0.46
0201469	TP9E	12.8	835	1300	1680	852	580	700	352	5.8	15.5	0.44
0201470	TP10A	13.8	587	797	1680	2100	389	148	568	23	6.6	0.58
0201471	TP10B	7.8	309	786	1200	1640	170	65	308	11.0	5.4	0.86
0201472	TP10C	9.2	949	1050	1900	1500	904	50	331	6.3	<2.0	0.43
0201473	TP10D	14.3	1300	806	1530	1400	847	60	420	5.9	<2.0	0.39
0201474	TP10E	8.7	96	932	1680	1170	93	30	247	2.8	<2.0	0.46

TES Bretby

TES Bretby
PO Box 100, Bretby Business Park,
Burton-on-Trent, Staffordshire, DE15 0XD
Tel +44 (0) 1283 554400
Fax +44 (0) 1283 554422

Client Name Exploration Associates

Contact Mr C White

Llanwonno Tip

Soils Sample Analysis

Amended Report

Date Printed	4 February 2002
Report Number	EFS/020214
Table Number	1
Page Number	1 of 1

TES Bretby

SOIL SAMPLE ANALYSIS

Report Notes

Results expressed as mg/kg air dried unless stated otherwise
SO4 analysis not conducted in accordance with BS1377
Water Soluble Sulphate on 2:1 water:soil extract
AR denotes analysis conducted on the As Received sample
Req Analysis Requested, see attached sheet for results
^ This analysis was subcontracted to another laboratory
I.S Insufficient sample for analysis
NBFO denotes No Bulk Fibres Observed
$$ Unable to analyse due to nature of sample
Available Magnesium expressed as mg/l in soil
Available Phosphorus expressed as mg/l in soil
Available Potassium expressed as mg/l in soil
Available Calcium expressed as mg/l in soil

End of Report

TEST REPORT

SOIL SAMPLE ANALYSIS

Amended Report
TES Report No. EFS/020213

Site: Llanwonno Tips

Exploration Associates
Unit 15
Crosby Yard
Wildmill
Bridgend
Mid Glamorgan
CF31 1JZ

The 30 samples described in this report were scheduled for analysis by TES Bretby on Monday, 21 January 2002. This is an amended report which replaces the original report issued 31/01/02. The analysis was completed by Monday, 4 February 2002.

The following tables are contained in this report:

Table 1 Main Analysis Results
Table of Report Notes (1 Page)

On behalf of
TES Bretby : J. Hannah
J Hannah Project Co-ordinator

Date of Issue: 04/02/02

nits :		/kg	'kg	kg	g	g	1				
Method Codes :		HANH3S	ICP/MAJ	ICPMAJ	ICPMAJ	ICPMAJ	SSAL1	SSAL1	SSAL1	SSL	WSLMG0	
Detection Limits :		0.5	1	3	1	30		1	1	0.1	0.1	
TES ID Number CL/	Client Sample Description	Ammoniacal Nitrogen.	Calcium	Magnesium	Potassium	Tot.Phosphorus (PO4)	Available Calcium	Available Magnesium	Available Potassium	Organic Matter %	Available Phosphorus	*Total Nitrogen %
0201425	TP1A	16.4	372	610	1760	921	251	262	301	11.0	8.0	0.67
0201426	TP1B	15.3	884	2060	1970	988	408	475	267	13.0	3.0	0.28
0201427	TP1C	10.7	1160	1120	1570	930	558	596	226	7.9	4.0	0.37
0201428	TP1D	22.7	900	1170	2080	725	614	764	301	5.8	9.0	0.33
0201429	TP1E	14.2	1450	1360	2480	1200	660	866	337	3.4	7.0	0.81
0201430	TP2A	21.8	387	830	2310	786	344	410	455	3.4	4.0	0.21
0201431	TP2B	11.7	544	843	1750	676	465	615	212	2.1	9.0	0.29
0201432	TP2C	9.4	670	1280	2360	991	470	628	198	2.4	5.0	0.27
0201433	TP2D	31.8	910	1740	2540	786	366	447	424	9.2	4.0	0.54
0201434	TP2E	10.2	382	719	1970	1050	225	410	209	2.4	8.0	0.43
0201435	TP3A	29.3	4530	3300	2930	1210	2430	2100	763	17	8.0	0.79
0201436	TP3B	42.6	1510	2340	2880	970	934	902	804	6.8	1.0	0.32
0201437	TP3C	14.7	963	1260	2250	434	713	779	384	3.3	3.0	0.31
0201438	TP3D	15.6	719	1060	2260	269	581	691	429	2.1	2.0	0.30
0201439	TP3E	30.8	626	1120	3120	286	502	633	751	2.0	5.0	0.36
0201440	TP4A	12.0	2740	2210	1440	1460	1480	906	338	15.0	8.0	0.19
0201441	TP4B	10.8	2290	1880	1200	1260	1370	855	282	16	5.0	0.49
0201442	TP4C	14.0	2260	2030	1510	1330	1270	764	340	15.0	5.0	0.50
0201443	TP4D	7.7	1640	2030	1940	1150	973	575	298	9.6	4.0	0.55
0201444	TP4E	6.2	803	1610	1400	906	538	351	214	3.9	3.0	0.33

TES Bretby
PO Box 100, Bretby Business Park,
Burton-on-Trent, Staffordshire, DE15 0XD
Tel +44 (0) 1283 554400
Fax +44 (0) 1283 554422

Client Name Exploration Associates

Contact Mr C White

Llanwonno Tips

Soils Sample Analysis

Amended Report

Date Printed	4 February 2002
Report Number	EFS/020213
Table Number	1
Page Number	1 of 2

TES ID Number CL/	Client Sample Description	Ammoniacal Nitrogen.	Calcium	Magnesium	Potassium	Tot.Phosphorus (PO4)	Available Calcium	Available Magnesium	Available Potassium	Organic Matter %	Available Phosphorus	^Total Nitrogen %
Inits :		j/kg	j/kg	/kg	kg	kg	mg/l	mg/l	mg/l	%	mg/l	%
Method Codes :		FIANH3S	ICP/MAJ	ICPMAJ	ICPMAJ	ICPMAJ	SSAL1	SSAL1	SSAL1	SSL	WSLM60	
Detection Limits :		0.5	1	3	1	30		1	1	0.1	0.1	
0201445	TP5A	26.0	1520	1300	2290	1530	740	455	430	19	5.0	0.54
0201446	TP5B	18.2	2070	1820	2320	1170	723	476	355	19	3.0	0.51
0201447	TP5C	12.4	778	1170	2580	1020	500	518	357	17	3.0	0.49
0201448	TP5D	12.3	688	1280	2380	1030	483	655	312	8.4	<2.0	0.25
0201449	TP5E	11.7	1180	1340	2580	1180	594	905	341	8.8	4.0	0.30
0201450	TP6A	23.1	1070	1270	2200	1980	694	249	455	14.0	13.0	0.57
0201451	TP6B	12.1	824	1240	1800	1780	505	173	221	9.1	5.0	0.64
0201452	TP6C	8.9	876	1340	1790	1580	525	173	168	8.1	3.0	0.60
0201453	TP6D	10.2	862	1420	1940	1510	540	193	219	7.7	4.0	0.43
0201454	TP6E	4.8	339	1890	1800	857	256	137	211	1.9	<2.0	0.30

TES Bretby

PO Box 100, Bretby Business Park,

Burton-on-Trent, Staffordshire, DE15 0XD

Tel +44 (0) 1283 554400

Fax +44 (0) 1283 554422

Client Name: Exploration Associates

Contact: Mr C White

Llanwonno Tips

Soils Sample Analysis

Amended Report

Date Printed	4 February 2002
Report Number	EFS/020213
Table Number	1
Page Number	2 of 2

TES Bretby

SOIL SAMPLE ANALYSIS

Report Notes

Results expressed as mg/kg air dried unless stated otherwise
SO4 analysis not conducted in accordance with BS1377
Water Soluble Sulphate on 2:1 water:soil extract
AR denotes analysis conducted on the As Received sample
Req Analysis Requested, see attached sheet for results
^ This analysis was subcontracted to another laboratory
I.S Insufficient sample for analysis
NBFO denotes No Bulk Fibres Observed
$$ Unable to analyse due to nature of sample
Available Magnesium expressed as mg/l in soil
Available Phosphorus expressed as mg/l in soil
Available Potassium expressed as mg/l in soil
Available Calcium expressed as mg/l in soil

End of Report

ENCLOSURE D

Groundwater

Piezometer Water Levels

PIEZOMETER READINGS

BOREHOLE NO.	WATER STRIKES	STANDING WATER	
LWT1A	DRY	17.71	
LWT1B		DRY	
LWT2A	DRY	DRY	
LWT2B		DRY	
LWT3A	9.50m	WET	
LWT3B		WET	
LWT4A	DRY	DRY	
LWT4B		DRY	
LWT5A	Damp at 11.5-13.2m	12.02	
LWT5B		14.70	
LWT6A	15.10m and 6.40m	6.14	
LWT6B		14.25	
LWT7A	10.00m	WET	
LWT7B		10.48	
LWT8A	DRY	DRY	
LWT8B		DRY	

Where WET has been included it represents that the base of the standpipe piezometer is wet.

APPENDIX

General Notes

General Notes

These notes, which accompany the ground investigation report, are intended to assist the user of the information contained in the report. They point out some inevitable shortcomings of any ground investigation and do not constitute a disclaimer of responsibility for the results obtained by Exploration Associates.

1. The information in this report is based on the ground conditions encountered during the ground investigation work and the results of any field and laboratory testing. The exploratory records describe the ground conditions at their specific locations and should not be regarded as representative of the ground as a whole.

2. Ground investigations are performed by the company in general accordance with the recommendations in BS 5930 (1981) "Code of Practice for Site Investigations". The testing of soils, rocks and aggregates generally follow the recommendations of BS 1377 (1990) "Methods of test for soils for Civil Engineering Purposes", the International Society of Rock Mechanics (Brown, 1981) "Rock characterisation, testing and monitoring, ISRM suggested methods", and BS 812 (1975) "Methods of sampling and testing of mineral aggregates, sands and filters", respectively.

3. The primary purpose of ground investigation boreholes and trial pits is to probe the stratified sequences of soil and/or rock. From the results of these probings no conclusions should be drawn concerning the presence of size, lithological nature and numbers per unit volume of ground of cobbles and boulders in soil types such as glacial till (boulder clay).

4. When cable percussion boring techniques are used in superficial and drift deposits some mixing of thin-layered soils inevitably occurs. If strong randomly-occurring pieces of rock are encountered in soil material then the rock may be either pushed aside or penetrated and broken up in which case the arisings that are recovered may not be indicative of the nature of the material in situ.

5. Rotary drilling techniques may sometimes be used for drilling through superficial deposits and rocks in order to provide a very general indication of the nature of the ground. Where open-hole methods have been used for the ground investigation the description of the ground is based on the cuttings recovered from the flushing medium and the rate of progress in advancing the hole. Descriptions of strata and the depths of changes in strata may not be accurate under these conditions.

6. Groundwater conditions noted during boring may be subject to change through seasonal and/or other effects such as, for example, boring and constructional excavation. When a groundwater inflow is encountered during boring, work on the hole is suspended, typically for 20 minutes, and any change in level is recorded. The groundwater level recorded on resumption of boring may not be the natural pre-boring standing water level. When piezometers are installed in boreholes the reported groundwater levels may also be subject to variation due to seasonal and/or other effects.

7. The factual information contained within the ground investigation report should not be used for any purpose other than for the development project for which it was prepared unless a check has been carried out on its applicability. Where the ground investigation report contains an interpretation of the factual information that interpretation must be considered in the context of the stated development proposals and should not be used in any other context.

8. This report is for the use of the person or organisation that commissioned the work. Exploration Associates accepts no responsibility if the information is used by any other party. The information is the property and copyright of the person or organisation that commissioned the investigation. It should not be reproduced or transmitted in any form without the owner's written permission.

March 2002

Intégral Géotechnique

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

12651/JJ

13 May 2020

Walters Group
Hirwaun House,
Hirwaun,
Aberdare,
CF44 9UL

For the attention of Mr Luke Holmes

Dear Sirs,

Tylorstown Landslip – Factual Report on Ground Conditions

We have now completed the intrusive ground investigation works at the above site and can report as follows.

Introduction

During the height of Storm Dennis, on 16th February 2020, a large landslip occurred at the site of a former coal tip on the north-eastern valley side of the Rhondda Fach, near Tylorstown. The slip resulted in the deposition of significant landslip materials at the toe of the valley slope, inundating the Rhondda Fach River.

Walters Group (Walters) have been appointed as the earthworks contractor to excavate and remove the slip deposits from the toe of the slope and from the riverbed. Capita are the consulting engineers for the scheme.

Intégral Géotechnique (Wales) Limited (IG) were instructed by Walters to attend site to inspect the make-up of landslip deposits, take representative soil samples for laboratory chemical and geotechnical testing (in accordance with a specification provided by Capita), and to factually report on the findings.

Site Description

The intrusive investigation was undertaken across an area of landslip deposits situated at the toe of the Rhondda Fach valley slope, see Figure 1. At the time of the site works, the Rhondda Fach River had cut a new path through the slip deposits and was flowing.

The deposition of the slip material had resulted in a variable surface across the investigation area.

The north-western and south-eastern areas, although covered by landslip deposits, were generally level. The central area was highly undulating and was characterised by a number of large heaps of more recent slip deposits.

A site plan is presented in Figure 2.

Upon initial inspection, following a period of dry weather, during a site walkover, the site surface appeared relatively firm / desiccated underfoot. However, upon being tracked across with a 5-tonne excavator, following minimal disturbance, the site surface rapidly deteriorated, and the excavator quickly became ‘bogged’ on numerous occasions.

Site Works

A Geotechnical Engineer from Intégral Géotechnique (Wales) Limited attended site on 20th April 2020.

6 No. trial pits (referenced TP1 to TP6) were excavated across the landslip deposits using a 5-tonne tracked excavator provided by Walters. The locations of the trial pits were communicated by Capita. The approximate locations of the trial pits are indicated on Figure 2 enclosed.

TP1 and TP2 were excavated across the south-eastern area, on generally level ground. TP3 and TP4 were excavated across the central area, on more elevated ground formed by large heaps of slip deposits. TP5 and TP6 were excavated across the north-western area, on generally level ground.

The trial pits were terminated at depths ranging between approximately 1.5m and 3.0m below existing ground level (bgl). The reason for termination was due to significant spalling and collapse of the excavation sides.

Representative soil samples were taken from the trial pits for laboratory chemical testing (including WAC analysis) and geotechnical testing. The soil samples were 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 trial pit logs are presented in Appendix A. A selection of trial pit photographs are presented in Appendix B.

Summary of Ground Conditions

The landslip deposits encountered within the trial pits typically comprised a thin crust of desiccated material consisting of (loose) grey silty sandy gravel (between approximately 0.1m and 0.2m thick), over (very loose) dark grey or grey brown variably silty variably sandy fine to coarse gravel with variable cobble and boulder content, or locally soft grey brown sandy gravelly clay/silt with variable cobble and boulder content.

The coarse constituents (i.e. gravel, cobbles and boulders) comprised variable amounts of mudstone, coal and sandstone.

Occasional organic matter, including roots and branches, was noted.

Although no groundwater inflows were noted within the excavations, the arisings were notably wet.

All excavations were unstable. Significant spalling and collapse of the sides was noted, often to ground level.

It was not possible to prove the depth to natural strata within any of the trial pits due to instability of the excavations.

Laboratory Chemical Testing (including WAC analysis)

A total of 7 No. soil samples were taken from the trial pits, stored at the appropriate temperature and dispatched to the UKAS and MCERTS accredited laboratories of i2 Analytical for laboratory chemical testing within 24 hours.

The samples were tested for a range of contaminants, in accordance with a testing specification provided by Capita.

A list of the soil testing carried out is given below:

General Inorganics

pH	Total Sulphur	Water Soluble Nitrate (2:1)
Total Sulphate	Water Soluble Fluoride	Carbonate as $CaCO_3$
Water Soluble Sulphate	Ammonium as NH_4	Calorific Value
Water Soluble Chloride	Loss on Ignition	Asbestos in Soil

Metals and Metalloids

Antimony	Copper	Tin
Arsenic	Iron	Vanadium
Barium	Lead	Zinc
Beryllium	Manganese	Calcium
Boron	Mercury	Magnesium
Cadmium	Molybdenum	Potassium
Chromium (hexavalent)	Nickel	Sodium
Chromium	Selenium	

Organics (PAHs and TPH)

Acenaphthene	Benzo(ghi)perylene	Indeno(123cd)pyrene
Acenaphthylene	Benzo(k)fluoranthene	Naphthalene
Anthracene	Chrysene	Phenanthrene
Benzo(a)anthracene	Dibenzo(ah)anthracene	Pyrene
Benzo(a)pyrene	Fluoranthene	
Benzo(b)fluoranthene	Fluorene	
TPH (C6-C40)		

Semi Volatile Organic Compounds (SVOCs)

Aniline	2-Nitrophenol	2,6-Dinitrotoluene
Phenol	2,4-Dimethylphenol	2,4-Dinitrotoluene
2-Chlorophenol	Bis(2chloroethoxy)methane	Dibenzofuran
Bis(2chloroethyl)ether	1,2,4-Trichlorobenzene	4-Chlorophenylphenyl ether
1,3-Dichlorobenzene	2,4-Dichlorophenol	Diethyl phthalate
1,2-Dichlorobenzene	4-Chloroaniline	4-Nitroaniline
1,4-Dichlorobenzene	Hexachlorobutadiene	Azobenzene
Bis(2chloroisopropyl)ether	4-Chloro-3-methylphenol	Bromophenyl phenyl ether
2-Methylphenol	2,4,6-Trichlorophenol	Hexachlorobenzene
Hexachloroethane	2,4,5-Trichlorophenol	Carbazole
Nitrobenzene	2-Methylnaphthalene	Dibutyl phthalate
4-Methylphenol	2-Chloronaphthalene	Anthraquinone
Is phorone	Dimethylphthalate	Butyl benzyl phthalate

In addition to the above, all 7 No. soil samples were also scheduled for Full Waste Acceptance Criteria (WAC) testing.

The results of the laboratory chemical testing (including the WAC testing results) are presented in Appendix D.

Laboratory Geotechnical Testing

A total of 7No. bulk soil samples were dispatched to the UKAS accredited laboratories of GEO Site and Testing Services (GSTL) Limited for laboratory geotechnical testing, in accordance with a testing specification provided by Capita.

A summary of the laboratory geotechnical testing undertaken on each sample is as follows:

- Moisture content
- Atterberg limits (4-point liquid and plastic limit)
- Particle size distribution (wet sieve method) and sedimentation
- Compaction testing (dry density/moisture content using 4.5kg rammer method in proctor mould)

The laboratory geotechnical testing results are presented in Appendix B.

We trust the above and enclosed are to your satisfaction. However, if you have any queries or require any further information, please do not hesitate to contact us.

Yours faithfully,

Jack Jones
For
Intégral Géotechnique (Wales) Limited
Encl.

Appendix A – Trial Pit Logs
Appendix B – Trial Pit Photographs
Appendix C – Laboratory Chemical Test Results (including WAC analysis)
Appendix D – Laboratory Geotechnical Test Results
Figures

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:	Project No.:	Trial Pit No.:
Tylorstown Landslip	**12651**	**TP1** Sheet 1 of 1

Location: Tylorstown, Rhondda Fach	Client: Walters Group	Logged By: JJ	Scale 1:25
Equipment: 5 tonne tracked excavator.	Coordinates:	**Dimensions** 2.50m × 1.20m	
Date Excavated: 20/04/2020	Level:	Depth : 1.50m	

Samples & In-situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description
Depth (m)	Type	Results				
			0.20			(Loose) grey slightly silty slightly sandy fine to coarse GRAVEL with medium cobble content. Gravel and cobbles are sub-angular to angular of mudstone, coal and sandstone [landslip deposits] - dessicated crust.
1.00 1.00	B ES		1.50			(Very loose) dark grey slightly silty sandy fine to coarse GRAVEL with medium cobble and boulder content. Gravel, cobbles and boulders are sub-angular to angular of mudstone, coal and sandstone. With occasional organic matter [landslip deposits] - very wet.
						End of Trialpit at 1.50 m

1
2
3
4
5

Remarks:
1. Trial pit terminated at 1.5m bgl due to instability of excavation sides.

Groundwater: Soils very wet throughout. No groundwater inflows/ seepage observed.

Stability: Unstable. Continuous spalling and collapse of excavation sides.

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

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

Project Name: **Tylorstown Landslip**	Project No.: **12651**	Trial Pit No.: **TP2** Sheet 1 of 1	
Location: Tylorstown, Rhondda Fach	Client: Walters Group	Logged By: JJ	Scale 1:25
Equipment: 5 tonne tracked excavator.	Coordinates:	**Dimensions** 2.50m × 1.20m; Depth : 1.50m	
Date Excavated: 20/04/2020	Level:		

Samples & In-situ Testing: Depth (m)	Type	Results	Depth (m)	Level (m AOD)	Legend	Stratum Description
			0.20			(Loose) grey slightly silty slightly sandy fine to coarse GRAVEL with medium cobble content. Gravel and cobbles are sub-angular to angular of mudstone, coal and sandstone [landslip deposits] - dessicated crust.
1.00 1.00	B ES		1.50			(Very loose) dark grey silty slightly sandy fine to coarse GRAVEL with medium cobble and boulder content. Gravel, cobbles and boulders are sub-angular to angular of mudstone, coal and sandstone. With occasional organic matter [landslip deposits] - very wet.
						End of Trialpit at 1.50 m

Depth scale: 1, 2, 3, 4, 5

Remarks:
1. Trial pit terminated at 1.5m bgl due to instability of excavation sides.

Groundwater: Soils very wet throughout. No groundwater inflows/ seepage observed.

Stability: Unstable. Continuous spalling and collapse of excavation sides.

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

AGS

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

Project Name:	Project No.:	Trial Pit No.:
Tylorstown Landslip	**12651**	**TP3** Sheet 1 of 1

Location:	Client:	Logged By:	Scale
Tylorstown, Rhondda Fach	Walters Group	JJ	1:25

Equipment: 5 tonne tracked excavator.

Coordinates:

Date Excavated: 20/04/2020

Level:

Dimensions

Depth : 3.00m

2.50m × 1.20m

Samples & In-situ Testing Depth (m)	Type	Results	Depth (m)	Level (m AOD)	Legend	Stratum Description
			0.15			(Loose) grey and brown slightly silty slightly sandy fine to coarse GRAVEL with medium cobble content. Gravel and cobbles are sub-angular to angular of mudstone, coal and sandstone [landslip deposits] - dessicated crust.
1.00 1.00	B ES		2.40			Soft grey brown slightly sandy slightly gravelly CLAY/SILT with medium cobble and boulder content. Gravel is fine to coarse sub-angular and sub-rounded of mudstone and sandstone with occasional coal. Cobbles and boulders are sub-angular and angular of sandstone and mudstone [landslip deposits].
			3.00			(Very loose) dark grey very silty slightly sandy fine to coarse GRAVEL with medium cobble and boulder content. Gravel, cobbles and boulders are sub-angular to angular of mudstone, coal and sandstone. With occasional organic matter [landslip deposits] - very wet.
						End of Trialpit at 3.00 m

Depth scale (m): 1, 2, 3, 4, 5

Remarks:

1. Trial pit terminated at 3.0m bgl due to instability of excavation sides.

Groundwater: Soils very wet throughout. No groundwater inflows/ seepage observed.

Stability: Unstable. Continuous spalling and collapse of excavation sides.

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

AGS

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

Project Name:	Project No.:	Trial Pit No.:
Tylorstown Landslip	**12651**	**TP4** Sheet 1 of 1

Location: Tylorstown, Rhondda Fach	Client: Walters Group	Logged By: JJ	Scale 1:25
Equipment: 5 tonne tracked excavator.	Coordinates:	**Dimensions** Depth : 1.90m	2.50m × 1.20m
Date Excavated: 20/04/2020	Level:		

Samples & In-situ Testing Depth (m)	Type	Results	Depth (m)	Level (m AOD)	Legend	Stratum Description
						(Loose) slightly silty sandy GRAVEL and COBBLES with medium boulder content. Gravel is fine to coarse sub-angular to angular of mudstone, coal and sandstone. Cobbles and boulders are sub-angular of sandstone and mudstone. With occasional branches and organic matter [landslip deposits].
1.00 1.00	B ES					
			1.40			(Very loose) dark grey silty sandy fine to coarse GRAVEL with medium cobble and boulder content. Gravel, cobbles and boulders are sub-angular to angular of mudstone, coal and sandstone. With occasional organic matter [landslip deposits] - very wet.
1.80 1.80	B ES					
			1.90			End of Trialpit at 1.90 m

Remarks:
1. Trial pit terminated at 1.9m bgl due to instability of excavation sides.

Groundwater: Soils very wet throughout. No groundwater inflows/ seepage observed.

Stability: Unstable. Continuous spalling and collapse of excavation sides.

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

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

Project Name:	Project No.:	Trial Pit No.:
Tylorstown Landslip	**12651**	**TP5** Sheet 1 of 1

Location: Tylorstown, Rhondda Fach	Client: Walters Group	Logged By: JJ	Scale: 1:25
Equipment: 5 tonne tracked excavator.	Coordinates:	**Dimensions** 2.50m	
Date Excavated: 20/04/2020	Level:	Depth : 1.20m	1.20m

Samples & In-situ Testing Depth (m)	Type	Results	Depth (m)	Level (m AOD)	Legend	Stratum Description
			0.15			(Loose) grey slightly silty slightly sandy fine to coarse GRAVEL with medium cobble content. Gravel and cobbles are sub-angular to angular of mudstone, coal and sandstone [landslip deposits] - dessicated crust.
1.00 1.00	B ES		1.20			(Very loose) dark grey slightly silty sandy fine to coarse GRAVEL with medium cobble and boulder content. Gravel, cobbles and boulders are sub-angular to angular of mudstone, coal and sandstone. With occasional organic matter [landslip deposits] - very wet.
						End of Trialpit at 1.20 m

1
2
3
4
5

Remarks:
1. Trial pit terminated at 1.2m bgl due to instability of excavation sides.

Groundwater: Soils very wet throughout. No groundwater inflows/ seepage observed.

Stability: Unstable. Continuous spalling and collapse of excavation sides.

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

AGS

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

Project Name: **Tylorstown Landslip**		Project No.: **12651**	Trial Pit No.: **TP6** Sheet 1 of 1
Location: Tylorstown, Rhondda Fach	Client: Walters Group	Logged By: JJ	Scale 1:25
Equipment: 5 tonne tracked excavator.	Coordinates:	**Dimensions** Depth : 2.00m	2.50m × 1.20m
Date Excavated: 20/04/2020	Level:		

Samples & In-situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description
Depth (m)	Type	Results				
			0.20			(Loose) grey slightly silty slightly sandy fine to coarse GRAVEL with medium cobble content. Gravel and cobbles are sub-angular to angular of mudstone, coal and sandstone [landslip deposits] - dessicated crust.
1.00 1.00	B ES		2.00			(Very loose) dark grey slightly silty sandy fine to coarse GRAVEL with medium cobble and boulder content. Gravel, cobbles and boulders are sub-angular to angular of mudstone, coal and sandstone. With occasional organic matter [landslip deposits] - very wet.
						End of Trialpit at 2.00 m

1 2 3 4 5

Remarks:
1. Trial pit terminated at 2.0m bgl due to instability of excavation sides.

Groundwater: Soils very wet throughout. No groundwater inflows/ seepage observed.

Stability: Unstable. Continuous spalling and collapse of excavation sides.

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

AGS

APPENDIX B

TRIAL PIT PHOTOGRAPHS

Appendix B - Trial Pit Photographs (TP1)

Tylorstown Landslip

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

Appendix B - Trial Pit Photographs (TP2)

Tylorstown Landslip

Intégral Géotechnique

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

Appendix B - Trial Pit Photographs (TP3)

Tylorstown Landslip

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

Appendix B - Trial Pit Photographs (TP5)

Tylorstown Landslip

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

Appendix B - Trial Pit Photographs (TP6)

Tylorstown Landslip

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

APPENDIX C

LABORATORY CHEMICAL TEST RESULTS (INCLUDING WAC ANALYSIS)

Jack Jones
Integral Geotechnique
Integral House
7 Beddau Way
Castlegate Business Park
CF83 2AX

t: 02920807991
f: 02920862176
e: jack@integralgeotec.com

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

t: 01923 225404
f: 01923 237404
e: reception@i2analytical.com

Analytical Report Number : 20-97228

Replaces Analytical Report Number : 20-97228, issue no. 1

Client references/information amended.

Project / Site name:	Tylorstown	**Samples received on:**	23/04/2020
Your job number:	12651	**Samples instructed on:**	24/04/2020
Your order number:		**Analysis completed by:**	06/05/2020
Report Issue Number:	2	**Report issued on:**	06/05/2020
Samples Analysed:	7 soil samples		

Signed: ______

Dr Claire Stone
Quality 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

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

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

Analytical Report Number: 20-97228

Project / Site name: Tylorstown

Lab Sample Number				1497741	1497742	1497743	1497744	1497745
Sample Reference				TP1	TP2	TP3	TP4	TP4
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				1.00	1.00	1.00	1.00	1.80
Date Sampled				20/04/2020	20/04/2020	20/04/2020	20/04/2020	20/04/2020
Time Taken				1015	1100	1145	1230	1245
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status					
Stone Content	%	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Moisture Content	%	N/A	NONE	14	12	13	8.7	15
Total mass of sample received	kg	0.001	NONE	2.0	2.0	2.0	2.0	2.0
Asbestos in Soil	Type	N/A	ISO 17025	Not-detected	Not-detected	Not-detected	Not-detected	Not-detected
General Inorganics								
pH - Automated	pH Units	N/A	MCERTS	6.7	6.6	6.5	6.6	7.8
Total Sulphate as SO_4	%	0.005	MCERTS	0.048	0.047	0.081	0.067	0.107
Water Soluble SO4 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	0.043	0.10	0.17	0.16	0.37
Water Soluble SO4 16hr extraction (2:1 Leachate Equivalent)	mg/l	1.25	MCERTS	42.8	101	168	159	367
Water Soluble Chloride (2:1)	mg/kg	1	MCERTS	6.6	5.2	6.9	4.3	12
Water Soluble Chloride (2:1) (leachate equivalent)	mg/l	0.5	MCERTS	3.3	2.6	3.4	2.1	6.0
Total Sulphur	%	0.005	MCERTS	0.136	0.113	0.104	0.128	0.158
Water Soluble Fluoride (2:1)	mg/kg	1	NONE	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Ammonium as NH_4	mg/kg	0.5	MCERTS	< 0.5	< 0.5	2.3	< 0.5	< 0.5
Ammonium as NH4 (10:1 leachate equivalent)	mg/l	0.05	MCERTS	< 0.05	< 0.05	0.23	< 0.05	< 0.05
Loss on Ignition @ 450°C	%	0.2	MCERTS	9.0	9.3	6.9	8.7	11.5
Water Soluble Nitrate (2:1) as N (leachate equivalent)	mg/l	2	NONE	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
Carbonate as $CaCO_3$	%	0.1	NONE	2.0	2.4	2.4	2.0	2.4
Calorific Value	MJ/Kg	0.12	ISO 17025	3.00	2.78	2.09	2.78	3.92
Heavy Metals / Metalloids								
Antimony (aqua regia extractable)	mg/kg	1	ISO 17025	1.9	2.9	2.2	2.6	2.8
Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	12	12	11	13	20
Barium (aqua regia extractable)	mg/kg	1	MCERTS	63	62	53	66	77
Beryllium (aqua regia extractable)	mg/kg	0.06	MCERTS	0.95	1.0	0.88	1.1	1.1
Boron (water soluble)	mg/kg	0.2	MCERTS	0.5	0.5	0.5	0.6	0.7
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Chromium (hexavalent)	mg/kg	4	MCERTS	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	11	11	12	13	13
Copper (aqua regia extractable)	mg/kg	1	MCERTS	33	34	26	34	43
Iron (aqua regia extractable)	mg/kg	40	MCERTS	29000	49000	34000	42000	36000
Lead (aqua regia extractable)	mg/kg	1	MCERTS	26	19	20	21	28
Manganese (aqua regia extractable)	mg/kg	1	MCERTS	420	920	470	730	690
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	0.3	< 0.3	< 0.3	< 0.3	0.4
Molybdenum (aqua regia extractable)	mg/kg	0.25	MCERTS	< 0.25	< 0.25	< 0.25	< 0.25	0.44
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	38	36	33	40	40
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	2.5	< 1.0	< 1.0	2.3	2.2
Tin (aqua regia extractable)	mg/kg	1	MCERTS	5.6	< 1.0	< 1.0	< 1.0	1.2
Vanadium (aqua regia extractable)	mg/kg	1	MCERTS	16	17	18	18	20
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	70	74	66	80	88
Calcium (aqua regia extractable)	mg/kg	20	ISO 17025	1300	1400	1200	1600	2300
Magnesium (aqua regia extractable)	mg/kg	20	ISO 17025	1800	2000	2000	2100	2200
Magnesium (water soluble)	mg/kg	5	NONE	32	61	100	100	210
Magnesium (leachate equivalent)	mg/l	2.5	NONE	16	31	52	52	100
Potassium (aqua regia extractable)	mg/kg	20	ISO 17025	1300	1500	1100	1400	1500
Sodium (aqua regia extractable)	mg/kg	20	ISO 17025	140	170	150	160	160
Petroleum Hydrocarbons								
TPH C10 - C40	mg/kg	10	MCERTS	< 10	< 10	< 10	< 10	< 10
TPH2 (C6 - C10)	mg/kg	0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
TPH C6 - C40	mg/kg	10	NONE	< 10	< 10	< 10	< 10	< 10

Analytical Report Number: 20-97228

Project / Site name: Tylorstown

Lab Sample Number				1497741	1497742	1497743	1497744	1497745
Sample Reference				TP1	TP2	TP3	TP4	TP4
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				1.00	1.00	1.00	1.00	1.80
Date Sampled				20/04/2020	20/04/2020	20/04/2020	20/04/2020	20/04/2020
Time Taken				1015	1100	1145	1230	1245
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					

Analytical Report Number: 20-97228

Project / Site name: Tylorstown

Lab Sample Number				1497741	1497742	1497743	1497744	1497745
Sample Reference				TP1	TP2	TP3	TP4	TP4
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Depth (m)				1.00	1.00	1.00	1.00	1.80
Date Sampled				20/04/2020	20/04/2020	20/04/2020	20/04/2020	20/04/2020
Time Taken				1015	1100	1145	1230	1245
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
SVOCs								
Aniline	mg/kg	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Phenol	mg/kg	0.2	ISO 17025	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
2-Chlorophenol	mg/kg	0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Bis(2-chloroethyl)ether	mg/kg	0.2	MCERTS	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
1,3-Dichlorobenzene	mg/kg	0.2	MCERTS	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
1,2-Dichlorobenzene	mg/kg	0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
1,4-Dichlorobenzene	mg/kg	0.2	MCERTS	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Bis(2-chloroisopropyl)ether	mg/kg	0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
2-Methylphenol	mg/kg	0.3	MCERTS	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
Hexachloroethane	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Nitrobenzene	mg/kg	0.3	MCERTS	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
4-Methylphenol	mg/kg	0.2	NONE	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Isophorone	mg/kg	0.2	MCERTS	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
2-Nitrophenol	mg/kg	0.3	MCERTS	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
2,4-Dimethylphenol	mg/kg	0.3	MCERTS	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
Bis(2-chloroethoxy)methane	mg/kg	0.3	MCERTS	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
1,2,4-Trichlorobenzene	mg/kg	0.3	MCERTS	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
Naphthalene	mg/kg	0.05	MCERTS	1.7	0.87	0.62	0.96	1.0
2,4-Dichlorophenol	mg/kg	0.3	MCERTS	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
4-Chloroaniline	mg/kg	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Hexachlorobutadiene	mg/kg	0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
4-Chloro-3-methylphenol	mg/kg	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
2,4,6-Trichlorophenol	mg/kg	0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
2,4,5-Trichlorophenol	mg/kg	0.2	MCERTS	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
2-Methylnaphthalene	mg/kg	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
2-Chloronaphthalene	mg/kg	0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Dimethylphthalate	mg/kg	0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
2,6-Dinitrotoluene	mg/kg	0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Acenaphthylene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Acenaphthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
2,4-Dinitrotoluene	mg/kg	0.2	MCERTS	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Dibenzofuran	mg/kg	0.2	MCERTS	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
4-Chlorophenyl phenyl ether	mg/kg	0.3	ISO 17025	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
Diethyl phthalate	mg/kg	0.2	MCERTS	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
4-Nitroaniline	mg/kg	0.2	MCERTS	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Fluorene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Azobenzene	mg/kg	0.3	MCERTS	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
Bromophenyl phenyl ether	mg/kg	0.2	MCERTS	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Hexachlorobenzene	mg/kg	0.3	MCERTS	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
Phenanthrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Carbazole	mg/kg	0.3	MCERTS	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
Dibutyl phthalate	mg/kg	0.2	MCERTS	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Anthraquinone	mg/kg	0.3	MCERTS	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
Fluoranthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Pyrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Butyl benzyl phthalate	mg/kg	0.3	ISO 17025	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
Benzo(a)anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Chrysene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Benzo(b)fluoranthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Benzo(a)pyrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05

Analytical Report Number: 20-97228

Project / Site name: Tylorstown

Lab Sample Number				1497746	1497747			
Sample Reference				TP5	TP6			
Sample Number				None Supplied	None Supplied			
Depth (m)				1.00	1.00			
Date Sampled				20/04/2020	20/04/2020			
Time Taken				1330	1415			
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
Stone Content	%	0.1	NONE	< 0.1	< 0.1			
Moisture Content	%	N/A	NONE	11	10			
Total mass of sample received	kg	0.001	NONE	2.0	2.0			
Asbestos in Soil	Type	N/A	ISO 17025	Not-detected	Not-detected			
General Inorganics								
pH - Automated	pH Units	N/A	MCERTS	8.0	8.0			
Total Sulphate as SO_4	%	0.005	MCERTS	0.094	0.087			
Water Soluble SO4 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	0.31	0.37			
Water Soluble SO4 16hr extraction (2:1 Leachate Equivalent)	mg/l	1.25	MCERTS	310	372			
Water Soluble Chloride (2:1)	mg/kg	1	MCERTS	4.9	7.3			
Water Soluble Chloride (2:1) (leachate equivalent)	mg/l	0.5	MCERTS	2.4	3.7			
Total Sulphur	%	0.005	MCERTS	0.267	0.104			
Water Soluble Fluoride (2:1)	mg/kg	1	NONE	2.9	1.3			
Ammonium as NH_4	mg/kg	0.5	MCERTS	< 0.5	< 0.5			
Ammonium as NH4 (10:1 leachate equivalent)	mg/l	0.05	MCERTS	< 0.05	< 0.05			
Loss on Ignition @ 450°C	%	0.2	MCERTS	13.3	7.2			
Water Soluble Nitrate (2:1) as N (leachate equivalent)	mg/l	2	NONE	< 2.0	< 2.0			
Carbonate as $CaCO_3$	%	0.1	NONE	2.0	3.2			
Calorific Value	MJ/Kg	0.12	ISO 17025	4.51	2.24			
Heavy Metals / Metalloids								
Antimony (aqua regia extractable)	mg/kg	1	ISO 17025	2.5	2.1			
Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	10	9.6			
Barium (aqua regia extractable)	mg/kg	1	MCERTS	86	130			
Beryllium (aqua regia extractable)	mg/kg	0.06	MCERTS	1.2	0.97			
Boron (water soluble)	mg/kg	0.2	MCERTS	0.8	0.7			
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	< 0.2	< 0.2			
Chromium (hexavalent)	mg/kg	4	MCERTS	< 4.0	< 4.0			
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	6.4	8.8			
Copper (aqua regia extractable)	mg/kg	1	MCERTS	55	43			
Iron (aqua regia extractable)	mg/kg	40	MCERTS	25000	24000			
Lead (aqua regia extractable)	mg/kg	1	MCERTS	28	22			
Manganese (aqua regia extractable)	mg/kg	1	MCERTS	400	410			
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3	< 0.3			
Molybdenum (aqua regia extractable)	mg/kg	0.25	MCERTS	0.51	< 0.25			
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	45	36			
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	2.8	1.8			
Tin (aqua regia extractable)	mg/kg	1	MCERTS	1.0	< 1.0			
Vanadium (aqua regia extractable)	mg/kg	1	MCERTS	14	15			
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	85	83			
Calcium (aqua regia extractable)	mg/kg	20	ISO 17025	2300	3000			
Magnesium (aqua regia extractable)	mg/kg	20	ISO 17025	1600	1600			
Magnesium (water soluble)	mg/kg	5	NONE	170	200			
Magnesium (leachate equivalent)	mg/l	2.5	NONE	83	100			
Potassium (aqua regia extractable)	mg/kg	20	ISO 17025	2000	1500			
Sodium (aqua regia extractable)	mg/kg	20	ISO 17025	160	170			
Petroleum Hydrocarbons								
TPH C10 - C40	mg/kg	10	MCERTS	< 10	< 10			
TPH2 (C6 - C10)	mg/kg	0.1	MCERTS	< 0.1	< 0.1			
TPH C6 - C40	mg/kg	10	NONE	< 10	< 10			

Analytical Report Number: 20-97228

Project / Site name: Tylorstown

Lab Sample Number				1497746	1497747			
Sample Reference				TP5	TP6			
Sample Number				None Supplied	None Supplied			
Depth (m)				1.00	1.00			
Date Sampled				20/04/2020	20/04/2020			
Time Taken				1330	1415			
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status					

Analytical Report Number: 20-97228

Project / Site name: Tylorstown

Lab Sample Number				1497746	1497747			
Sample Reference				TP5	TP6			
Sample Number				None Supplied	None Supplied			
Depth (m)				1.00	1.00			
Date Sampled				20/04/2020	20/04/2020			
Time Taken				1330	1415			
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
SVOCs								
Aniline	mg/kg	0.1	NONE	< 0.1	< 0.1			
Phenol	mg/kg	0.2	ISO 17025	< 0.2	< 0.2			
2-Chlorophenol	mg/kg	0.1	MCERTS	< 0.1	< 0.1			
Bis(2-chloroethyl)ether	mg/kg	0.2	MCERTS	< 0.2	< 0.2			
1,3-Dichlorobenzene	mg/kg	0.2	MCERTS	< 0.2	< 0.2			
1,2-Dichlorobenzene	mg/kg	0.1	MCERTS	< 0.1	< 0.1			
1,4-Dichlorobenzene	mg/kg	0.2	MCERTS	< 0.2	< 0.2			
Bis(2-chloroisopropyl)ether	mg/kg	0.1	MCERTS	< 0.1	< 0.1			
2-Methylphenol	mg/kg	0.3	MCERTS	< 0.3	< 0.3			
Hexachloroethane	mg/kg	0.05	MCERTS	< 0.05	< 0.05			
Nitrobenzene	mg/kg	0.3	MCERTS	< 0.3	< 0.3			
4-Methylphenol	mg/kg	0.2	NONE	< 0.2	< 0.2			
Isophorone	mg/kg	0.2	MCERTS	< 0.2	< 0.2			
2-Nitrophenol	mg/kg	0.3	MCERTS	< 0.3	< 0.3			
2,4-Dimethylphenol	mg/kg	0.3	MCERTS	< 0.3	< 0.3			
Bis(2-chloroethoxy)methane	mg/kg	0.3	MCERTS	< 0.3	< 0.3			
1,2,4-Trichlorobenzene	mg/kg	0.3	MCERTS	< 0.3	< 0.3			
Naphthalene	mg/kg	0.05	MCERTS	1.6	1.3			
2,4-Dichlorophenol	mg/kg	0.3	MCERTS	< 0.3	< 0.3			
4-Chloroaniline	mg/kg	0.1	NONE	< 0.1	< 0.1			
Hexachlorobutadiene	mg/kg	0.1	MCERTS	< 0.1	< 0.1			
4-Chloro-3-methylphenol	mg/kg	0.1	NONE	< 0.1	< 0.1			
2,4,6-Trichlorophenol	mg/kg	0.1	MCERTS	< 0.1	< 0.1			
2,4,5-Trichlorophenol	mg/kg	0.2	MCERTS	< 0.2	< 0.2			
2-Methylnaphthalene	mg/kg	0.1	NONE	< 0.1	< 0.1			
2-Chloronaphthalene	mg/kg	0.1	MCERTS	< 0.1	< 0.1			
Dimethylphthalate	mg/kg	0.1	MCERTS	< 0.1	< 0.1			
2,6-Dinitrotoluene	mg/kg	0.1	MCERTS	< 0.1	< 0.1			
Acenaphthylene	mg/kg	0.05	MCERTS	< 0.05	< 0.05			
Acenaphthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05			
2,4-Dinitrotoluene	mg/kg	0.2	MCERTS	< 0.2	< 0.2			
Dibenzofuran	mg/kg	0.2	MCERTS	< 0.2	< 0.2			
4-Chlorophenyl phenyl ether	mg/kg	0.3	ISO 17025	< 0.3	< 0.3			
Diethyl phthalate	mg/kg	0.2	MCERTS	< 0.2	< 0.2			
4-Nitroaniline	mg/kg	0.2	MCERTS	< 0.2	< 0.2			
Fluorene	mg/kg	0.05	MCERTS	< 0.05	< 0.05			
Azobenzene	mg/kg	0.3	MCERTS	< 0.3	< 0.3			
Bromophenyl phenyl ether	mg/kg	0.2	MCERTS	< 0.2	< 0.2			
Hexachlorobenzene	mg/kg	0.3	MCERTS	< 0.3	< 0.3			
Phenanthrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05			
Anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05			
Carbazole	mg/kg	0.3	MCERTS	< 0.3	< 0.3			
Dibutyl phthalate	mg/kg	0.2	MCERTS	< 0.2	< 0.2			
Anthraquinone	mg/kg	0.3	MCERTS	< 0.3	< 0.3			
Fluoranthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05			
Pyrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05			
Butyl benzyl phthalate	mg/kg	0.3	ISO 17025	< 0.3	< 0.3			
Benzo(a)anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05			
Chrysene	mg/kg	0.05	MCERTS	< 0.05	< 0.05			
Benzo(b)fluoranthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05			
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05			
Benzo(a)pyrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05			
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05			
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05			
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	< 0.05	< 0.05			

Analytical Report Number : 20-97228

Project / Site name: Tylorstown

* 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 *
1497741	TP1	None Supplied	1.00	Grey clay and sand with vegetation.
1497742	TP2	None Supplied	1.00	Grey clay with gravel.
1497743	TP3	None Supplied	1.00	Grey clay with gravel.
1497744	TP4	None Supplied	1.00	Grey sand with gravel.
1497745	TP4	None Supplied	1.80	Grey clay with gravel and vegetation.
1497746	TP5	None Supplied	1.00	Grey sandy gravel.
1497747	TP6	None Supplied	1.00	Grey clay with gravel and vegetation.

UKAS TESTING 4041 MCERTS

Analytical Environmental Science

Analytical Report Number : 20-97228

Project / Site name: Tylorstown

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
Ammonium as NH4 in soil	Determination of Ammonium/Ammonia/ Ammoniacal Nitrogen by the colorimetric salicylate/nitroprusside method, 10:1 water extraction.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L082-PL	W	MCERTS
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
Calorific Value of soil	Determination of the calorific value of soil by combustion in a controlled environment.	Calorific Value of Soil by Bomb Calorimeter	L013-PL	D	ISO 17025
Carbonate in soil	Determination of Carbonate by extraction with 1M HCl followed by titration with 1M NaOH.	In house method.	L034-PL	D	NONE
Cations in soil by ICP-OES	Determination of cations 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	ISO 17025
Chloride, water soluble, in soil	Determination of Chloride colorimetrically by discrete analyser.	In house method.	L082-PL	D	MCERTS
Fluoride, water soluble, in soil	Determination of fluoride in soil by water extraction followed by 1:1 ratio with a buffer solution followed by Ion Selective Electrode.	In-house method based on Use of Total Ionic Strength Adjustment Buffer for Electrode Determination"	L033-PL	D	NONE
Hexavalent chromium in soil	Determination of hexavalent chromium in soil by extraction in water then by acidification, addition of 1,5 diphenylcarbazide followed by colorimetry.	In-house method	L080-PL	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.	L047-PL	D	MCERTS
Magnesium, water soluble, in soil	Determination of water soluble magnesium by extraction with water followed by ICP-OES.	In-house method based on TRL 447	L038-PL	D	NONE
Metals in soil by ICP-OES	Determination of metals in soil by aqua-regia digestion followed by ICP-OES.	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.	L038-PL	D	MCERTS
Moisture Content	Moisture content, determined gravimetrically. (30 oC)	In house method.	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.	L099-PL	D	MCERTS
Semi-volatile organic compounds in soil	Determination of semi-volatile organic compounds in soil by extraction in dichloromethane and hexane followed by GC-MS.	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.	L038-PL	D	MCERTS

Analytical Report Number : 20-97228

Project / Site name: Tylorstown

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
Total Sulphate in soil as %	Determination of total sulphate in soil by extraction with 10% HCl followed by ICP-OES.	In house method.	L038-PL	D	MCERTS
Total Sulphur in soil as %	Determination of total sulphur in soil by extraction with aqua-regia, potassium bromide/bromate followed by ICP-OES.	In house method.	L038-PL	D	MCERTS
TPH Banding in Soil by FID	Determination of hexane extractable hydrocarbons in soil by GC-FID.	In-house method, TPH with carbon banding and silica gel split/cleanup.	L076-PL	W	MCERTS
TPH C6 - C40 (soil)	Determination of TPH bands by HS-GC-MS/GC-FID	In-house method.	L076-PL	W	NONE
TPH2 (Soil)	Determination of hydrocarbons C6-C10 by headspace GC-MS.	In-house method based on USEPA8260	L088-PL	W	MCERTS
Water Soluble Nitrate (2:1) as N in soil	Determination of nitrate by reaction with sodium salicylate and colorimetry.	In-house method based on Examination of Water and Wastewatern & Polish Standard Method PN-82/C-04579.08, 2:1 extraction.	L078-PL	W	NONE

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

Jack Jones
Integral Geotechnique
Integral House
7 Beddau Way
Castlegate Business Park
CF83 2AX

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

t: 02920807991
f: 02920862176
e: jack@integralgeotec.com

t: 01923 225404
f: 01923 237404
e: reception@i2analytical.com

Analytical Report Number : 20-97229

Project / Site name:	Tylorstown	**Samples received on:**	23/04/2020
Your job number:	12651	**Samples instructed on:**	24/04/2020
Your order number:		**Analysis completed by:**	04/05/2020
Report Issue Number:	1	**Report issued on:**	04/05/2020
Samples Analysed:	7 10:1 WAC samples		

Signed:

Agnieszka Czerwińska

Technical Reviewer (Reporting Team)
For & on behalf of i2 Analytical Ltd.

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

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

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

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

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

i2 Analytical

7 Woodshots Meadow
Croxley Green Business Park
Watford, WD18 8YS

Telephone: 01923 225404
Fax: 01923 237404
email:reception@i2analytical.com

Waste Acceptance Criteria Analytical Results

Report No:	**20-97229**						
					Client:	**INTEGGEO**	
Location	**Tylorstown**						
Lab Reference (Sample Number)	1497748 / 1497749				**Landfill Waste Acceptance Criteria Limits**		
Sampling Date	20/04/2020				Inert Waste Landfill	Stable Non-reactive HAZARDOUS waste in non-hazardous Landfill	Hazardous Waste Landfill
Sample ID	TP1						
Depth (m)	1.00						
Solid Waste Analysis							
TOC (%)**	2.1				3%	5%	6%
Loss on Ignition (%) **	9.0				--	--	10%
BTEX (µg/kg) **	< 10				6000	--	--
Sum of PCBs (mg/kg) **	< 0.007				1	--	--
Mineral Oil (mg/kg)	< 10				500	--	--
Total PAH (WAC-17) (mg/kg)	< 0.9				100	--	--
pH (units)**	8.3				--	>6	--
Acid Neutralisation Capacity (mol / kg)	4.4				--	To be evaluated	To be evaluated
Eluate Analysis	10:1			10:1	Limit values for compliance leaching test		
(BS EN 12457 - 2 preparation utilising end over end leaching procedure)	mg/l			mg/kg	using BS EN 12457-2 at L/S 10 l/kg (mg/kg)		
Arsenic *	< 0.0011			< 0.0110	0.5	2	25
Barium *	0.0074			0.0635	20	100	300
Cadmium *	< 0.0001			< 0.0008	0.04	1	5
Chromium *	0.0005			0.0042	0.5	10	70
Copper *	0.010			0.088	2	50	100
Mercury *	< 0.0005			< 0.0050	0.01	0.2	2
Molybdenum *	0.0004			< 0.0040	0.5	10	30
Nickel *	0.0025			0.022	0.4	10	40
Lead *	< 0.0010			< 0.010	0.5	10	50
Antimony *	< 0.0017			< 0.017	0.06	0.7	5
Selenium *	< 0.0040			< 0.040	0.1	0.5	7
Zinc *	0.042			0.36	4	50	200
Chloride *	0.75			6.4	800	15000	25000
Fluoride	0.25			2.2	10	150	500
Sulphate *	9.6			82	1000	20000	50000
TDS*	25			220	4000	60000	100000
Phenol Index (Monohydric Phenols) *	< 0.010			< 0.10	1	-	-
DOC	8.59			73.6	500	800	1000
Leach Test Information							
Stone Content (%)	< 0.1						
Sample Mass (kg)	2.0						
Dry Matter (%)	86						
Moisture (%)	14						

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

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7 Woodshots Meadow
Croxley Green Business Park
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Fax: 01923 237404
email:reception@i2analytical.com

Waste Acceptance Criteria Analytical Results

Report No:	**20-97229**						
					Client: INTEGGEO		
Location	**Tylorstown**						
Lab Reference (Sample Number)	1497750 / 1497751				**Landfill Waste Acceptance Criteria Limits**		
Sampling Date	20/04/2020				Inert Waste Landfill	Stable Non-reactive HAZARDOUS waste in non-hazardous Landfill	Hazardous Waste Landfill
Sample ID	TP2						
Depth (m)	1.00						
Solid Waste Analysis							
TOC (%)**	2.2				3%	5%	6%
Loss on Ignition (%) **	9.3				--	--	10%
BTEX (µg/kg) **	< 10				6000	--	--
Sum of PCBs (mg/kg) **	< 0.007				1	--	--
Mineral Oil (mg/kg)	< 10				500	--	--
Total PAH (WAC-17) (mg/kg)	< 0.9				100	--	--
pH (units)**	8.6				--	>6	--
Acid Neutralisation Capacity (mol / kg)	13				--	To be evaluated	To be evaluated
Eluate Analysis	10:1			10:1	Limit values for compliance leaching test		
(BS EN 12457 - 2 preparation utilising end over end leaching procedure)	mg/l			mg/kg	using BS EN 12457-2 at L/S 10 l/kg (mg/kg)		
Arsenic *	0.0043			0.0371	0.5	2	25
Barium *	0.0072			0.0618	20	100	300
Cadmium *	< 0.0001			< 0.0008	0.04	1	5
Chromium *	0.0013			0.011	0.5	10	70
Copper *	0.014			0.12	2	50	100
Mercury *	< 0.0005			< 0.0050	0.01	0.2	2
Molybdenum *	0.0009			0.0076	0.5	10	30
Nickel *	0.0025			0.022	0.4	10	40
Lead *	< 0.0010			< 0.010	0.5	10	50
Antimony *	< 0.0017			< 0.017	0.06	0.7	5
Selenium *	< 0.0040			< 0.040	0.1	0.5	7
Zinc *	0.014			0.12	4	50	200
Chloride *	0.86			7.4	800	15000	25000
Fluoride	0.20			1.7	10	150	500
Sulphate *	5.0			43	1000	20000	50000
TDS*	19			170	4000	60000	100000
Phenol Index (Monhydric Phenols) *	< 0.010			< 0.10	1	-	-
DOC	10.7			92.7	500	800	1000
Leach Test Information							
Stone Content (%)	< 0.1						
Sample Mass (kg)	2.0						
Dry Matter (%)	88						
Moisture (%)	12						

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

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i2 Analytical

7 Woodshots Meadow
Croxley Green Business Park
Watford, WD18 8YS

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Fax: 01923 237404
email:reception@i2analytical.com

Waste Acceptance Criteria Analytical Results

Report No:	**20-97229**						
					Client:	**INTEGGEO**	
Location	**Tylorstown**						
Lab Reference (Sample Number)	1497752 / 1497753				**Landfill Waste Acceptance Criteria Limits**		
Sampling Date	20/04/2020				Inert Waste Landfill	Stable Non-reactive HAZARDOUS waste in non-hazardous Landfill	Hazardous Waste Landfill
Sample ID	TP3						
Depth (m)	1.00						
Solid Waste Analysis							
TOC (%)**	3.2				3%	5%	6%
Loss on Ignition (%) **	6.9				--	--	10%
BTEX (µg/kg) **	< 10				6000	--	--
Sum of PCBs (mg/kg) **	< 0.007				1	--	--
Mineral Oil (mg/kg)	< 10				500	--	--
Total PAH (WAC-17) (mg/kg)	< 0.9				100	--	--
pH (units)**	7.0				--	>6	--
Acid Neutralisation Capacity (mol / kg)	0.00				--	To be evaluated	To be evaluated
Eluate Analysis	10:1			10:1	Limit values for compliance leaching test		
(BS EN 12457 - 2 preparation utilising end over end leaching procedure)	mg/l			mg/kg	using BS EN 12457-2 at L/S 10 l/kg (mg/kg)		
Arsenic *	0.0016			0.0135	0.5	2	25
Barium *	0.0039			0.0337	20	100	300
Cadmium *	< 0.0001			< 0.0008	0.04	1	5
Chromium *	0.0011			0.0093	0.5	10	70
Copper *	0.013			0.11	2	50	100
Mercury *	< 0.0005			< 0.0050	0.01	0.2	2
Molybdenum *	0.0005			0.0044	0.5	10	30
Nickel *	0.0015			0.013	0.4	10	40
Lead *	< 0.0010			< 0.010	0.5	10	50
Antimony *	< 0.0017			< 0.017	0.06	0.7	5
Selenium *	< 0.0040			< 0.040	0.1	0.5	7
Zinc *	0.015			0.13	4	50	200
Chloride *	0.82			7.0	800	15000	25000
Fluoride	0.10			0.90	10	150	500
Sulphate *	7.4			63	1000	20000	50000
TDS*	19			160	4000	60000	100000
Phenol Index (Monhydric Phenols) *	< 0.010			< 0.10	1	-	-
DOC	10.9			93.2	500	800	1000
Leach Test Information							
Stone Content (%)	< 0.1						
Sample Mass (kg)	2.0						
Dry Matter (%)	87						
Moisture (%)	13						

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

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7 Woodshots Meadow
Croxley Green Business Park
Watford, WD18 8YS

Telephone: 01923 225404
Fax: 01923 237404
email:reception@i2analytical.com

Waste Acceptance Criteria Analytical Results

Report No:	**20-97229**						
					Client:	**INTEGGEO**	
Location	**Tylorstown**						
Lab Reference (Sample Number)	1497754 / 1497755				**Landfill Waste Acceptance Criteria Limits**		
Sampling Date	20/04/2020				Inert Waste Landfill	Stable Non-reactive HAZARDOUS waste in non-hazardous Landfill	Hazardous Waste Landfill
Sample ID	TP4						
Depth (m)	1.00						
Solid Waste Analysis							
TOC (%)**	3.2				3%	5%	6%
Loss on Ignition (%) **	8.7				--	--	10%
BTEX (µg/kg) **	< 10				6000	--	--
Sum of PCBs (mg/kg) **	< 0.007				1	--	--
Mineral Oil (mg/kg)	< 10				500	--	--
Total PAH (WAC-17) (mg/kg)	< 0.9				100	--	--
pH (units)**	6.5				--	>6	--
Acid Neutralisation Capacity (mol / kg)	-9.5				--	To be evaluated	To be evaluated
Eluate Analysis	10:1			10:1	Limit values for compliance leaching test		
(BS EN 12457 - 2 preparation utilising end over end leaching procedure)	mg/l			mg/kg	using BS EN 12457-2 at L/S 10 l/kg (mg/kg)		
Arsenic *	0.0013			0.0117	0.5	2	25
Barium *	0.0052			0.0468	20	100	300
Cadmium *	< 0.0001			< 0.0008	0.04	1	5
Chromium *	< 0.0004			< 0.0040	0.5	10	70
Copper *	0.0066			0.059	2	50	100
Mercury *	< 0.0005			< 0.0050	0.01	0.2	2
Molybdenum *	< 0.0004			< 0.0040	0.5	10	30
Nickel *	0.0003			0.0031	0.4	10	40
Lead *	< 0.0010			< 0.010	0.5	10	50
Antimony *	< 0.0017			< 0.017	0.06	0.7	5
Selenium *	< 0.0040			< 0.040	0.1	0.5	7
Zinc *	0.0044			0.040	4	50	200
Chloride *	0.50			4.4	800	15000	25000
Fluoride	0.16			1.4	10	150	500
Sulphate *	5.5			49	1000	20000	50000
TDS*	17			150	4000	60000	100000
Phenol Index (Monhydric Phenols) *	< 0.010			< 0.10	1	-	-
DOC	7.45			66.7	500	800	1000
Leach Test Information							
Stone Content (%)	< 0.1						
Sample Mass (kg)	2.0						
Dry Matter (%)	91						
Moisture (%)	8.7						

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

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

Telephone: 01923 225404
Fax: 01923 237404
email:reception@i2analytical.com

Waste Acceptance Criteria Analytical Results

Report No:	**20-97229**						
					Client:	**INTEGGEO**	
Location	**Tylorstown**						
Lab Reference (Sample Number)	1497756 / 1497757				**Landfill Waste Acceptance Criteria Limits**		
Sampling Date	20/04/2020				Inert Waste Landfill	Stable Non-reactive HAZARDOUS waste in non-hazardous Landfill	Hazardous Waste Landfill
Sample ID	TP4						
Depth (m)	1.80						
Solid Waste Analysis							
TOC (%)**	2.9				3%	5%	6%
Loss on Ignition (%) **	11.5				--	--	10%
BTEX (µg/kg) **	< 10				6000	--	--
Sum of PCBs (mg/kg) **	< 0.007				1	--	--
Mineral Oil (mg/kg)	< 10				500	--	--
Total PAH (WAC-17) (mg/kg)	< 0.9				100	--	--
pH (units)**	7.1				--	>6	--
Acid Neutralisation Capacity (mol / kg)	0.00				--	To be evaluated	To be evaluated
Eluate Analysis	10:1			10:1	Limit values for compliance leaching test		
(BS EN 12457 - 2 preparation utilising end over end leaching procedure)	mg/l			mg/kg	using BS EN 12457-2 at L/S 10 l/kg (mg/kg)		
Arsenic *	< 0.0011			< 0.0110	0.5	2	25
Barium *	0.0029			0.0248	20	100	300
Cadmium *	< 0.0001			< 0.0008	0.04	1	5
Chromium *	0.0005			0.0041	0.5	10	70
Copper *	0.0081			0.069	2	50	100
Mercury *	< 0.0005			< 0.0050	0.01	0.2	2
Molybdenum *	0.0011			0.0095	0.5	10	30
Nickel *	0.0008			0.0066	0.4	10	40
Lead *	< 0.0010			< 0.010	0.5	10	50
Antimony *	< 0.0017			< 0.017	0.06	0.7	5
Selenium *	< 0.0040			< 0.040	0.1	0.5	7
Zinc *	0.0082			0.071	4	50	200
Chloride *	0.75			6.4	800	15000	25000
Fluoride	0.17			1.5	10	150	500
Sulphate *	6.3			54	1000	20000	50000
TDS*	18			160	4000	60000	100000
Phenol Index (Monhydric Phenols) *	< 0.010			< 0.10	1	-	-
DOC	9.76			83.6	500	800	1000
Leach Test Information							
Stone Content (%)	< 0.1						
Sample Mass (kg)	2.0						
Dry Matter (%)	85						
Moisture (%)	15						

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7 Woodshots Meadow
Croxley Green Business Park
Watford, WD18 8YS

Telephone: 01923 225404
Fax: 01923 237404
email:reception@i2analytical.com

Waste Acceptance Criteria Analytical Results

Report No:	**20-97229**						
					Client:	**INTEGGEO**	
Location	**Tylorstown**						
Lab Reference (Sample Number)	1497758 / 1497759				**Landfill Waste Acceptance Criteria Limits**		
Sampling Date	20/04/2020				Inert Waste Landfill	Stable Non-reactive HAZARDOUS waste in non-hazardous Landfill	Hazardous Waste Landfill
Sample ID	TP5						
Depth (m)	1.00						
Solid Waste Analysis							
TOC (%)**	1.8				3%	5%	6%
Loss on Ignition (%) **	13.3				--	--	10%
BTEX (µg/kg) **	< 10				6000	--	--
Sum of PCBs (mg/kg) **	< 0.007				1	--	--
Mineral Oil (mg/kg)	< 10				500	--	--
Total PAH (WAC-17) (mg/kg)	< 0.9				100	--	--
pH (units)**	7.0				--	>6	--
Acid Neutralisation Capacity (mol / kg)	0.00				--	To be evaluated	To be evaluated
Eluate Analysis	10:1			10:1	Limit values for compliance leaching test		
(BS EN 12457 - 2 preparation utilising end over end leaching procedure)	mg/l			mg/kg	using BS EN 12457-2 at L/S 10 l/kg (mg/kg)		
Arsenic *	< 0.0011			< 0.0110	0.5	2	25
Barium *	0.0052			0.0466	20	100	300
Cadmium *	< 0.0001			< 0.0008	0.04	1	5
Chromium *	< 0.0004			< 0.0040	0.5	10	70
Copper *	0.0064			0.058	2	50	100
Mercury *	< 0.0005			< 0.0050	0.01	0.2	2
Molybdenum *	0.0005			0.0048	0.5	10	30
Nickel *	0.0011			0.010	0.4	10	40
Lead *	< 0.0010			< 0.010	0.5	10	50
Antimony *	< 0.0017			< 0.017	0.06	0.7	5
Selenium *	< 0.0040			< 0.040	0.1	0.5	7
Zinc *	0.0064			0.058	4	50	200
Chloride *	0.59			5.3	800	15000	25000
Fluoride	0.28			2.5	10	150	500
Sulphate *	7.6			68	1000	20000	50000
TDS*	24			210	4000	60000	100000
Phenol Index (Monhydric Phenols) *	< 0.010			< 0.10	1	-	-
DOC	8.02			72.3	500	800	1000
Leach Test Information							
Stone Content (%)	< 0.1						
Sample Mass (kg)	2.0						
Dry Matter (%)	89						
Moisture (%)	11						

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Croxley Green Business Park
Watford, WD18 8YS

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Fax: 01923 237404
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Waste Acceptance Criteria Analytical Results

Report No:	**20-97229**						
					Client:	**INTEGGEO**	
Location	**Tylorstown**						
Lab Reference (Sample Number)	1497760 / 1497761				**Landfill Waste Acceptance Criteria Limits**		
Sampling Date	20/04/2020				Inert Waste Landfill	Stable Non-reactive HAZARDOUS waste in non-hazardous Landfill	Hazardous Waste Landfill
Sample ID	TP6						
Depth (m)	1.00						
Solid Waste Analysis							
TOC (%)**	1.6				3%	5%	6%
Loss on Ignition (%) **	7.2				--	--	10%
BTEX (µg/kg) **	< 10				6000	--	--
Sum of PCBs (mg/kg) **	< 0.007				1	--	--
Mineral Oil (mg/kg)	< 10				500	--	--
Total PAH (WAC-17) (mg/kg)	< 0.9				100	--	--
pH (units)**	7.3				--	>6	--
Acid Neutralisation Capacity (mol / kg)	12				--	To be evaluated	To be evaluated
Eluate Analysis	10:1			10:1	Limit values for compliance leaching test		
(BS EN 12457 - 2 preparation utilising end over end leaching procedure)	mg/l			mg/kg	using BS EN 12457-2 at L/S 10 l/kg (mg/kg)		
Arsenic *	< 0.0011			< 0.0110	0.5	2	25
Barium *	0.0062			0.0533	20	100	300
Cadmium *	< 0.0001			< 0.0008	0.04	1	5
Chromium *	0.0007			0.0059	0.5	10	70
Copper *	0.011			0.096	2	50	100
Mercury *	< 0.0005			< 0.0050	0.01	0.2	2
Molybdenum *	0.0008			0.0072	0.5	10	30
Nickel *	0.0056			0.049	0.4	10	40
Lead *	< 0.0010			< 0.010	0.5	10	50
Antimony *	< 0.0017			< 0.017	0.06	0.7	5
Selenium *	< 0.0040			< 0.040	0.1	0.5	7
Zinc *	0.031			0.27	4	50	200
Chloride *	0.62			5.4	800	15000	25000
Fluoride	0.22			1.9	10	150	500
Sulphate *	7.3			63	1000	20000	50000
TDS*	22			190	4000	60000	100000
Phenol Index (Monhydric Phenols) *	< 0.010			< 0.10	1	-	-
DOC	8.87			76.8	500	800	1000
Leach Test Information							
Stone Content (%)	< 0.1						
Sample Mass (kg)	2.0						
Dry Matter (%)	90						
Moisture (%)	10						

Results are expressed on a dry weight basis, after correction for moisture content where applicable.
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Analytical Report Number : 20-97229

Project / Site name: Tylorstown

* 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 *
1497748	TP1	None Supplied	1.00	Grey clay and sand with vegetation.
1497750	TP2	None Supplied	1.00	Grey clay with gravel.
1497752	TP3	None Supplied	1.00	Grey clay with gravel.
1497754	TP4	None Supplied	1.00	Grey sand with gravel.
1497756	TP4	None Supplied	1.80	Grey clay with gravel and vegetation.
1497758	TP5	None Supplied	1.00	Grey sandy gravel.**
1497760	TP6	None Supplied	1.00	Grey clay with gravel and vegetation.

** Non MCERTS Matrix

Analytical Report Number : 20-97229

Project / Site name: Tylorstown

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
Acid neutralisation capacity of soil	Determination of acid neutralisation capacity by addition of acid or alkali followed by electronic probe.	In-house method based on Guidance an Sampling and Testing of Wastes to Meet Landfill Waste Acceptance""	L046-PL	W	NONE
BS EN 12457-2 (10:1) Leachate Prep	10:1 (as recieved, moisture adjusted) end over end extraction with water for 24 hours. Eluate filtered prior to analysis.	In-house method based on BSEN12457-2.	L043-PL	W	NONE
BTEX in soil (Monoaromatics)	Determination of BTEX in soil by headspace GC-MS.	In-house method based on USEPA8260	L073B-PL	W	MCERTS
Chloride 10:1 WAC	Determination of Chloride colorimetrically by discrete analyser.	In house based on MEWAM Method ISBN 0117516260.	L082-PL	W	ISO 17025
Dissolved organic carbon 10:1 WAC	Determination of dissolved inorganic carbon in leachate by TOC/DOC NDIR Analyser.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L037-PL	W	NONE
Fluoride 10:1 WAC	Determination of fluoride in leachate by 1:1ratio with a buffer solution followed by Ion Selective Electrode.	In-house method based on Use of Total Ionic Strength Adjustment Buffer for Electrode Determination"	L033B-PL	W	ISO 17025
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.	L047-PL	D	MCERTS
Metals in leachate by ICP-OES	Determination of metals in leachate by acidification followed by ICP-OES.	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil""	L039-PL	W	ISO 17025
Mineral Oil (Soil) C10 - C40	Determination of mineral oil fraction extractable hydrocarbons in soil by GC-MS/GC-FID.	In-house method with silica gel split/clean up.	L076-PL	D	NONE
Moisture Content	Moisture content, determined gravimetrically. (30 oC)	In house method.	L019-UK/PL	W	NONE
Monohydric phenols 10:1 WAC	Determination of phenols in leachate by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L080-PL	W	ISO 17025
PCB's By GC-MS in soil	Determination of PCB by extraction with acetone and hexane followed by GC-MS.	In-house method based on USEPA 8082	L027-PL	D	MCERTS
pH at 20oC in soil	Determination of pH in soil by addition of water followed by electrometric measurement.	In house method.	L005-PL	W	MCERTS
Speciated WAC-17 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. MCERTS accredited except Coronene.	L064-PL	D	NONE
Stones content of soil	Standard preparation for all samples unless otherwise detailed. Gravimetric determination of stone > 10 mm as % dry weight.	In-house method based on British Standard Methods and MCERTS requirements.	L019-UK/PL	D	NONE
Sulphate 10:1 WAC	Determination of sulphate in leachate by ICP-OES	In-house method based on MEWAM 1986 Methods for the Determination of Metals in Soil""	L039-PL	W	ISO 17025
Total dissolved solids 10:1 WAC	Determination of total dissolved solids in water by electrometric measurement.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L004-PL	W	ISO 17025

Analytical Report Number : 20-97229

Project / Site name: Tylorstown

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
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.	L009-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.

APPENDIX D

LABORATORY GEOTECHNICAL TEST RESULTS

Laboratory Report

2788

GEO Site & Testing Services Ltd

Contract Number: 48483

Client Ref:

Client PO:

Report Date: **12-05-2020**

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

Contract Title: **Tylerstown**

For the attention of: **Jack Jones**

Date Received: **21-04-2020**

Date Completed: **12-05-2020**

Test Description	Qty
Moisture Content BS 1377:1990 - Part 2 : 3.2 - * UKAS	7
4 Point Liquid & Plastic Limit BS 1377:1990 - Part 2 : 4.3 & 5.3 - * UKAS	7
PSD Wet Sieve method BS 1377:1990 - Part 2 : 9.2 - * UKAS	7
PSD: Sedimentation by pipette carried out with Wet Sieve (Wet Sieve must also be selected) BS 1377:1990 - Part 2 : 9.4 - * UKAS	1
Dry Den/MC (4.5kg Rammer Method 1 Litre Mould) BS 1377:1990 - Part 4 : 3.5 - * UKAS	7
Disposal of samples for job	1

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

Approved Signatories:
Emma Sharp (Office Manager) - Paul Evans (Quality/Technical Manager) - Richard John (Advanced Testing Manager)
Sean Penn (Administrative/Accounts Assistant) - Shaun Jones (Laboratory manager) - Wayne Honey (Administrative/Quality Assistant)

GSTL	NATURAL MOISTURE, LIQUID LIMIT, PLASTIC LIMIT AND PLASTICITY INDEX (BS 1377 : Part 2 : 1990 Method 5)	
Contract Number	48483	
Site Name	Tylerstown	
Date Tested	30/04/2020	
	DESCRIPTIONS	

Sample/Hole Reference	Sample Number	Sample Type	Depth (m)			Descriptions
TP1		B	1.00	-		Grey slightly silty/clayey fine to coarse sandy fine to coarse GRAVEL
TP2		B	1.00	-		Grey silty/clayey fine to coarse sandy fine to coarse GRAVEL
TP3		B	1.00	-		Greyish brown silty clayey fine to coarse gravelly fine to coarse SAND
TP4		B	1.00	-		Grey slightly clayey/silty fine to coarse sandy fine to coarse GRAVEL
TP4		B	1.80	-		Grey silty/clayey fine to coarse sandy fine to coarse GRAVEL
TP5		B	1.00	-		Grey slightly clayey/silty fine to coarse sandy fine to coarse GRAVEL
TP6		B	1.00	-		Grey slightly silty/clayey fine to coarse sandy fine to coarse GRAVEL
				-		
				-		
				-		
				-		
				-		
				-		
				-		
				-		
				-		
				-		
				-		
				-		
				-		
				-		
				-		
				-		
				-		

Operators	Checked	12/05/2020	Wayne Honey (Administrative/Quality Assistant)
Luke Williams	Approved	12/05/2020	Paul Evans (Quality/Technical Manager)

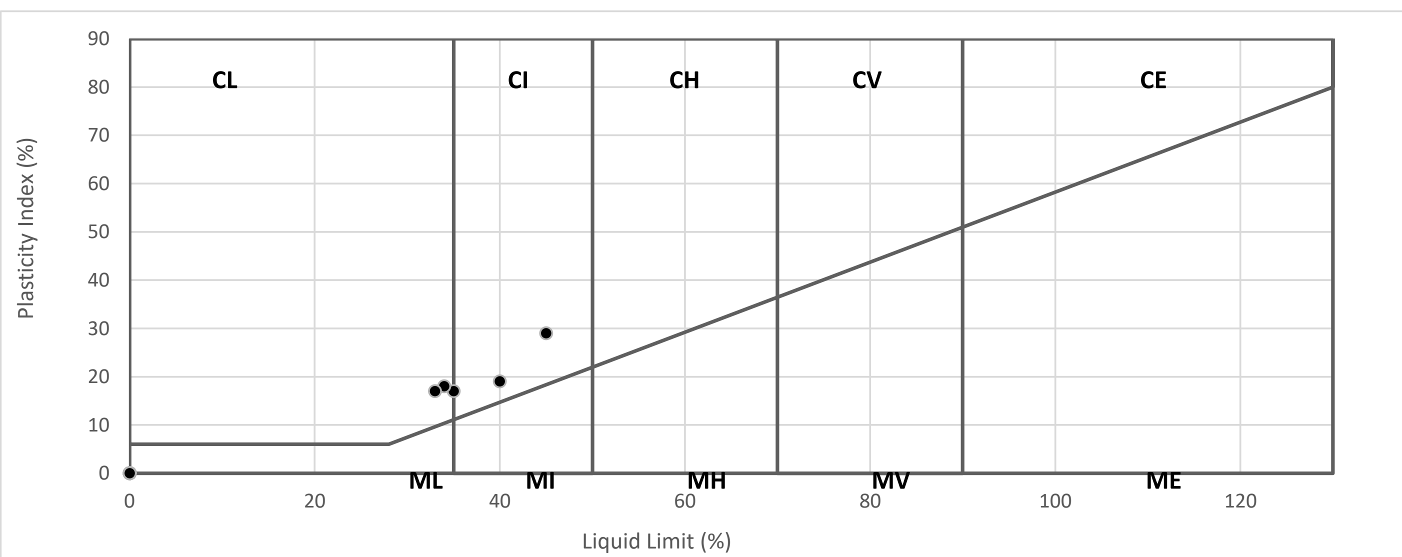
UKAS TESTING 2788

GSTL	NATURAL MOISTURE, LIQUID LIMIT, PLASTIC LIMIT AND PLASTICITY INDEX (BS 1377 : Part 2 : 1990 Method 5)
Contract Number	**48483**
Project Location	**Tylerstown**
Date Tested	**30/04/2020**

Sample/Hole Reference	Sample Number	Sample Type	Depth (m)			Moisture Content %	Liquid Limit %	Plastic Limit %	Plasticity index %	Passing 0.425mm %	Remarks
TP1		B	1.00	-		16	35	18	17	18	CL/I Low/Inter. Plasticity
TP2		B	1.00	-		16	45	16	29	29	CI Intermediate Plasticity
TP3		B	1.00	-		15	34	16	18	56	CL Low Plasticity
TP4		B	1.00	-		8.0		NP		18	
TP4		B	1.80	-		20	40	21	19	23	CI Intermediate Plasticity
TP5		B	1.00	-		10		NP		14	
TP6		B	1.00	-		14	33	16	17	14	CL Low Plasticity
				-							
				-							
				-							
				-							
				-							
				-							
				-							
				-							
				-							
				-							
				-							
				-							
				-							
				-							
				-							
				-							
				-							

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

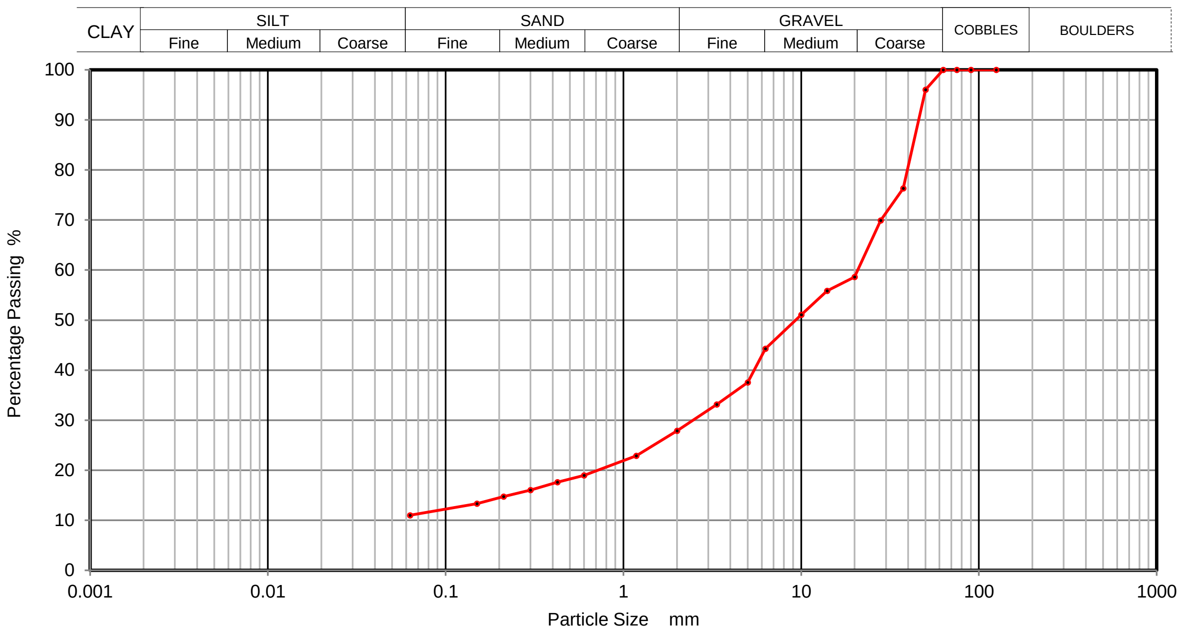
PLASTICITY CHART FOR CASAGRANDE CLASSIFICATION
BS 5930:1999+A2:2010



Operators	Checked	12/05/2020	Wayne Honey (Administrative/Quality Assistant)
Luke Williams	Approved	12/05/2020	Paul Evans (Quality/Technical Manager)

UKAS TESTING 2788

GSTL	PARTICLE SIZE DISTRIBUTION BS 1377 Part 2:1990 Wet Sieve, Clause 9.2	Contract Number	48483
		Borehole/Pit No.	TP1
Site Name	**Tylerstown**	Sample No.	
Soil Description	Grey slightly silty/clayey fine to coarse sandy fine to coarse GRAVEL	Depth Top	1.00
		Depth Base	
Date Tested	05/05/2020	Sample Type	B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	96		
37.5	76		
28	70		
20	59		
14	56		
10	51		
6.3	44		
5	38		
3.35	33		
2	28		
1.18	23		
0.6	19		
0.425	18		
0.3	16		
0.212	15		
0.15	13		
0.063	11		

Sample Proportions	% dry mass
Cobbles	0
Gravel	72
Sand	17
Silt and Clay	11

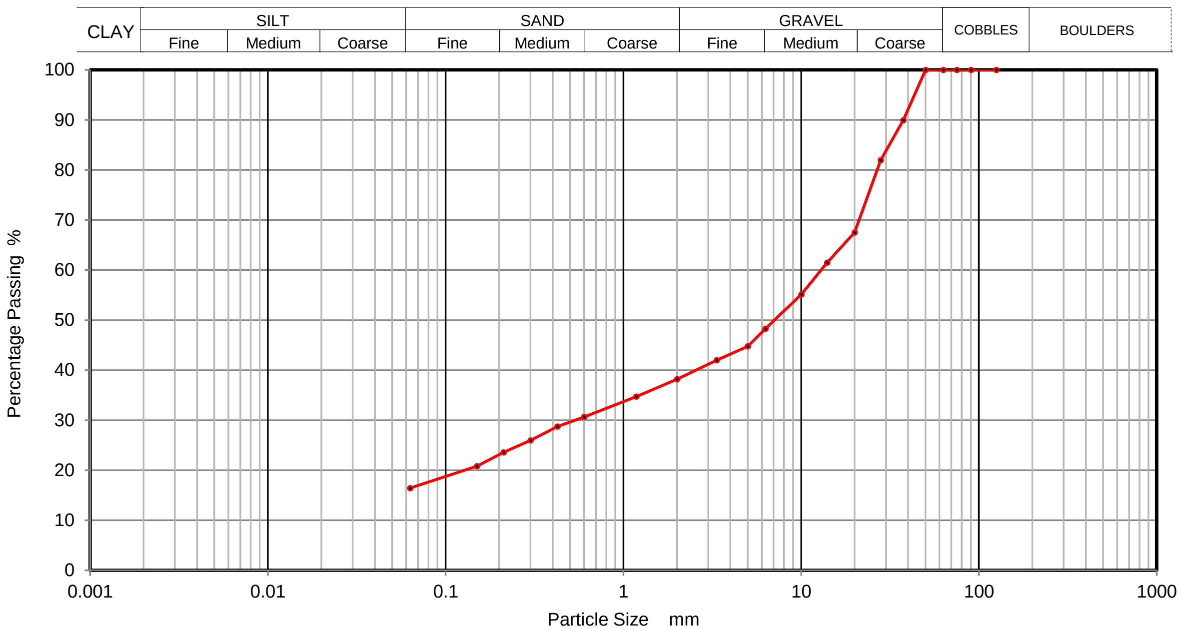
Remarks

Preparation and testing in accordance with BS1377 unless noted below

Operators	Checked	11/05/2020	Wayne Honey	W. Honey
RO/MH	Approved	12/05/2020	Paul Evans	D P Evans

UKAS TESTING 2788

GSTL	PARTICLE SIZE DISTRIBUTION BS 1377 Part 2:1990 Wet Sieve, Clause 9.2	Contract Number	48483
		Borehole/Pit No.	TP2
Site Name	**Tylerstown**	Sample No.	
Soil Description	Grey silty/clayey fine to coarse sandy fine to coarse GRAVEL	Depth Top	**1.00**
		Depth Base	
Date Tested	05/05/2020	Sample Type	**B**



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	90		
28	82		
20	67		
14	61		
10	55		
6.3	48		
5	45		
3.35	42		
2	38		
1.18	35		
0.6	31		
0.425	29		
0.3	26		
0.212	24		
0.15	21		
0.063	16		

Sample Proportions	% dry mass
Cobbles	0
Gravel	62
Sand	22
Silt and Clay	16

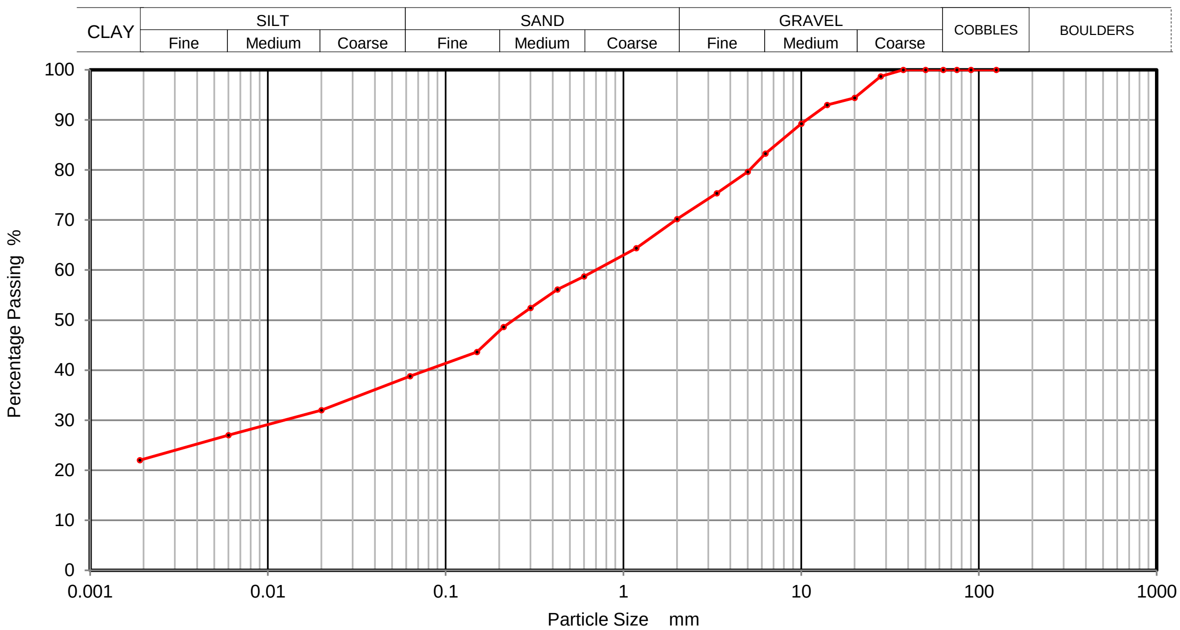
Remarks

Preparation and testing in accordance with BS1377 unless noted below

Operators	Checked	11/05/2020	Wayne Honey	W. Honey
RO/MH	Approved	12/05/2020	Paul Evans	P Evans

UKAS TESTING 2788

GSTL	**PARTICLE SIZE DISTRIBUTION** **BS 1377 Part 2:1990** **Wet Sieve & Pipette Analysis, Clause 9.2 & 9.4**	Contract Number	**48483**
		Borehole/Pit No.	**TP3**
Site Name	**Tylerstown**	Sample No.	
Soil Description	Greyish brown silty clayey fine to coarse gravelly fine to coarse SAND	Depth Top	**1.00**
		Depth Base	
Date Tested	05/05/2020	Sample Type	**B**



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0200	32
90	100	0.0060	27
75	100	0.0020	22
63	100		
50	100		
37.5	100		
28	99		
20	94		
14	93		
10	89		
6.3	83		
5	80		
3.35	75		
2	70		
1.18	64		
0.6	59		
0.425	56		
0.3	52		
0.212	49		
0.15	44		
0.063	39		

Sample Proportions	% dry mass
Cobbles	0
Gravel	30
Sand	31
Silt	17
Clay	22

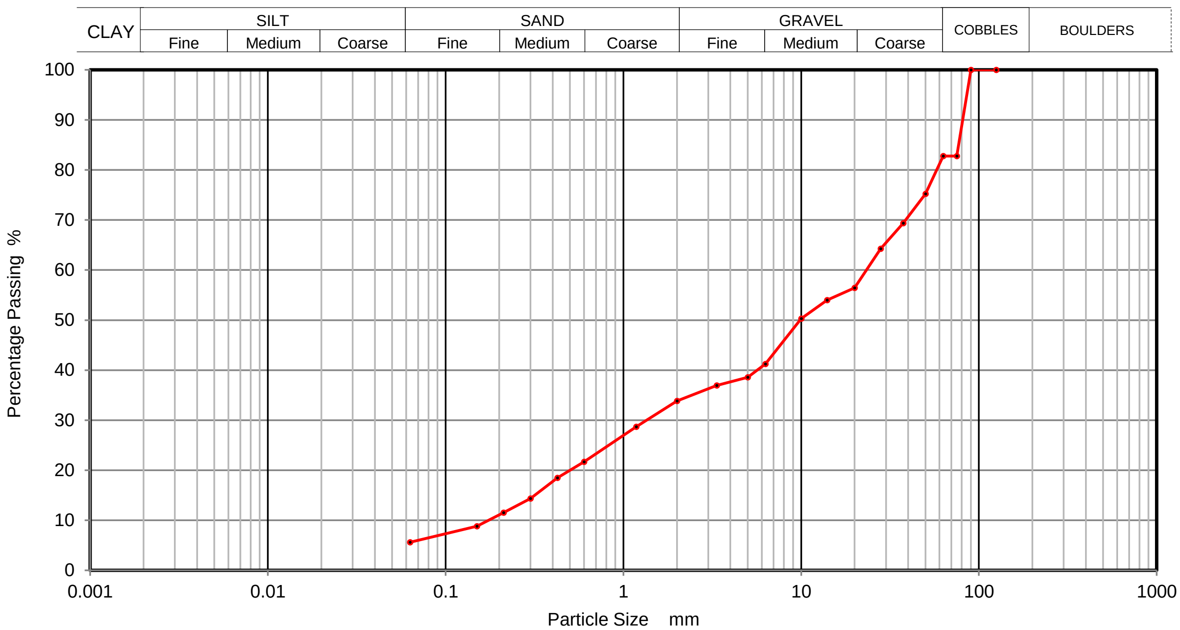
Remarks

Preparation and testing in accordance with BS1377 unless noted below

Operators	Checked	11/05/2020	Wayne Honey	W. Honey
RO/MH	Approved	12/05/2020	Paul Evans	P Evans

UKAS TESTING 2788

GSTL	PARTICLE SIZE DISTRIBUTION BS 1377 Part 2:1990 Wet Sieve, Clause 9.2	Contract Number	48483
		Borehole/Pit No.	TP4
Site Name	Tylerstown	Sample No.	
Soil Description	Grey slightly clayey/silty fine to coarse sandy fine to coarse GRAVEL (with cobbles)	Depth Top	1.00
		Depth Base	
Date Tested	05/05/2020	Sample Type	B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	83		
63	83		
50	75		
37.5	69		
28	64		
20	56		
14	54		
10	50		
6.3	41		
5	39		
3.35	37		
2	34		
1.18	29		
0.6	22		
0.425	18		
0.3	14		
0.212	12		
0.15	9		
0.063	6		

Sample Proportions	% dry mass
Cobbles	17
Gravel	49
Sand	28
Silt and Clay	6

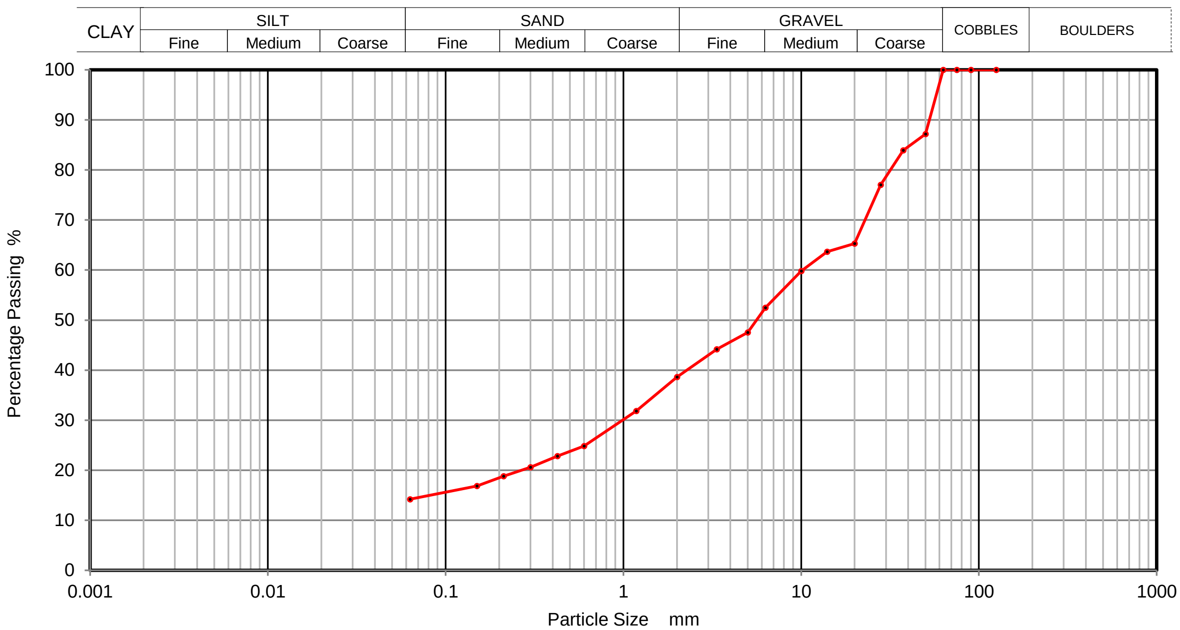
Remarks

Preparation and testing in accordance with BS1377 unless noted below

Operators	Checked	11/05/2020	Wayne Honey	W. Honey
RO/MH	Approved	12/05/2020	Paul Evans	D P Evans

UKAS TESTING 2788

GSTL	PARTICLE SIZE DISTRIBUTION BS 1377 Part 2:1990 Wet Sieve, Clause 9.2	Contract Number	48483
		Borehole/Pit No.	TP4
Site Name	Tylerstown	Sample No.	
Soil Description	Grey silty/clayey fine to coarse sandy fine to coarse GRAVEL	Depth Top	1.80
		Depth Base	
Date Tested	05/05/2020	Sample Type	B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	87		
37.5	84		
28	77		
20	65		
14	64		
10	60		
6.3	52		
5	48		
3.35	44		
2	39		
1.18	32		
0.6	25		
0.425	23		
0.3	21		
0.212	19		
0.15	17		
0.063	14		

Sample Proportions	% dry mass
Cobbles	0
Gravel	61
Sand	25
Silt and Clay	14

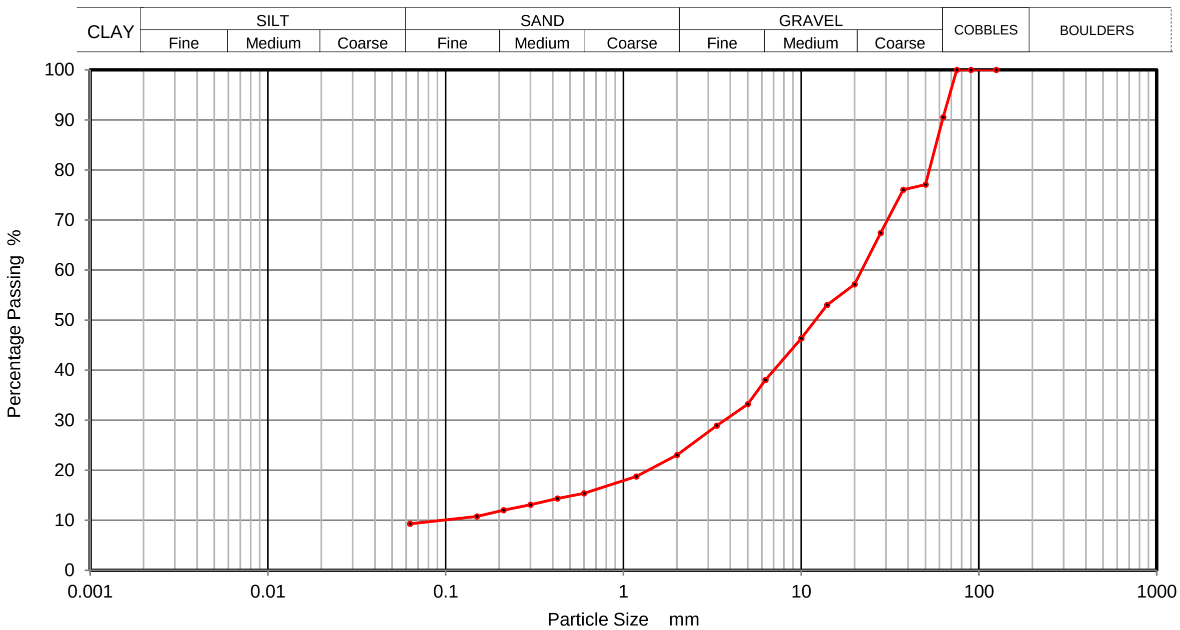
Remarks

Preparation and testing in accordance with BS1377 unless noted below

Operators	Checked	11/05/2020	Wayne Honey	W. Honey
RO/MH	Approved	12/05/2020	Paul Evans	D P Evans

UKAS TESTING 2788

GSTL	PARTICLE SIZE DISTRIBUTION BS 1377 Part 2:1990 Wet Sieve, Clause 9.2	Contract Number	**48483**
		Borehole/Pit No.	**TP5**
Site Name	**Tylerstown**	Sample No.	
Soil Description	Grey slightly clayey/silty fine to coarse sandy fine to coarse GRAVEL (with cobbles)	Depth Top	**1.00**
		Depth Base	
Date Tested	05/05/2020	Sample Type	**B**



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	91		
50	77		
37.5	76		
28	67		
20	57		
14	53		
10	46		
6.3	38		
5	33		
3.35	29		
2	23		
1.18	19		
0.6	15		
0.425	14		
0.3	13		
0.212	12		
0.15	11		
0.063	9		

Sample Proportions	% dry mass
Cobbles	9
Gravel	68
Sand	14
Silt and Clay	9

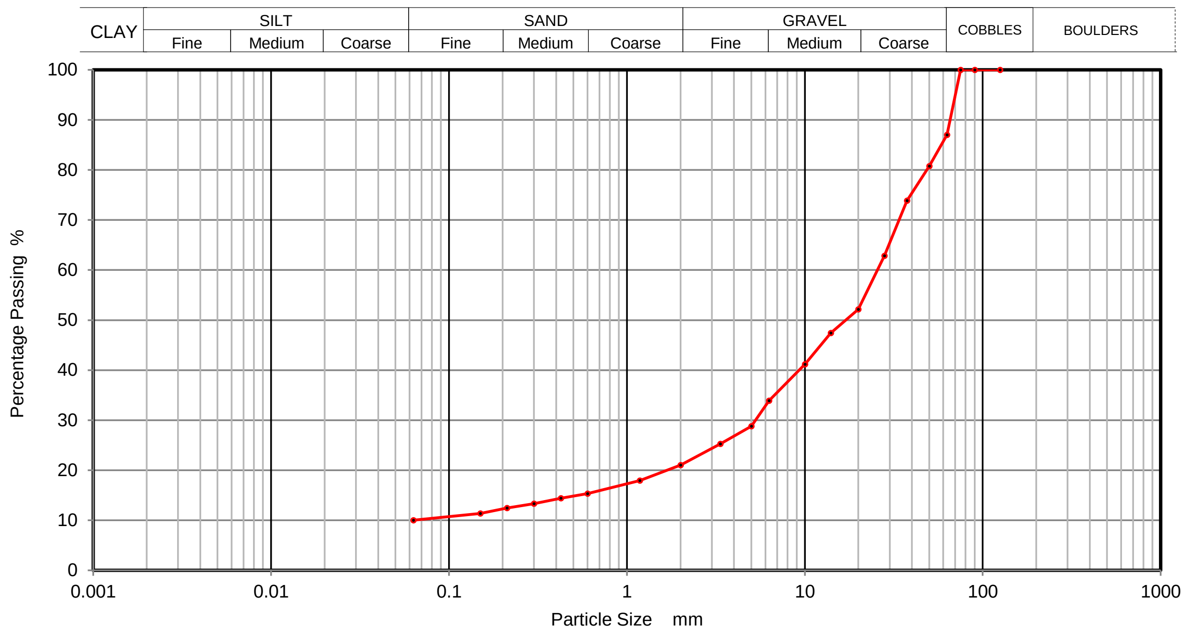
Remarks

Preparation and testing in accordance with BS1377 unless noted below

Operators	Checked	11/05/2020	Wayne Honey	W. Honey
RO/MH	Approved	12/05/2020	Paul Evans	D P Evans

UKAS TESTING 2788

GSTL	PARTICLE SIZE DISTRIBUTION BS 1377 Part 2:1990 Wet Sieve, Clause 9.2	Contract Number	48483
		Borehole/Pit No.	TP6
Site Name	Tylerstown	Sample No.	
Soil Description	Grey slightly silty/clayey fine to coarse sandy fine to coarse GRAVEL (with cobbles)	Depth Top	1.00
		Depth Base	
Date Tested	05/05/2020	Sample Type	B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	87		
50	81		
37.5	74		
28	63		
20	52		
14	47		
10	41		
6.3	34		
5	29		
3.35	25		
2	21		
1.18	18		
0.6	15		
0.425	14		
0.3	13		
0.212	12		
0.15	11		
0.063	10		

Sample Proportions	% dry mass
Cobbles	13
Gravel	66
Sand	11
Silt and Clay	10

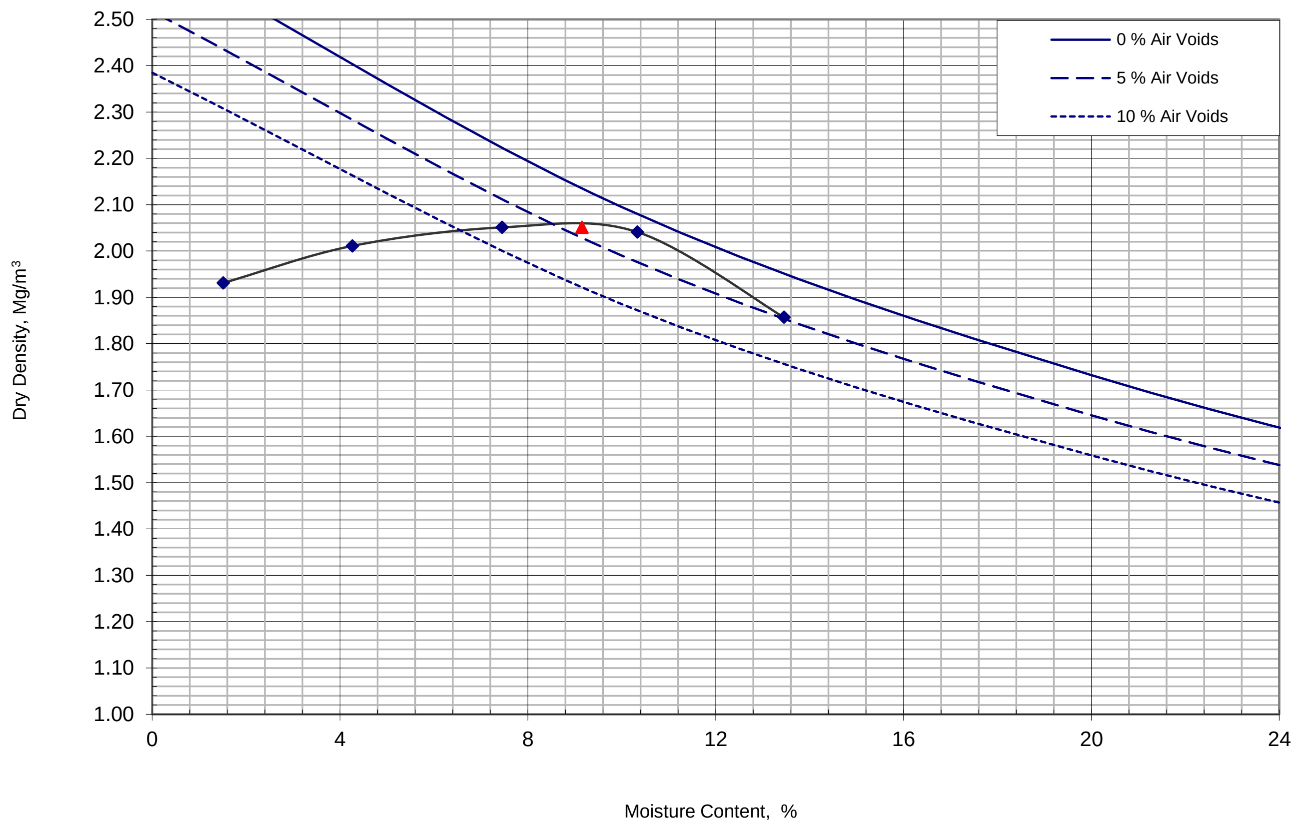
Remarks

Preparation and testing in accordance with BS1377 unless noted below

Operators	Checked	11/05/2020	Wayne Honey	W. Honey
RO/MH	Approved	12/05/2020	Paul Evans	P Evans

UKAS TESTING 2788

GSTL	Dry Density / Moisture Content Relationship BS 1377:Part 4:1990	Contract Number	48483
		Borehole / Pit No	TP1
Project Location	Tylerstown	Sample No	
Date Tested	07/05/2020	Depth Top	1.00
Compaction Method	4.5 Kg Rammer	Depth Base	
Compaction Clause	BS1377:Part 4:1990, Clause 3.5	Sample Type	B
Sample Description			



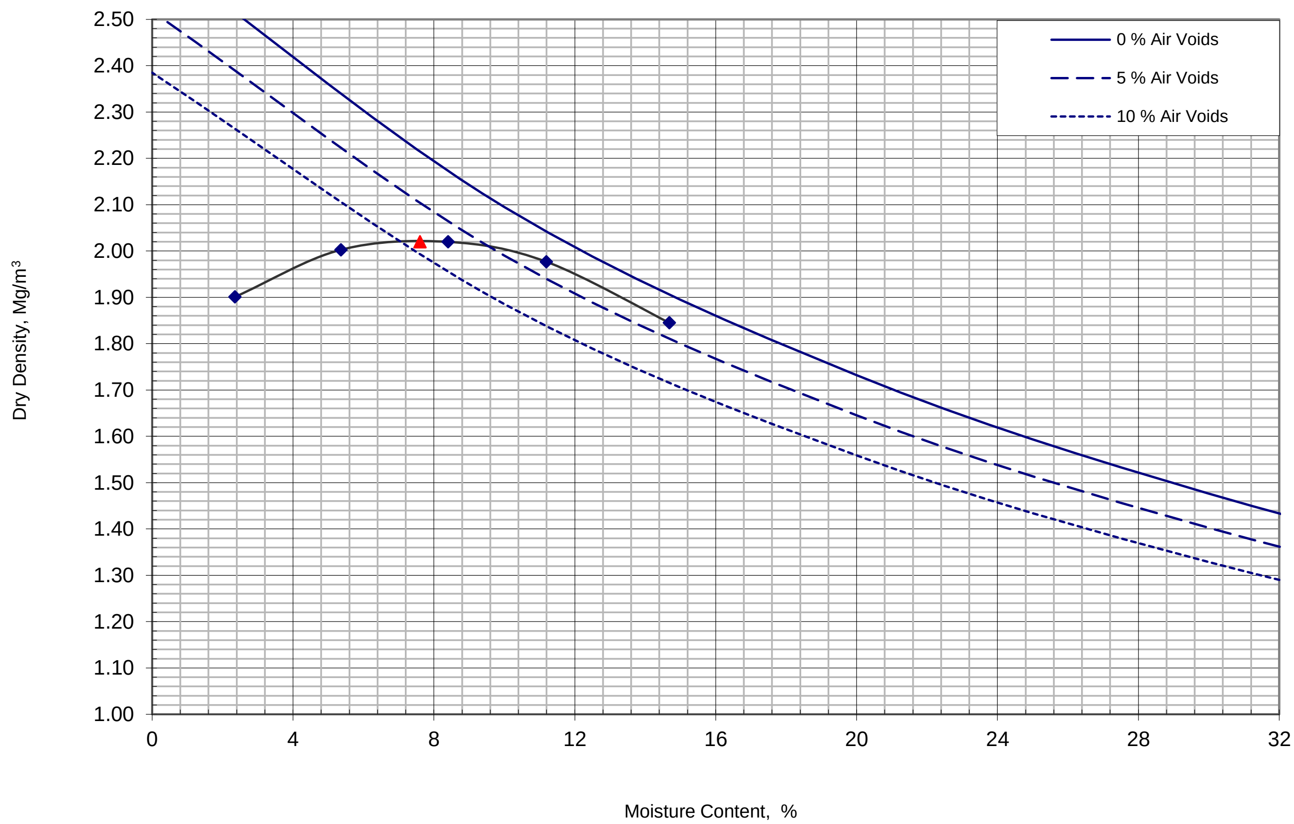
Compaction Point	1	2	3	4	5							
Moisture Content	1.5	4.3	7.5	10	13							
Bulk Density	1.96	2.10	2.20	2.25	2.11							
Dry Density	1.93	2.01	2.05	2.04	1.86							

Initial Moisture Content	13	%
Maximum Dry Density	2.05	Mg/m3
Optimum Moisture Content	9	%
Particle Density	2.65 Assumed	Mg/m3
Material Retained 37.5mm	24	%
Material Retained 20mm	17	%

Operators	Checked	11/05/2020	Emma Sharp	
CA	Approved	12/05/2020	Paul Evans	

UKAS TESTING 2788

GSTL	Dry Density / Moisture Content Relationship BS 1377:Part 4:1990	Contract Number	48483
		Borehole / Pit No	TP2
Project Location	**Tylerstown**	Sample No	
Date Tested	**07/05/2020**	Depth Top	**1.00**
Compaction Method	**4.5 Kg Rammer**	Depth Base	
Compaction Clause	**BS1377:Part 4:1990, Clause 3.5**	Sample Type	**B**
Sample Description			



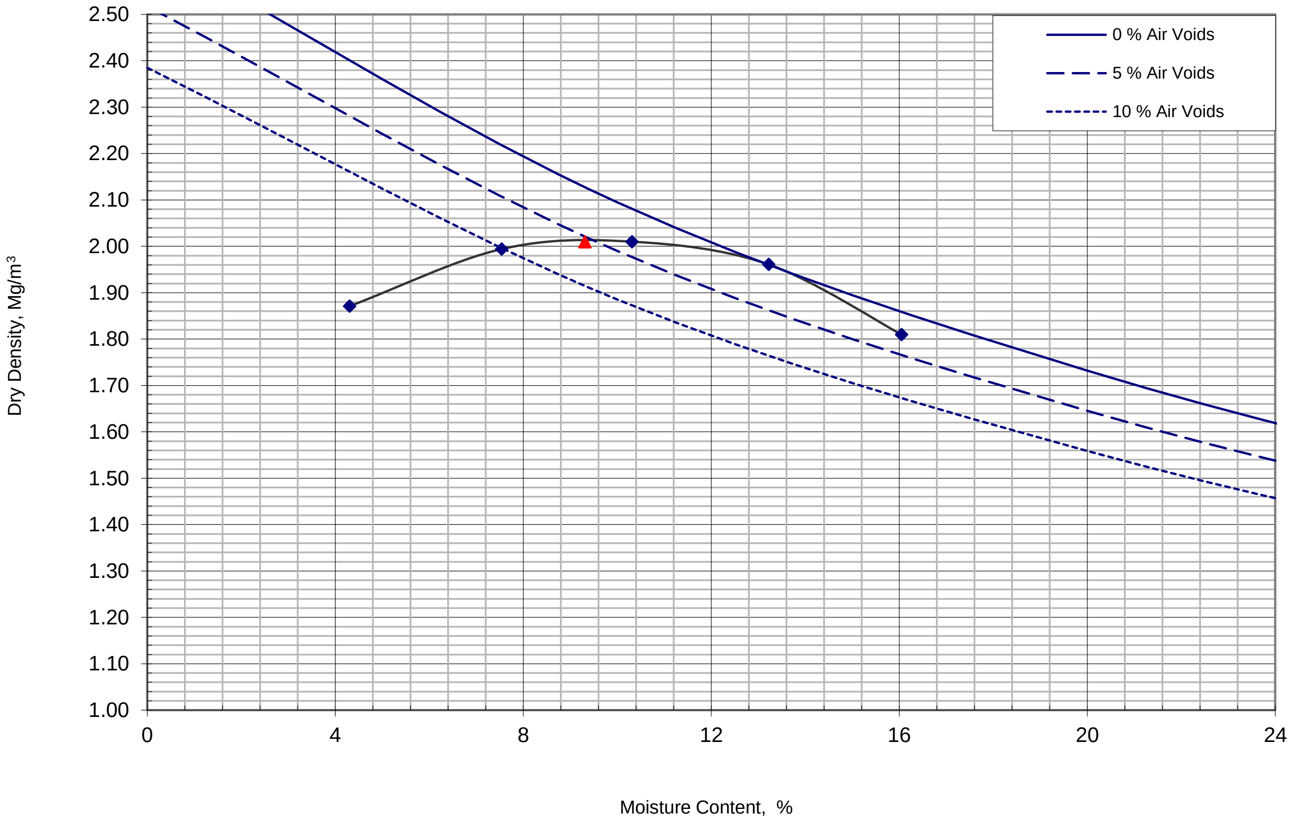
Compaction Point	1	2	3	4	5							
Moisture Content	2.4	5.4	8.4	11	15							
Bulk Density	1.95	2.11	2.19	2.20	2.12							
Dry Density	1.90	2.00	2.02	1.98	1.85							

Initial Moisture Content	15	%
Maximum Dry Density	2.02	Mg/m3
Optimum Moisture Content	8	%
Particle Density	2.65 Assumed	Mg/m3
Material Retained 37.5mm	10	%
Material Retained 20mm	23	%

Operators	Checked	11/05/2020	Emma Sharp	[signature]
CA	Approved	12/05/2020	Paul Evans	[signature]

UKAS TESTING 2788

GSTL	Dry Density / Moisture Content Relationship BS 1377:Part 4:1990	Contract Number	48483
		Borehole / Pit No	TP3
Project Location	**Tylerstown**	Sample No	
Date Tested	**07/05/2020**	Depth Top	**1.00**
Compaction Method	**4.5 Kg Rammer**	Depth Base	
Compaction Clause	**BS1377:Part 4:1990, Clause 3.5**	Sample Type	**B**
Sample Description			



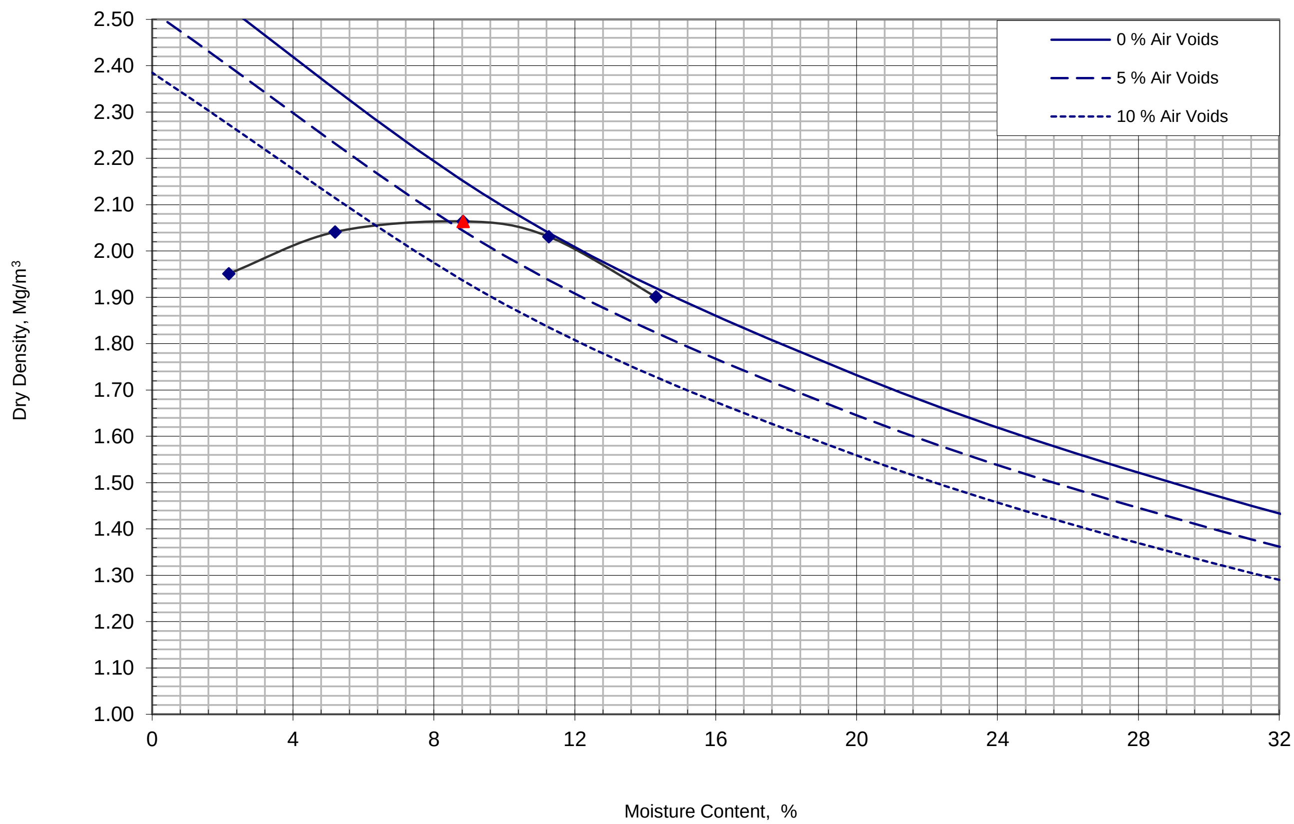
Compaction Point	1	2	3	4	5							
Moisture Content	4.3	7.5	10	13	16							
Bulk Density	1.95	2.14	2.22	2.22	2.10							
Dry Density	1.87	1.99	2.01	1.96	1.81							

Initial Moisture Content	16	%
Maximum Dry Density	2.01	Mg/m3
Optimum Moisture Content	9	%
Particle Density	2.65 Assumed	Mg/m3
Material Retained 37.5mm	0	%
Material Retained 20mm	6	%

Operators	Checked	11/05/2020	Emma Sharp	
CA	Approved	12/05/2020	Paul Evans	

UKAS TESTING 2788

GSTL	**Dry Density / Moisture Content Relationship** **BS 1377:Part 4:1990**	Contract Number	**48483**
		Borehole / Pit No	**TP4**
Project Location	**Tylerstown**	Sample No	
Date Tested	**07/05/2020**	Depth Top	**1.00**
Compaction Method	**4.5 Kg Rammer**	Depth Base	
Compaction Clause	**BS1377:Part 4:1990, Clause 3.5**	Sample Type	**B**
Sample Description			



Compaction Point	1	2	3	4	5							
Moisture Content	2.2	5.2	8.8	11	14							
Bulk Density	1.99	2.15	2.25	2.26	2.17							
Dry Density	1.95	2.04	2.06	2.03	1.90							

Initial Moisture Content	8.8	%
Maximum Dry Density	2.06	Mg/m3
Optimum Moisture Content	9	%
Particle Density	2.65 Assumed	Mg/m3
Material Retained 37.5mm	31	%
Material Retained 20mm	13	%

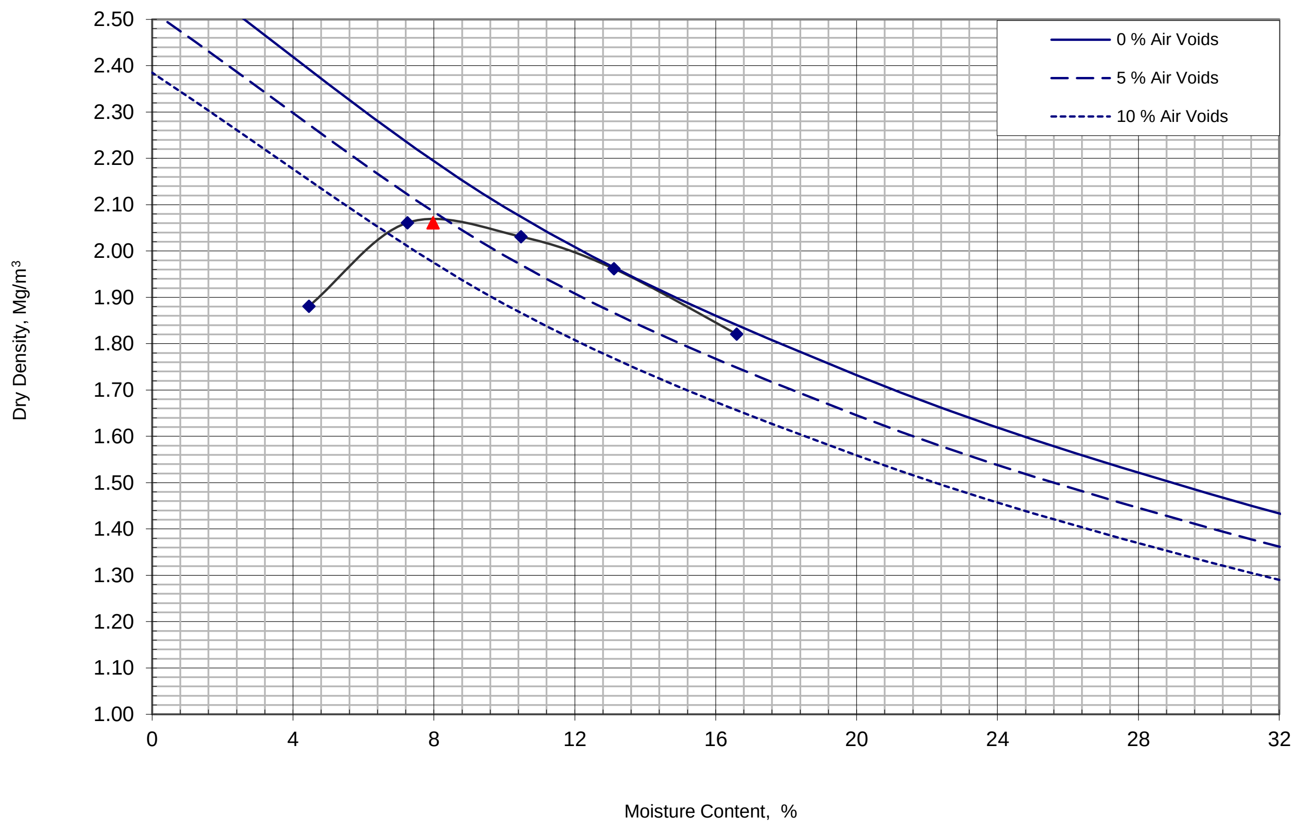
Operators	Checked	11/05/2020	Emma Sharp	[signature]
CA	Approved	12/05/2020	Paul Evans	[signature]

UKAS TESTING 2788

GSTL

Dry Density / Moisture Content Relationship
BS 1377:Part 4:1990

Contract Number	48483		
Borehole / Pit No	TP4		
Project Location	Tylerstown	Sample No	
Date Tested	07/05/2020	Depth Top	1.80
Compaction Method	4.5 Kg Rammer	Depth Base	
Compaction Clause	BS1377:Part 4:1990, Clause 3.5	Sample Type	B
Sample Description			



Compaction Point	1	2	3	4	5							
Moisture Content	4.5	7.3	10	13	17							
Bulk Density	1.96	2.21	2.24	2.22	2.12							
Dry Density	1.88	2.06	2.03	1.96	1.82							

Initial Moisture Content	17	%
Maximum Dry Density	2.06	Mg/m3
Optimum Moisture Content	8	%
Particle Density	2.65 Assumed	Mg/m3
Material Retained 37.5mm	16	%
Material Retained 20mm	19	%

Operators	Checked	11/05/2020	Emma Sharp	[signature]
CA	Approved	12/05/2020	Paul Evans	[signature]

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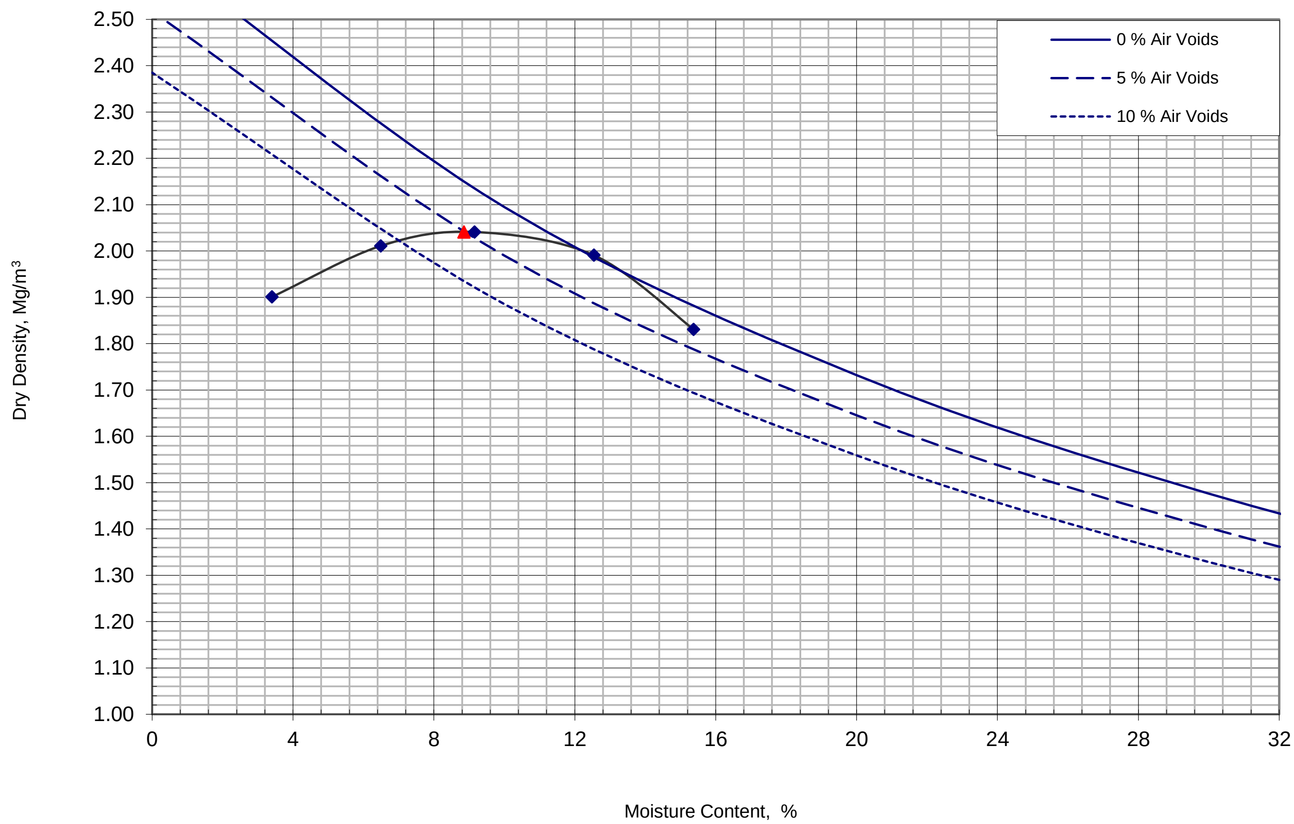
GSTL	Dry Density / Moisture Content Relationship BS 1377:Part 4:1990	Contract Number	48483
		Borehole / Pit No	TP5
Project Location	**Tylerstown**	Sample No	
Date Tested	**07/05/2020**	Depth Top	**1.00**
Compaction Method	**4.5 Kg Rammer**	Depth Base	
Compaction Clause	**BS1377:Part 4:1990, Clause 3.5**	Sample Type	**B**
Sample Description			



Compaction Point	1	2	3	4	5							
Moisture Content	3.4	6.5	9.2	13	15							
Bulk Density	1.97	2.14	2.23	2.24	2.11							
Dry Density	1.90	2.01	2.04	1.99	1.83							

Initial Moisture Content	9.2	%
Maximum Dry Density	2.04	Mg/m3
Optimum Moisture Content	9	%
Particle Density	2.65 Assumed	Mg/m3
Material Retained 37.5mm	24	%
Material Retained 20mm	19	%

Operators	Checked	11/05/2020	Emma Sharp	[signature]
CA	Approved	12/05/2020	Paul Evans	[signature]

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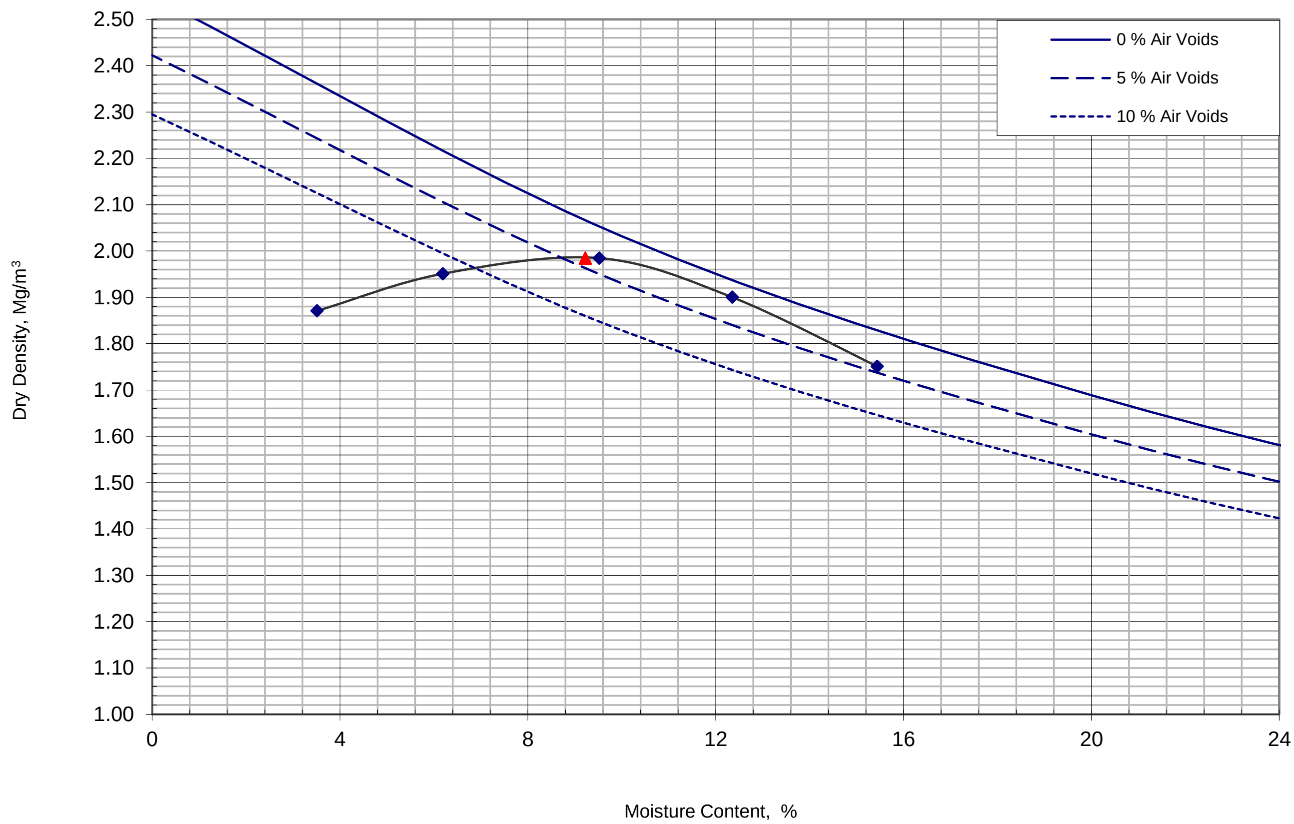
GSTL	Dry Density / Moisture Content Relationship BS 1377:Part 4:1990	Contract Number	48483
		Borehole / Pit No	TP6
Project Location	**Tylerstown**	Sample No	
Date Tested	**07/05/2020**	Depth Top	**1.00**
Compaction Method	**4.5 Kg Rammer**	Depth Base	
Compaction Clause	**BS1377:Part 4:1990, Clause 3.5**	Sample Type	**B**
Sample Description			



Compaction Point	1	2	3	4	5							
Moisture Content	3.5	6.2	9.5	12	15							
Bulk Density	1.94	2.07	2.17	2.13	2.02							
Dry Density	1.87	1.95	1.98	1.90	1.75							

Initial Moisture Content	12	%
Maximum Dry Density	1.98	Mg/m3
Optimum Moisture Content	9	%
Particle Density	2.55 Assumed	Mg/m3
Material Retained 37.5mm	26	%
Material Retained 20mm	22	%

Operators	Checked	11/05/2020	Emma Sharp	
CA	Approved	12/05/2020	Paul Evans	

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FIGURES

Site Location

N

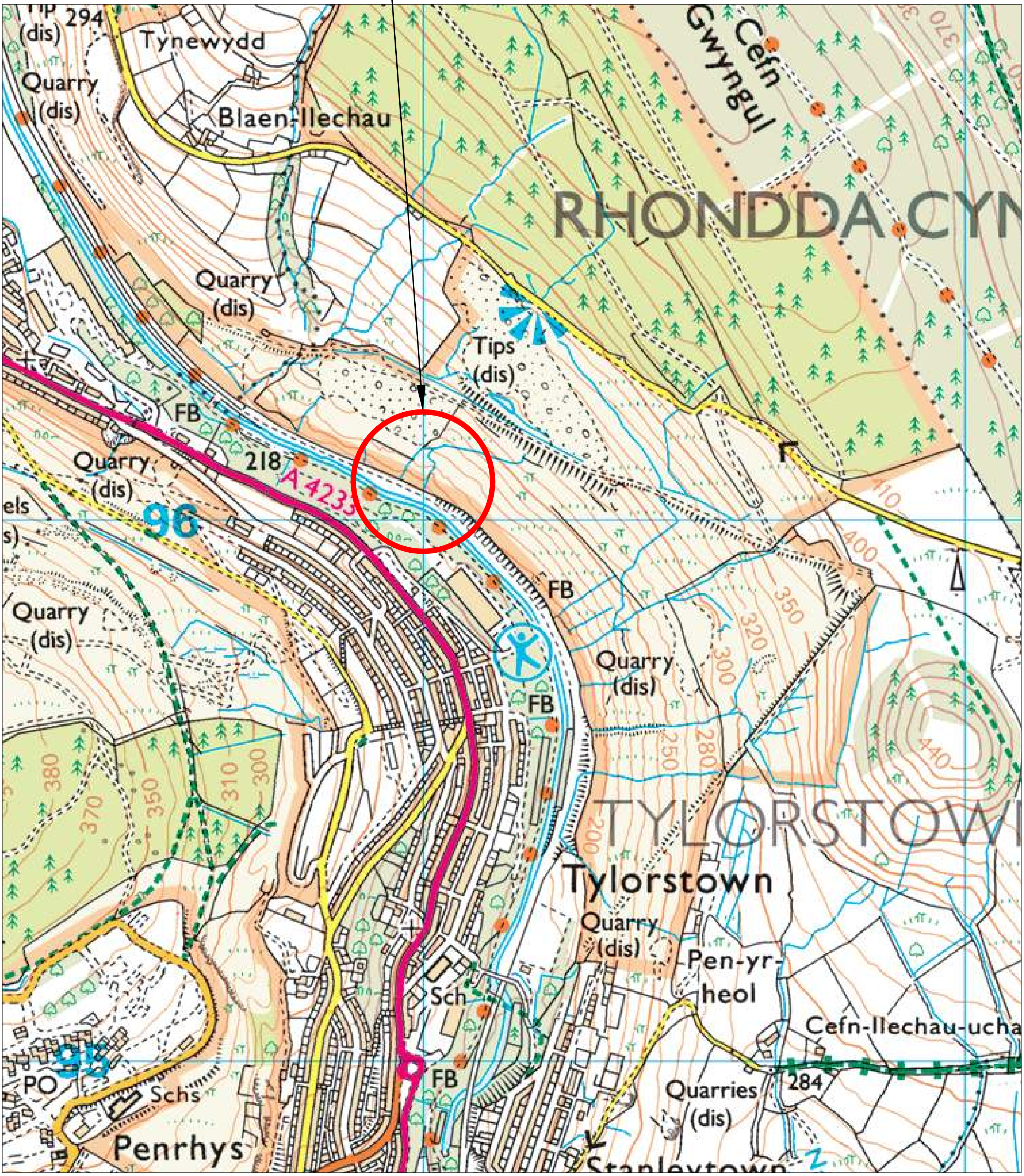

Figure 1: Site Location

Project: Tylorstown Landslip	Job no.: 12651	Intégral Géotechnique
Client: Walters Group	Scale: 1:10,000 at A4	

Integral House,
7 Beddau Way,
Castlegate Business Park,
Caerphilly,
CF83 2AX.
Tel: 029 2080 7991

Figure 2: Trial Pit Location Plan

Project: Tylorstown Landslip	Job No.: 12651	Intégral Géotechnique	Integral House, 7 Beddau Way, Castlegate Business Park, Caerphilly, CF83 2AX. Tel: 029 2080 7991
Client: Walter Group	Scale: NTS		

Tylorstown Tip - Phase 4 Ground Investigation

GROUND INVESTIGATION FACTUAL REPORT

Factual Report

Report No. Q0463/FR April 2021

DOCUMENT CONTROL	
Contract Name:	**Tylorstown Phase 4 GI**
Contract Reference:	**Q0463**
Report Type:	**Ground Investigation Factual Report**
Report Reference:	**Q0463/FR**
Date of Report Production:	**April 2021**
Client:	**Redstart**

Version:	Date:	Prepared by:	Checked by:	Approved by:
		Steffan Picton	P. Darby	R. McDermott
Draft	09/04/21			
		Engineering Geologist *B.Sc. (Hons.),*	Senior Engineering Geologist *B.Sc.(Hons.),M.Sc., C.Geol., F.G.S.*	Company Manager *B.Sc.(Hons.),M.Sc., C.Geol., F.G.S.*

Quantum Geotechnic Ltd, Plas Newydd, Llanedi, Pontarddulais, Swansea, SA4 0FQ T: 01554 744880 E: enquiries@quantumgeotech.co.uk

CONTENTS

APPENDICES

0. FOREWORD

The following Conditions and Notes on Site Investigation Procedures should be read in conjunction with this report.

0.1. General

Recommendations made and opinions expressed in the report are based on the strata observed in the excavations, together with the results of site and laboratory tests. No responsibility can be held for conditions which have not been revealed by the Exploratory Holes or which occur between Exploratory Holes. Whilst the report may suggest the likely configuration of strata, both between Exploratory Holes and below the maximum depth of investigation, this is only indicative and liability cannot be accepted for its accuracy.

Unless specifically stated, no account has been taken of possible subsidence due to mineral extraction below or close to the site.

0.2. Investigation Procedures

Rotary borehole drilling, window sampling and trial pitting techniques for ground investigation have been employed within the project. All Exploratory Hole operations, sampling and logging of soils, rocks and in-situ testing complies with the recommendations of the British Code of Practice BS 5930:2015, 'Site Investigations', British Code of Practice BS 10175: 2011 + A1:2013, 'Investigation of Potentially Contaminated Sites' and BS 1377: 1990, 'Methods of Test for Soils for Engineering Purposes'.

0.3. Routine Sampling

Representative bulk, undisturbed, disturbed and environmental samples of the different strata are taken following completion of logging. These samples are sealed and labelled in clear plastic bags and 2kg plastic tubs. Soil samples obtained for environmental testing are sampled and sealed in borosilicate amber jars or in specialist vessels where required. All samples are returned from site to QGL's laboratory for controlled storage within 24 hours of sampling to await test scheduling /requirements.

0.4. In-Situ Testing

In-situ testing comprised:
- Standard Penetration Tests (SPTs/CPTs) in Boreholes and Window Sample holes
- In-Situ CBR tests

0.5. Groundwater

Where possible, the depth of entry of any influx of groundwater is recorded during the course of excavation or boring operations. The rate of inflow into the excavation or borehole is monitored during the course of the excavation or during boring procedures. Upon encountering any water strikes, work is temporarily halted and the water levels monitored for a standard twenty-minute period recording the change in water level at the end of the twenty minutes.

Groundwater conditions observed in the excavations are those appertaining to the period of investigation. It should be noted, however, that groundwater levels are subject to diurnal, seasonal and climatic variations and can also be affected by drainage conditions or other causes.

0.6. Retention of Samples

After satisfactory completion of all the scheduled laboratory tests on any sample, the remaining material is discarded. Further to notifying the Engineer/ Client with one week's notice all soil and/or rock samples will be discarded 28 days after submission of the approved final report.

1. INTRODUCTION

1.1. General

Upon the instructions of Redstart, the Scheme Engineer / Investigation Supervisor / Client, Quantum Geotechnic Limited was commissioned to undertake a ground investigation for the proposed phase 4 reprofiling works of the collery spoil tips located on the eastern side of the Rhondda Fach valley, close to the centre of the South Wales Coal Field. The purpose of this ground investigation is to determine the existing ground and groundwater conditions on the site to allow the design to proceed.

The approximate Ordnance Survey National Grid Reference of the site is 302027,195772.

A Site Location Plan is presented as Figure 1 in Appendix I.

Other available sources of information that have been consulted in the preparation of this Factual Report include the published geological maps for the area and online databases.

General notes on the techniques employed by QGL are described in the Foreword together with the limitations inherent in carrying out site investigation work.

Full on site gas monitoring was carried out through the duration of the drilling works.

1.2. Purpose of Ground Investigation

The purpose of the ground investigation is to determine the existing ground conditions on the site to allow the design of the proposed works to proceed. The proposed works will comprise of building a haul road, re-profiling, levelling and cutting and filling of the collery spoil tips to create an embankment and drainage works and can be summarised as follows:

- A proposed haul road and potential receptor site around the eastern side of Tylorstown Tip (RH02), which will permit the landslide debris to be removed, stockpiled, treated and land formed

1.3. Scope of Work

The scheduled scope of works due to be undertaken was as follows:

- 1 no. Dynamic sampled with rotary core boreholes
- 6 no. Rotary probe boreholes
- 6 no. Window Sample holes, adjacent to the rotary probe holes
- 7 no. Trial Pits
- 6 no. In-Situ CBR tests
- A non-intrusive utility survey around all exploratory hole locations
- Surface water sampling

General

- Post fieldwork groundwater and ground gas monitoring.
- Geotechnical and Geo-environmental Laboratory Testing.
- Provide a factual report detailing the investigation.

2. SITE DETAIL

2.1. Site Description

The site is located to the eastern side of the Rhondda Fach Valley, close to the centre of the South-East Wales Coal Field. The nearest village in the valley bottom is Tylorstown, with Ferndale lying a little way to its north. Vehicle access to the tips is via Llanwonno Road, which links to the valley bottom in the village of Blaenllechau, to the north at approximate Ordnance Survey (OS) Ref 302027,195772.

The Site (RS-C) lies to the east/north-east of Tylorstown Tip (Old Smokey) and south/south-east of Llanwonno Road (vehicular access point to RS-C). The eastern edge of RS- C is bounded by conifer plantations, owned by Natural Resources Wales (NRW). The ground levels are relatively flat over RS-C with a gentle fall from the north-west to the southeast behind Old Smokey. To the South-east of Old Smokey the ground levels become more naturally undulating.

Old Smokey is perched on the crest of the plateau and deposited mostly upon the steep valley side below, so ground levels on the south-western edge of RS-C fall rapidly in that direction. Immediately to the rear of Old Smokey (east) is a large area of bare ground, comprising a surface of burnt colliery shale, and east of this is a shallow depression or man-made ephemeral pond, which lies in the centre of RS-C.

The general extent of the site is shown in Figure 1 below.

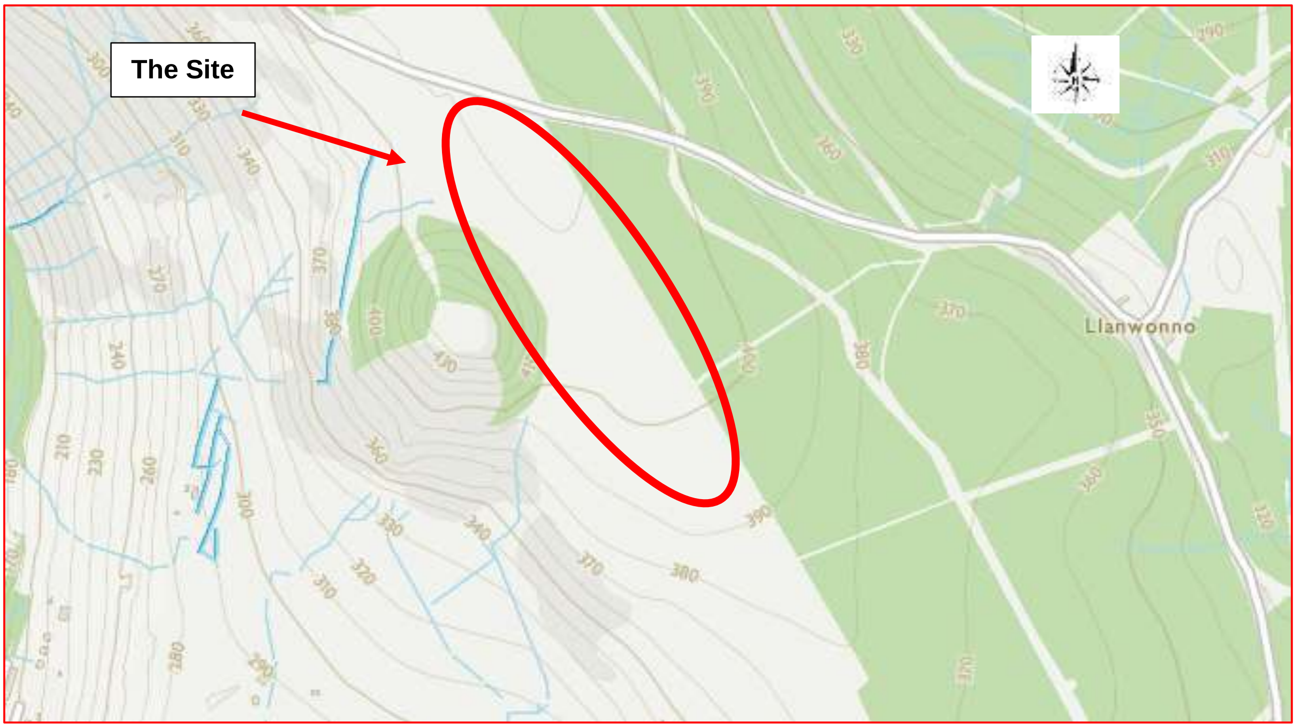

Figure 1: Site location Map for area under investigation. NOT TO SCALE ©Ordinance Survey

2.2. Statutory Service Information

All service information was held by the client with the relevant plans and information made available to QGL prior to commencement of the intrusive works.

A permit to excavate was issued by QGL for all exploratory holes. Standard QGL procedures for breaking ground were followed and all areas were scanned using a cable avoidance tool. A hand dug trial pit was excavated to 1.2m prior to commencement of all drilling. All hand excavation was undertaken using insulated digging tools.

A Utility survey to comply with PAS 128:2014 type B was undertaken at all exploratory hole locations. The Survey was undertaken by Intersect Surveys to locate and permit marking up of existing buried services.

2.3. Published Geology

Details of the geology of the site are provided by British Geological Survey (BGS) Sheet 248 'Pontypridd' at 1:50,000 scale, and BGS's online resource Geology of Britain Viewer. Details of the published and inferred geology of the site are summarised as followed:

Maps indicate no superficial deposits present, however the presence of till cannot entirely be ruled out as stoney clay is observed in some areas of bare ground. Based on historical uses in the area, some Made Ground is expected.

Solid geology beneath the site is mapped as the Brithdir Member of the Pennant Sandstone Formation typically comprising of Sandstone with many thin coal seams..

3. FIELDWORK

3.1. General

The fieldwork was carried out between the 3rd and 16th March 2021. Full-time on-site supervision and attendance by an Engineering Geologist from QGL was undertaken on all aspects of the site works and subsequent reinstatement works of all exploratory hole locations.

A summary of the works completed and covered by this report are given below:

- Vegetation clearance to access exploratory hole positions
- 1 No. Rotary dynamic sampled with coring boreholes
- 6 No. Rotary probe boreholes
- 6 No. Window sample boreholes
- 7 No. Machine excavated trial pits
- 6 No. In-Situ CBR tests
- 6 No. Installations of gas/groundwater monitoring wells in selected boreholes
- PAS 128:2014 type B was undertaken at all exploratory hole locations
- Surface water sampling

3.2. Exploratory Hole Locations

The exploratory hole locations were set out by QGL in liaison with the Investigation Supervisor on the first day of fieldwork.

On completion of the ground investigation exploratory hole positions were surveyed to ordnance datum (accurate to 0.005m horizontal and 0.01m vertical).

An Exploratory Hole Location Plan is presented within Appendix I, and exploratory hole coordinates and levels are presented on the engineer's log sheets in the corresponding Appendices. Table 1 presents the National Grid Co-Ordinates and Ordnance Datum for the exploratory holes:

Table 1: *Exploratory Hole Co-Ordinates & Levels*

Exploratory Hole ID	Easting	Northing	Height (mAOD)
BHC01	301957.668	195778.7	405.063
BHC02	302110.066	195632.466	404.816
BHC03	302125.799	195472.75	397.604
BHC04	302098.224	195798.787	411.093
BHC05	302180.007	195666.333	408.566
BHC06	302197.224	195526.225	403.195
BHC07	302304.2	195429.145	398.306
TPC01	302035.557	195795.672	411.093
TPC02	302048.406	195726.395	407.681
TPC03	302142.214	195695.329	409.763
TPC04	302174.224	195592.522	405.346
TPC05	302186.24	195476.041	399.401
TPC06	302257.37	195498.167	402.225
TPC07	302260.329	195412.875	399.474
WS01	301957.668	195778.7	405.063
WS03	302125.799	195472.75	397.604
WS04	302098.224	195798.787	411.093
WS05	302180.007	195666.333	408.566
WS06	302197.224	195526.225	403.195
WS07	302304.2	195429.145	398.306
CBR01	301379.663	196072.679	308.107
CBR02	301437.735	196051.76	319.896
CBR03	301597.296	195974.231	350.556
CBR04	301632.666	195956.263	357.822
CBR05	301733.965	195927.152	376.212
CBR06	301806.289	195893.472	393.29
BH01A (Exisiting borehole)	302079.808	195683.629	406.96
BH02A (Existing borehole)	302140.513	195564.608	404.311
BH03A (Existing borehole)	302114.3	195476.591	397.257

3.3. Boreholes

Rotary Dynamic Sampled Boreholes with Rotary Coring

A combination of drilling methods were employed to drill 1 No. boreholes referenced BH02 to a depth of 20.00m using a multi-purpose Commachio MC 450 rotary dill rig, owned and operated by QGL. This borehole was progressed through the superficial deposits by Dynamic Sampling and Rotary Percussive methods using the ODEX drill system to the specified depth, or until rockhead was encountered, whereby Rotary Coring techniques were employed.

The Dynamic Sampling technique is where a hydraulically driven percussive hammer attached to the head of the rotary drill rig mast is used to drive a 1.50m length, 101mm diameter, steel sampling tube through the soils to obtain undisturbed samples within 87mm core liner. Rock coring methods utilising the 412 size core bit (recovered core diameter 79mm) was used with mist flush (in accordance with the Coal Authority Permit) to specified depths. Rigid plastic liner (coreliner) was employed where possible to reduce disturbance of the core both during drilling and subsequent handling, giving a triple lined approach to coring.

All rotary boreholes were kept open using an ODEX casing system of 115mm diameter which also permitted the boreholes to be progressed within the superficial deposits upon encountering dense strata or boulder obstructions. The ODEX system would be utilised to penetrate the dense material/ boulder obstruction and all continued Dynamic Sample methods beyond. A combined air/mist flush was used to clear the hole of returns and debris with water being used during the coring process.

The recovered rock sample liners were split and logged in accordance with BS5930: (2015+A1:2020); BS EN ISO 14688-1:2018; BS EN ISO 14688-2:2018 and BS EN ISO 14689-1:2018, including fracture spacing, by a QGL Engineering Geologist. All retrieved core is stored in wooden lockable boxes and was logged and photographed on site prior to being transported back to QGL premises for storage.

Selected rock cores were sub-sampled for laboratory testing by QGL onsite prior to core boxes being transported. All sub-sampled rock core specimens were labelled, sealed and wrapped in bubble pack ready for shipment to the dedicated laboratory testing houses. A complete set of Engineering Geologist’s logs for the Boreholes are presented in Appendix II.

Rotary Probe Boreholes

A Comacchio MC450P track-mounted rotary drilling rig was used to progress the six rotary open-hole boreholes to target depths of between 8.00-20.00mbgl.

115mm diameter casing was drilled through the overlying superficial deposits (ODEX system) to keep the hole open and a 4-inch hammer used to break through obstructions and progress (probe) through rock. A combined air/mist flush was used to clear the hole of returns and debris on all boreholes through the boreholes. Heavy mist flush was used whilst drilling within the bedrock.

Details of the exploratory holes, including final depths in metres below ground level (mbgl) and SPT Hammer used are provided below in Table 2:

***Table 2**: Borehole details*

Exploratory Hole ID	Drilling method	SPT Hammer Reference	Termination Depth (mbgl)	Terminating Strata	Notes/Reason for Termination
BHC01	RO	Q1	20.0	Bedrock	Specified depth
BHC02	DS+RC	Q1	24.0	Bedrock	Specified depth
BHC03	RO	Q1	20.0	Bedrock	Specified depth
BHC04	RO	Q1	8.0	Bedrock	Specified depth
BHC05	RO	Q1	8.0	Bedrock	Specified depth
BHC06	RO	Q1	8.0	Bedrock	Specified depth
BHC07	RO	Q1	20.0	Bedrock	Specified depth

CP – Cable Percussive Drilling
DS – Dynamic Sampling
RO – Rotary Percussive 'Open Hole' Drilling
RC – Rotary Coring

The Engineering Geologist's borehole logs are presented within Appendix II.

3.4. Window Sample Holes

6 No. Windowless Sampling Boreholes were undertaken using a Dando Terrier Rig, adjacent to the rotary probe holes. This rig utilises dynamically driven 1m length sampling tubes, nominally 116mm in diameter to begin with then reduced diameters as depth increases. This technique allows a relatively undisturbed sample of soil to be taken in a plastic liner, or alternatively sub sampled as a disturbed jar sample. Within competent granular-cohesive soils the portable equipment used for Windowless Sampling is limited by the nature of the ground and robustness of the driving tool. The Windowless Sample Boreholes were installed/backfilled as per Investigation Supervisor instructions with bentonite pellets upon completion.

The windowless samples were progressed to scheduled depth or until refusal. Table 3 details the final depths achieved by each windowless sample borehole.

Table 3: *Windowless Sample Borehole Detail*

Exploratory Hole ID	Exploratory Hole Type	Final Depth (mbgl)	Notes/Reason for Termination
WS01	Windowless Sample Borehole	3.00	Refusal
WS03	Windowless Sample Borehole	1.00	Refusal
WS04	Windowless Sample Borehole	1.00	Refusal
WS05	Windowless Sample Borehole	0.80	Refusal
WS06	Windowless Sample Borehole	1.00	Refusal
WS07	Windowless Sample Borehole	1.40	Refusal

A complete set of Engineering Geologist's logs for the Windowless Sample Boreholes are presented within Appendix III.

3.5. Trial Pits

7 No. Trial Pits were excavated using a 9 tonne tracked 360 excavator at the positions shown on the exploratory hole location plan in Appendix I.

This method of investigation allows direct sampling of the near surface deposits for identification purposes, as well as assessment of any salient features and Made Ground or disturbed ground. The trial pits were logged in accordance with BS5930:2018; BS EN ISO 14688-1:2018 and BS EN ISO 14688-2:2018, and supervised at all times by an Engineering Geologist from QGL.

All trial pits/hand pits were backfilled with compacted layers of arisings upon completion with suitable reinstatement where required.

Geotechnical and Environmental samples were taken within the superficial deposits for laboratory testing purposes.

Details of the Trial Pits, including final depths in metres below ground level (mbgl) are provided in Table 4.

Table 4: *Trial Pit Detail*

Exploratory Hole ID	Exploratory Hole Type	Final Length (mbgl)	Reason for termination
TPC01	Machine Excavated Trial Pit	1.30	Possible bedrock
TPC02	Machine Excavated Trial Pit	1.20	Possible bedrock
TPC03	Machine Excavated Trial Pit	0.60	Possible bedrock
TPC04	Machine Excavated Trial Pit	1.70	Possible bedrock
TPC05	Machine Excavated Trial Pit	1.70	Possible bedrock
TPC06	Machine Excavated Trial Pit	0.60	Possible bedrock
TPC07	Machine Excavated Trial Pit	2.70	Possible bedrock

A complete set of Engineering Geologist's trial pit logs are presented within Appendix IV.

3.6. Land gas and Groundwater Standpipe Installations

19mm and 50mm (internal) diameter standpipes were installed in selected boreholes for the purposes of land gas and groundwater monitoring and sampling.

Monitoring standpipes consist of plastic pipework set in filter aggregate (pea gravel) forming a well. The filter is sealed at one or both ends by use of bentonite pellets which 'go off' and become watertight. Parts of the pipe itself are slotted, allowing the infiltration of groundwater which can then be accessed through the pipe from ground level. Slotted sections are covered by 'geo-sock' to reduce the intrusion of silt into the standpipes and the range of depths at which the groundwater is intercepted is known as the 'response zone'.

Standpipes were installed using a combination of 1m and 3m lengths of pipework (threaded at either end) fitted together and lowered into the borehole. The boreholes were then filled with either pea gravel or bentonite pellets (depending on which zone or level) and cemented in place at ground level with an iron flush cover.

Each standpipe installation was designed by the Investigation Supervisor and instructed on site, subsequent to the completion of each borehole. All standpipe installations were sealed above the response zone by a minimum of 0.50m of bentonite pellets.

A summary of the pipe installation details is presented in Table 5.

Table 5: *Borehole Installation Details*

Exploratory Hole ID	Installation Pipe ID	Standpipe Diameter (Internal mm)	Response Zone (mbgl)		Total Standpipe Length (m)
			Top	Bottom	
BHC01	1	50	17.00	20.00	20.00
BHC02	1	50	21.00	24.00	24.00
BHC03	1	50	5.00	8.00	8.00
BHC05	1	50	17.00	20.00	20.00
BHC06	1	50	17.00	20.00	20.00
BHC07	1	50	5.00	8.00	8.00
BH01A (Existing borehole)	1	19	-	-	65
BH01B (Existing borehole)	1	19	-	-	70
BH01C (Existing borehole)	1	19	-	-	69

3.7. In-Situ Testing

3.7.1. Standard Penetration Testing

Standard penetration tests (SPTs) were undertaken within boreholes and window sample holes through the superficial deposits and weak bedrock at intervals detailed within the Specification.

This dynamic in-situ test measures the density of soil or rock and is described in BS1377:1990 (part 9), partially superseded by BS EN ISO 22476-3 (2005). Within fine grained or cohesive soils, the test incorporates a small diameter tube (650mm length, 50mm external diameter and 35mm internal diameter) with a cutting shoe known as the 'split barrel sampler'. The sampler is forced into the soil dynamically using blows from a 63.5kg hammer dropped through 760mm. The sampler is initially advanced 150mm into the soil with seating blows, then the number of blows required to advance the sampler each 75mm increment up to a depth of 300mm is recorded. This cumulative total number of blows over the 300mm test is referred to as the "N" value. For coarse gravels and bedrock, the split barrel is replaced by a 60° cone.

SPT results can be found on the corresponding borehole logs in Appendix II and III.

3.7.2. In-Situ CBR Testing

6 No. In-situ CBR tests were carried out at locations specified by the investigation supervisor. The California Bearing Capacity Test (CBR), covers the determination of Bearing Capacity of a soil or aggregate tested in-situ, at selected pressures, by the action of a circular plate loading & penetrating the strata at a given rate and measuring the relationship between force and penetration into the soil. Test carried out to BS1377: Part 9:1990. The plate is bedded on a thin bed of sand, and pressure cell/jack placed on the plate and raised against the base of the Kentledge (9Tonne 360 excavator or similar mass).

The CBR test results are presented in Appendix V.

3.8. Soil, Rock and Groundwater Sampling

Sampling of soil, rock and waters were undertaken as instructed by the Client in accordance with the specification, BS 5930:2015 and BS EN ISO 22475-1:2006. Bulk, disturbed and undisturbed samples were taken where required within the superficial deposits for strata identification and laboratory testing purposes.

Sample type depth are recorded on the corresponding exploratory hole logs found within Appendices II to IV.

Geotechnical samples were returned from site to QGL's laboratory for controlled storage to await test scheduling/requirements. For specific details of laboratory testing see Section 4.

3.9. Ground Gas and Water Monitoring

Constant on site gas monitoring was carried out through the duration of the drilling works. Gas safe working levels were not exceeding during the works.

Following completion of the site works, QGL shall undertake 3 No. Monitoring visits to record land gas and groundwater within the installed borehole standpipes. Initial intervals are set at fortnightly however this may be subject to change by the Investigation Supervisor pending the results. Monitoring results obtained to date are presented within Appendix VI. Remaining results shall be issued as an addendum report. Two rounds of surface water sampling was also undertaken during the monitoring visit at specified locations on site with the samples sent for testing. The results are presented within Appendix VIII.

4. LABORATORY TESTING

The laboratory testing was scheduled by the Investigation Supervisor and comprised a number of geotechnical and geo-environmental tests on selected soil, water and rock samples recovered from the investigation.

4.1. Geotechnical Laboratory Testing

Geotechnical tests undertaken on selected soil samples are detailed in Table 6. All the geotechnical soil testing work was carried out in accordance with the procedures stipulated in the various sections of BS 1377:1990 "Methods of test for soils for civil engineering purposes" and to UKAS accreditation where applicable.

Table 6: *Geotechnical Laboratory Tests (Soil/Rock)*

Test	Number of Tests
Moisture content	13
Liquid limit, plastic limit and plasticity index	6
Particle size distribution by wet sieving	19
Organic matter content	18
Mass loss on ignition	13
Sulphate content of acid extract from soil	6
Sulphate content of acid extract from water	6
Total sulphur content	4
pH value	6
Single point load	6

A full set of geotechnical laboratory test certificates are provided within Appendix VII.

4.2. Geo-Environmental Laboratory Testing

Geo-Environmental chemical testing was undertaken at ChemTest, Coventry. All testing was scheduled by Redstart. The following suites of testing were scheduled:

- 16 No Suite E (Soil samples Schedule S1.20.3)
- 5 No Suite F (Soil samples Schedule S1.20.3)
- 3 No DOC, dissolved calcium
- 3 No Topsoil to BS 3882:2015
- 2 No Calorific value
- 2 No Suite H Non Hazardous

A full set of geo-environmental laboratory test certificates are provided within Appendix VIII.

5. REFERENCES

British Geological Survey (BGS)

- BGS Lexicon of Named Rock Units (www.bgs.ac.uk/lexicon)
- BGS Geology of Britain Viewer (www.bgs.ac.uk)
- BGS Sheet 248 'Pontypridd' Solid and Drift edition at 1:50,000 scale.

British Standards / Eurocode

- British Code of Practice BS 5930:2015 *'Code of Practice for Site Investigations'*
- British Code of Practice BS 1377:1990 *'Methods of test for soils for civil engineering purposes.*
- British Code of Practice BS EN ISO 14688-1:2002+A2:2013 *'Geotechnical investigation and testing – Identification and classification of soil – Part 1: Identification and description'*
- British Code of Practice BS EN ISO 14688-2:2004+A2:2013 *'Geotechnical investigation and testing – Identification and classification of soil – Part 2: Principles for a classification'*
- British Code of Practice BS EN ISO 22475-1:2006 *'Geotechnical investigation and testing – Sampling methods and groundwater measurements'*
- British Code of Practice BS EN ISO 22476-3:2005+A1:2011 *'Geotechnical investigation and testing – Field Testing – Part 3: Standard penetration test'*

APPENDIX I – SITE PLANS

APPENDIX II – ENGINEERING GEOLOGIST'S ROTARY BOREHOLE LOGS

Contract : Tylorstown Phase 4 GI

Client : RCTCC

Borehole No. BHC01

Dates : 10/3/21 - 11/3/21

Location : Within receptor site C

Job Number : Q0463

Engineer : Redstart

Ground Level : 405.06 m A.O.D. *Level to Ordnance Datum*

Coordinates: 301957.67 E 195778.70 N *Co-ordinates to National Grid*

Samples Depth	Type No. Blows	Strata Depth (Thickness)	Description	Red. Level A.O.D.
0.10	ES1	(0.70)	MADE GROUND - Black dark grey slightly sandy silty GRAVEL with metal. Gravel is fine to coarse angular to sub-angular Mudstone, clinker and coal	(0.70)
0.50	B1	0.70		
1.00	ES2			
	ES3			
1.20	B2	(2.60)	Grey slightly silty clayey GRAVEL with low to medium cobble content. Gravel is fine to coarse angular to sub-angular Mudstone and Sandstone. Cobbles are angular to sub-angular Sandstone	(2.60)
		3.30	DRILLERS DESCRIPTION - Strong grey SANDSTONE	
		(16.70)		(16.70)
		20.00	BH terminated at 20.00mbgl specified depth	

Insitu Tests: Depth 20 — SPT (C) 50/8mm (25/3mm-**50/8mm**---)

Hole Progress / Water Obs

Date / Time	H. Depth	C. Depth	Water
10/03/2021 17:00	20.00	3.50	
11/03/2021 07:30	20.00	3.50	

Casing

Depth	Diam.
3.50	115.00

Groundwater

Struck	Rose To	Behaviour	Sealed
		No groundwater encountered	

Flush

Depth	Type	Returns
0.00 - 20.00	Air Mist	100

Remarks: Commachio MC450 tracked drilling rig BH marked out by QGL in liaison with client. Area CAT scanned, PAS survey undertaken and hand pit to 1.20mbgl undertaken. Gas meters were active at all times during drilling, Gas levels did not exceed O2 - 20.8, H2S - 0, CO - 0, COMB/EX - 0, CH4 - 0

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SA4 0FQ
Tel:
Fax:
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G Blades	S Picton	1 Of 1	21

All measurements in metres unless otherwise stated

Contract : Tylorstown Phase 4 GI

Client : RCTCC

Borehole No. BHC02

Dates : 5/3/21 - 8/3/21

Location : Within receptor site C

Job Number : Q0463

Engineer : Redstart

Ground Level : 404.82 m A.O.D. *Level to Ordnance Datum*

Coordinates: 302110.07 E 195632.47 N *Co-ordinates to National Grid*

Core Run	TCR %	SCR %	RQD %	Fractures Min/Avg/Max	FI	Insitu Depth	Test Results	Sample Depth	Type No. Blows	Depth (Thickness)	Description	Red. Level A.O.D.
								0.10 - 0.20	ES1	(0.20) 0.20	Grass over soft dark grey slightly sandy slighty gravelly SILT with rootlets and rare coal/charcoal. Gravel is fine to coarse sub-angular to sub-rounded Sandstone and Mudstone	(0.20)
								0.50	B1 ES2	(0.40) 0.60		(0.40)
						1.2	SPT (S) 50/45mm (2-2-**50/45mm**---)	1.00 1.20 - 3.00 1.20	ES3 D1 SPT1 B2	(0.90) 1.50		(0.90)
											Dense orange and light brown slightly clayey slightly silty GRAVEL. Gravel is fine to coarse sub-angular to sub-rounded Sandstone and Mudstone	
						3	SPT (S) 50/160mm (5-13-**10-25-15/10mm**-)	3.00 - 4.50 3.00	D2 SPT2	(3.00)	Dense grey light brown slightly silty clayey GRAVEL with medium to high cobble and boulder content. Gravel is fine to medium angular to sub-angular Sandstone. Cobbles and boulders are sub-angular to angular Sandstone (HIGHLY WEATHERED BRITHDIR MEMBER)	(3.00)
4.50	100	97	13	NI	3, 7, 4	4.5	SPT (C) 50/10mm (25/5mm-**50/10mm**---)			4.50	Grey SANDSTONE. Recovered as silty sandy GRAVEL. Gravel is fine to coarse angular to sub-angular ...Casing to 4.50mbgl	
6.00	100	100	0		6, 4, 7						Strong grey fine grained SANDSTONE (BRITHDIR MEMBER) Discontinuities are horizontal to 15 degrees tight to partly open, closely to very closely spaced, rough undulating with iron staining on fracture surfaces and locally highly weathered up to 100mm penetration ...From 5.20-5.40mbgl sub-vertical fracture tight to partly open, rough undulating with iron staining on fracture surfaces ...From 6.20-6.40mbgl vertical fracture tight to partly open, rough undulating with iron staining on fracture surfaces	
7.00	100	100	60		3							
7.50	100	97	60	NI	1, 3							
9.00	100	100	90		3							
10.50	100	87	37		10							

Hole Progress / Water Obs

Date / Time	H. Depth	C. Depth	Water
05/03/2021 17:00	7.00	4.50	
08/03/2021 07:30	7.00	4.50	

Casing

Depth	Diam.
4.50	115.00

Groundwater

Struck	Rose To	Behaviour	Sealed
		No groundwater encountered	

Flush

Depth	Type	Returns
0.00 - 4.50	Air	100
4.50 - 24.00	Mist	100

Remarks: Commachio MC450 tracked drill rig BH marked out by QGL in liaison with client. Area CAT scanned, PAS survey undertaken and hand pit to 1.20mbgl undertaken. Gas meters were active at all times during drilling, Gas levels did not exceed O2 - 20.8, H2S - 0, CO - 0, COMB/EX - 0, CH4 - 0

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Plas Newydd, Llanedi
SA4 0FQ
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Contract : Tylorstown Phase 4 GI	Borehole No.
Client : RCTCC	BHC02

Dates : 5/3/21 - 8/3/21	Job Number : Q0463	Ground Level :	404.82 m A.O.D. *Level to Ordnance Datum*
Location : Within receptor site C	Engineer : Redstart	Coordinates:	302110.07 E 195632.47 N *Co-ordinates to National Grid*

m B.G.L.	Core Run	TCR %	SCR %	RQD %	Fractures Min Avg Max	FI	Insitu Tests Depth	Test Results	Samples Depth	Type No. Blows	Strata Depth (Thickness)	Description	Legend	Red. Level A.O.D.	Water	Install/ Backfill
11		100	87	37		10					(0.30)	...From 10.90 - 11.10mbgl sub-vertical fracture tight to partly open, rough undulating with iron staining on fracture surfaces		(0.30)		
						6					11.80					
12	12.00	100	100	80		6						Strong grey fine grained SANDSTONE (BRITHDIR MEMBER)				
13	13.50	100	47	20		7					(19.50)	Discontinuities are horizontal to 15 degrees tight to partly open, closely to very closely spaced, rough undulating with iron staining on fracture surfaces and locally highly weathered up to 100mm penetration ...From 11.50-11.80mbgl Weak brown moderately weathered SANDSTONE		(19.50)		
14																
15	15.00	100	100	67		6										
16	16.50					2										
17		100	97	87	NI											
18	18.00					6										
		100	97	67												
19	19.50				NI											
20		100	97	77		6										
21	21.00	100	97	67												

Hole Progress / Water Obs				Casing		Groundwater				Flush		
Date / Time	H. Depth	C. Depth	Water	Depth	Diam.	Struck	Rose To	Behaviour	Sealed	Depth	Type	Returns

Remarks: Commachio MC450 tracked drill rig BH marked out by QGL in liaison with client. Area CAT scanned, PAS survey undertaken and hand pit to 1.20mbgl undertaken. Gas meters were active at all times during drilling, Gas levels did not exceed O2 - 20.8, H2S - 0, CO - 0, COMB/EX - 0, CH4 - 0

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Contract : Tylorstown Phase 4 GI

Client : RCTCC

Borehole No. BHC02

Dates : 5/3/21 - 8/3/21

Location : Within receptor site C

Job Number : Q0463

Engineer : Redstart

Ground Level : 404.82 m A.O.D. *Level to Ordnance Datum*

Coordinates: 302110.07 E 195632.47 N *Co-ordinates to National Grid*

m B.G.L.	Core Run	TCR %	SCR %	RQD %	Fractures Min Avg Max	FI	Insitu Tests Depth	Test Results	Samples Depth	Type No. Blows	Depth (Thickness)	Description	Legend	Red. Level A.O.D.	Water	Install/ Backfill
22	22.50	100	97	67	NI	1										
23		100	100	100		0										
24	24						24	SPT (C) 50/5mm (25/0mm-**50/5mm**---)			24.00	BH terminated at 24.00mbgl specified depth				
25																
26																
27																
28																
29																
30																
31																
32																

Hole Progress / Water Obs				Casing		Groundwater				Flush		
Date / Time	H. Depth	C. Depth	Water	Depth	Diam.	Struck	Rose To	Behaviour	Sealed	Depth	Type	Returns

Remarks: Commachio MC450 tracked drill rig BH marked out by QGL in liaison with client. Area CAT scanned, PAS survey undertaken and hand pit to 1.20mbgl undertaken. Gas meters were active at all times during drilling, Gas levels did not exceed O2 - 20.8, H2S - 0, CO - 0, COMB/EX - 0, CH4 - 0

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AGS

Contract : Tylorstown Phase 4 GI Client : RCTCC			Borehole No. **BHC02**
Dates : 5/3/21 - 8/3/21 Location : Within receptor site C	Job Number : Q0463 Engineer : Redstart	Ground Level : 404.82 m A.O.D. *Level to Ordnance Datum*	
		Coordinates: 302110.07 E 195632.47 N *Co-ordinates to National Grid*	

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Contract : Tylorstown Phase 4 GI			Borehole No.
Client : RCTCC			BHC02
Dates : 5/3/21 - 8/3/21	Job Number : Q0463	Ground Level :	404.82 m A.O.D. *Level to Ordnance Datum*
Location : Within receptor site C	Engineer : Redstart	Coordinates:	302110.07 E 195632.47 N *Co-ordinates to National Grid*

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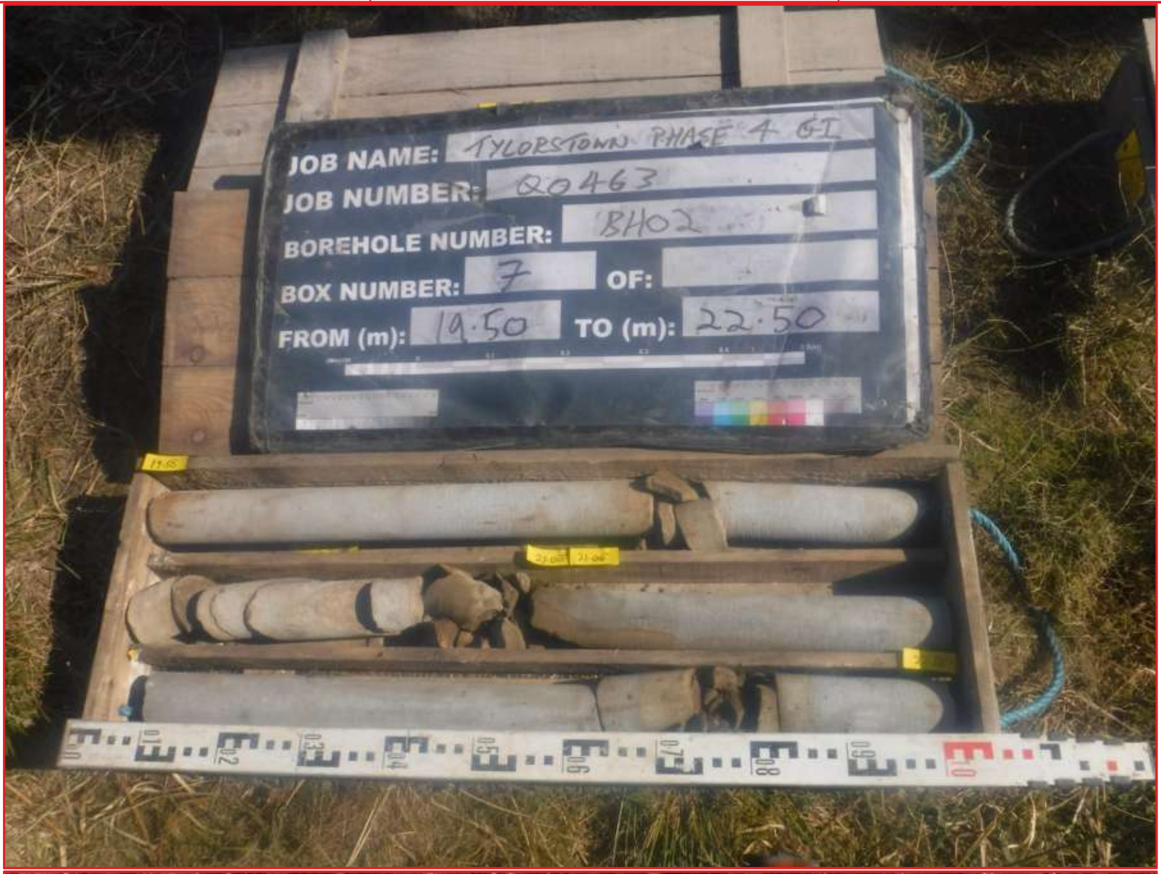
Contract : Tylorstown Phase 4 GI **Client : RCTCC**			**Borehole No.** **BHC02**
Dates : 5/3/21 - 8/3/21 Location : Within receptor site C	Job Number : Q0463 Engineer : Redstart	Ground Level : 404.82 m A.O.D. *Level to Ordnance Datum* Coordinates: 302110.07 E 195632.47 N *Co-ordinates to National Grid*	

Contract : Tylorstown Phase 4 GI

Client : RCTCC

Borehole No. **BHC02**

Dates : 5/3/21 - 8/3/21	Job Number : Q0463	Ground Level : 404.82 m A.O.D. *Level to Ordnance Datum*
Location : Within receptor site C	Engineer : Redstart	Coordinates: 302110.07 E 195632.47 N *Co-ordinates to National Grid*



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Contract : Tylorstown Phase 4 GI

Client : RCTCC

Borehole No. BHC03

Date : 10/3/21
Location : Within receptor site C

Job Number : Q0463
Engineer : Redstart

Ground Level : 397.60 m A.O.D. *Level to Ordnance Datum*
Coordinates: 302125.80 E 195472.75 N *Co-ordinates to National Grid*

Depth (m B.G.L.)	Insitu Tests: Test Results	Samples: Depth	Samples: Type No. Blows	Depth (Thickness)	Description	Red. Level A.O.D.
0.15		0.10	ES1	0.15 (0.15)	Grass over soft dark grey slightly sandy slighty gravelly SILT with rootlets and rare coal/charcoal. Gravel is fine to coarse sub-angular to sub-rounded Sandstone and Mudstone	(0.15)
0.60		0.50 1.00 1.20	B1, ES2 ES3 B2	0.60 (0.45)	Orange and light brown slightly clayey sandy GRAVEL. Gravel is fine to coarse sub-angular to sub-rounded Sandstone and Mudstone	(0.45)
8.00				8.00 (7.40)	DRILLERS DESCRIPTION - Strong grey SANDSTONE	(7.40)
8	SPT (C) 50/5mm (25/0mm-**50/5mm**---)				BH terminated at 8.00mbgl specified depth	

Run Details (Core Run, TCR %, SCR %, RQD %), Fractures (Min Avg Max, FI), Water, Install/Backfill

Hole Progress / Water Obs

Date / Time	H. Depth	C. Depth	Water

Casing

Depth	Diam.
3.50	115.00

Groundwater

Struck	Rose To	Behaviour	Sealed
		No groundwater encountered	

Flush

Depth	Type	Returns
0.00 - 8.00	Air Mist	100

Remarks: Commachio MC450 tracked drilling rig BH marked out by QGL in liaison with client. Area CAT scanned, PAS survey undertaken and hand pit to 1.20mbgl undertaken. Gas meters were active at all times during drilling, Gas levels did not exceed O2 - 20.8, H2S - 0, CO - 0, COMB/EX - 0, CH4 - 0

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All measurements in metres unless otherwise stated

AGS

Contract : Tylorstown Phase 4 GI
Client : RCTCC

Borehole No. BHC04

Date : 11/3/21
Location : Within receptor site C
Job Number : Q0463
Engineer : Redstart
Ground Level : 411.09 m A.O.D. *Level to Ordnance Datum*
Coordinates: 302098.22 E 195798.79 N *Co-ordinates to National Grid*

Samples

Depth	Type No. Blows
0.10	ES1
0.50	B1 ES2
1.00	ES3
1.20	B2

Insitu Tests

Depth	Test Results
8	SPT (C) 50/10mm (25/5mm-**50/10mm**---)

Strata

Depth (Thickness)	Description	Red. Level A.O.D.
(0.15) 0.15	Grass soft over dark grey slightly sandy slighty gravelly SILT with rootlets and rare coal/charcoal. Gravel is fine to coarse sub-angular to sub-rounded Sandstone and Mudstone	(0.15)
(0.45) 0.60	Orange and light brown slightly clayey sandy GRAVEL. Gravel is fine to coarse sub-angular to sub-rounded Sandstone (HIGHLY WEATHERED BRITHDIR MEMBER)	(0.45)
(7.40) 8.00	DRILLERS DESCRIPTION - Strong grey SANDSTONE	(7.40)
	BH terminated at 8.00mbgl specified depth	

Hole Progress / Water Obs, Casing, Groundwater, Flush

Date / Time	H. Depth	C. Depth	Water	Casing Depth	Casing Diam.	Struck	Rose To	Behaviour	Sealed	Flush Depth	Flush Type	Returns
				3.50	115.00			No groundwater encountered		0.00 - 8.00	Air Mist	100

Remarks: Commachio MC450 tracked drilling rig BH marked out by QGL in liaison with client. Area CAT scanned, PAS survey undertaken and hand pit to 1.20mbgl undertaken. Gas meters were active at all times during drilling, Gas levels did not exceed O2 - 20.8, H2S - 0, CO - 0, COMB/EX - 0, CH4 - 0

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All measurements in metres unless otherwise stated

Contract : Tylorstown Phase 4 GI	Borehole No. BHC05
Client : RCTCC	

Dates : 8/3/21 - 9/3/21	Job Number : Q0463	Ground Level : 408.57 m A.O.D. *Level to Ordnance Datum*
Location : Within receptor site C	Engineer : Redstart	Coordinates: 302180.01 E 195666.33 N *Co-ordinates to National Grid*

Run Details / Insitu Tests / Samples / Strata

Insitu Depth	Test Results	Sample Depth	Type No. Blows	Depth (Thickness)	Description	Red. Level A.O.D.
		0.10	ES1	(0.20) 0.20	Grass over soft dark grey slightly sandy slighty gravelly SILT with rootlets and rare coal/charcoal. Gravel is fine to coarse sub-angular to sub-rounded Sandstone and Mudstone	(0.20)
		0.50	B1	(0.30) 0.50	Orange and light brown slightly clayey sandy GRAVEL. Gravel is fine to coarse sub-angular to sub-rounded Sandstone and Mudstone	(0.30)
		0.60	ES2 B2 ES3	(0.10) 0.60	Grey slightly sandy Gravel. Gravel is fine to medium angular to sub-angular Sandstone (HIGHLY WEATHERED BRITHDIR FORMATION)	(0.10)
				(8.90) 9.50	DRILLERS DESCRIPTION - Strong grey SANDSTONE	(8.90)
				(4.00) 13.50	DRILLERS DESCRIPTION - Weak brown grey highly weathered SANDSTONE	(4.00)
				(6.50) 20.00	DRILLERS DESCRIPTION - Strong grey SANDSTONE	(6.50)
20	SPT (C) 50/6mm (25/0mm-**50/6mm**---)			20.00	BH terminated at 20.00mbgl specified depth	

Hole Progress / Water Obs

Date / Time	H. Depth	C. Depth	Water
08/03/2021 17:00	9.50	1.00	
09/03/2021 07:30	9.50	1.00	

Casing

Depth	Diam.
1.00	115.00

Groundwater

Struck	Rose To	Behaviour	Sealed
		No groundwater encountered	

Flush

Depth	Type	Returns
0.00 - 20.00	Air Mist	100

Remarks: Commcachio MC450 tracked drill rig BH marked out by QGL in liaison with client. Area CAT scanned, PAS survey undertaken and hand pit to 1.20mbgl undertaken. Gas meters were active at all times during drilling, Gas levels did not exceed O2 - 20.8, H2S - 0, CO - 0, COMB/EX - 0, CH4 - 0

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All measurements in metres unless otherwise stated

Contract : Tylorstown Phase 4 GI	Borehole No.
Client : RCTCC	BHC06

Date : 9/3/21	Job Number : Q0463	Ground Level : 403.20 m A.O.D. *Level to Ordnance Datum*
Location : Within receptor site C	Engineer : Redstart	Coordinates: 302197.22 E 195526.23 N *Co-ordinates to National Grid*

Run Details (Core Run, TCR %, SCR %, RQD %) | **Fractures** (Min Avg Max, FI) | **Insitu Tests** (Depth, Test Results) | **Samples** (Depth, Type No. Blows) | **Strata** (Depth (Thickness), Description, Legend, Red. Level A.O.D.) | Water | Install/ Backfill

Scale: m B.G.L. 0–20

Insitu Depth	Test Results	Sample Depth	Type No. Blows	Depth (Thickness)	Description	Red. Level A.O.D.
		0.10	ES1	(0.20) 0.20	Grass over soft dark grey slightly sandy slighty gravelly SILT with rootlets and rare coal/charcoal. Gravel is fine to coarse sub-angular to sub-rounded Sandstone and Mudstone	(0.20)
		0.50	B1	(0.30) 0.50	Orange and light brown slightly clayey sandy GRAVEL. Gravel is fine to coarse sub-angular to sub-rounded Sandstone and Mudstone	(0.30)
		1.00	ES2	(0.70) 1.20	Grey slightly sandy Gravel. Gravel is fine to medium angular to sub-angular Sandstone (HIGHLY WEATHERED BRITHDIR MEMBER)	(0.70)
		1.20	ES3	(2.40) 3.60	DRILLERS DESCRIPTION - Weak brown grey highly weathered SANDSTONE	(2.40)
			B2	(12.80) 16.40	DRILLERS DESCRIPTION - Strong grey SANDSTONE	(12.80)
				(3.60) 20.00	DRILLERS DESCRIPTION - Strong grey SANDSTONE with brown weathered Mudstone/Sandstone bands	(3.60)
20	SPT (C) 50/15mm (25/10mm-**50/15mm**---)				BH terminated at 20.00mbgl specified depth	

Hole Progress / Water Obs				Casing		Groundwater				Flush		
Date / Time	H. Depth	C. Depth	Water	Depth	Diam.	Struck	Rose To	Behaviour	Sealed	Depth	Type	Returns
				1.50	115.00			No groundwater encountered		0.00 - 20.00	Air Mist	100

Remarks: Commachio MC450 tracked drill rig BH marked out by QGL in liaison with client. Area CAT scanned, PAS survey undertaken and hand pit to 1.20mbgl undertaken. Gas meters were active at all times during drilling, Gas levels did not exceed O2 - 20.8, H2S - 0, CO - 0, COMB/EX - 0, CH4 - 0

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Contract : Tylorstown Phase 4 GI | **Borehole No. BHC07**

Client : RCTCC

Dates : 9/3/21 - 10/3/21 | Job Number : Q0463 | Ground Level : 398.31 m A.O.D. *Level to Ordnance Datum*

Location : Within receptor site C | Engineer : Redstart | Coordinates: 302304.20 E 195429.15 N *Co-ordinates to National Grid*

Insitu Tests Depth	Test Results	Samples Depth	Type No. Blows	Depth (Thickness)	Description	Red. Level A.O.D.	Install/Backfill
		0.10	ES1	0.15 (0.15)	Grass over soft dark grey slightly sandy slighty gravelly SILT with rootlets and rare coal/charcoal. Gravel is fine to coarse sub-angular to sub-rounded Sandstone and Mudstone	(0.15)	
		0.50	B1 ES2	0.60 (0.45)		(0.45)	
		1.00	ES3				
		1.20	B2	2.00 (1.40)	Orange and light brown slightly clayey sandy GRAVEL. Gravel is fine to coarse sub-angular to sub-rounded Sandstone and Mudstone	(1.40)	
				3.40 (1.40)	Grey slightly sandy Gravel. Gravel is fine to medium angular to sub-angular Sandstone (HIGHLY WEATHERED BRITHDIR MEMBER)	(1.40)	
					DRILLERS DESCRIPTION - Weak brown grey weathered SANDSTONE		
				8.00 (4.60)	DRILLERS DESCRIPTION - Strong grey SANDSTONE	(4.60)	
8	SPT (C) 50/8mm (25/0mm-**50/8mm**---)				BH terminated at 8.00mbgl specified depth		

Hole Progress / Water Obs

Date / Time	H. Depth	C. Depth	Water
09/03/2021 17:00	8.00	2.50	
10/03/2021 07:30	8.00	2.50	

Casing

Depth	Diam.
2.50	115.00

Groundwater

Struck	Rose To	Behaviour	Sealed
		No groundwater encountered	

Flush

Depth	Type	Returns
0.00 - 8.00	Air Mist	100

Remarks: Commachio MC450 tracked drilling rig BH marked out by QGL in liaison with client. Area CAT scanned, PAS survey undertaken and hand pit to 1.20mbgl undertaken. Gas meters were active at all times during drilling, Gas levels did not exceed O2 - 20.8, H2S - 0, CO - 0, COMB/EX - 0, CH4 - 0

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G Blades	S Picton	1 Of 1	10	All measurements in metres unless otherwise stated

APPENDIX III – ENGINEERING GEOLOGIST'S WINDOW SANPLE HOLE LOGS

Contract : Tylorstown Phase 4 GI

Client : RCTCC

Window Sample No. WS01

Date : 16/3/21

Location : Within receptor site C

Job Number : Q0463

Engineer : Redstart

Ground Level : 405.06 m A.O.D. *Level to Ordnance Datum*

Coordinates: 301957.67 E 195778.70 N *Co-ordinates to National Grid*

Samples Depth	Samples Type No.	Sample Run Diam. (mm)	Sample Run Recovery (%)	Tests Depth	SPT & Hand Vane Results	Depth (Thickness)	DESCRIPTION	Legend	Red. Level A.O.D.	Water	Install/ Backfill
0.00 - 1.00	B 1					(2.35) 2.35	MADE GROUND - Black dark grey rand ed slightly sandy silty GRAVEL with metal fragments. Gravel is fine to coarse angular to sub-angular Mudstone, clinker, ash and coal		402.71		
1.00 - 1.00 - 2.00	SPT 1 B 2		80	1.00 - 1.45	SPT (S) 15 (4-4-**2-3-4-6**)						
2.00 - 2.00 - 2.00 - 3.00	ES 1 SPT 2 B 3		90	2.00 - 2.45	SPT (S) 12 (2-4-**4-3-3-2**)	(0.55) 2.90	Soft to firm grey slightly sandy very gravelly CLAY with low to medium cobble content. Gravel is fine to coarse angular to sub-angular Mudstone and Sandstone. Cobbles are angular to sub-angular Sandstone (COMPLETELY TO HIGHLY WEATHERED BRITHDIR MEMBER)		402.16		
						(0.10) 3.00	Grey sandy silty GRAVEL. Gravel is fine to coarse angular to sub-angular Sandstone (HIGHLY WEATHERED BRITHDIR MEMBER)		402.06		
3.00 - 3.00 -	D 1 SPT 3			3.00 - 3.44	SPT (S) 50/285mm (10-11-**12-10-10-18/60mm**)		WS refused at 3.00mbgl on bedrock				

Depth scale (m): 1, 2, 3

Remarks: Dando terrier tracked window sampling rig WS marked out by QGL in liaison with client. Area CAT scanned, PAS survey undertaken and hand pit undertaken

No groundwater encountered

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G Blades	S Picton	1 Of 1	4	All measurements in metres unless otherwise stated

AGS

Contract : Tylorstown Phase 4 GI			Borehole No.
Client : RCTCC			**WS01**
Date : 16/3/21	Job Number : Q0463	Ground Level : 405.06 m A.O.D. *Level to Ordnance Datum*	
Location : Within receptor site C	Engineer : Redstart	Coordinates: 301957.67 E 195778.70 N *Co-ordinates to National Grid*	

Quantum Geotech	Plas Newydd, Llanedi SA4 0FQ Tel: Fax: email:	Operator: G Blades	Logged By. S Picton	Sheet No. 1 Of 1	m Per Page 2	All measurements in metres unless otherwise stated	AGS

Contract : Tylorstown Phase 4 GI

Client : RCTCC

Window Sample No. WS03

Date : 16/3/21

Location : Within receptor site C

Job Number : Q0463

Engineer : Redstart

Ground Level : 397.60 m A.O.D. *Level to Ordnance Datum*

Coordinates: 302125.80 E 195472.75 N *Co-ordinates to National Grid*

Samples Depth	Samples Type No.	Sample Run Diam. (mm)	Sample Run Recovery (%)	Tests Depth	Tests SPT & Hand Vane Results	Depth (Thickness)	DESCRIPTION	Legend	Red. Level A.O.D.	Water	Install/ Backfill
0.00 - 1.00	B 1					(0.15) 0.15	Grass over soft dark grey slightly sandy slighty gravelly SILT with rootlets and rare coal/charcoal. Gravel is fine to coarse sub-angular to sub-rounded Sandstone and Mudstone		397.45		
						(0.45) 0.60	Soft to firm orange and light brown sandy very gravelly CLAY. Gravel is fine to coarse sub-angular to sub-rounded Sandstone and Mudstone		397.00		
						(0.40) 1.00	Grey clayey Gravel. Gravel is fine to medium angular to sub-angular Sandstone (HIGHLY WEATHERED BRITHDIR MEMBER)		396.60		
1.00 -	SPT 1		0	1.00 - 1.38	SPT (S) 50/230mm (10-10-**15-15-18-2/5mm**)		WS refused at 1.00mbgl on bedrock				

Remarks: Dando terrier tracked window sampling rig WS marked out by QGL in liaison with client. Area CAT scanned, PAS survey undertaken and hand pit undertaken

No groundwater encountered

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G Blades	S Picton	1 Of 1	4	All measurements in metres unless otherwise stated

AGS

Contract : Tylorstown Phase 4 GI

Client : RCTCC

Window Sample No. WS04

Date : 16/3/21

Location : Within receptor site C

Job Number : Q0463

Engineer : Redstart

Ground Level : 411.09 m A.O.D.
Level to Ordnance Datum

Coordinates: 302098.22 E 195798.79 N
Co-ordinates to National Grid

Samples Depth	Type No.	Sample Run Diam. (mm)	Recovery (%)	Tests Depth	SPT & Hand Vane Results	Depth (Thickness)	DESCRIPTION	Legend	Red. Level A.O.D.	Water	Install/ Backfill
0.00 - 1.00	B 1					(0.15) 0.15	Grass over soft dark grey slightly sandy slighty gravelly SILT with rootlets and rare coal/charcoal. Gravel is fine to coarse sub-angular to sub-rounded Sandstone and Mudstone		410.94		
						(0.80) 0.95	Soft to firm orange and light brown sandy very gravelly CLAY. Gravel is fine to coarse sub-angular to sub-rounded Sandstone and Mudstone		410.14		
1.00 -	SPT 1		0	1.00 -	SPT (S) 50/200mm (13-12/35mm-**16-17-17/50mm**-)	(0.05) 1.00	Grey clayey Gravel. Gravel is fine to medium angular to sub-angular Sandstone (HIGHLY WEATHERED BRITHDIR MEMBER)		410.09		
							WS refused at 1.00mbgl on bedrock				

Remarks: Dando terrier tracked window sampling rig WS marked out by QGL in liaison with client. Area CAT scanned, PAS survey undertaken and hand pit undertaken

No groundwater encountered

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G Blades	S Picton	1 Of 1	4	All measurements in metres unless otherwise stated

Contract : Tylorstown Phase 4 GI

Client : RCTCC

Window Sample No. WS05

Date : 16/3/21	Job Number : Q0463
Location : Within receptor site C	Engineer : Redstart
Ground Level : 408.57 m A.O.D. *Level to Ordnance Datum*	Coordinates: 302180.01 E 195666.33 N *Co-ordinates to National Grid*

Samples: Depth	Samples: Type No.	Sample Run: Diam. (mm)	Sample Run: Recovery (%)	Tests: Depth	Tests: SPT & Hand Vane Results	Depth (Thickness)	DESCRIPTION	Red. Level . A.O.D.	Water	Install/ Backfill
0.00 - 0.50	B 1					(0.20)	Grass over soft dark grey slightly sandy slighty gravelly SILT with rootlets and rare coal/charcoal. Gravel is fine to coarse sub-angular to sub-rounded Sandstone and Mudstone			
						0.20 (0.30)	Soft to firm orange and light brown sandy very gravelly CLAY. Gravel is fine to coarse sub-angular to sub-rounded Sandstone and Mudstone	408.37		
0.50 - 0.80	B 2		100			0.50 (0.30)	Grey slightly sandy Gravel. Gravel is fine to medium angular to sub-angular Sandstone (HIGHLY WEATHERED BRITHDIR MEMBER)	408.07		
				0.80 -	SPT (C) 50/140mm (16-9/30mm-**27-23/65mm**--)	0.80	WS refused at 0.80mbgl on bedrock	407.77		

Remarks: Dando terrier tracked window sampling rig WS marked out by QGL in liaison with client. Area CAT scanned, PAS survey undertaken and hand pit undertaken

No groundwater encountered

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Operator:	Logged By.	Sheet No.	m Per Page	
G Blades	S Picton	1 Of 1	4	All measurements in metres unless otherwise stated

AGS

Contract : Tylorstown Phase 4 GI

Client : RCTCC

Window Sample No. WS06

Date : 16/3/21

Location : Within receptor site C

Job Number : Q0463

Engineer : Redstart

Ground Level : 403.20 m A.O.D.
Level to Ordnance Datum

Coordinates: 302197.22 E 195526.23 N
Co-ordinates to National Grid

	Samples: Depth	Samples: Type No.	Sample Run: Diam. (mm)	Sample Run: Recovery (%)	Tests: Depth	Tests: SPT & Hand Vane Results	Strata: Depth (Thickness)	Strata: DESCRIPTION	Legend	Red. Level A.O.D.	Water	Install/ Backfill
	0.00 - 1.00	B 1					(0.20)	Grass over soft dark grey slightly sandy slighty gravelly SILT with rootlets and rare coal/charcoal.				
							0.20 (0.30)	Gravel is fine to coarse sub-angular to sub-rounded Sandstone and Mudstone Soft to firm orange and light brown sandy very gravelly CLAY. Gravel is fine to coarse sub-angular to sub-rounded Sandstone and Mudstone		403.00		
							0.50 (0.50)	Grey slightly sandy Gravel. Gravel is fine to medium angular to sub-angular Sandstone (HIGHLY WEATHERED BRITHDIR MEMBER)		402.70		
1	1.00 -	SPT 1		0	1.00 - 1.43	SPT (S) 50/275mm (7-8-**7-8-15-20/50mm**)	1.00	WS refused at 1.00mbgl on bedrock		402.20		

Remarks: Dando terrier tracked window sampling rig WS marked out by QGL in liaison with client. Area CAT scanned, PAS survey undertaken and hand pit undertaken

No groundwater encountered

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G Blades	S Picton	1 Of 1	4	

Contract : Tylorstown Phase 4 GI

Client : RCTCC

Window Sample No. WS07

Date : 16/3/21

Location : Within receptor site C

Job Number : Q0463

Engineer : Redstart

Ground Level : 398.31 m A.O.D. *Level to Ordnance Datum*

Coordinates: 302304.20 E 195429.15 N *Co-ordinates to National Grid*

Samples Depth	Samples Type No.	Sample Run Diam. (mm)	Sample Run Recovery (%)	Tests Depth	Tests SPT & Hand Vane Results	Depth (Thickness)	DESCRIPTION	Legend	Red. Level A.O.D.	Water	Install/ Backfill
0.00 - 1.00	B 1					(0.15)	Grass over soft dark grey slightly sandy slighty gravelly SILT with rootlets and rare coal/charcoal.				
						0.15 (0.45)	Gravel is fine to coarse sub-angular to sub-rounded Sandstone and Mudstone Soft to firm orange and light brown sandy very gravelly CLAY. Gravel is fine to coarse sub-angular to sub-rounded Sandstone and Mudstone		398.16		
						0.60 (0.80)	Grey slightly sandy Gravel. Gravel is fine to medium angular to sub-angular Sandstone (HIGHLY WEATHERED BRITHDIR MEMBER)		397.71		
1.00 - 1.00 - 1.40	SPT 1 B 2		100	1.00 - 1.45	SPT (S) 39 (5-6-**6-7-11-15**)						
1.40 - 1.40 -	ES 1 SPT 2			1.40 -	SPT (S) 50/180mm (10-15/60mm-**20-23-7/30mm**-)	1.40	WS refused at 1.40mbgl on bedrock		396.91		

Remarks: Dando terrier tracked window sampling rig WS marked out by QGL in liaison with client. Area CAT scanned, PAS survey undertaken and hand pit undertaken

No groundwater encountered

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G Blades	S Picton	1 Of 1	4	

Contract : Tylorstown Phase 4 GI			Borehole No.
Client : RCTCC			WS07
Date : 16/3/21	Job Number : Q0463	Ground Level :	398.31 m A.O.D. *Level to Ordnance Datum*
Location : Within receptor site C	Engineer : Redstart	Coordinates:	302304.20 E 195429.15 N *Co-ordinates to National Grid*

	Operator:	Logged By.	Sheet No.	m Per Page	All measurements in metres unless otherwise stated
Quantum Geotech Plas Newydd, Llanedi SA4 0FQ Tel: Fax: email:	G Blades	S Picton	1 Of 1	2	AGS

APPENDIX IV – ENGINEERING GEOLOGIST'S TRIAL PIT LOGS

Contract : Tylorstown Phase 4 GI

Client : RCTCC

Trial Pit No. TPC01

Date : 4/3/21

Location : Within receptor site C

Job Number : Q0463

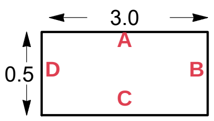
Engineer : Redstart

Ground Level : 411.09 m A.O.D. *Level to Ordnance Datum*

Coordinates: 302035.56 E 195795.67 N *Co-ordinates to National Grid*

m B.G.L.	Samples Depth	Type No.	Tests Depth	Test Results	Depth (Thickness)	Strata Description	Legend	Red. Level A.O.D.	WATER
	0.00 - 0.60	B1				MADE GROUND - Black dark grey slightly silty clayey GRAVEL with metal fragments. Gravel is fine to coarse angular to sub-angular Mudstone, clinker and coal			
	0.20 -	ES1			(0.60)				
	0.50 -	ES2							
	0.60 - 0.70	D1			0.60 (0.10)	Very soft to soft brown fibrous PEAT		410.49	
	0.70 - 1.10	B2 B3			0.70 (0.40)	Light brown and orange sandy slightly silty clayey GRAVEL with low to medium cobble content. Gravel is fine to coarse angular to sub-angular Mudstone and Sandstone. Cobbles are angular to sub-angular Sandstone		410.39	
1	1.00 -	ES3							
	1.10 - 1.30	B4			1.10 (0.20)	Grey SANDSTONE. Recovered as sandy silty GRAVEL. Gravel is fine to coarse angular to sub-angular Sandstone (HIGHLY WEATHERED BRITHDIR MEMBER)		409.99	
					1.30	to terminated at 1.30mbgl, on Sandstone bedrock		409.79	

PLAN



Groundwater: No groundwater encountered

Stability: Stable

Shoring: N/A

Remarks : TP marked out by QGL in liaison with client. Area CAT scanned and PAS survey undertaken

Equipment Used: 9 tonne tracked 360 excavator

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QGL	S Picton	1 Of 2	4	

AGS

Contract : Tylorstown Phase 4 GI		Trial Pit No.
Client : RCTCC		TPC01

Date : 4/3/21	Job Number : Q0463	Ground Level : 411.09 m A.O.D. *Level to Ordnance Datum*
Location : Within receptor site C	Engineer : Redstart	Coordinates: 302035.56 E 195795.67 N *Co-ordinates to National Grid*

		Operator:	Logged By.	Sheet No.	m Per Page	All measurements in metres unless otherwise stated	
Quantum Geotech	Plas Newydd, Llanedi SA4 0FQ Tel: Fax: email:	QGL	S Picton	2 Of 2			AGS

Contract : Tylorstown Phase 4 GI

Client : RCTCC

Trial Pit No. TPC02

Date : 4/3/21

Location : Within receptor site C

Job Number : Q0463

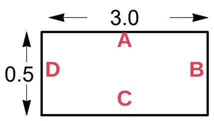
Engineer : Redstart

Ground Level : 407.68 m A.O.D. *Level to Ordnance Datum*

Coordinates: 302048.41 E 195726.40 N *Co-ordinates to National Grid*

Samples Depth	Samples Type No.	Tests Depth	Test Results	Strata Depth (Thickness)	Description	Legend	Red. Level A.O.D.	WATER
0.00 - 0.60	B1				MADE GROUND - Black dark grey slightly clayey silty GRAVEL with metal fragments. Gravel is fine to coarse angular to sub-angular Mudstone, clinker and coal			
0.20 -	ES1							
				0.60				
0.50 -	ES2							
0.60 - 0.70	B2			0.60 (0.10)	Dark grey slightly clayey silty GRAVEL. Gravel is fine to coarse angular to sub-angular Mudstone and Sandstone		407.08	
0.70 - 1.10	B3			0.70 (0.40)	Grey slightly silty clayey gravelly SAND with low to medium cobble content. Gravel is fine to medium angular to sub-angular Mudstone and Sandstone. Cobbles are angular to sub-angular Sandstone		406.98	
1.00 -	ES3							
1.10 - 1.20	B4			1.10 (0.10)	Grey SANDSTONE. Recovered as sandy silty GRAVEL. Gravel is fine to coarse angular to sub-angular Sandstone (HIGHLY WEATHERED BRITHDIR MEMBER)		406.58	
				1.20	to terminated at 1.20mbgl, on Sandstone bedrock		406.48	

PLAN



Groundwater: No groundwater encountered

Stability: Stable

Shoring: N/A

Remarks : TP marked out by QGL in liaison with client. Area CAT scanned and PAS survey undertaken

Equipment Used: 9 tonne tracked 360 excavator

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Operator: QGL | Logged By. S Picton | Sheet No. 1 Of 2 | m Per Page 4 | All measurements in metres unless otherwise stated

Contract : Tylorstown Phase 4 GI			Trial Pit No.
Client : RCTCC			**TPC02**
Date : 4/3/21	Job Number : Q0463	Ground Level : 407.68 m A.O.D. *Level to Ordnance Datum*	
Location : Within receptor site C	Engineer : Redstart	Coordinates: 302048.41 E 195726.40 N *Co-ordinates to National Grid*	

	Operator:	Logged By.	Sheet No.	m Per Page	All measurements in metres unless otherwise stated	
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Contract : Tylorstown Phase 4 GI

Client : RCTCC

Trial Pit No. TPC03

Date : 4/3/21

Location : Within receptor site C

Job Number : Q0463

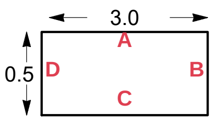
Engineer : Redstart

Ground Level : 409.76 m A.O.D. *Level to Ordnance Datum*

Coordinates: 302142.21 E 195695.33 N *Co-ordinates to National Grid*

Samples Depth	Samples Type No.	Tests Depth	Test Results	Strata Depth (Thickness)	Description	Legend	Red. Level A.O.D.	WATER
				0.20	Grass over soft dark grey slightly sandy slighty gravelly SILT with rootlets and rare coal/charcoal. Gravel is fine to coarse sub-angular to sub-rounded Sandstone and Mudstone			
0.20 - 0.50	B1			0.20	Grey slightly silty clayey gravelly SAND with low to medium cobble content. Gravel is fine to medium angular to sub-angular Mudstone and Sandstone. Cobbles are angular to sub-angular Sandstone		409.56	
0.20 -	ES1			(0.30)				
0.50 -	ES2			0.50	Grey Gravel. Gravel is fine to medium angular to sub-angular SANDSTONE (HIGHLY WEATHERED BRITHDIR MEMBER)		409.26	
0.60 -	B2			(0.10)				
				0.60	to terminated at 0.60mbgl, on Sandstone bedrock		409.16	

PLAN



Groundwater: No groundwater encountered

Stability: Stable

Shoring: N/A

Remarks : TP marked out by QGL in liaison with client. Area CAT scanned and PAS survey undertaken

Equipment Used: 9 tonne tracked 360 excavator

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Operator:	Logged By.	Sheet No.	m Per Page	
QGL	S Picton	1 Of 2	4	All measurements in metres unless otherwise stated

Contract : Tylorstown Phase 4 GI	**Trial Pit No.**
Client : RCTCC	**TPC03**

Date : 4/3/21	Job Number : Q0463	Ground Level : 409.76 m A.O.D. *Level to Ordnance Datum*
Location : Within receptor site C	Engineer : Redstart	Coordinates: 302142.21 E 195695.33 N *Co-ordinates to National Grid*

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Operator:	Logged By.	Sheet No.	m Per Page	All measurements in metres unless otherwise stated
QGL	S Picton	2 Of 2		

Contract : Tylorstown Phase 4 GI

Client : RCTCC

Trial Pit No. TPC04

Date : 4/3/21

Location : Within receptor site C

Job Number : Q0463

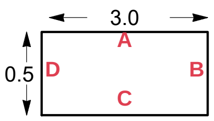
Engineer : Redstart

Ground Level : 405.35 m A.O.D. *Level to Ordnance Datum*

Coordinates: 302174.22 E 195592.52 N *Co-ordinates to National Grid*

m B.G.L.	Samples Depth	Samples Type No.	Tests Depth	Test Results	Depth (Thickness)	Description	Legend	Red. Level A.O.D.	WATER
	0.20 -	ES1			0.30	Grass over soft dark grey slightly sandy slighty gravelly SILT with rootlets and rare coal/charcoal. Gravel is fine to coarse sub-angular to sub-rounded Sandstone and Mudstone			
	0.30 - 0.60	B1							
	0.50 -	ES2			0.30 (0.30)	Orange grey and light brown slightly clayey silty sandy GRAVEL. Gravel is fine to coarse sub-angular to sub-rounded Sandstone and Mudstone		405.05	
1	1.00 -	B2 ES3			0.60 (0.90)	Grey light brown slightly silty clayey sandy GRAVEL with medium to high cobble and boulder content. Gravel is fine to medium angular to sub-angular Sandstone. Cobbles and boulders are sub-angular to angular Sandstone (POSSIBLE HIGHLY WEATHERED BRITHDIR MEMBER)		404.75	
	1.50 - 1.70	B3			1.50 (0.20)	Grey silty sandy GRAVEL. Gravel is fine to coarse angular to sub-angular Sandstone (HIGHLY WEATHERED BRITHDIR MEMBER)		403.85	
					1.70	to terminated at 1.70mbgl, on Sandstone bedrock		403.65	

PLAN



Groundwater: No groundwater encountered

Stability: Stable

Shoring: N/A

Remarks : TP marked out by QGL in liaison with client. Area CAT scanned and PAS survey undertaken

Equipment Used: 9 tonne tracked 360 excavator

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Operator:	Logged By.	Sheet No.	m Per Page	
QGL	S Picton	1 Of 2	4	All measurements in metres unless otherwise stated

Contract : **Tylorstown Phase 4 GI**

Client : **RCTCC**

Trial Pit No.
TPC04

Date : 4/3/21	Job Number : Q0463	Ground Level : 405.35 m A.O.D. *Level to Ordnance Datum*
Location : Within receptor site C	Engineer : Redstart	Coordinates: 302174.22 E 195592.52 N *Co-ordinates to National Grid*

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Contract : Tylorstown Phase 4 GI

Client : RCTCC

Trial Pit No. TPC05

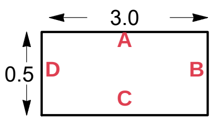
Date : 4/3/21
Location : Within receptor site C

Job Number : Q0463
Engineer : Redstart

Ground Level : 399.40 m A.O.D. *Level to Ordnance Datum*
Coordinates: 302186.24 E 195476.04 N *Co-ordinates to National Grid*

m B.G.L.	Samples: Depth	Samples: Type No.	Tests: Depth	Tests: Test Results	Strata: Depth (Thickness)	Strata: Description	Legend	Red. Level A.O.D.	WATER
	0.20 -	ES1			0.30 (0.30)	Grass over soft dark grey slightly sandy slighty gravelly SILT with rootlets and rare coal/charcoal. Gravel is fine to coarse sub-angular to sub-rounded Sandstone and Mudstone			
	0.30 - 0.90	B1							
	0.50 -	ES2			0.90 (0.60)	Soft to firm orange with light brown slightly clayey silty sandy GRAVEL. Gravel is fine to coarse sub-angular to sub-rounded Sandstone and Mudstone		399.10	
1	1.00 -	B2 ES3			1.65 (0.75)	Grey brown slightly sandy silty clayey GRAVEL with medium to high cobble and boulder content. Gravel is fine to medium angular to sub-angular Sandstone. Cobbles and boulders are sub-angular to angular Sandstone (HIGHLY WEATHERED BRITHDIR MEMBER)		398.50	
	1.70 -	B3 ES4			1.70 (0.05)	Grey SANDSTONE bedrock (BRITHDIR MEMBER)		397.75	
						to terminated at 1.70mbgl, on Sandstone bedrock		397.70	

PLAN



Groundwater: No groundwater encountered

Stability: Stable

Shoring: N/A

Remarks : TP marked out by QGL in liaison with client. Area CAT scanned and PAS survey undertaken

Equipment Used: 9 tonne tracked 360 excavator

Quantum Geotech
Plas Newydd, Llanedi
SA4 0FQ
Tel:
Fax:
email:

Operator:	Logged By.	Sheet No.	m Per Page	
QGL	S Picton	1 Of 2	4	All measurements in metres unless otherwise stated

Contract : Tylorstown Phase 4 GI			Trial Pit No.
Client : RCTCC			TPC05

Date : 4/3/21	Job Number : Q0463	Ground Level : 399.40 m A.O.D. *Level to Ordnance Datum*
Location : Within receptor site C	Engineer : Redstart	Coordinates: 302186.24 E 195476.04 N *Co-ordinates to National Grid*

Quantum Geotech	Plas Newydd, Llanedi SA4 0FQ Tel: Fax: email:	Operator: QGL	Logged By. S Picton	Sheet No. 2 Of 2	m Per Page	All measurements in metres unless otherwise stated	AGS

Contract : Tylorstown Phase 4 GI

Client : RCTCC

Trial Pit No. TPC06

Date : 4/3/21

Location : Within receptor site C

Job Number : Q0463

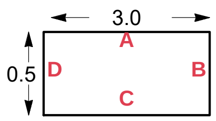
Engineer : Redstart

Ground Level : 402.23 m A.O.D. *Level to Ordnance Datum*

Coordinates: 302257.37 E 195498.17 N *Co-ordinates to National Grid*

Samples Depth	Samples Type No.	Tests Depth	Test Results	Strata Depth (Thickness)	Description	Legend	Red. Level A.O.D.	WATER
				0.20	Grass over soft dark grey slightly sandy slighty gravelly SILT with rootlets and rare coal/charcoal. Gravel is fine to coarse sub-angular to sub-rounded Sandstone and Mudstone			
0.20 - 0.50 0.20 - 0.30	B1 ES1			0.20 0.30	Orange and light brown slightly clayey silty sandy GRAVEL. Gravel is fine to coarse sub-angular to sub-rounded Sandstone and Mudstone		402.03	
0.50 - 0.60 0.50 - 0.60 -	B2 ES2 B3			0.50 0.05 0.55	Grey silty sandy GRAVEL with medium to high cobble and boulder content. Gravel is fine to medium angular to sub-angular Sandstone. Cobbles and boulders are sub-angular to angular Sandstone (HIGHLY WEATHERED BRITHDIR MEMBER)		401.73 401.68	
				0.05 0.60	Grey SANDSTONE boulder/bedrock		401.63	
				0.60	Terminated at 0.60mbgl, on possible Sandstone boulder/bedrock			

PLAN



Groundwater: No groundwater encountered

Stability: Stable

Shoring: N/A

Remarks : TP marked out by QGL in liaison with client. Area CAT scanned and PAS survey undertaken

Equipment Used: 9 tonne tracked 360 excavator

Quantum Geotech
Plas Newydd, Llanedi
SA4 0FQ
Tel:
Fax:
email:

Operator:	Logged By.	Sheet No.	m Per Page	All measurements in metres unless otherwise stated
QGL	S Picton	1 Of 2	4	

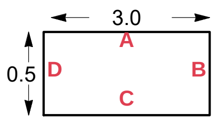
Contract : Tylorstown Phase 4 GI			**Trial Pit No.**
Client : RCTCC			**TPC06**
Date : 4/3/21	Job Number : Q0463	Ground Level : 402.23 m A.O.D. *Level to Ordnance Datum*	
Location : Within receptor site C	Engineer : Redstart	Coordinates: 302257.37 E 195498.17 N *Co-ordinates to National Grid*	

Contract : Tylorstown Phase 4 GI	Trial Pit No.
Client : RCTCC	TPC07

Date : 4/3/21	Job Number : Q0463	Ground Level : 399.47 m A.O.D. *Level to Ordnance Datum*
Location : Within receptor site C	Engineer : Redstart	Coordinates: 302260.33 E 195412.88 N *Co-ordinates to National Grid*

m B.G.L.	Samples: Depth	Samples: Type No.	Tests: Depth	Tests: Test Results	Strata: Depth (Thickness)	Strata: Description	Legend	Red. Level A.O.D.	WATER
	0.20 -	ES1			0.30	Grass over soft dark grey slightly sandy slighty gravelly SILT with rootlets and rare coal/charcoal. Gravel is fine to coarse sub-angular to sub-rounded Sandstone and Mudstone			
	0.30 - 0.80	B1			0.30 (0.50)	Orange and light brown slightly silty clayey SAND. Sand is fine to coarse		399.17	
	0.50 -	ES2							
					0.80 (1.90)	Grey silty sandy GRAVEL with medium to high cobble and boulder content. Gravel is fine to medium angular to sub-angular Sandstone. Cobbles and boulders are sub-angular to angular Sandstone (HIGHLY WEATHERED BRITHDIR MEMBER)		398.67	
1	1.00 -	B2 ES3							
2	2.00 - 2.70 2.00 -	B3 ES4							
					2.70	to terminated at 2.70mbgl, sides collapsing little progress being made		396.77	

PLAN



Groundwater: No groundwater encountered

Stability: Unstable and collapsing below 1.50mbgl

Shoring: N/A

Remarks : TP marked out by QGL in liaison with client. Area CAT scanned and PAS survey undertaken

Equipment Used: 9 tonne tracked 360 excavator

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SA4 0FQ
Tel:
Fax:
email:

Operator:	Logged By.	Sheet No.	m Per Page	
QGL	S Picton	1 Of 2	4	All measurements in metres unless otherwise stated

Contract : Tylorstown Phase 4 GI

Client : RCTCC

Trial Pit No.
TPC07

Date : 4/3/21 Location : Within receptor site C	Job Number : Q0463 Engineer : Redstart	Ground Level : 399.47 m A.O.D. *Level to Ordnance Datum* Coordinates: 302260.33 E 195412.88 N *Co-ordinates to National Grid*

		Operator:	Logged By.	Sheet No.	m Per Page	All measurements in metres unless otherwise stated	
Quantum Geotech	Plas Newydd, Llanedi SA4 0FQ Tel: Fax: email:	QGL	S Picton	2 Of 2			AGS

APPENDIX V – CBR TEST RESULTS

Quantum

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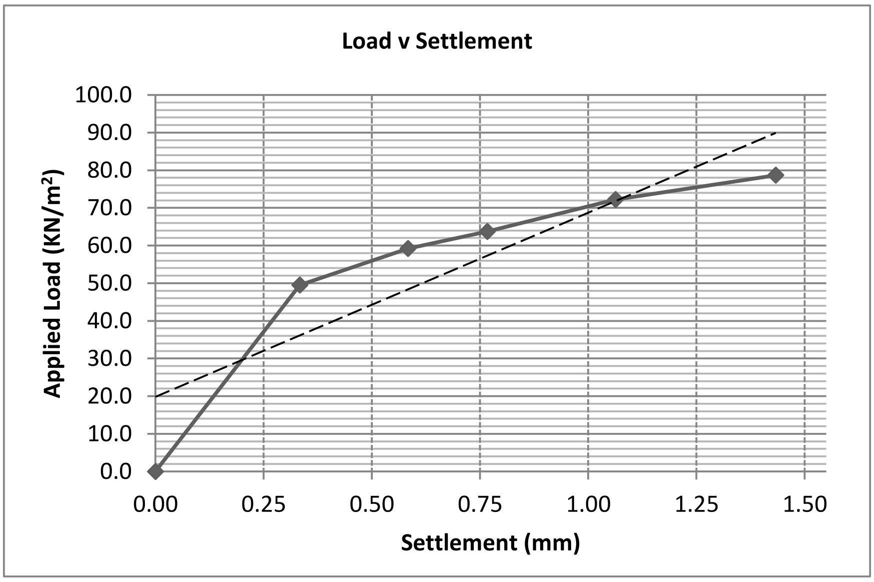
Plas Newydd, Llanedi,
Pontarddulais, Swansea
SA4 0FQ
Tel.: 01554 744880

Determination of CBR Using the Plate Load Test to BS 1377: Part 9: 1990, TP09 & IAN73/06 Rev.1

Client Name:	Redstart		
Client Address:			
Contract Name:	Tylerstown Phase 4 GI	**Contract No.:**	Q0463

Site Reference:	1	Lab. Reference:	1.1	Date Tested:	12/03/2021
Sample Location:	CBR 1			Date Received:	12/03/2021
Material Description:	Brown sandy gravelly CLAY				
Supplier:	In-Situ	Source:	In-Situ		
Depth Below Ground Level:	0.3	Reaction Load:	8 Tonne Tracked Excavator		
Plate Diameter (mm):	300	Plate Area (m^2):	0.071		

Settlement (mm)	Load (KN/m^2)	Settlement Time (min)
0.00	0.0	0
0.33	49.5	2
0.58	59.2	2
0.77	63.8	2
1.06	72.2	2
1.43	78.7	2
Derived Load At 1.25mm	75.5	



Modulus Of Subgrade Reaction (k_{762})(MN/m2/m)	**27**

Equivalent CBR Value (%)	**2.8**

Remarks:

Signed: A Jones

Position: Project Manager

Dated: 12 March 2021

Quantum

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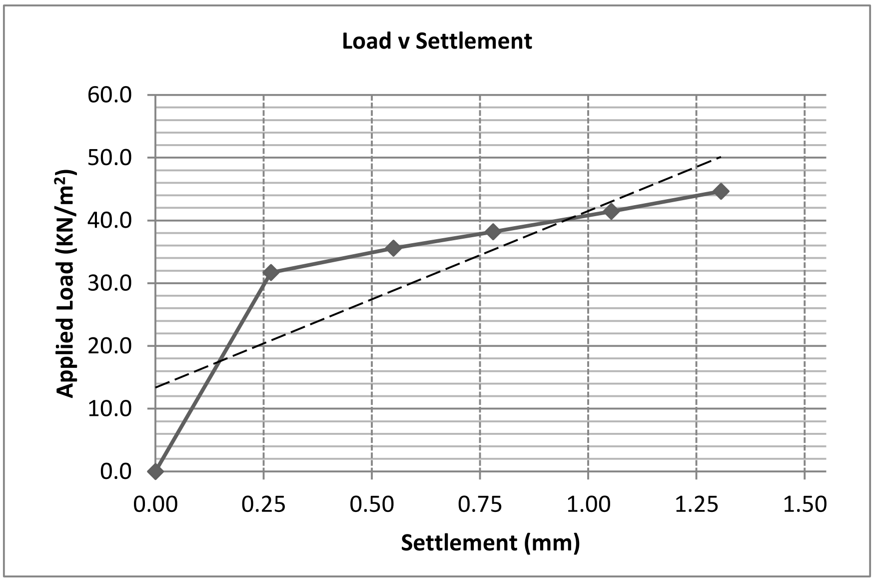
Plas Newydd, Llanedi,
Pontarddulais, Swansea
SA4 0FQ
Tel.: 01554 744880

Determination of CBR Using the Plate Load Test to BS 1377: Part 9: 1990, TP09 & IAN73/06 Rev.1

Client Name:	Redstart		
Client Address:			
Contract Name:	Tylerstown Phase 4 GI	**Contract No.:**	Q0463

Site Reference:	2	Lab. Reference:	1.2	Date Tested:	12/03/2021
Sample Location:	CBR 2			Date Received:	12/03/2021
Material Description:	MADE GROUND: Black silty slightly sandy Gravel (Colliery Spoil)				
Supplier:	In-Situ	Source:	In-Situ		
Depth Below Ground Level:	0.3	Reaction Load:	8 Tonne Tracked Excavator		
Plate Diameter (mm):	300	Plate Area (m^2):	0.071		

Settlement (mm)	Load (KN/m^2)	Settlement Time (min)
0.00	0.0	0
0.27	31.7	2
0.55	35.6	2
0.78	38.2	2
1.05	41.4	2
1.31	44.7	2
Derived Load At 1.25mm	43.9	



Modulus Of Subgrade Reaction (k_{762})(MN/m2/m)	**15**

Equivalent CBR Value (%)	**1.1**

Remarks:

Signed: A Jones

Position: Project Manager

Dated: 12 March 2021

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Plas Newydd, Llanedi,
Pontarddulais, Swansea
SA4 0FQ
Tel.: 01554 744880

Determination of CBR Using the Plate Load Test to BS 1377: Part 9: 1990, TP09 & IAN73/06 Rev.1

Client Name:	Redstart		
Client Address:			
Contract Name:	Tylerstown Phase 4 GI	**Contract No.:**	Q0463

Site Reference:	3	Lab. Reference:	1.3	Date Tested:	12/03/2021
Sample Location:	CBR 3			Date Received:	12/03/2021
Material Description:	MADE GROUND: Black silty slightly sandy Gravel (Colliery Spoil)				
Supplier:	In-Situ	Source:	In-Situ		
Depth Below Ground Level:	0.3	Reaction Load:	8 Tonne Tracked Excavator		
Plate Diameter (mm):	300	Plate Area (m^2):	0.071		

Settlement (mm)	Load (KN/m^2)	Settlement Time (min)
0.00	0.0	0
0.28	39.8	2
0.53	46.3	2
0.76	56.0	2
1.05	62.5	2
1.31	68.9	2
Derived Load At 1.25mm	67.5	

Modulus Of Subgrade Reaction (k_{762})(MN/m2/m)	**24**

Equivalent CBR Value (%)	**2.3**

Remarks:

Signed: A Jones

Position: Project Manager
Dated: 12 March 2021

Quantum

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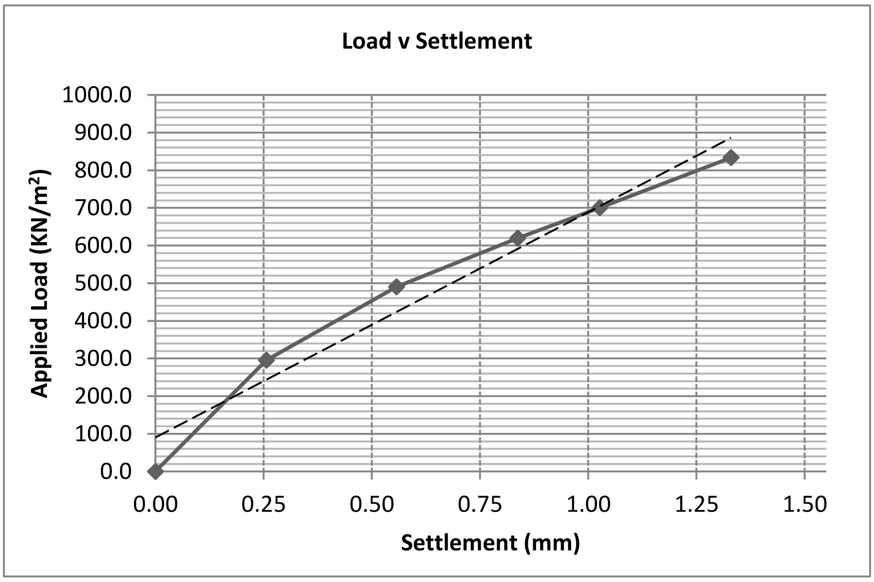
Pontarddulais, Swansea
SA4 0FQ
Tel.: 01554 744880

Determination of CBR Using the Plate Load Test to BS 1377: Part 9: 1990, TP09 & IAN73/06 Rev.1

Client Name:	Redstart		
Client Address:			
Contract Name:	Tylerstown Phase 4 GI	**Contract No.:**	Q0463

Site Reference:	4	Lab. Reference:	1.4	Date Tested:	12/03/2021
Sample Location:	CBR 4			Date Received:	12/03/2021
Material Description:	Brownish grey Rock				
Supplier:	In-Situ	Source:	In-Situ		
Depth Below Ground Level:	0.3	Reaction Load:	8 Tonne Tracked Excavator		
Plate Diameter (mm):	300	Plate Area (m^2):	0.071		

Settlement (mm)	Load (KN/m^2)	Settlement Time (min)
0.00	0.0	0
0.26	295.7	2
0.56	490.1	2
0.84	619.6	2
1.03	700.6	2
1.33	833.4	2
Derived Load At 1.25mm	798.4	



Modulus Of Subgrade Reaction (k_{762})(MN/m2/m)	**281**

Equivalent CBR Value (%)	**169.1**

Remarks:

Signed: A Jones

Position: Project Manager

Dated: 12 March 2021

Quantum

Plas Newydd, Llanedi,
Pontarddulais, Swansea
SA4 0FQ
Tel.: 01554 744880

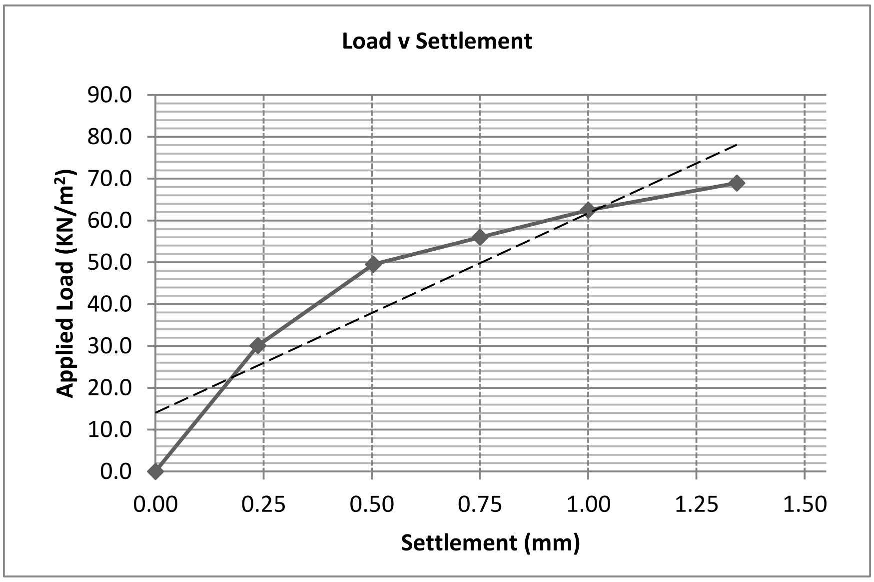
Quantum Geotech

Determination of CBR Using the Plate Load Test to BS 1377: Part 9: 1990, TP09 & IAN73/06 Rev.1

Client Name:	Redstart		
Client Address:			
Contract Name:	Tylerstown Phase 4 GI	**Contract No.:**	Q0463

Site Reference:	5	Lab. Reference:	1.5	Date Tested:	12/03/2021
Sample Location:	CBR 5			Date Received:	12/03/2021
Material Description:	MADE GROUND: Black silty slightly sandy Gravel (Colliery Spoil)				
Supplier:	In-Situ	Source:	In-Situ		
Depth Below Ground Level:	0.3	Reaction Load:	8 Tonne Tracked Excavator		
Plate Diameter (mm):	300	Plate Area (m^2):	0.071		

Settlement (mm)	Load (KN/m^2)	Settlement Time (min)
0.00	0.0	0
0.24	30.1	2
0.50	49.5	2
0.75	56.0	2
1.00	62.5	2
1.34	68.9	2
Derived Load At 1.25mm	67.2	



Modulus Of Subgrade Reaction (k_{762})(MN/m2/m)	**24**

Equivalent CBR Value (%)	**2.3**

Remarks:

Signed: *A Jones*

Position: Project Manager

Dated: 12 March 2021

Quantum

Quantum Geotech

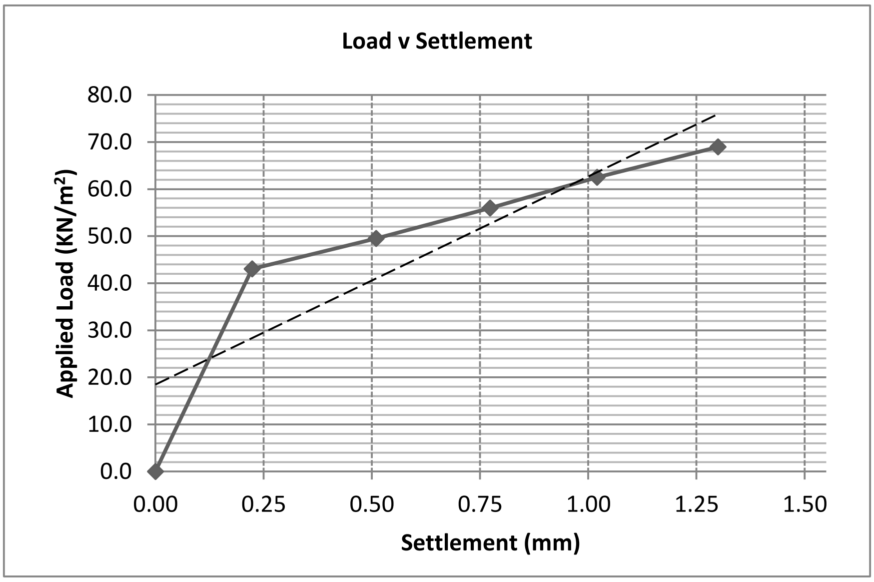
Plas Newydd, Llanedi,
Pontarddulais, Swansea
SA4 0FQ
Tel.: 01554 744880

Determination of CBR Using the Plate Load Test to BS 1377: Part 9: 1990, TP09 & IAN73/06 Rev.1

Client Name:	Redstart		
Client Address:			
Contract Name:	Tylerstown Phase 4 GI	**Contract No.:**	Q0463

Site Reference:	6	Lab. Reference:	1.6	Date Tested:	12/03/2021
Sample Location:	CBR 6			Date Received:	12/03/2021
Material Description:	MADE GROUND: Black silty slightly sandy Gravel (Colliery Spoil)				
Supplier:	In-Situ	Source:	In-Situ		
Depth Below Ground Level:	0.3	Reaction Load:	8 Tonne Tracked Excavator		
Plate Diameter (mm):	300	Plate Area (m^2):	0.071		

Settlement (mm)	Load (KN/m^2)	Settlement Time (min)
0.00	0.0	0
0.22	43.0	2
0.51	49.5	2
0.77	56.0	2
1.02	62.5	2
1.30	68.9	2
Derived Load At 1.25mm	67.8	



Modulus Of Subgrade Reaction (k_{762})(MN/m2/m)	**24**

Equivalent CBR Value (%)	**2.4**

Remarks:

Signed: A Jones

Position: Project Manager

Dated: 12 March 2021

APPENDIX VI – POST FIELDWORK MONITORING RESULTS

LANDGAS & GROUNDWATER MONITORING RECORD SHEET

Project Name:	Tylorstown Phase 4 GI
Project No.:	Q0463
BH/TP No.:	BH01
Instruments Used:	Water Dip Meter Probe, GA2000 Gas Anaylser

Installation Date:				
GL (mAOD)	Pipe	Type	Installation Depth (mbgl)	Response Zone (mbgl)
405.06	A	50	20.00	17.00-20.00

Quantum Geotech

Pipe	Date	Time (24hrs)	Atmos Pressure mBar	Differential Well Pressure mBar	Flow L/hr	CH_4 %	CO_2 %	O_2 %	CO ppm	H_2S ppm	Water Level mbgl	Water Level mAOD	HoleDepth mbgl	HoleDepth mAOD	Local Weather Recent	Local Weather Current	Remarks
A	19.03.21	09:30	982	-0.26	0.0	0.0	1.0	20.8	0	0	DRY		20.00	385.06	Cloudy	Cloudy	
A	06.04.21	08:00	980	0.16	0.0	0.0	1.2	20.6	0	0	DRY		20.00	385.06	Fine	Snowing	

LANDGAS & GROUNDWATER MONITORING RECORD SHEET

Project Name:	Tylorstown Phase 4 GI
Project No.:	Q0463
BH/TP No.:	BH02
Instruments Used:	Water Dip Meter Probe, GA2000 Gas Anaylser

Installation Date:				
GL (mAOD)	Pipe	Type	Installation Depth (mbgl)	Response Zone (mbgl)
404.82	A	50	24.00	21.00-24.00

Pipe	Date	Time (24hrs)	Atmos Pressure mBar	Differential Well Pressure mBar	Flow L/hr	CH_4 %	CO_2 %	O_2 %	CO ppm	H_2S ppm	Water Level mbgl	Water Level mAOD	HoleDepth mbgl	HoleDepth mAOD	Local Weather Recent	Local Weather Current	Remarks
A	19.03.21	09:45	982	0.50	0.0	0.0	0.2	21.4	0	0	23.20	381.62	24.00	380.82	Cloudy	Cloudy	Insufficient water for sample
A	06.04.21	08:15	980	0.23	0.0	0.0	0.4	20.8	0	0	DRY		24.00	380.82	Fine	Cloudy	

LANDGAS & GROUNDWATER MONITORING RECORD SHEET

Project Name:	Tylorstown Phase 4 GI
Project No.:	Q0463
BH/TP No.:	BH03
Instruments Used:	Water Dip Meter Probe, GA2000 Gas Anaylser

Installation Date:				
GL (mAOD)	Pipe	Type	Installation Depth (mbgl)	Response Zone (mbgl)
397.6	A	50	8.00	5.00-8.00

Pipe	Date	Time (24hrs)	Atmos Pressure mBar	Differential Well Pressure mBar	Flow L/hr	CH_4 %	CO_2 %	O_2 %	CO ppm	H_2S ppm	Water Level mbgl	Water Level mAOD	HoleDepth mbgl	HoleDepth mAOD	Local Weather Recent	Local Weather Current	Remarks
A	19.03.21	10:30	983	0.13	0.0	0.0	0.5	21.2	0	0	DRY		8.00	389.60	Cloudy	Cloudy	
A	06.04.21	08:30	981	0.25	0.0	0.0	0.7	21.0	0	0	DRY		8.00	389.60	Fine	Snowing	

LANDGAS & GROUNDWATER MONITORING RECORD SHEET

Project Name:	Tylorstown Phase 4 GI
Project No.:	Q0463
BH/TP No.:	BH05
Instruments Used:	Water Dip Meter Probe, GA2000 Gas Anaylser

Installation Date:				
GL (mAOD)	Pipe	Type	Installation Depth (mbgl)	Response Zone (mbgl)
408.57	A	50	20.00	17.00-20.00

Pipe	Date	Time (24hrs)	Atmos Pressure mBar	Differential Well Pressure mBar	Flow L/hr	CH_4 %	CO_2 %	O_2 %	CO ppm	H_2S ppm	Water Level mbgl	Water Level mAOD	HoleDepth mbgl	HoleDepth mAOD	Local Weather Recent	Local Weather Current	Remarks
A	19.03.21	10:00	982	3.00	0.0	0.0	0.6	18.2	0	0	19.85	388.72	20.00	388.57	Cloudy	Cloudy	Insufficient water for sample
A	06.04.21	08:45	980	0.24	0.0	0.0	0.8	19.8	0	0	DRY		20.00	388.57	Fine	Snowing	

LANDGAS & GROUNDWATER MONITORING RECORD SHEET

Project Name:	Tylorstown Phase 4 GI
Project No.:	Q0463
BH/TP No.:	BH06
Instruments Used:	Water Dip Meter Probe, GA2000 Gas Anaylser

Installation Date:				
GL (mAOD)	Pipe	Type	Installation Depth (mbgl)	Response Zone (mbgl)
403.19	A	50	20.00	17.00-20.00

Pipe	Date	Time (24hrs)	Atmos Pressure mBar	Differential Well Pressure mBar	Flow L/hr	CH_4 %	CO_2 %	O_2 %	CO ppm	H_2S ppm	Water Level mbgl	Water Level mAOD	HoleDepth mbgl	HoleDepth mAOD	Local Weather Recent	Local Weather Current	Remarks
A	19.03.21	10:45	983	1.25	0.0	0.0	0.1	20.2	0	0	DRY		20.00	383.19	Cloudy	Cloudy	
A	06.04.21	09:00	980	0.23	0.0	0.0	1.0	20.3	0	0	DRY		20.00	383.19	Fine	Snowing	

LANDGAS & GROUNDWATER MONITORING RECORD SHEET

Project Name:	Tylorstown Phase 4 GI
Project No.:	Q0463
BH/TP No.:	BH07
Instruments Used:	Water Dip Meter Probe, GA2000 Gas Anaylser

Installation Date:				
GL (mAOD)	Pipe	Type	Installation Depth (mbgl)	Response Zone (mbgl)
398.31	A	50	8.00	5.00-8.00

Pipe	Date	Time (24hrs)	Atmos Pressure mBar	Differential Well Pressure mBar	Flow L/hr	CH_4 %	CO_2 %	O_2 %	CO ppm	H_2S ppm	Water Level mbgl	Water Level mAOD	HoleDepth mbgl	HoleDepth mAOD	Local Weather Recent	Local Weather Current	Remarks
A	19.03.21	10:15	983	0.08	0.0	0.0	0.2	21.1	0	0	6.43	391.88	8.00	390.31	Cloudy	Cloudy	Sample taken
A	06.04.21	09:15	980	0.23	0.0	0.0	0.5	20.3	0	0	DRY		8.00	390.31	Fine	Snowing	

LANDGAS & GROUNDWATER MONITORING RECORD SHEET

Project Name:	Tylorstown Phase 4 GI
Project No.:	Q0463
BH/TP No.:	BH01A - Old existing
Instruments Used:	Water Dip Meter Probe, GA2000 Gas Anaylser

Installation Date:				
GL (mAOD)	Pipe	Type	Installation Depth (mbgl)	Response Zone (mbgl)
	A	19		

Quantum Geotech

Pipe	Date	Time (24hrs)	Atmos Pressure	Differential Well Pressure	Flow	CH_4	CO_2	O_2	CO	H_2S	Water Level		HoleDepth		Local Weather		Remarks
			mBar	mBar	L/hr	%	%	%	ppm	ppm	mbgl	mAOD	mbgl	mAOD	Recent	Current	
A	19.03.21	11:00	983	0.10	0.0	0.0	0.1	21.4	0	0	DRY		65.00		Cloudy	Cloudy	
A	06.04.21	09:30	980	0.21	0.0	0.0	0.2	21.2	0	0	DRY		65.00		Fine	Snowing	

LANDGAS & GROUNDWATER MONITORING RECORD SHEET

Project Name:	Tylorstown Phase 4 GI
Project No.:	Q0463
BH/TP No.:	BH02A - Old existing
Instruments Used:	Water Dip Meter Probe, GA2000 Gas Anaylser

Installation Date:				
GL (mAOD)	Pipe	Type	Installation Depth (mbgl)	Response Zone (mbgl)
	A	19		

Pipe	Date	Time (24hrs)	Atmos Pressure mBar	Differential Well Pressure mBar	Flow L/hr	CH_4 %	CO_2 %	O_2 %	CO ppm	H_2S ppm	Water Level mbgl	Water Level mAOD	HoleDepth mbgl	HoleDepth mAOD	Local Weather Recent	Local Weather Current	Remarks
A	19.03.21	11:15	983	0.10	0.0	0.0	0.3	20.9	0	0	DRY		70.00		Cloudy	Cloudy	
A	06.04.21	09:45	980	0.23	0.0	0.0	0.1	21.0	0	0	DRY		70.00		Fine	Snowing	

LANDGAS & GROUNDWATER MONITORING RECORD SHEET

Quantum Geotech

Project Name:	Tylorstown Phase 4 GI
Project No.:	Q0463
BH/TP No.:	BH03A - Old existing
Instruments Used:	Water Dip Meter Probe, GA2000 Gas Anaylser

Installation Date:				
GL (mAOD)	Pipe	Type	Installation Depth (mbgl)	Response Zone (mbgl)
	A	19		

Pipe	Date	Time (24hrs)	Atmos Pressure mBar	Differential Well Pressure mBar	Flow L/hr	CH_4 %	CO_2 %	O_2 %	CO ppm	H_2S ppm	Water Level mbgl	Water Level mAOD	HoleDepth mbgl	HoleDepth mAOD	Local Weather Recent	Local Weather Current	Remarks
A	19.03.21	11:30	983	0.10	0.0	0.0	0.1	21.3	0	0	DRY		69.00		Cloudy	Cloudy	
A	06.04.21	10:00	980	0.23	0.0	0.0	0.0	21.4	0	0	DRY		69.00		Fine	Snowing	

APPENDIX VII – GEOTECHNICAL LABORATORY TEST CERTIFICATES

Laboratory Report

GEO Site & Testing Services Ltd

UKAS TESTING 2788

Contract Number: 53030

Client Ref: **Q0463**

Report Date: **31-03-2021**

Client PO:

Client **Quantum Geotechnic Ltd**
Ty Berwig
Bynea
Llanelli.
Carmarthenshire.
SA14 9ST

Contract Title: **Tylorstown Phase 4 GI**
For the attention of: **Steffan Picton**

Date Received: **17-03-2021**
Date Completed: **31-03-2021**

Test Description	Qty
Moisture Content BS 1377:1990 - Part 2 : 3.2 - * UKAS	18
4 Point Liquid & Plastic Limit BS 1377:1990 - Part 2 : 4.3 & 5.3 - * UKAS	11
PSD Wet Sieve method BS 1377:1990 - Part 2 : 9.2 - * UKAS	20
PSD: Sedimentation by pipette carried out with Wet Sieve (Wet Sieve must also be selected) BS 1377:1990 - Part 2 : 9.4 - * UKAS	1
Organic Matter Content-dichromate method Sub-contracted Test - @ Non Accredited Test	8
Acid Soluble Sulphate Sub-contracted Test - @ Non Accredited Test	7
Water Soluble Sulphate 2:1 extract Sub-contracted Test - @ Non Accredited Test	5

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

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

Approved Signatories:
Emma Sharp (Office Manager) - Paul Evans (Quality/Technical Manager) - Richard John (Advanced Testing Manager)
Shaun Jones (Laboratory manager) - Wayne Honey (Administrative/Quality Assistant)

Laboratory Report

UKAS TESTING 2788

GSTL
GEO Site & Testing Services Ltd

Contract Number: 53030

Test Description	Qty
pH value of soil Sub-contracted Test - @ Non Accredited Test	7
Loss on Ignition Sub-contracted Test - @ Non Accredited Test	3
Determination of the Total Sulphur content of Soil Sub-contracted Test - @ Non Accredited Test	5
Determination of Point Load Value Axial or Diametrical including WC ***Please note GSTL is not accredited for the water content of rock*** ISRM Suggested Method for Point Load Strength - * UKAS	6
Samples Received - @ Non Accredited Test	58
Disposal of samples for job	1

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

Approved Signatories:
Emma Sharp (Office Manager) - Paul Evans (Quality/Technical Manager) - Richard John (Advanced Testing Manager)
Shaun Jones (Laboratory manager) - Wayne Honey (Administrative/Quality Assistant)

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

GSTL	Natural Moisture Content (BS 1377:1990 - Part 2 : 3.2) **DESCRIPTIONS**	
Contract Number	**53030**	
Site Name	**Tylorstown Phase 4 GI**	
Date Tested	**29/03/2021**	

Sample/Hole Reference	Sample Number	Sample Type	Depth (m)			Descriptions
WS01	2	SPT	2.00	-		Reddish brown sandy CLAY
BHC03	1	B	0.50	-		Brown fine to coarse gravelly sandy silty CLAY
BHC04	1	B	0.50	-		Brown fine to coarse gravelly sandy silty CLAY
BHC07	1	B	1.20	-		Brown sandy silty fine to coarse gravelly CLAY
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Operators	Checked	31/03/2021	Richard John (Advanced Testing Manager)
Gavin Jenkins	Approved	31/03/2021	Paul Evans (Quality/Technical Manager)

UKAS TESTING 2788

GSTL

Natural Moisture Content
(BS 1377:1990 - Part 2 : 3.2)

Contract Number	**53030**	
Site Name	**Tylorstown Phase 4 GI**	
Date Tested	**29/03/2021**	

Sample/Hole Reference	Sample Number	Sample Type	Depth (m)			Moisture Content %	Remarks
WS01	2	SPT	2.00	-		8.5	
BHC03	1	B	0.50	-		29	
BHC04	1	B	0.50	-		39	
BHC07	1	B	1.20	-		49	
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Operators	Checked	31/03/2021	Richard John (Advanced Testing Manager)
Gavin Jenkins	Approved	31/03/2021	Paul Evans (Quality/Technical Manager)

UKAS TESTING 2788

GSTL	**NATURAL MOISTURE, LIQUID LIMIT, PLASTIC LIMIT AND PLASTICITY INDEX (BS 1377 : Part 2 : 1990 Method 5)**	
Contract Number	**53030**	
Site Name	**Tylorstown Phase 4 GI**	
Date Tested	**29/03/2021**	
	DESCRIPTIONS	

Sample/Hole Reference	Sample Number	Sample Type	Depth (m)			Descriptions
TPC01	3	B	0.70	-	1.10	Brown fine to coarse sandy silty/clayey fine to coarse GRAVEL (with cobbles)
TPC02	3	B	0.70	-	1.10	Brown silty/clayey fine to coarse sandy fine to coarse SAND
TPC03	1	B	0.20	-	0.50	Brown silty/clayey fine to coarse sandy fine to coarse SAND
TPC04	1	B	0.30	-	0.60	Grey clayey/silty fine to coare sandy fine to coarse GRAVEL (with cobbles)
TPC04	2	B	1.00	-		Brown silty/clayey fine to coarse sandy fine to coarse GRAVEL
TPC05	1	B	0.30	-	0.90	Brown clayey/silty fine to coarse sandy fine to coarse GRAVEL
TPC05	2	B	1.00	-		Brown fine to coarse sandy silty/clayey fine to coarse GRAVEL (with cobbles)
TPC06	1	B	0.20	-	0.50	Dark brown clayey/silty fine to coarse sandy fine to coarse GRAVEL
TPC07	1	B	0.30	-	0.80	Brown silty/clayey fine to coarse sandy fine to coarse SAND
TPC07	2	B	1.00	-		Light brown slightly silty/clayey fine to coarse sandy fine to coarse GRAVEL
WS01	3	B	2.00	-	3.00	Brown sandy silty CLAY
				-		
				-		
				-		
				-		
				-		
				-		
				-		
				-		
				-		
				-		
				-		
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				-		

Operators	Checked	31/03/2021	Richard John (Advanced Testing Manager)
Gavin Jenkins	Approved	31/03/2021	Paul Evans (Quality/Technical Manager)

UKAS TESTING 2788

GSTL	NATURAL MOISTURE, LIQUID LIMIT, PLASTIC LIMIT AND PLASTICITY INDEX (BS 1377 : Part 2 : 1990 Method 5)	
Contract Number	**53030**	
Project Location	**Tylorstown Phase 4 GI**	
Date Tested	**29/03/2021**	

Sample/Hole Reference	Sample Number	Sample Type	Depth (m)			Moisture Content %	Liquid Limit %	Plastic Limit %	Plasticity index %	Passing 0.425mm %	Remarks
TPC01	3	B	0.70	-	1.10	22	38	21	17	42	CI Intermediate Plasticity
TPC02	3	B	0.70	-	1.10	35	49	27	22	54	CI Intermediate Plasticity
TPC03	1	B	0.20	-	0.50	34	58	31	27	34	MH High Plasticity
TPC04	1	B	0.30	-	0.60	34	63	39	24	23	MH High Plasticity
TPC04	2	B	1.00	-		17	35	17	18	28	CL/I Low/Inter. Plasticity
TPC05	1	B	0.30	-	0.90	29	54	35	19	25	MH High Plasticity
TPC05	2	B	1.00	-		16	37	20	17	31	CI Intermediate Plasticity
TPC06	1	B	0.20	-	0.50	31	62	37	25	32	MH High Plasticity
TPC07	1	B	0.30	-	0.80	17	32	15	17	40	CL Low Plasticity
TPC07	2	B	1.00	-		14	40	18	22	18	CI Intermediate Plasticity
WS01	3	B	2.00	-	3.00	18	39	15	24	80	CI Intermediate Plasticity
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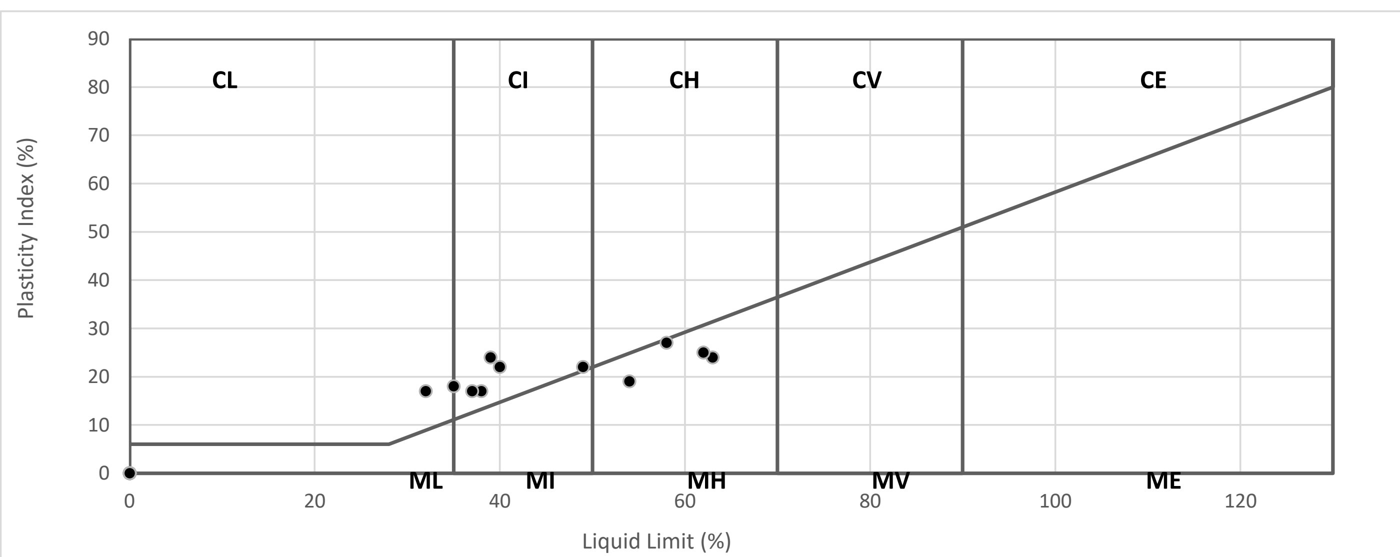
				-							

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

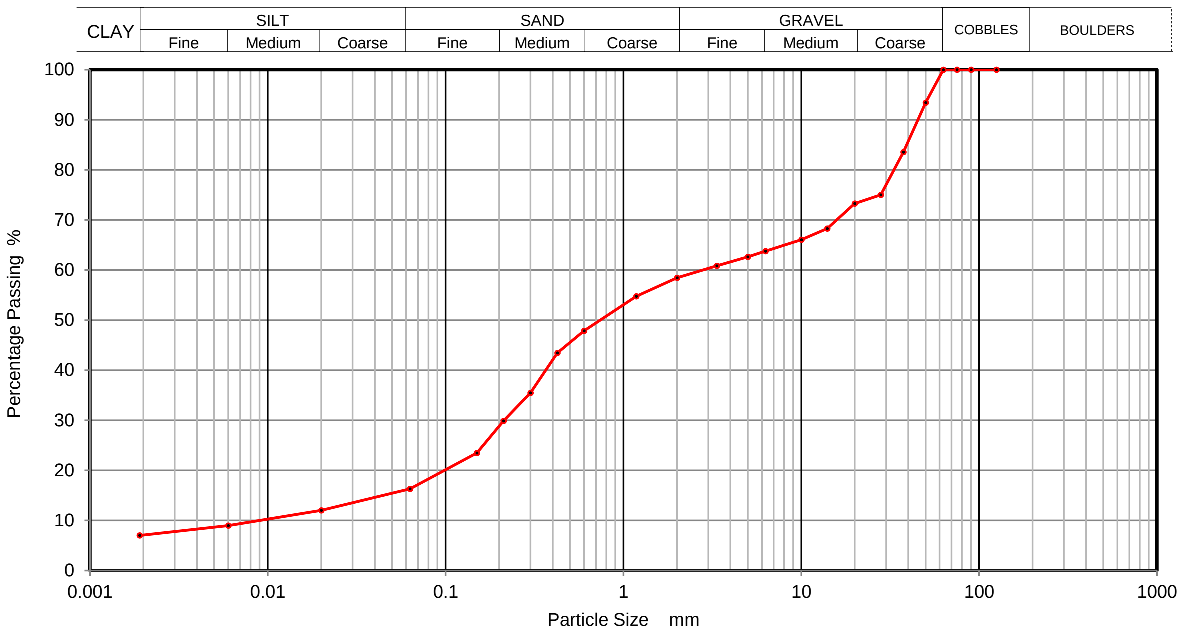
PLASTICITY CHART FOR CASAGRANDE CLASSIFICATION
BS 5930:1999+A2:2010



Operators	Checked	31/03/2021	Richard John (Advanced Testing Manager)
Gavin Jenkins	Approved	31/03/2021	Paul Evans (Quality/Technical Manager)

UKAS TESTING 2788

GSTL	PARTICLE SIZE DISTRIBUTION BS 1377 Part 2:1990 Wet Sieve & Pipette Analysis, Clause 9.2 & 9.4	Contract Number	53030
		Borehole/Pit No.	BH02
Site Name	Tylorstown Phase 4 GI	Sample No.	1
Soil Description	Brown slightly clayey slightly silty fine to coarse sandy fine to coarse GRAVEL	Depth Top	0.50
		Depth Base	
Date Tested	26/03/2021	Sample Type	B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.0200	12
90	100	0.0060	9
75	100	0.0020	7
63	100		
50	93		
37.5	84		
28	75		
20	73		
14	68		
10	66		
6.3	64		
5	63		
3.35	61		
2	58		
1.18	55		
0.6	48		
0.425	43		
0.3	35		
0.212	30		
0.15	23		
0.063	16		

MC in accordance with BS1377 Part 2 1990 Clause 3.2	
Moisture Content %	42

Sample Proportions	% dry mass
Cobbles	0
Gravel	42
Sand	42
Silt	9
Clay	7

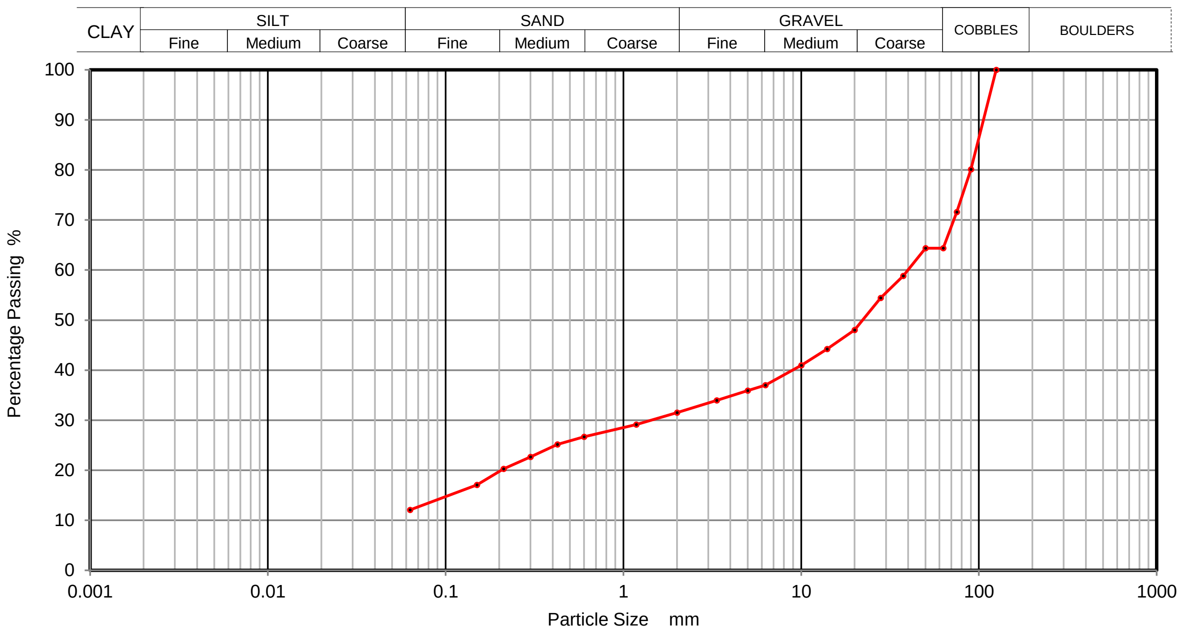
Remarks

Preparation and testing in accordance with BS1377 unless noted below

Operator	Checked	30/03/2021	Richard John	
David	Approved	31/03/2021	Paul Evans	

UKAS TESTING 2788

GSTL	PARTICLE SIZE DISTRIBUTION BS 1377 Part 2:1990 Wet Sieve, Clause 9.2	Contract Number	53030
		Borehole/Pit No.	BH02
Site Name	Tylorstown Phase 4 GI	Sample No.	2
Soil Description	Brown clayey/silty fine to coarse sandy fine to coarse GRAVEL (with cobbles)	Depth Top	1.20
		Depth Base	
Date Tested	26/03/2021	Sample Type	B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	80		
75	72		
63	64		
50	64		
37.5	59		
28	54		
20	48		
14	44		
10	41		
6.3	37		
5	36		
3.35	34		
2	32		
1.18	29		
0.6	27		
0.425	25		
0.3	23		
0.212	20		
0.15	17		
0.063	12		

Sample Proportions	% dry mass
Cobbles	36
Gravel	32
Sand	20
Silt and Clay	12

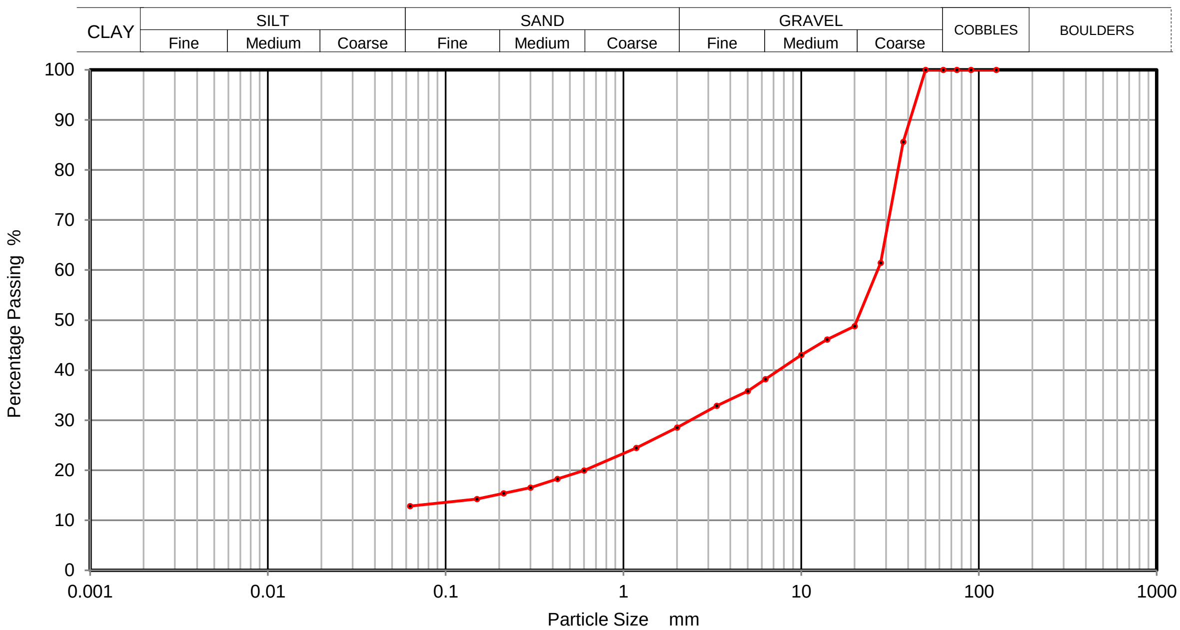
Remarks

Preparation and testing in accordance with BS1377 unless noted below

Operator	Checked	30/03/2021	Richard John	[signature]
David	Approved	31/03/2021	Paul Evans	[signature]

UKAS TESTING 2788

GSTL	PARTICLE SIZE DISTRIBUTION BS 1377 Part 2:1990 Wet Sieve, Clause 9.2	Contract Number	53030
		Borehole/Pit No.	BHC01
Site Name	Tylorstown Phase 4 GI	Sample No.	2
Soil Description	Grey clayey/silty fine to coarse sandy fine to coarse GRAVEL	Depth Top	1.20
		Depth Base	
Date Tested	26/03/2021	Sample Type	B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	86		
28	61		
20	49		
14	46		
10	43		
6.3	38		
5	36		
3.35	33		
2	29		
1.18	24		
0.6	20		
0.425	18		
0.3	17		
0.212	15		
0.15	14		
0.063	13		

MC in accordance with BS1377 Part 2 1990 Clause 3.2	
Moisture Content %	20

Sample Proportions	% dry mass
Cobbles	0
Gravel	71
Sand	16
Silt and Clay	13

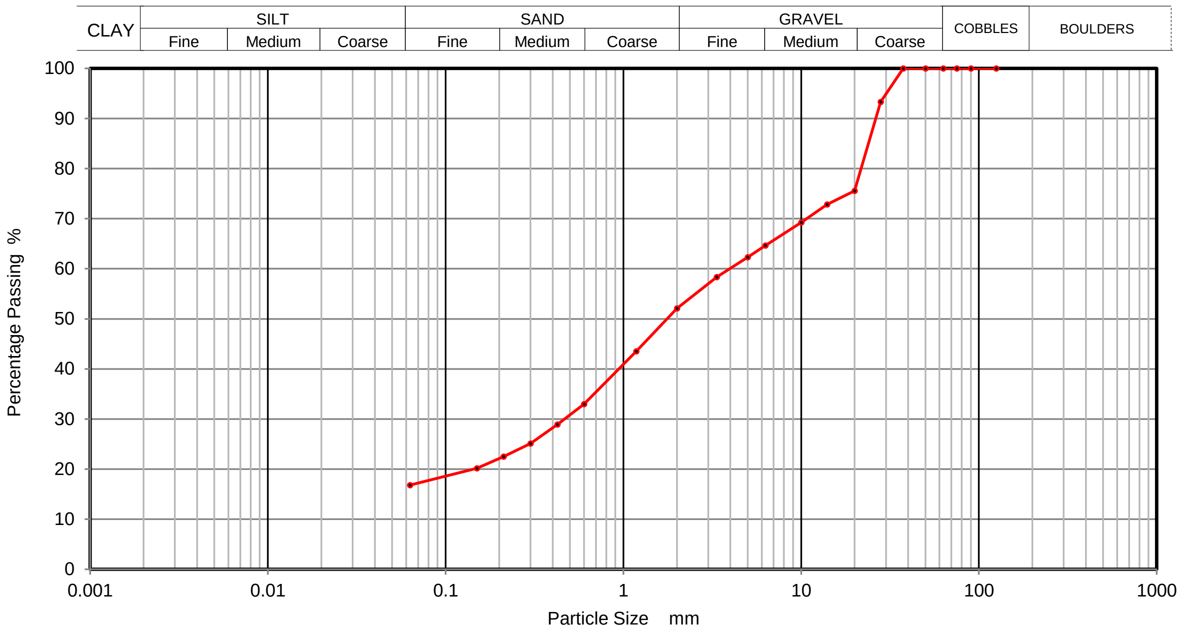
Remarks

Preparation and testing in accordance with BS1377 unless noted below

Operator	Checked	30/03/2021	Richard John	
David	Approved	31/03/2021	Paul Evans	

UKAS TESTING 2788

	PARTICLE SIZE DISTRIBUTION BS 1377 Part 2:1990 Wet Sieve, Clause 9.2	Contract Number	53030
		Borehole/Pit No.	TPC01
Site Name	Tylorstown Phase 4 GI	Sample No.	1
Soil Description	Grey clayey/silty fine to coarse sandy fine to coarse GRAVEL	Depth Top	0.00
		Depth Base	0.60
Date Tested	26/03/2021	Sample Type	B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	93		
20	76		
14	73		
10	69		
6.3	65		
5	62		
3.35	58		
2	52		
1.18	44		
0.6	33		
0.425	29		
0.3	25		
0.212	22		
0.15	20		
0.063	17		

Sample Proportions	% dry mass
Cobbles	0
Gravel	48
Sand	35
Silt and Clay	17

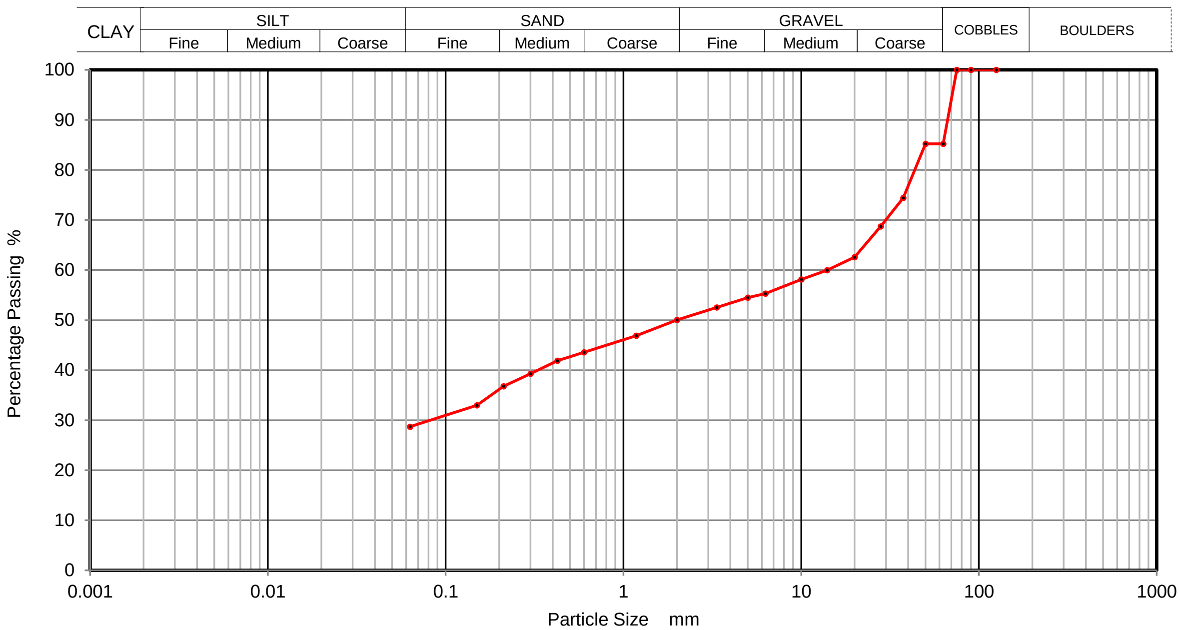
Remarks

Preparation and testing in accordance with BS1377 unless noted below

Operator	Checked	30/03/2021	Richard John	
David	Approved	31/03/2021	Paul Evans	

UKAS TESTING 2788

GSTL	PARTICLE SIZE DISTRIBUTION BS 1377 Part 2:1990 Wet Sieve, Clause 9.2	Contract Number	53030
		Borehole/Pit No.	TPC01
Site Name	Tylorstown Phase 4 GI	Sample No.	3
Soil Description	Brown fine to coarse sandy silty/clayey fine to coarse GRAVEL (with cobbles)	Depth Top	0.70
		Depth Base	1.10
Date Tested	26/03/2021	Sample Type	B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	85		
50	85		
37.5	74		
28	69		
20	63		
14	60		
10	58		
6.3	55		
5	54		
3.35	53		
2	50		
1.18	47		
0.6	44		
0.425	42		
0.3	39		
0.212	37		
0.15	33		
0.063	29		

Sample Proportions	% dry mass
Cobbles	15
Gravel	35
Sand	21
Silt and Clay	29

Remarks

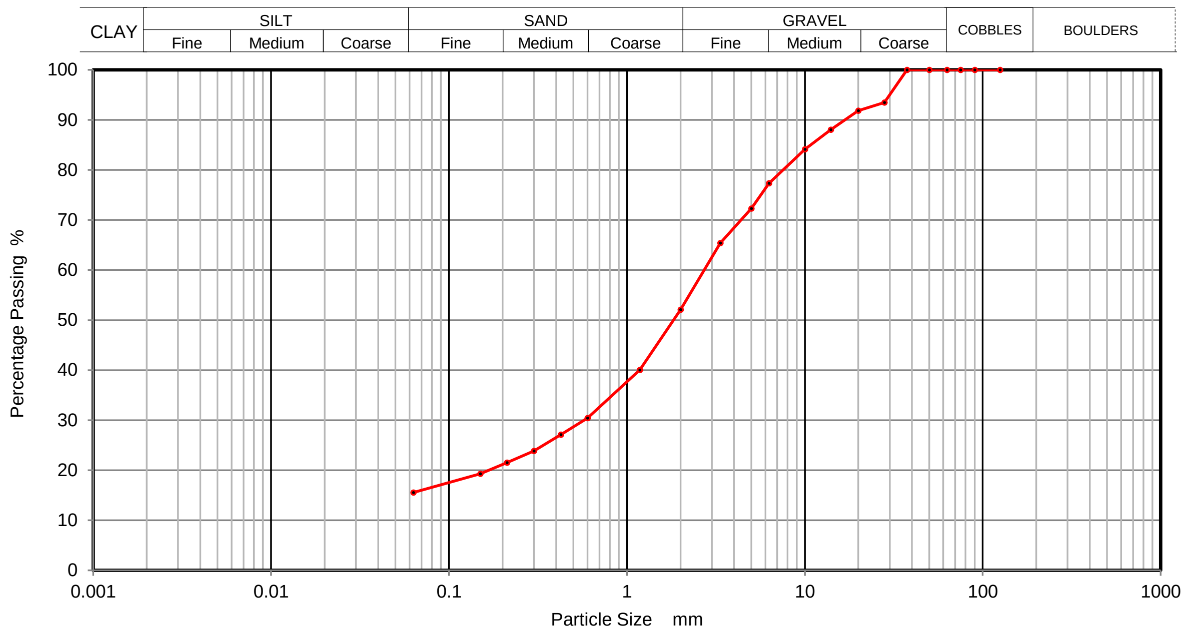
Preparation and testing in accordance with BS1377 unless noted below

Operator	Checked	30/03/2021	Richard John	[signature]
David	Approved	31/03/2021	Paul Evans	[signature]

UKAS TESTING 2788

PARTICLE SIZE DISTRIBUTION
BS 1377 Part 2:1990
Wet Sieve, Clause 9.2

GSTL	PARTICLE SIZE DISTRIBUTION BS 1377 Part 2:1990 Wet Sieve, Clause 9.2	Contract Number	**53030**
		Borehole/Pit No.	**TPC02**
Site Name	**Tylorstown Phase 4 GI**	Sample No.	**1**
Soil Description	Grey clayey/silty fine to coarse sandy fine to coarse GRAVEL	Depth Top	**0.00**
		Depth Base	**0.60**
Date Tested	26/03/2021	Sample Type	**B**



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	93		
20	92		
14	88		
10	84		
6.3	77		
5	72		
3.35	65		
2	52		
1.18	40		
0.6	30		
0.425	27		
0.3	24		
0.212	22		
0.15	19		
0.063	16		

Sample Proportions	% dry mass
Cobbles	0
Gravel	48
Sand	36
Silt and Clay	16

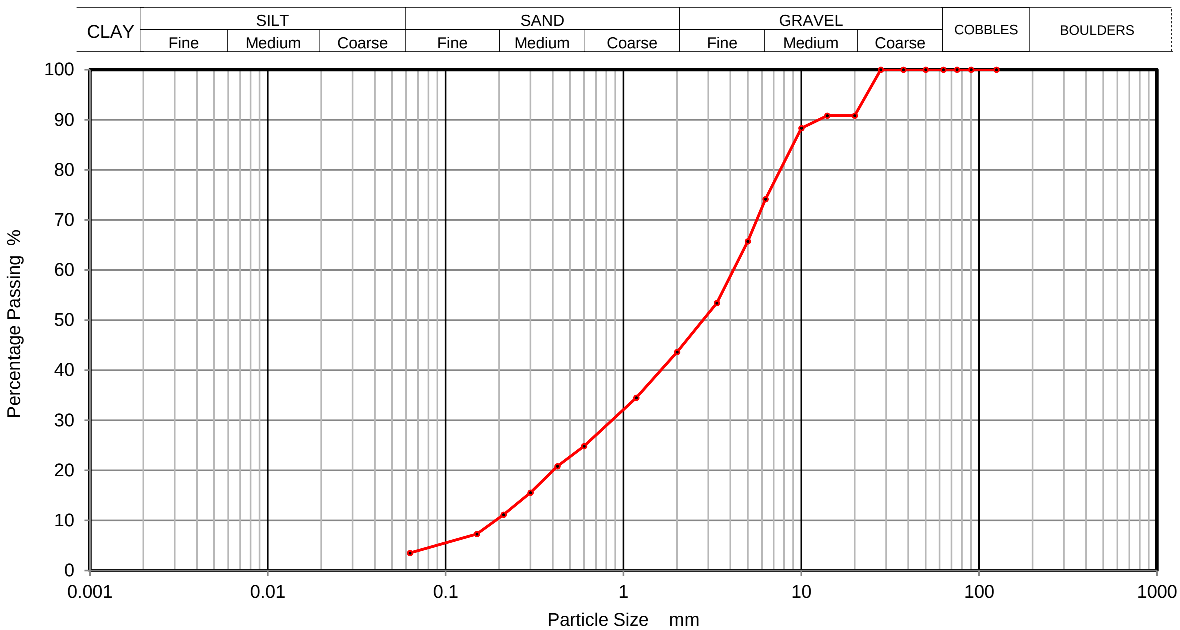
Remarks

Preparation and testing in accordance with BS1377 unless noted below

Operator	Checked	30/03/2021	Richard John	
David	Approved	31/03/2021	Paul Evans	

UKAS TESTING 2788

GSTL	PARTICLE SIZE DISTRIBUTION BS 1377 Part 2:1990 Wet Sieve, Clause 9.2	Contract Number	53030
		Borehole/Pit No.	TPC02
Site Name	Tylorstown Phase 4 GI	Sample No.	2
Soil Description	Dark grey slightly clayey/silty fine to coarse sandy fine to coarse GRAVEL	Depth Top	0.60
		Depth Base	0.70
Date Tested	26/03/2021	Sample Type	B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	91		
14	91		
10	88		
6.3	74		
5	66		
3.35	53		
2	44		
1.18	35		
0.6	25		
0.425	21		
0.3	16		
0.212	11		
0.15	7		
0.063	4		

Sample Proportions	% dry mass
Cobbles	0
Gravel	56
Sand	40
Silt and Clay	4

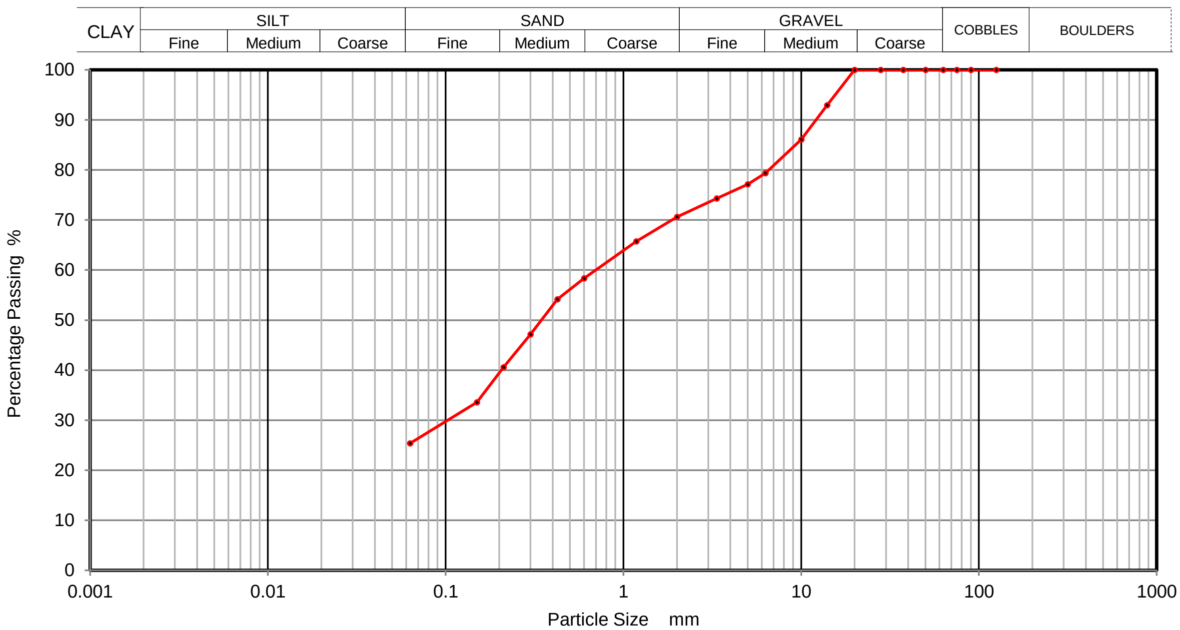
Remarks

Preparation and testing in accordance with BS1377 unless noted below

Operator	Checked	30/03/2021	Richard John	[signature]
David	Approved	31/03/2021	Paul Evans	[signature]

UKAS TESTING 2788

GSTL	PARTICLE SIZE DISTRIBUTION BS 1377 Part 2:1990 Wet Sieve, Clause 9.2	Contract Number	53030
		Borehole/Pit No.	TPC02
Site Name	Tylorstown Phase 4 GI	Sample No.	2
Soil Description	Brown silty/clayey fine to medium gravelly fine to coarse SAND	Depth Top	0.70
		Depth Base	1.10
Date Tested	26/03/2021	Sample Type	B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	93		
10	86		
6.3	79		
5	77		
3.35	74		
2	71		
1.18	66		
0.6	58		
0.425	54		
0.3	47		
0.212	41		
0.15	34		
0.063	25		

Sample Proportions	% dry mass
Cobbles	0
Gravel	29
Sand	46
Silt and Clay	25

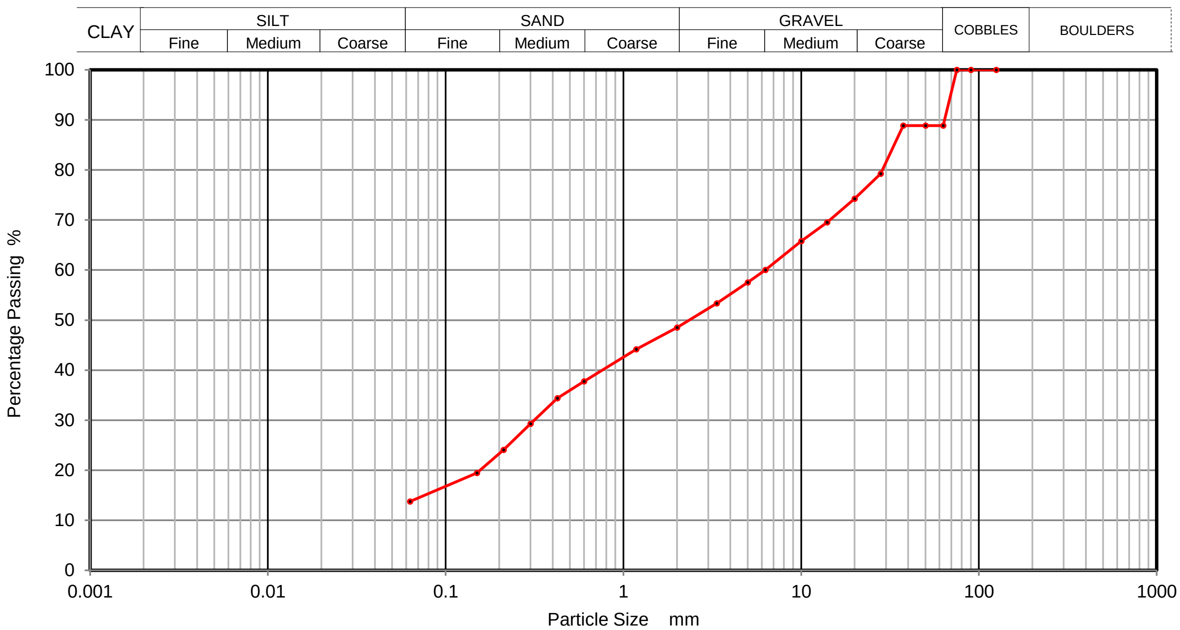
Remarks

Preparation and testing in accordance with BS1377 unless noted below

Operator	Checked	30/03/2021	Richard John	
David	Approved	31/03/2021	Paul Evans	

UKAS TESTING 2788

GSTL	PARTICLE SIZE DISTRIBUTION BS 1377 Part 2:1990 Wet Sieve, Clause 9.2	Contract Number	53030
		Borehole/Pit No.	TPC03
Site Name	Tylorstown Phase 4 GI	Sample No.	1
Soil Description	Brown clayey/silty fine to coarse gravelly fine to coarse SAND (with cobbles)	Depth Top	0.20
		Depth Base	0.50
Date Tested	26/03/2021	Sample Type	B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	89		
50	89		
37.5	89		
28	79		
20	74		
14	70		
10	66		
6.3	60		
5	58		
3.35	53		
2	49		
1.18	44		
0.6	38		
0.425	34		
0.3	29		
0.212	24		
0.15	19		
0.063	14		

Sample Proportions	% dry mass
Cobbles	11
Gravel	40
Sand	35
Silt and Clay	14

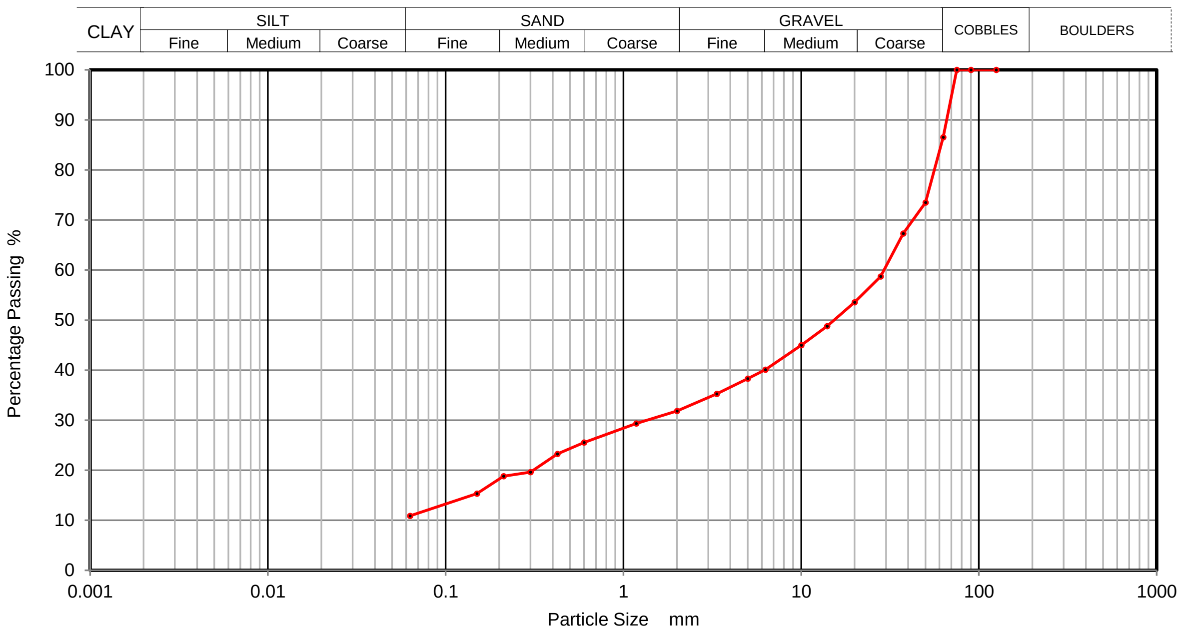
Remarks

Preparation and testing in accordance with BS1377 unless noted below

Operator	Checked	30/03/2021	Richard John	
David	Approved	31/03/2021	Paul Evans	

UKAS TESTING 2788

GSTL	PARTICLE SIZE DISTRIBUTION BS 1377 Part 2:1990 Wet Sieve, Clause 9.2	Contract Number	53030
		Borehole/Pit No.	TPC04
Site Name	Tylorstown Phase 4 GI	Sample No.	1
Soil Description	Grey clayey/silty fine to coare sandy fine to coarse GRAVEL (with cobbles)	Depth Top	0.30
		Depth Base	0.60
Date Tested	26/03/2021	Sample Type	B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	87		
50	73		
37.5	67		
28	59		
20	54		
14	49		
10	45		
6.3	40		
5	38		
3.35	35		
2	32		
1.18	29		
0.6	26		
0.425	23		
0.3	20		
0.212	19		
0.15	15		
0.063	11		

Sample Proportions	% dry mass
Cobbles	13
Gravel	55
Sand	21
Silt and Clay	11

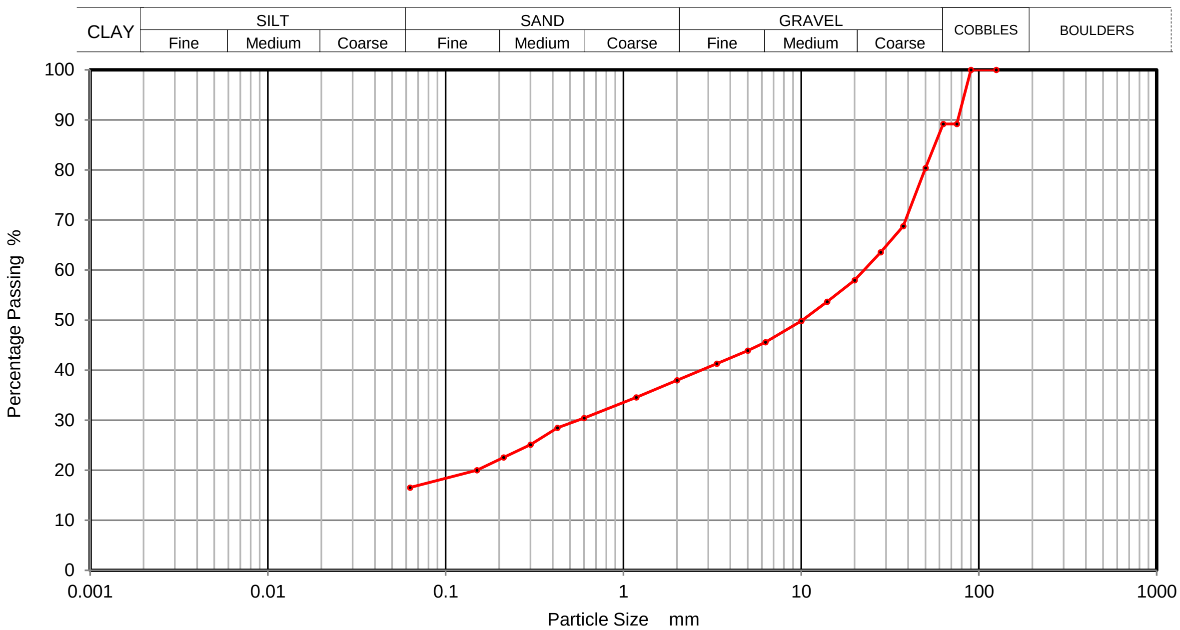
Remarks

Preparation and testing in accordance with BS1377 unless noted below

Operator	Checked	30/03/2021	Richard John	
David	Approved	31/03/2021	Paul Evans	

UKAS TESTING 2788

GSTL	PARTICLE SIZE DISTRIBUTION BS 1377 Part 2:1990 Wet Sieve, Clause 9.2	Contract Number	53030
		Borehole/Pit No.	TPC04
Site Name	Tylorstown Phase 4 GI	Sample No.	2
Soil Description	Grey silty/clayey fine to coarse sandy fine to coarse GRAVEL (with cobbles)	Depth Top	1.00
		Depth Base	
Date Tested	26/03/2021	Sample Type	B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	89		
63	89		
50	80		
37.5	69		
28	64		
20	58		
14	54		
10	50		
6.3	46		
5	44		
3.35	41		
2	38		
1.18	35		
0.6	30		
0.425	28		
0.3	25		
0.212	23		
0.15	20		
0.063	17		

Sample Proportions	% dry mass
Cobbles	11
Gravel	51
Sand	21
Silt and Clay	17

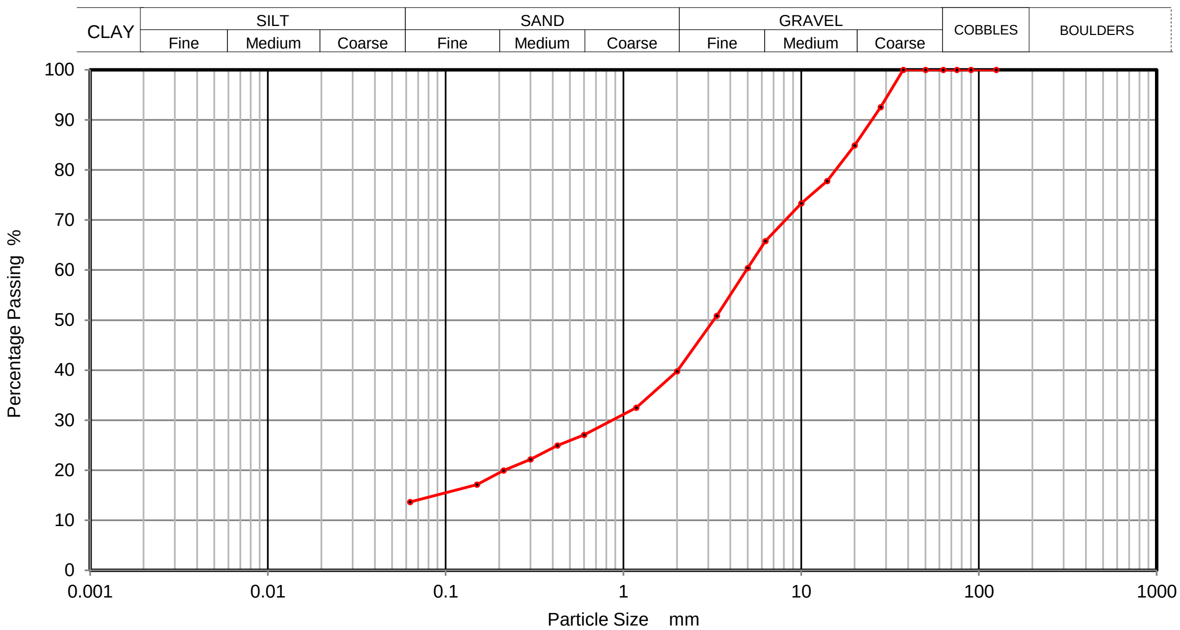
Remarks

Preparation and testing in accordance with BS1377 unless noted below

Operator	Checked	30/03/2021	Richard John	[signature]
David	Approved	31/03/2021	Paul Evans	[signature]

UKAS TESTING 2788

GSTL	PARTICLE SIZE DISTRIBUTION BS 1377 Part 2:1990 Wet Sieve, Clause 9.2	Contract Number	53030
		Borehole/Pit No.	TPC05
Site Name	Tylorstown Phase 4 GI	Sample No.	1
Soil Description	Brown clayey/silty fine to coarse sandy fine to coarse GRAVEL	Depth Top	0.30
		Depth Base	0.90
Date Tested	26/03/2021	Sample Type	B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	93		
20	85		
14	78		
10	73		
6.3	66		
5	60		
3.35	51		
2	40		
1.18	32		
0.6	27		
0.425	25		
0.3	22		
0.212	20		
0.15	17		
0.063	14		

Sample Proportions	% dry mass
Cobbles	0
Gravel	60
Sand	26
Silt and Clay	14

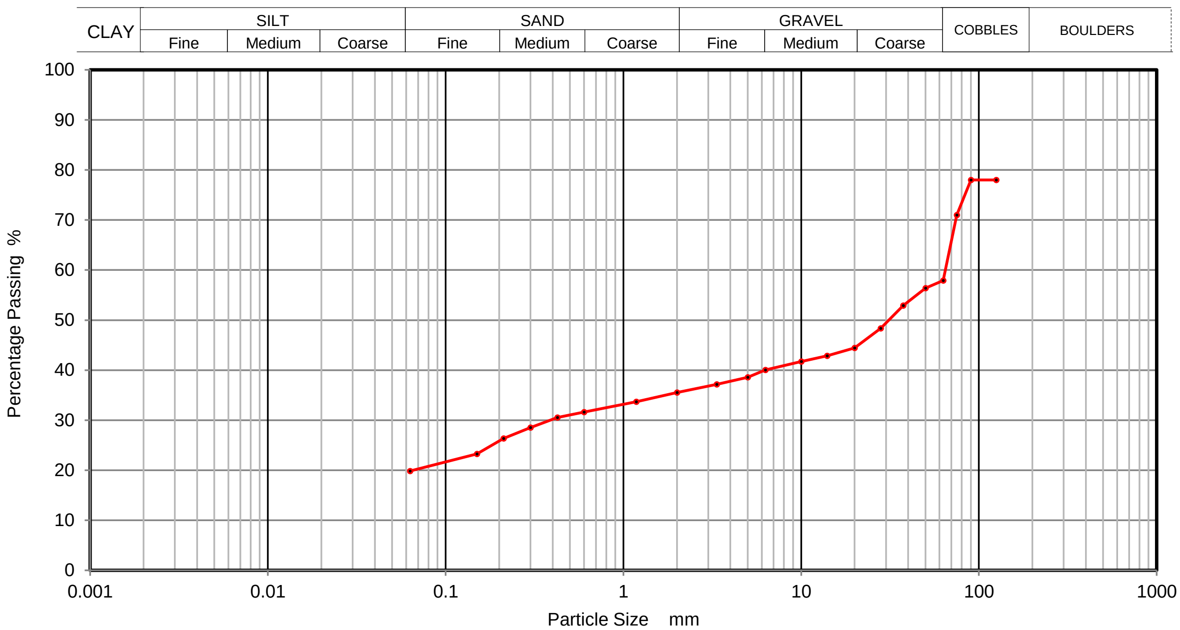
Remarks

Preparation and testing in accordance with BS1377 unless noted below

Operator	Checked	30/03/2021	Richard John	[signature]
David	Approved	31/03/2021	Paul Evans	[signature]

UKAS TESTING 2788

GSTL	PARTICLE SIZE DISTRIBUTION BS 1377 Part 2:1990 Wet Sieve, Clause 9.2	Contract Number	53030
		Borehole/Pit No.	TPC05
Site Name	Tylorstown Phase 4 GI	Sample No.	2
Soil Description	Brown fine to coarse sandy silty/clayey fine to coarse GRAVEL (with cobbles)	Depth Top	1.00
		Depth Base	
Date Tested	26/03/2021	Sample Type	B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	78		
90	78		
75	71		
63	58		
50	56		
37.5	53		
28	48		
20	44		
14	43		
10	42		
6.3	40		
5	39		
3.35	37		
2	36		
1.18	34		
0.6	32		
0.425	31		
0.3	29		
0.212	26		
0.15	23		
0.063	20		

Sample Proportions	% dry mass
Cobbles	42
Gravel	22
Sand	16
Silt and Clay	20

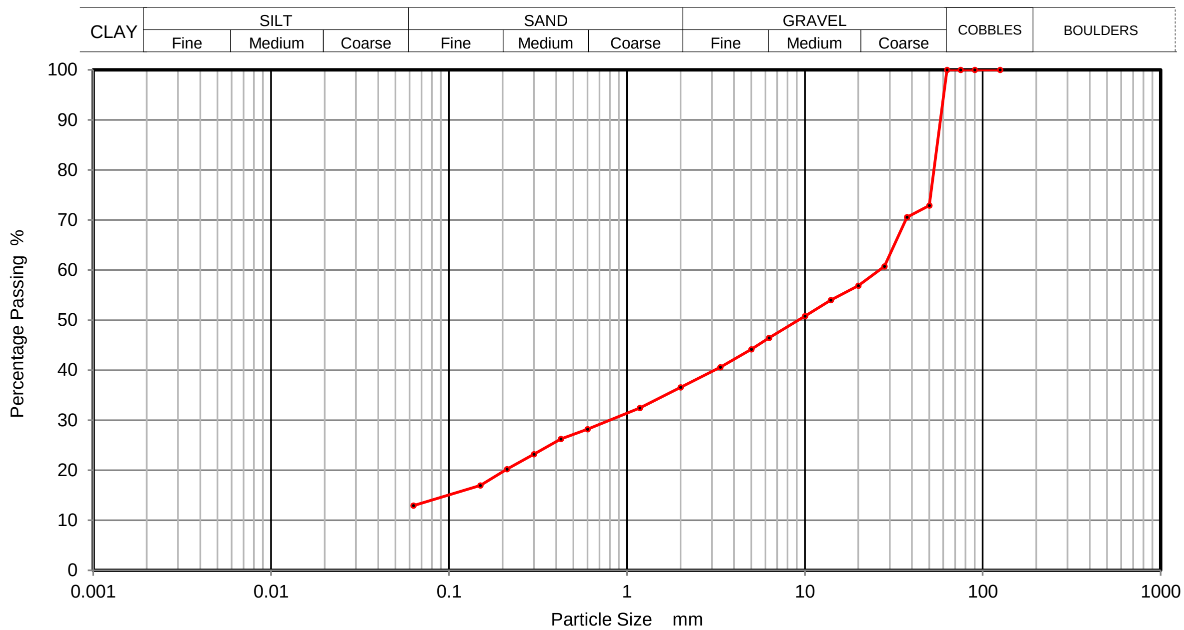
Remarks

Preparation and testing in accordance with BS1377 unless noted below

Operator	Checked	30/03/2021	Richard John	
David	Approved	31/03/2021	Paul Evans	

UKAS TESTING 2788

GSTL	PARTICLE SIZE DISTRIBUTION BS 1377 Part 2:1990 Wet Sieve, Clause 9.2	Contract Number	53030
		Borehole/Pit No.	TPC05
Site Name	Tylorstown Phase 4 GI	Sample No.	3
Soil Description	Light brown clayey/silty fine to coarse sandy fine to coarse GRAVEL	Depth Top	1.70
		Depth Base	
Date Tested	26/03/2021	Sample Type	B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	73		
37.5	71		
28	61		
20	57		
14	54		
10	51		
6.3	46		
5	44		
3.35	41		
2	37		
1.18	32		
0.6	28		
0.425	26		
0.3	23		
0.212	20		
0.15	17		
0.063	13		

Sample Proportions	% dry mass
Cobbles	0
Gravel	63
Sand	24
Silt and Clay	13

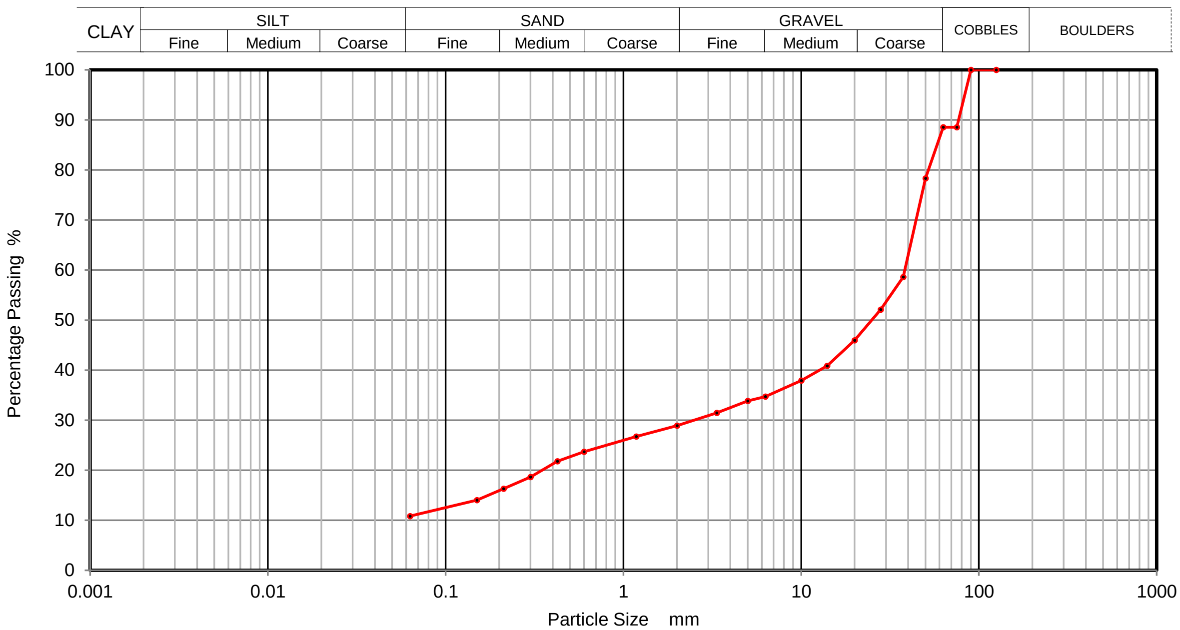
Remarks

Preparation and testing in accordance with BS1377 unless noted below

Operator	Checked	30/03/2021	Richard John	[signature]
David	Approved	31/03/2021	Paul Evans	[signature]

UKAS TESTING 2788

GSTL	PARTICLE SIZE DISTRIBUTION BS 1377 Part 2:1990 Wet Sieve, Clause 9.2	Contract Number	53030
		Borehole/Pit No.	TPC06
Site Name	**Tylorstown Phase 4 GI**	Sample No.	2
Soil Description	Brown clayey/silty fine to coarse sandy fine to coarse GRAVEL (with cobbles)	Depth Top	0.50
		Depth Base	0.60
Date Tested	26/03/2021	Sample Type	B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	89		
63	89		
50	78		
37.5	59		
28	52		
20	46		
14	41		
10	38		
6.3	35		
5	34		
3.35	31		
2	29		
1.18	27		
0.6	24		
0.425	22		
0.3	19		
0.212	16		
0.15	14		
0.063	11		

Sample Proportions	% dry mass
Cobbles	11
Gravel	60
Sand	18
Silt and Clay	11

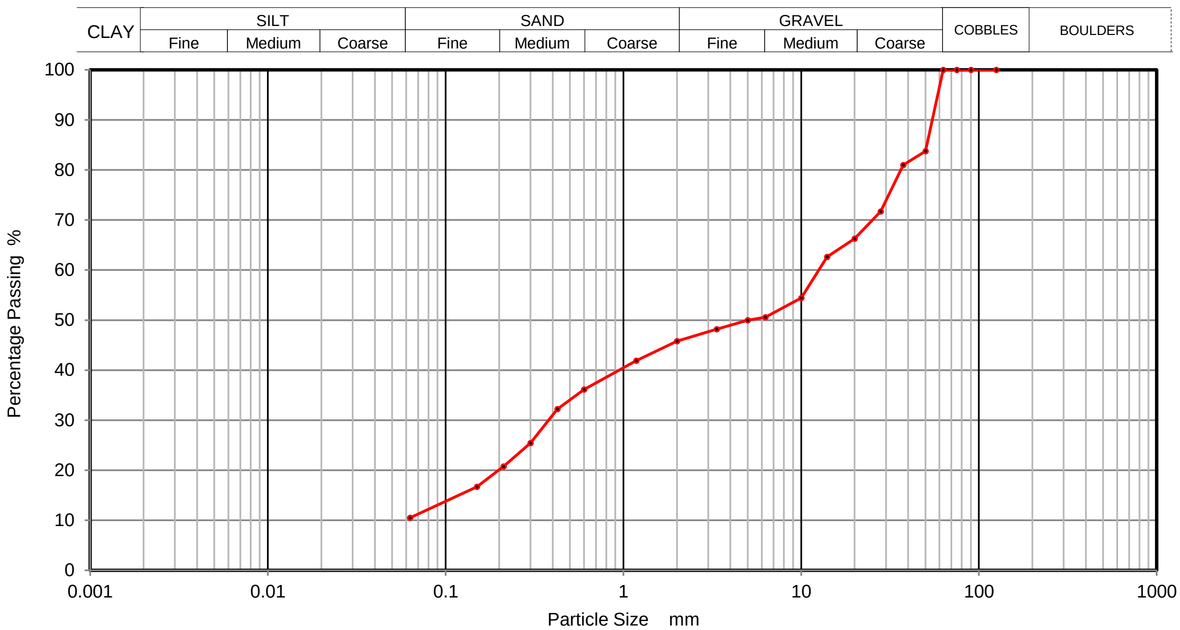
Remarks

Preparation and testing in accordance with BS1377 unless noted below

Operator	Checked	30/03/2021	Richard John	
David	Approved	31/03/2021	Paul Evans	

UKAS TESTING 2788

GSTL	PARTICLE SIZE DISTRIBUTION BS 1377 Part 2:1990 Wet Sieve, Clause 9.2	Contract Number	53030
		Borehole/Pit No.	TPC06
Site Name	Tylorstown Phase 4 GI	Sample No.	1
Soil Description	Dark brown clayey/silty fine to coarse sandy fine to coarse GRAVEL	Depth Top	0.20
		Depth Base	0.50
Date Tested	26/03/2021	Sample Type	B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	84		
37.5	81		
28	72		
20	66		
14	63		
10	54		
6.3	51		
5	50		
3.35	48		
2	46		
1.18	42		
0.6	36		
0.425	32		
0.3	25		
0.212	21		
0.15	17		
0.063	10		

Sample Proportions	% dry mass
Cobbles	0
Gravel	54
Sand	36
Silt and Clay	10

Remarks

Preparation and testing in accordance with BS1377 unless noted below

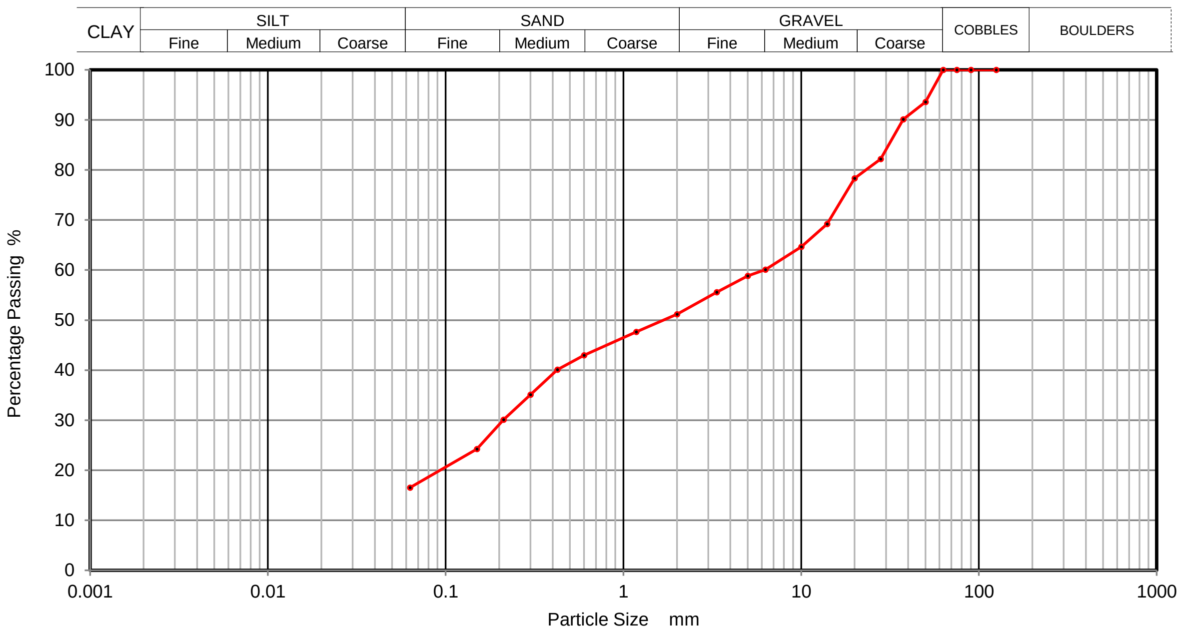
Operator	Checked	30/03/2021	Richard John	[signature]
David	Approved	31/03/2021	Paul Evans	[signature]

UKAS TESTING 2788

GSTL

PARTICLE SIZE DISTRIBUTION
BS 1377 Part 2:1990
Wet Sieve, Clause 9.2

Site Name	**Tylorstown Phase 4 GI**	Contract Number	**53030**
		Borehole/Pit No.	**TPC07**
Soil Description	Brown silty/clayey fine to coarse sandy fine to coarse SAND	Sample No.	**1**
		Depth Top	**0.30**
		Depth Base	**0.80**
Date Tested	26/03/2021	Sample Type	**B**



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	94		
37.5	90		
28	82		
20	78		
14	69		
10	65		
6.3	60		
5	59		
3.35	56		
2	51		
1.18	48		
0.6	43		
0.425	40		
0.3	35		
0.212	30		
0.15	24		
0.063	17		

Sample Proportions	% dry mass
Cobbles	0
Gravel	49
Sand	34
Silt and Clay	17

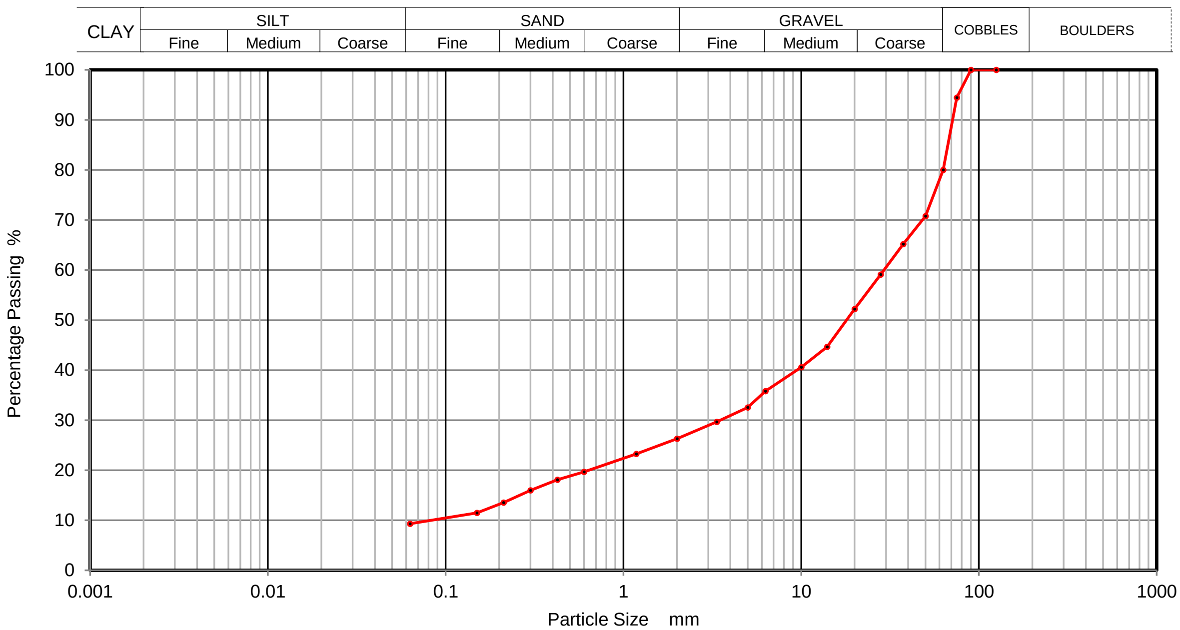
Remarks

Preparation and testing in accordance with BS1377 unless noted below

Operator	Checked	30/03/2021	Richard John	
David	Approved	31/03/2021	Paul Evans	

UKAS TESTING 2788

GSTL	PARTICLE SIZE DISTRIBUTION BS 1377 Part 2:1990 Wet Sieve, Clause 9.2	Contract Number	53030
		Borehole/Pit No.	TPC07
Site Name	Tylorstown Phase 4 GI	Sample No.	2
Soil Description	Light brown slightly silty/clayey fine to coarse sandy fine to coarse GRAVEL (with cobbles)	Depth Top	1.00
		Depth Base	
Date Tested	26/03/2021	Sample Type	B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	94		
63	80		
50	71		
37.5	65		
28	59		
20	52		
14	45		
10	41		
6.3	36		
5	33		
3.35	30		
2	26		
1.18	23		
0.6	20		
0.425	18		
0.3	16		
0.212	14		
0.15	11		
0.063	9		

Sample Proportions	% dry mass
Cobbles	20
Gravel	54
Sand	17
Silt and Clay	9

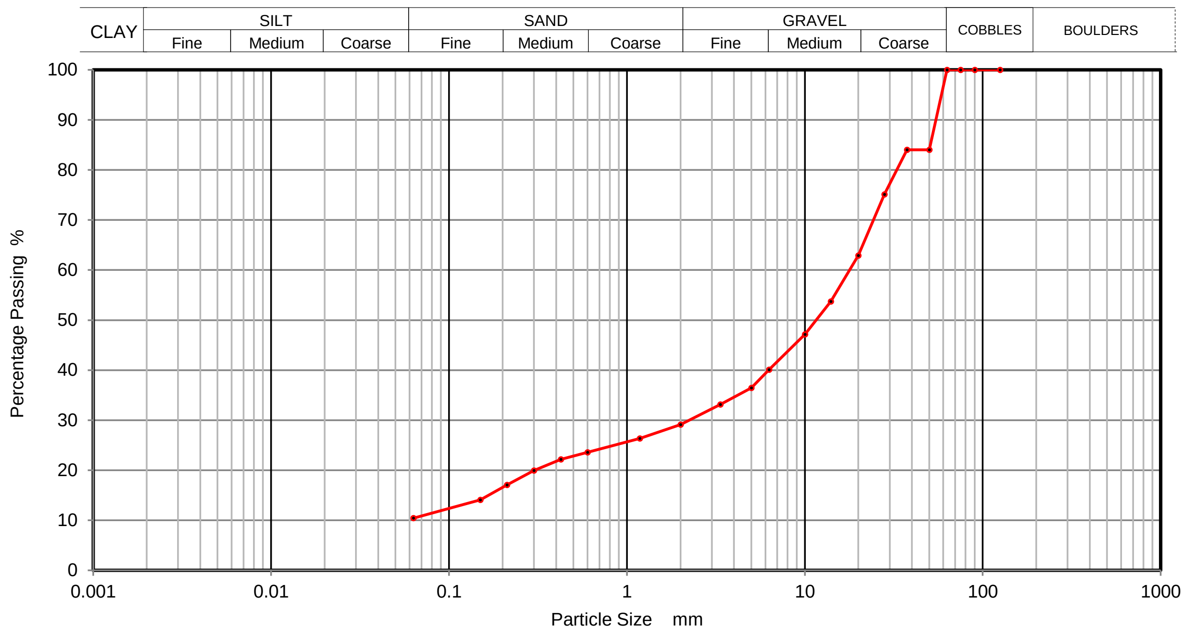
Remarks

Preparation and testing in accordance with BS1377 unless noted below

Operator	Checked	30/03/2021	Richard John	[signature]
David	Approved	31/03/2021	Paul Evans	[signature]

UKAS TESTING 2788

GSTL	PARTICLE SIZE DISTRIBUTION BS 1377 Part 2:1990 Wet Sieve, Clause 9.2	Contract Number	53030
		Borehole/Pit No.	TPC07
Site Name	Tylorstown Phase 4 GI	Sample No.	3
Soil Description	Brown clayey/silty fine to coarse sandy fine to coarse GRAVEL	Depth Top	2.00
		Depth Base	2.70
Date Tested	26/03/2021	Sample Type	B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	84		
37.5	84		
28	75		
20	63		
14	54		
10	47		
6.3	40		
5	36		
3.35	33		
2	29		
1.18	26		
0.6	24		
0.425	22		
0.3	20		
0.212	17		
0.15	14		
0.063	10		

Sample Proportions	% dry mass
Cobbles	0
Gravel	71
Sand	19
Silt and Clay	10

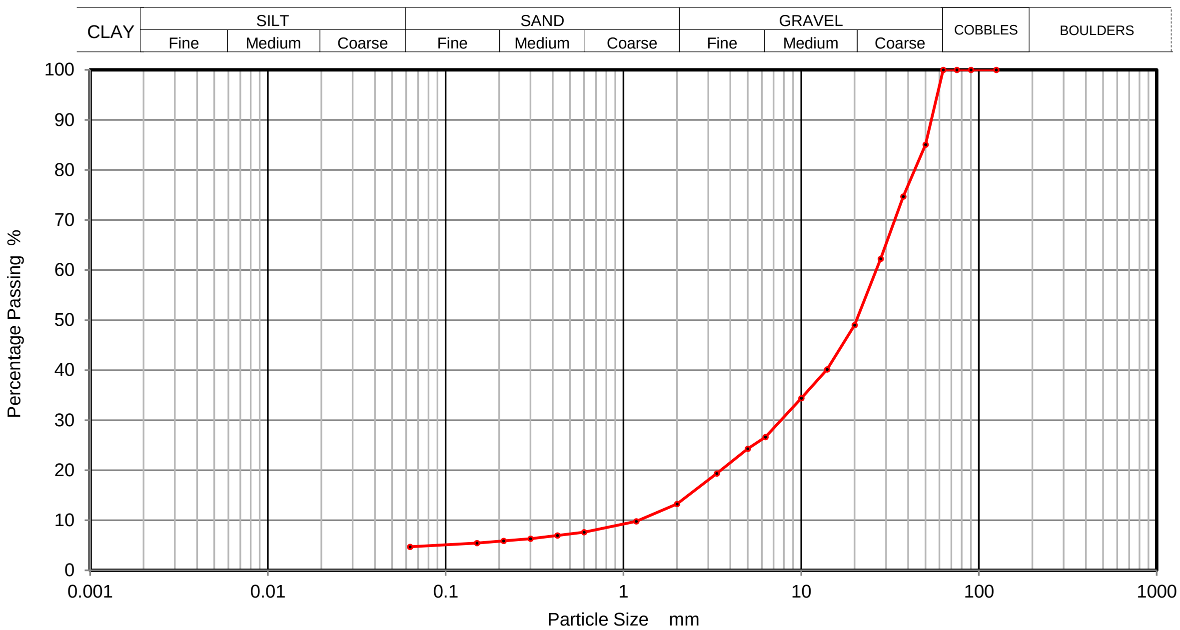
Remarks

Preparation and testing in accordance with BS1377 unless noted below

Operator	Checked	30/03/2021	Richard John	[signature]
David	Approved	31/03/2021	Paul Evans	[signature]

UKAS TESTING 2788

GSTL	PARTICLE SIZE DISTRIBUTION BS 1377 Part 2:1990 Wet Sieve, Clause 9.2	Contract Number	53030
		Borehole/Pit No.	WS01
Site Name	Tylorstown Phase 4 GI	Sample No.	2
Soil Description	Grey slightly clayey/silty slightly fine to coarse sandy fine to coarse GRAVEL	Depth Top	1.00
		Depth Base	2.00
Date Tested	26/03/2021	Sample Type	B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	85		
37.5	75		
28	62		
20	49		
14	40		
10	34		
6.3	27		
5	24		
3.35	19		
2	13		
1.18	10		
0.6	8		
0.425	7		
0.3	6		
0.212	6		
0.15	5		
0.063	5		

MC in accordance with BS1377 Part 2 1990 Clause 3.2	
Moisture Content %	5.7

Sample Proportions	% dry mass
Cobbles	0
Gravel	87
Sand	8
Silt and Clay	5

Remarks

Preparation and testing in accordance with BS1377 unless noted below

Operator	Checked	30/03/2021	Richard John	
David	Approved	31/03/2021	Paul Evans	

UKAS TESTING 2788

GSTL	Point Load Test Int. J. Rock Mech. Sci. & Geomech. Abstr. Vol. 22, No. 2, pp. 51 - 60, 1985.	
Contract Number	53030	
Site Name	Tylorstown Phase 4 GI	
Sample Type	Core	
Date Tested	23/03/2021	
	*Please note that GSTL is not accredited for the water content of rock	

Hole Reference	Depth (m)			Test Type		Width	Platen Seperation	Failure Load	Equivalent Diameter	Point Load	Size Factor	Point Load Index	Moisture Content	Description	Angle Between Plane of Anisotropy & Core Axis	Type of Anisotropy (Bedding or Cleavage)
				d / a / b / i	I //											
BH02	6.70	-	6.85	d			73	7.27		1.36	1.19	1.62	1.6	SILTSTONE		
BH02	7.35	-	7.50	d			73	14.20		2.66	1.19	3.16	1.0	SILTSTONE		
BH02	10.55	-	10.95	d			73	14.56		2.73	1.19	3.24	1.4	SILTSTONE		
BH02	15.50	-	15.70	d			73	10.37		1.95	1.19	2.31	1.4	SILTSTONE		
BH02	18.00	-	18.20	d			73	18.91		3.55	1.19	4.21	1.2	SILTSTONE		
BH02	22.35	-	22.50	d			73	17.41		3.27	1.19	3.87	0.9	SILTSTONE		
		-														
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Key	Reported As
Width	(W) mm
Platen Separation	(D) mm
Failure Load	(P) kN
Equivalent Diameter	(De) mm
Point Load	(Is) MPa
Size Factor	(F)
Point Load Index	(Is(50)) MPa
Moisture Content	%
Description	SC

Operators	Checked	30/03/2021	Emma Sharp	
JJ	Approved	31/03/2021	Paul Evans	

UKAS TESTING 2788

Certificate of Analysis

Certificate Number	21-05945	*Issued:*	25-Mar-21
Client	GEO Site and Testing Services Ltd Unit 4 Heol Aur Dafen Ind Est Dafen Carmarthenshire SA14 8QN		
Our Reference	21-05945		
Client Reference	(not supplied)		
Order No	(not supplied)		
Contract Title	Tylorstown Phase 4 GI		
Description	14 Soil samples.		
Date Received	19-Mar-21		
Date Started	19-Mar-21		
Date Completed	25-Mar-21		
Test Procedures	Identified by prefix DETSn (details on request).		
Notes	Opinions and interpretations are outside the laboratory's scope of ISO 17025 accreditation. This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced except in full, without the prior written approval of the laboratory.		

Approved By

Adam Fenwick
Contracts Manager

UKAS TESTING
2139

Summary of Chemical Analysis
Soil Samples

Our Ref 21-05945
Client Ref
Contract Title Tylorstown Phase 4 GI

Test	Method	LOD	Units											
			Lab No	1819882	1819883	1819884	1819885	1819886	1819887	1819888	1819889	1819890	1819891	1819892
			.Sample ID	TPC01	TPC01	TPC02	TPC02	TPC05	TPC06	TPC07	BH02	WS01	WS01	WS07
			Depth	0.00-0.60	0.60	0.00-0.60	1.10-1.20	0.30-0.90	0.20-0.50	0.30-0.80	0.50	1.00-2.00	2.00	1.00-1.40
			Other ID											
			Sample Type	B	D	B	B	B	B	B	B	B	SPT	B
			Sampling Date	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s
			Sampling Time	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s	n/s
Inorganics														
Loss on Ignition at 440oC	DETSC 2003#	0.01	%	16		13						2.9		
pH	DETSC 2008#		pH	7.0		6.5						6.0		5.2
Organic matter	DETSC 2002#	0.1	%		18		6.3	2.8	5.3	5.3	10	0.5	0.5	
Sulphate Aqueous Extract as SO4	DETSC 2076#	10	mg/l									34		17
Sulphur as S, Total	DETSC 2320	0.01	%	0.11		0.08						0.14		0.02
Sulphate as SO4, Total	DETSC 2321#	0.01	%	0.10		0.07						0.34		0.04

Key: # -MCERTS (accreditation only applies if report carries the MCERTS logo). n/s -not supplied.

Summary of Chemical Analysis
Soil Samples

Our Ref 21-05945
Client Ref
Contract Title Tylorstown Phase 4 GI

			Lab No	1819893	1819894	1819895
			.Sample ID	BHC01	BHC01	BHC04
			Depth	0.50	1.20	0.50
			Other ID			
			Sample Type	B	B	B
			Sampling Date	n/s	n/s	n/s
			Sampling Time	n/s	n/s	n/s
Test	**Method**	**LOD**	**Units**			
Inorganics						
Loss on Ignition at 440oC	DETSC 2003#	0.01	%			
pH	DETSC 2008#		pH	6.1	6.4	5.2
Organic matter	DETSC 2002#	0.1	%			
Sulphate Aqueous Extract as SO4	DETSC 2076#	10	mg/l	29	28	26
Sulphur as S, Total	DETSC 2320	0.01	%	0.08		
Sulphate as SO4, Total	DETSC 2321#	0.01	%	0.15	0.17	0.10

Key: # -MCERTS (accreditation only applies if report carries the MCERTS logo). n/s -not supplied.

Information in Support of the Analytical Results

Our Ref 21-05945
Client Ref
Contract Tylorstown Phase 4 GI

Containers Received & Deviating Samples

Lab No	Sample ID	Date Sampled	Containers Received	Holding time exceeded for tests	Inappropriate container for tests
1819882	TPC01 0.00-0.60 SOIL		PT 1L	Sample date not supplied, Total Sulphur ICP (7 days), Total Sulphate ICP (30 days), Metals ICP Prep (182 days), Loss on Ignition (730 days), pH + Conductivity (7 days)	
1819883	TPC01 0.60 SOIL		PT 1L	Sample date not supplied, Organic Matter (Manual) (28 days)	
1819884	TPC02 0.00-0.60 SOIL		PT 1L	Sample date not supplied, Total Sulphur ICP (7 days), Total Sulphate ICP (30 days), Metals ICP Prep (182 days), Loss on Ignition (730 days), pH + Conductivity (7 days)	
1819885	TPC02 1.10-1.20 SOIL		PT 1L	Sample date not supplied, Organic Matter (Manual) (28 days)	
1819886	TPC05 0.30-0.90 SOIL		PT 1L	Sample date not supplied, Organic Matter (Manual) (28 days)	
1819887	TPC06 0.20-0.50 SOIL		PT 1L	Sample date not supplied, Organic Matter (Manual) (28 days)	
1819888	TPC07 0.30-0.80 SOIL		PT 1L	Sample date not supplied, Organic Matter (Manual) (28 days)	
1819889	BH02 0.50 SOIL		PT 1L	Sample date not supplied, Organic Matter (Manual) (28 days)	
1819890	WS01 1.00-2.00 SOIL		PT 1L	Sample date not supplied, Anions 2:1 (30 days), Total Sulphur ICP (7 days), Total Sulphate ICP (30 days), Metals ICP Prep (182 days), Loss on Ignition (730 days), Organic Matter (Manual) (28 days), pH + Conductivity (7 days)	
1819891	WS01 2.00 SOIL		PT 1L	Sample date not supplied, Organic Matter (Manual) (28 days)	
1819892	WS07 1.00-1.40 SOIL		PT 1L	Sample date not supplied, Anions 2:1 (30 days), Total Sulphur ICP (7 days), Total Sulphate ICP (30 days), Metals ICP Prep (182 days), pH + Conductivity (7 days)	
1819893	BHC01 0.50 SOIL		PT 1L	Sample date not supplied, Anions 2:1 (30 days), Total Sulphur ICP (7 days), Total Sulphate ICP (30 days), Metals ICP Prep (182 days), pH + Conductivity (7 days)	
1819894	BHC01 1.20 SOIL		PT 1L	Sample date not supplied, Anions 2:1 (30 days), Total Sulphate ICP (30 days), pH + Conductivity (7 days)	
1819895	BHC04 0.50 SOIL		PT 1L	Sample date not supplied, Anions 2:1 (30 days), Total Sulphate ICP (30 days), pH + Conductivity (7 days)	

Information in Support of the Analytical Results

Our Ref 21-05945
Client Ref
Contract Tylorstown Phase 4 GI

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

Soil Analysis Notes

Inorganic soil analysis was carried out on a dried sample, crushed to pass a 425µm sieve, in accordance with BS1377.
Organic soil analysis was carried out on an 'as received' sample. Organics results are corrected for moisture and expressed on a dry weight basis.
The Loss on Drying, used to express organics analysis on an air dried basis, is carried out at a temperature of 28°C +/-2°C.

Disposal

From the issue date of this test certificate, samples will be held for the following times prior to disposal :-
Soils - 1 month, Liquids - 2 weeks, Asbestos (test portion) - 6 months

End of Report

Laboratory Report

UKAS TESTING 2788

GSTL
GEO Site & Testing Services Ltd

Contract Number: 53135

Client Ref: **Q0463**
Report Date: **31-03-2021**
Client PO:

Client **Quantum Geotechnic Ltd**
Ty Berwig
Bynea
Llanelli.
Carmarthenshire.
SA14 9ST

Contract Title: **Tylorstown Phase 4 GI**
For the attention of: **Steffan Picton**

Date Received: **18-03-2021**
Date Completed: **31-03-2021**

Test Description	Qty
Moisture Content BS 1377:1990 - Part 2 : 3.2 - * UKAS	2
4 Point Liquid & Plastic Limit BS 1377:1990 - Part 2 : 4.3 & 5.3 - * UKAS	2
PSD Wet Sieve method BS 1377:1990 - Part 2 : 9.2 - * UKAS	6
Bulk Density - Linear Measurement Method BS EN ISO 17892-2:2014 - * UKAS	6
Loss on Ignition Sub-contracted Test - @ Non Accredited Test	4
Disposal of samples for job	1

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

Approved Signatories:
Emma Sharp (Office Manager) - Paul Evans (Quality/Technical Manager) - Richard John (Advanced Testing Manager)
Shaun Jones (Laboratory manager) - Wayne Honey (Administrative/Quality Assistant)

GSTL	NATURAL MOISTURE, LIQUID LIMIT, PLASTIC LIMIT AND PLASTICITY INDEX (BS 1377 : Part 2 : 1990 Method 5)	
Contract Number	53135	
Project Location	Tylorstown Phase 4 GI	
Date Tested	29/03/2021	

Sample/Hole Reference	Sample Number	Sample Type	Depth (m)			Moisture Content %	Liquid Limit %	Plastic Limit %	Plasticity index %	Passing 0.425mm %	Remarks
CBR2	1	B	0.30	-		11	24	14	10	14	CL Low Plasticity
CBR4	1	B	0.30	-		17	26	18	8	16	CL Low Plasticity
				-							
				-							
				-							
				-							
				-							
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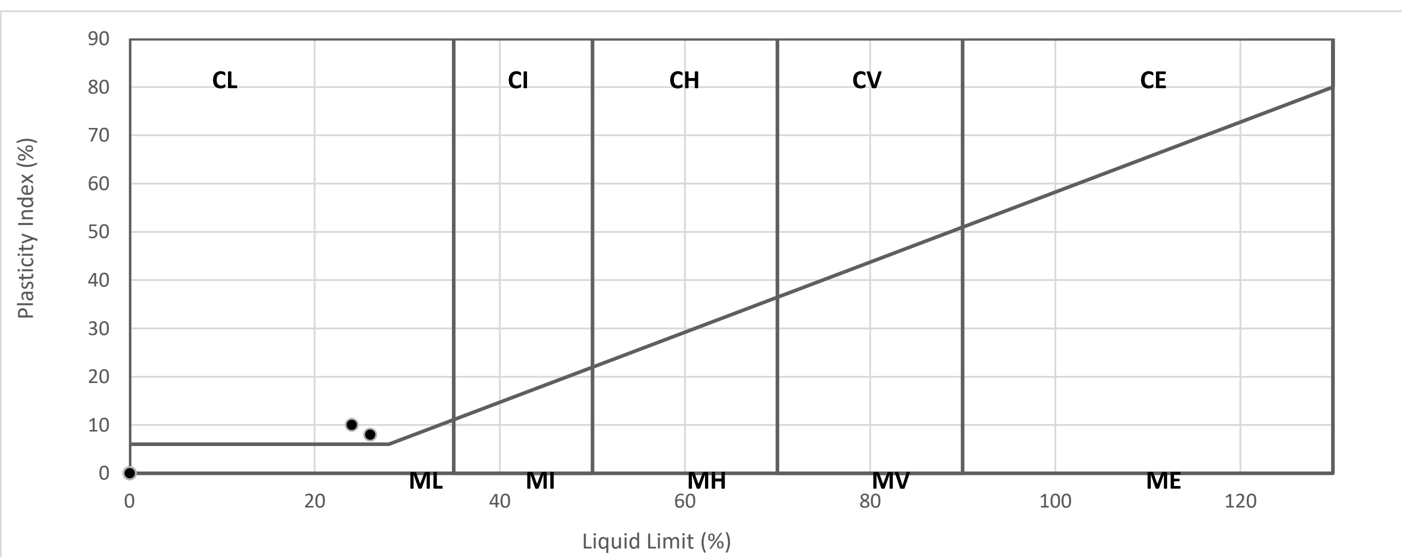
				-							
				-							

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

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

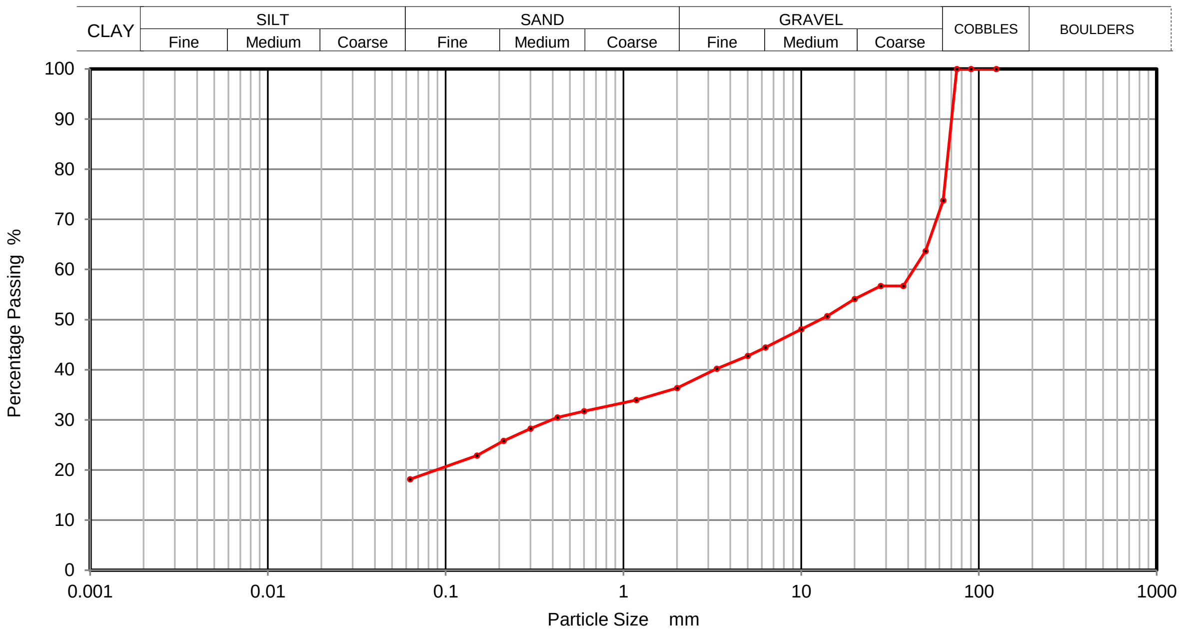


Operators	Checked	31/03/2021	Richard John (Advanced Testing Manager)
Clayton Jenkins	Approved	31/03/2021	Paul Evans (Quality/Technical Manager)

UKAS TESTING 2788

PARTICLE SIZE DISTRIBUTION
BS 1377 Part 2:1990
Wet Sieve, Clause 9.2

GSTL	PARTICLE SIZE DISTRIBUTION BS 1377 Part 2:1990 Wet Sieve, Clause 9.2	Contract Number	**53135**
		Borehole/Pit No.	**CBR1**
Site Name	**Tylorstown Phase 4 GI**	Sample No.	**1**
Soil Description	Brown silty/ clayey fine to coarse sandy fine to coarse GRAVEL with cobbles	Depth Top	**0.30**
		Depth Base	
Date Tested	29/03/2021	Sample Type	**B**



Sieving		**Sedimentation**	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	74		
50	64		
37.5	57		
28	57		
20	54		
14	51		
10	48		
6.3	44		
5	43		
3.35	40		
2	36		
1.18	34		
0.6	32		
0.425	30		
0.3	28		
0.212	26		
0.15	23		
0.063	18		

Sample Proportions	% dry mass
Cobbles	26
Gravel	38
Sand	18
Silt and Clay	18

Remarks

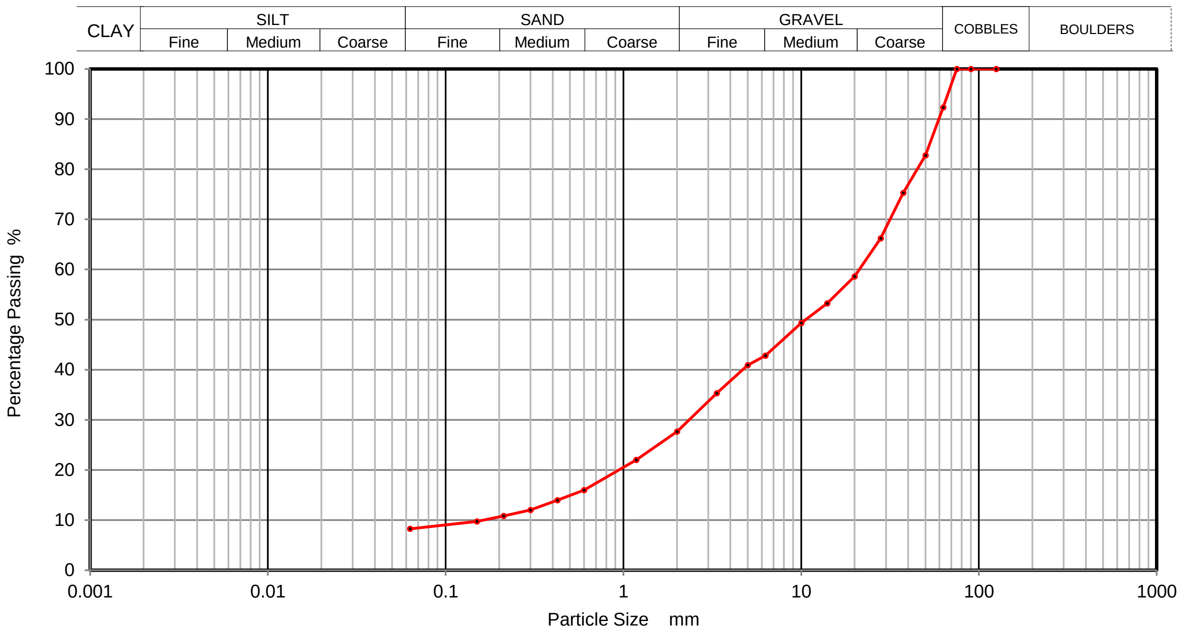
Preparation and testing in accordance with BS1377 unless noted below

Operator	Checked	30/03/2021	Richard John	[signature]
David	Approved	31/03/2021	Paul Evans	[signature]

UKAS TESTING 2788

PARTICLE SIZE DISTRIBUTION
BS 1377 Part 2:1990
Wet Sieve, Clause 9.2

Site Name	**Tylorstown Phase 4 GI**	Contract Number	**53135**
		Borehole/Pit No.	**CBR2**
		Sample No.	**1**
Soil Description	Brown slightly silty/ clayey fine to coarse sandy fine to coarse GRAVEL with cobbles	Depth Top	**0.30**
		Depth Base	
Date Tested	29/03/2021	Sample Type	**B**



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	92		
50	83		
37.5	75		
28	66		
20	59		
14	53		
10	49		
6.3	43		
5	41		
3.35	35		
2	28		
1.18	22		
0.6	16		
0.425	14		
0.3	12		
0.212	11		
0.15	10		
0.063	8		

Sample Proportions	% dry mass
Cobbles	8
Gravel	64
Sand	20
Silt and Clay	8

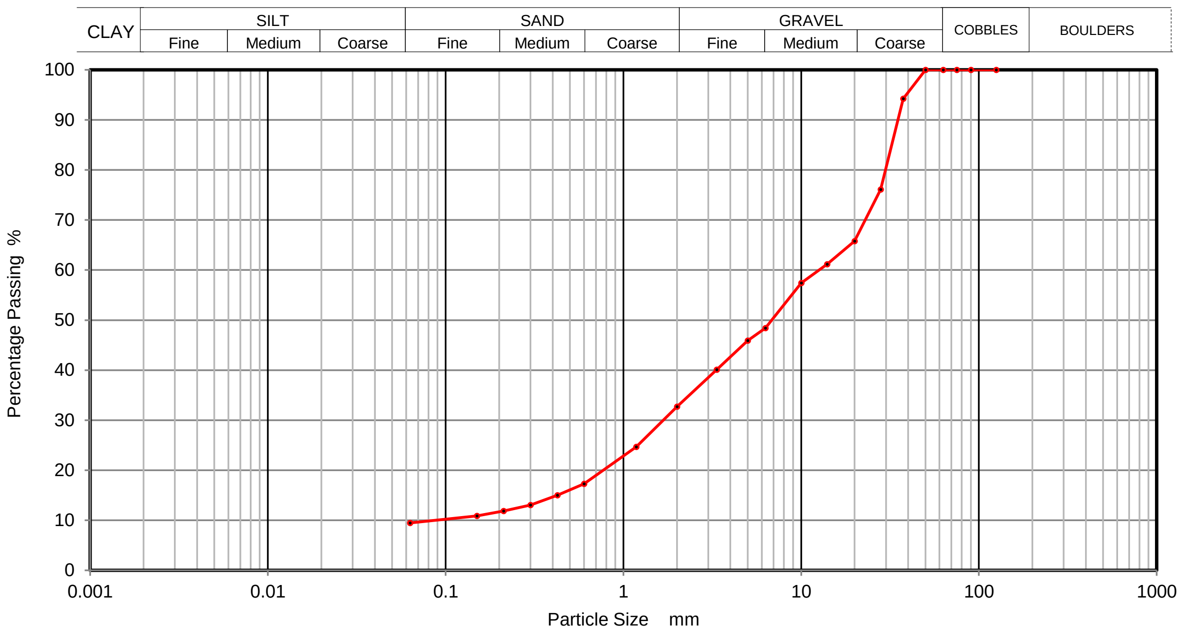
Remarks

Preparation and testing in accordance with BS1377 unless noted below

Operator	Checked	30/03/2021	Richard John	[signature]
David	Approved	31/03/2021	Paul Evans	[signature]

UKAS TESTING 2788

GSTL	PARTICLE SIZE DISTRIBUTION BS 1377 Part 2:1990 Wet Sieve, Clause 9.2	Contract Number	53135
		Borehole/Pit No.	CBR3
Site Name	**Tylorstown Phase 4 GI**	Sample No.	1
Soil Description	Brown slightly silty/ clayey fine to coarse sandy fine to coarse GRAVEL	Depth Top	0.30
		Depth Base	
Date Tested	29/03/2021	Sample Type	B



Sieving		**Sedimentation**	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	94		
28	76		
20	66		
14	61		
10	57		
6.3	48		
5	46		
3.35	40		
2	33		
1.18	25		
0.6	17		
0.425	15		
0.3	13		
0.212	12		
0.15	11		
0.063	9		

Sample Proportions	% dry mass
Cobbles	0
Gravel	67
Sand	24
Silt and Clay	9

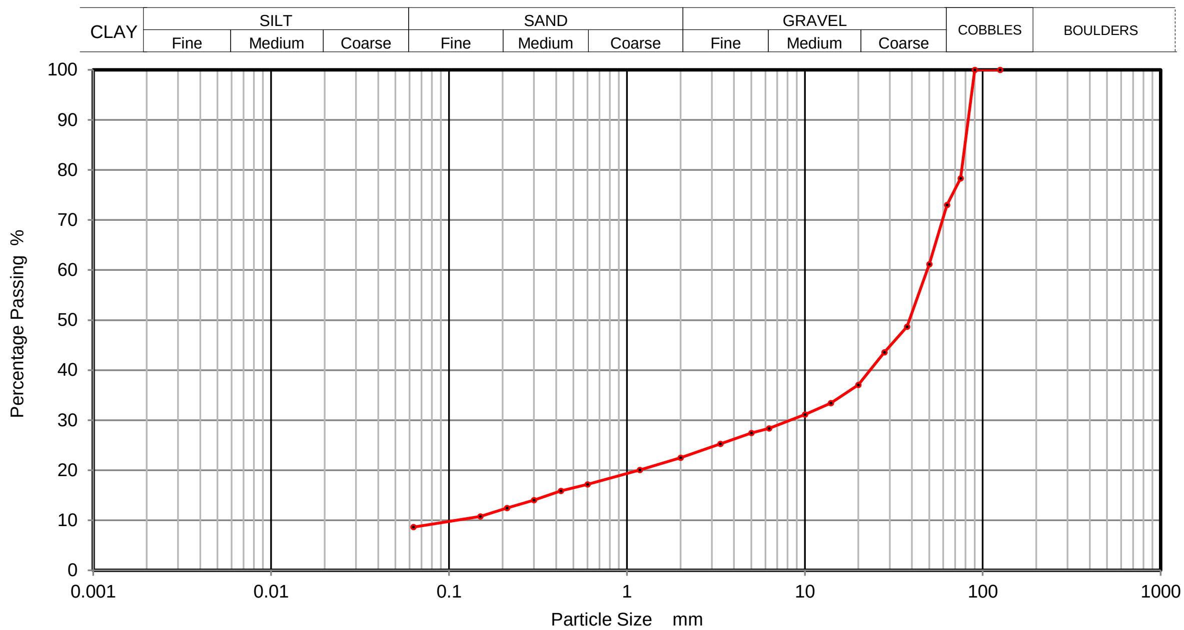
Remarks

Preparation and testing in accordance with BS1377 unless noted below

Operator	Checked	30/03/2021	Richard John	
David	Approved	31/03/2021	Paul Evans	

UKAS TESTING 2788

GSTL	PARTICLE SIZE DISTRIBUTION BS 1377 Part 2:1990 Wet Sieve, Clause 9.2	Contract Number	53135
		Borehole/Pit No.	CBR4
Site Name	**Tylorstown Phase 4 GI**	Sample No.	1
Soil Description	Brown slightly silty/ clayey fine to coarse sandy fine to coarse GRAVEL with cobbles	Depth Top	0.30
		Depth Base	
Date Tested	29/03/2021	Sample Type	B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	78		
63	73		
50	61		
37.5	49		
28	44		
20	37		
14	33		
10	31		
6.3	28		
5	27		
3.35	25		
2	22		
1.18	20		
0.6	17		
0.425	16		
0.3	14		
0.212	12		
0.15	11		
0.063	9		

Sample Proportions	% dry mass
Cobbles	27
Gravel	51
Sand	13
Silt and Clay	9

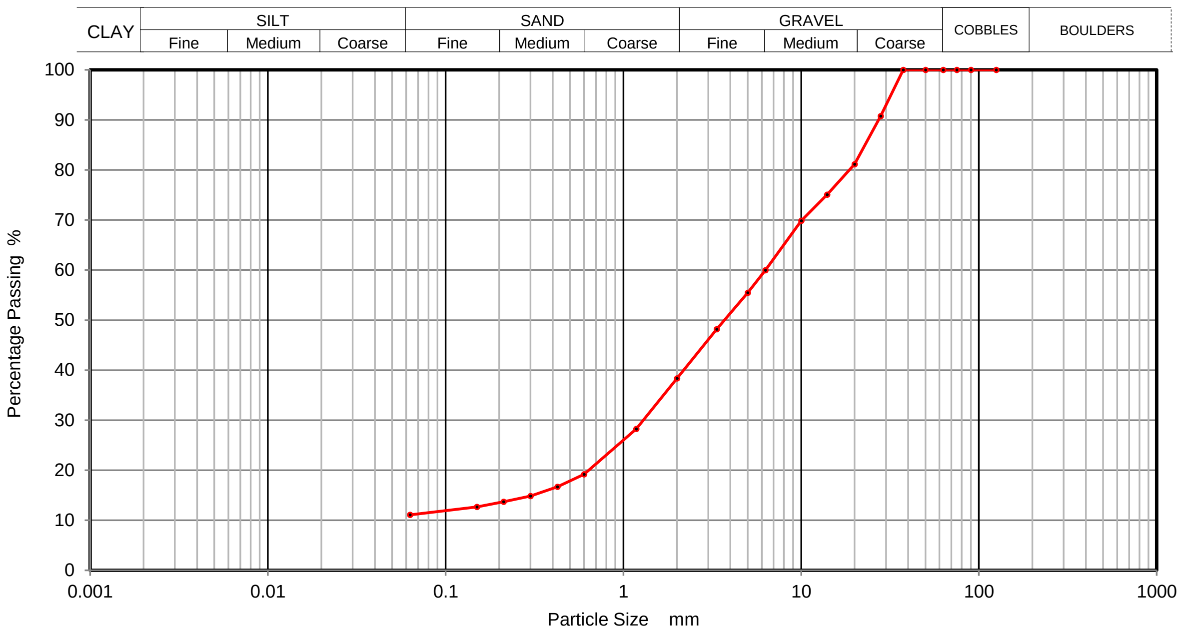
Remarks

Preparation and testing in accordance with BS1377 unless noted below

Operator	Checked	30/03/2021	Richard John	
David	Approved	31/03/2021	Paul Evans	

UKAS TESTING 2788

GSTL	PARTICLE SIZE DISTRIBUTION BS 1377 Part 2:1990 Wet Sieve, Clause 9.2	Contract Number	53135
		Borehole/Pit No.	CBR5
Site Name	Tylorstown Phase 4 GI	Sample No.	1
Soil Description	Brown silty/ clayey fine to coarse sandy fine to coarse GRAVEL	Depth Top	0.30
		Depth Base	
Date Tested	29/03/2021	Sample Type	B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	91		
20	81		
14	75		
10	70		
6.3	60		
5	55		
3.35	48		
2	38		
1.18	28		
0.6	19		
0.425	17		
0.3	15		
0.212	14		
0.15	13		
0.063	11		

Sample Proportions	% dry mass
Cobbles	0
Gravel	62
Sand	27
Silt and Clay	11

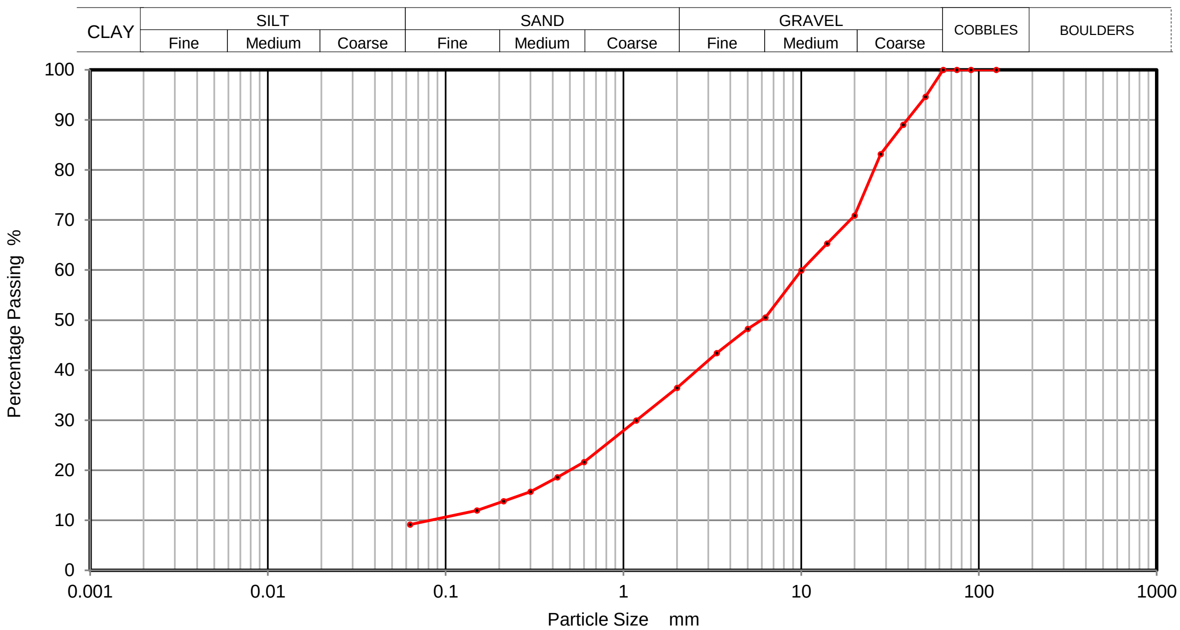
Remarks

Preparation and testing in accordance with BS1377 unless noted below

Operator	Checked	30/03/2021	Richard John	
David	Approved	31/03/2021	Paul Evans	

UKAS TESTING 2788

GSTL	PARTICLE SIZE DISTRIBUTION BS 1377 Part 2:1990 Wet Sieve, Clause 9.2	Contract Number	53135
		Borehole/Pit No.	CBR6
Site Name	Tylorstown Phase 4 GI	Sample No.	1
Soil Description	Brown slightly silty/ clayey fine to coarse sandy fine to coarse GRAVEL	Depth Top	0.30
		Depth Base	
Date Tested	29/03/2021	Sample Type	B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	95		
37.5	89		
28	83		
20	71		
14	65		
10	60		
6.3	51		
5	48		
3.35	43		
2	36		
1.18	30		
0.6	22		
0.425	19		
0.3	16		
0.212	14		
0.15	12		
0.063	9		

Sample Proportions	% dry mass
Cobbles	0
Gravel	64
Sand	27
Silt and Clay	9

Remarks

Preparation and testing in accordance with BS1377 unless noted below

Operator	Checked	30/03/2021	Richard John	
David	Approved	31/03/2021	Paul Evans	

UKAS TESTING 2788

GSTL	SUMMARY OF SOIL DENSITY TESTS (BS EN ISO 17892-2:2014)	
Contract Number	**53135**	
Site Name	**Tylorstown Phase 4 GI**	
Date Tested	**24/03/2021**	

Hole Reference	Sample Number	Sample Type	Depth (m)			Moisture Content	Bulk Density	Dry Density	Compaction Method /Natural Condition		Estimated Air Voids	Remarks
CBR1		B	0.30	-		24	1.91	1.54	2.5kg Rammer			
CBR2		B	0.30	-		12	2.01	1.80	2.5kg Rammer			
CBR3		B	0.30	-		9.0	2.12	1.95	2.5kg Rammer			
CBR4		B	0.30	-		13	2.23	1.97	2.5kg Rammer			
CBR5		B	0.30	-		9.4	2.09	1.91	2.5kg Rammer			
CBR6		B	0.30	-		8.9	2.02	1.85	2.5kg Rammer			
				-								
				-								
				-								
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Key	Reported As
Moisture Content	%
Bulk Density	Mg/m^3
Dry Density	Mg/m^3
Particle Density	Mg/m^3
Air Voids	%

Operators	Checked	30/03/2021	Wayne Honey	W. Honey
CA/JS	Approved	31/03/2021	Paul Evans	P Evans

UKAS TESTING 2788

Certificate of Analysis

Certificate Number	21-05937	*Issued:* 24-Mar-21
Client	GEO Site and Testing Services Ltd Unit 4 Heol Aur Dafen Ind Est Dafen Carmarthenshire SA14 8QN	
Our Reference	21-05937	
Client Reference	(not supplied)	
Order No	(not supplied)	
Contract Title	Tylorstown Phase 4 GI	
Description	4 Soil samples.	
Date Received	19-Mar-21	
Date Started	19-Mar-21	
Date Completed	24-Mar-21	
Test Procedures	Identified by prefix DETSn (details on request).	
Notes	Opinions and interpretations are outside the laboratory's scope of ISO 17025 accreditation. This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced except in full, without the prior written approval of the laboratory.	

Approved By

Adam Fenwick
Contracts Manager

UKAS TESTING 2139

Summary of Chemical Analysis
Soil Samples

Our Ref 21-05937
Client Ref
Contract Title Tylorstown Phase 4 GI

			Lab No	1819842	1819843	1819844	1819845
			.Sample ID	CBR 1	CBR 3	CBR 5	CBR 6
			Depth	0.30	0.30	0.30	0.30
			Other ID				
			Sample Type	B	B	B	B
			Sampling Date	n/s	n/s	n/s	n/s
			Sampling Time	n/s	n/s	n/s	n/s
Test	**Method**	**LOD**	**Units**				
Inorganics							
Loss on Ignition at 440oC	DETSC 2003#	0.01	%	6.5	17	18	17

Key: # -MCERTS (accreditation only applies if report carries the MCERTS logo). n/s -not supplied.

Information in Support of the Analytical Results

Our Ref 21-05937
Client Ref
Contract Tylorstown Phase 4 GI

Containers Received & Deviating Samples

Lab No	Sample ID	Date Sampled	Containers Received	Holding time exceeded for tests	Inappropriate container for tests
1819842	CBR 1 0.30 SOIL		PT 1L	Sample date not supplied, Loss on Ignition (730 days)	
1819843	CBR 3 0.30 SOIL		PT 1L	Sample date not supplied, Loss on Ignition (730 days)	
1819844	CBR 5 0.30 SOIL		PT 1L	Sample date not supplied, Loss on Ignition (730 days)	
1819845	CBR 6 0.30 SOIL		PT 1L	Sample date not supplied, Loss on Ignition (730 days)	

Key: P-Plastic T-Tub

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

Soil Analysis Notes

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

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

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

Disposal

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

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

End of Report

APPENDIX VIII – GEO-ENVIRONMENTAL LABORATORY TEST CERTIFICATES

Eurofins Chemtest Ltd
Depot Road
Newmarket
CB8 0AL
Tel: 01638 606070
Email: info@chemtest.com

Final Report

Report No.:	21-07126-1		
Initial Date of Issue:	22-Mar-2021		
Client	Quantum Geotechnic Ltd		
Client Address:	Plas Newydd Llanedi Pontarddulais Swansea SA4 0FQ		
Contact(s):	Steffan Picton		
Project	QO463 Tylorstown Phase 4 GI		
Quotation No.:	Q21-22667	**Date Received:**	08-Mar-2021
Order No.:		**Date Instructed:**	16-Mar-2021
No. of Samples:	7		
Turnaround (Wkdays):	5	**Results Due:**	22-Mar-2021
Date Approved:	22-Mar-2021		
Approved By:			
Details:	Glynn Harvey, Technical Manager		

Results - Leachate

Project: QO463 Tylorstown Phase 4 GI

Client: Quantum Geotechnic Ltd					**Chemtest Job No.:**	21-07126	21-07126	21-07126
Quotation No.: Q21-22667					**Chemtest Sample ID.:**	1155050	1155052	1155055
Order No.:					Client Sample Ref.:	2	1	1
					Client Sample ID.:	ES2	ES1	ES1
					Sample Location:	TP1	TP2	TP3
					Sample Type:	SOIL	SOIL	SOIL
					Top Depth (m):	0.5	0.2	0.2
					Date Sampled:	04-Mar-2021	04-Mar-2021	04-Mar-2021
Determinand	**Accred.**	**SOP**	**Type**	**Units**	**LOD**			
pH	U	1010	10:1		N/A	8.2	8.0	8.2
Sulphate	U	1220	10:1	mg/l	1.0	2.4	2.6	< 1.0
Cyanide (Total)	U	1300	10:1	mg/l	0.050	< 0.050	< 0.050	< 0.050
Calcium	U	1455	10:1	mg/l	2.00	< 2.0	< 2.0	< 2.0
Hardness	N	1415	10:1	mg/l	1.0	4.7	2.0	< 1.0
Aluminium (Dissolved)	N	1455	10:1	µg/l	5.0	87	78	190
Arsenic (Dissolved)	U	1455	10:1	µg/l	0.20	0.48	0.44	0.48
Boron (Dissolved)	U	1455	10:1	µg/l	10.0	< 10	13	< 10
Cadmium (Dissolved)	U	1455	10:1	µg/l	0.12	< 0.12	< 0.12	< 0.12
Copper (Dissolved)	U	1455	10:1	µg/l	0.50	2.1	0.96	0.56
Mercury (Dissolved)	U	1455	10:1	µg/l	0.05	< 0.05	< 0.05	< 0.05
Manganese (Dissolved)	U	1455	10:1	µg/l	0.50	12	21	19
Nickel (Dissolved)	U	1455	10:1	µg/l	0.50	1.8	0.93	< 0.50
Lead (Dissolved)	U	1455	10:1	µg/l	0.50	1.2	0.74	0.67
Antimony (Dissolved)	U	1455	10:1	µg/l	0.50	< 0.50	< 0.50	< 0.50
Selenium (Dissolved)	U	1455	10:1	µg/l	0.50	< 0.50	< 0.50	< 0.50
Zinc (Dissolved)	U	1455	10:1	µg/l	3.0	6.7	< 3.0	38
Chromium (Total)	U	1455	10:1	µg/l	0.50	< 0.50	< 0.50	< 0.50
Iron (Dissolved)	N	1455	10:1	µg/l	5.0	550	240	750
Dissolved Organic Carbon Low Level	N	1610	10:1	mg/l	N/A	6.5	5.4	6.1
Aliphatic TPH >C5-C6	N	1675	10:1	µg/l	0.010	< 0.010	< 0.010	< 0.010
Aliphatic TPH >C6-C8	N	1675	10:1	µg/l	0.010	< 0.010	< 0.010	< 0.010
Aliphatic TPH >C8-C10	N	1675	10:1	µg/l	0.10	< 0.10	< 0.10	< 0.10
Aliphatic TPH >C10-C12	N	1675	10:1	µg/l	0.10	< 0.10	< 0.10	< 0.10
Aliphatic TPH >C12-C16	N	1675	10:1	µg/l	0.10	< 0.10	< 0.10	< 0.10
Aliphatic TPH >C16-C21	N	1675	10:1	µg/l	0.10	< 0.10	< 0.10	< 0.10
Aliphatic TPH >C21-C35	N	1675	10:1	µg/l	0.10	< 0.10	< 0.10	< 0.10
Aliphatic TPH >C35-C44	N	1675	10:1	µg/l	0.10	< 0.10	< 0.10	< 0.10
Total Aliphatic Hydrocarbons	N	1675	10:1	µg/l	1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C5-C7	N	1675	10:1	µg/l	0.010	< 0.010	< 0.010	< 0.010
Aromatic TPH >C7-C8	N	1675	10:1	µg/l	0.010	< 0.010	< 0.010	< 0.010
Aromatic TPH >C8-C10	N	1675	10:1	µg/l	0.10	< 0.10	< 0.10	< 0.10
Aromatic TPH >C10-C12	N	1675	10:1	µg/l	0.10	< 0.10	< 0.10	< 0.10
Aromatic TPH >C12-C16	N	1675	10:1	µg/l	0.10	< 0.10	< 0.10	< 0.10
Aromatic TPH >C16-C21	N	1675	10:1	µg/l	0.10	< 0.10	< 0.10	< 0.10
Aromatic TPH >C21-C35	N	1675	10:1	µg/l	0.10	< 0.10	< 0.10	< 0.10
Aromatic TPH >C35-C44	N	1675	10:1	µg/l	0.10	< 0.10	< 0.10	< 0.10
Total Aromatic Hydrocarbons	N	1675	10:1	µg/l	1.0	< 1.0	< 1.0	< 1.0

Results - Leachate

Project: QO463 Tylorstown Phase 4 GI

Client: Quantum Geotechnic Ltd					**Chemtest Job No.:**	21-07126	21-07126	21-07126
Quotation No.: Q21-22667					**Chemtest Sample ID.:**	1155050	1155052	1155055
Order No.:					Client Sample Ref.:	2	1	1
					Client Sample ID.:	ES2	ES1	ES1
					Sample Location:	TP1	TP2	TP3
					Sample Type:	SOIL	SOIL	SOIL
					Top Depth (m):	0.5	0.2	0.2
					Date Sampled:	04-Mar-2021	04-Mar-2021	04-Mar-2021
Determinand	**Accred.**	**SOP**	**Type**	**Units**	**LOD**			
Total Petroleum Hydrocarbons	N	1675	10:1	µg/l	2.0	< 2.0	< 2.0	< 2.0
Naphthalene	U	1700	10:1	µg/l	0.10	< 0.10	< 0.10	< 0.10
Acenaphthylene	U	1700	10:1	µg/l	0.10	< 0.10	< 0.10	< 0.10
Acenaphthene	U	1700	10:1	µg/l	0.10	< 0.10	< 0.10	< 0.10
Fluorene	U	1700	10:1	µg/l	0.10	< 0.10	< 0.10	< 0.10
Phenanthrene	U	1700	10:1	µg/l	0.10	< 0.10	< 0.10	< 0.10
Anthracene	U	1700	10:1	µg/l	0.10	< 0.10	< 0.10	< 0.10
Fluoranthene	U	1700	10:1	µg/l	0.10	< 0.10	< 0.10	< 0.10
Pyrene	U	1700	10:1	µg/l	0.10	< 0.10	< 0.10	< 0.10
Benzo[a]anthracene	U	1700	10:1	µg/l	0.10	< 0.10	< 0.10	< 0.10
Chrysene	N	1700	10:1	µg/l	0.10	< 0.10	< 0.10	< 0.10
Benzo[b]fluoranthene	U	1700	10:1	µg/l	0.10	< 0.10	< 0.10	< 0.10
Benzo[k]fluoranthene	U	1700	10:1	µg/l	0.10	< 0.10	< 0.10	< 0.10
Benzo[a]pyrene	U	1700	10:1	µg/l	0.10	< 0.10	< 0.10	< 0.10
Indeno(1,2,3-c,d)Pyrene	U	1700	10:1	µg/l	0.10	< 0.10	< 0.10	< 0.10
Dibenz(a,h)Anthracene	U	1700	10:1	µg/l	0.10	< 0.10	< 0.10	< 0.10
Benzo[g,h,i]perylene	U	1700	10:1	µg/l	0.10	< 0.10	< 0.10	< 0.10
Total Of 16 PAH's	N	1700	10:1	µg/l	2.0	< 2.0	< 2.0	< 2.0
Total Phenols	U	1920	10:1	mg/l	0.030	< 0.030	< 0.030	< 0.030

Results - Soil

Project: QO463 Tylorstown Phase 4 GI

Client: Quantum Geotechnic Ltd				**Chemtest Job No.:**	21-07126	21-07126	21-07126	21-07126	21-07126	21-07126	21-07126
Quotation No.: Q21-22667				**Chemtest Sample ID.:**	1155049	1155050	1155052	1155053	1155054	1155055	1155057
Order No.:				Client Sample Ref.:	1	2	1	2	3	1	1
				Client Sample ID.:	ES1	ES2	ES1	ES2	ES3	ES1	ES1
				Sample Location:	TP1	TP1	TP2	TP2	TP2	TP3	TP4
				Sample Type:	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
				Top Depth (m):	0.2	0.5	0.2	0.5	1.0	0.2	0.2
				Date Sampled:	04-Mar-2021	04-Mar-2021	04-Mar-2021	04-Mar-2021	04-Mar-2021	04-Mar-2021	04-Mar-2021
				Asbestos Lab:	COVENTRY	COVENTRY	COVENTRY		COVENTRY	COVENTRY	COVENTRY
Determinand	**Accred.**	**SOP**	**Units**	**LOD**							
ACM Type	U	2192		N/A	-	-	-		-	-	-
Asbestos Identification	U	2192		N/A	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected		No Asbestos Detected	No Asbestos Detected	No Asbestos Detected
ACM Detection Stage	U	2192		N/A	-	-	-		-	-	-
Moisture	N	2030	%	0.020	16	19	18	26	16	16	76
pH	M	2010		4.0	7.8	7.5	7.6	7.3	7.2	5.4	4.8
Boron (Hot Water Soluble)	M	2120	mg/kg	0.40	0.51	< 0.40	0.59		< 0.40	< 0.40	0.71
Sulphate (2:1 Water Soluble) as SO4	M	2120	g/l	0.010	0.049	0.031	< 0.010		< 0.010	< 0.010	0.046
Calorific Value	N	2140	MJ/kg	0.10	2.1			8.1			
Cyanide (Total)	M	2300	mg/kg	0.50	< 0.50	< 0.50	< 0.50		< 0.50	< 0.50	< 0.50
Aluminium (Total)	N	2430	mg/kg	100	8000	6200	5400		8000	12000	2200
Arsenic	M	2450	mg/kg	1.0	11	7.7	9.4		7.8	12	6.9
Cadmium	M	2450	mg/kg	0.10	0.37	0.33	0.27		0.12	0.19	0.45
Chromium	M	2450	mg/kg	1.0	12	10	8.7		13	18	9.9
Manganese	M	2450	mg/kg	5.0	470	320	390		210	310	59
Antimony	N	2450	mg/kg	2.0	2.6	< 2.0	< 2.0		< 2.0	< 2.0	5.5
Copper	M	2450	mg/kg	0.50	39	32	39		15	6.1	170
Mercury	M	2450	mg/kg	0.10	0.21	0.37	0.35		0.14	< 0.10	0.33
Nickel	M	2450	mg/kg	0.50	33	25	29		18	22	13
Lead	M	2450	mg/kg	0.50	40	30	36		18	13	190
Selenium	M	2450	mg/kg	0.20	1.2	1.1	1.7		1.1	1.5	1.8
Zinc	M	2450	mg/kg	0.50	88	57	59		36	42	59
Chromium (Hexavalent)	N	2490	mg/kg	0.50	< 0.50	< 0.50	< 0.50		< 0.50	< 0.50	< 0.50
Organic Matter	M	2625	%	0.40	11	9.3	16		9.1	3.3	45
Aliphatic TPH >C5-C6	N	2680	mg/kg	0.010	< 0.010	< 0.010	< 0.010		< 0.010	< 0.010	< 0.010
Aliphatic TPH >C6-C8	N	2680	mg/kg	0.010	< 0.010	< 0.010	< 0.010		< 0.010	< 0.010	< 0.010
Aliphatic TPH >C8-C10	N	2680	mg/kg	0.10	< 0.10	< 0.10	< 0.10		< 0.10	< 0.10	< 0.10
Aliphatic TPH >C10-C12	N	2680	mg/kg	0.10	0.77	< 0.10	< 0.10		< 0.10	< 0.10	< 0.10
Aliphatic TPH >C12-C16	N	2680	mg/kg	0.10	0.53	< 0.10	< 0.10		< 0.10	< 0.10	< 0.10
Aliphatic TPH >C16-C21	N	2680	mg/kg	0.10	< 0.10	< 0.10	< 0.10		< 0.10	< 0.10	< 0.10
Aliphatic TPH >C21-C35	N	2680	mg/kg	0.10	4.0	< 0.10	< 0.10		< 0.10	< 0.10	< 0.10
Aliphatic TPH >C35-C44	N	2680	mg/kg	0.10	< 0.10	< 0.10	< 0.10		< 0.10	< 0.10	< 0.10
Total Aliphatic Hydrocarbons	N	2680	mg/kg	1.0	5.3	< 1.0	< 1.0		< 1.0	< 1.0	< 1.0
Aromatic TPH >C5-C7	N	2680	mg/kg	0.010	< 0.010	< 0.010	< 0.010		< 0.010	< 0.010	< 0.010
Aromatic TPH >C7-C8	N	2680	mg/kg	0.010	< 0.010	< 0.010	< 0.010		< 0.010	< 0.010	< 0.010
Aromatic TPH >C8-C10	N	2680	mg/kg	0.10	3.6	< 0.10	< 0.10		< 0.10	< 0.10	< 0.10
Aromatic TPH >C10-C12	N	2680	mg/kg	0.10	< 0.10	< 0.10	< 0.10		< 0.10	< 0.10	< 0.10

Results - Soil

Project: QO463 Tylorstown Phase 4 GI

Client: Quantum Geotechnic Ltd				**Chemtest Job No.:**	21-07126	21-07126	21-07126	21-07126	21-07126	21-07126	21-07126
Quotation No.: Q21-22667				**Chemtest Sample ID.:**	1155049	1155050	1155052	1155053	1155054	1155055	1155057
Order No.:				Client Sample Ref.:	1	2	1	2	3	1	1
				Client Sample ID.:	ES1	ES2	ES1	ES2	ES3	ES1	ES1
				Sample Location:	TP1	TP1	TP2	TP2	TP2	TP3	TP4
				Sample Type:	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
				Top Depth (m):	0.2	0.5	0.2	0.5	1.0	0.2	0.2
				Date Sampled:	04-Mar-2021	04-Mar-2021	04-Mar-2021	04-Mar-2021	04-Mar-2021	04-Mar-2021	04-Mar-2021
				Asbestos Lab:	COVENTRY	COVENTRY	COVENTRY		COVENTRY	COVENTRY	COVENTRY
Determinand	**Accred.**	**SOP**	**Units**	**LOD**							
Aromatic TPH >C12-C16	N	2680	mg/kg	0.10	< 0.10	< 0.10	< 0.10		< 0.10	< 0.10	< 0.10
Aromatic TPH >C16-C21	N	2680	mg/kg	0.10	1.8	< 0.10	< 0.10		< 0.10	< 0.10	< 0.10
Aromatic TPH >C21-C35	N	2680	mg/kg	0.10	16	< 0.10	< 0.10		< 0.10	< 0.10	< 0.10
Aromatic TPH >C35-C44	N	2680	mg/kg	0.10	< 0.10	< 0.10	< 0.10		< 0.10	< 0.10	< 0.10
Total Aromatic Hydrocarbons	N	2680	mg/kg	1.0	22	< 1.0	< 1.0		< 1.0	< 1.0	< 1.0
Total Petroleum Hydrocarbons	N	2680	mg/kg	2.0	27	< 2.0	< 2.0		< 2.0	< 2.0	< 2.0
Naphthalene	M	2700	mg/kg	0.10	0.88	< 0.10	< 0.10		< 0.10	< 0.10	< 0.10
Acenaphthylene	M	2700	mg/kg	0.10	0.33	< 0.10	< 0.10		< 0.10	< 0.10	< 0.10
Acenaphthene	M	2700	mg/kg	0.10	0.47	< 0.10	< 0.10		< 0.10	< 0.10	< 0.10
Fluorene	M	2700	mg/kg	0.10	0.55	< 0.10	< 0.10		< 0.10	< 0.10	< 0.10
Phenanthrene	M	2700	mg/kg	0.10	2.8	< 0.10	< 0.10		< 0.10	< 0.10	< 0.10
Anthracene	M	2700	mg/kg	0.10	0.51	< 0.10	< 0.10		< 0.10	< 0.10	< 0.10
Fluoranthene	M	2700	mg/kg	0.10	2.7	< 0.10	< 0.10		< 0.10	< 0.10	1.9
Pyrene	M	2700	mg/kg	0.10	2.5	< 0.10	< 0.10		< 0.10	< 0.10	1.8
Benzo[a]anthracene	M	2700	mg/kg	0.10	1.1	< 0.10	< 0.10		< 0.10	< 0.10	< 0.10
Chrysene	M	2700	mg/kg	0.10	1.8	< 0.10	< 0.10		< 0.10	< 0.10	< 0.10
Benzo[b]fluoranthene	M	2700	mg/kg	0.10	0.81	< 0.10	< 0.10		< 0.10	< 0.10	< 0.10
Benzo[k]fluoranthene	M	2700	mg/kg	0.10	1.5	< 0.10	< 0.10		< 0.10	< 0.10	< 0.10
Benzo[a]pyrene	M	2700	mg/kg	0.10	0.69	< 0.10	< 0.10		< 0.10	< 0.10	< 0.10
Indeno(1,2,3-c,d)Pyrene	M	2700	mg/kg	0.10	0.39	< 0.10	< 0.10		< 0.10	< 0.10	< 0.10
Dibenz(a,h)Anthracene	M	2700	mg/kg	0.10	0.54	< 0.10	< 0.10		< 0.10	< 0.10	< 0.10
Benzo[g,h,i]perylene	M	2700	mg/kg	0.10	0.58	< 0.10	< 0.10		< 0.10	< 0.10	< 0.10
Total Of 16 PAH's	M	2700	mg/kg	2.0	18	< 2.0	< 2.0		< 2.0	< 2.0	3.7
Total Phenols	M	2920	mg/kg	0.30	< 0.30	< 0.30	< 0.30		< 0.30	< 0.30	< 0.30

Results - Single Stage WAC

Project: QO463 Tylorstown Phase 4 GI

Chemtest Job No:	21-07126				**Landfill Waste Acceptance Criteria Limits**		
Chemtest Sample ID:	1155049						
Sample Ref:	1				**Inert Waste Landfill**	**Stable, Non-reactive hazardous waste in non-hazardous Landfill**	**Hazardous Waste Landfill**
Sample ID:	ES1						
Sample Location:	TP1						
Top Depth(m):	0.2						
Bottom Depth(m):							
Sampling Date:	04-Mar-2021						
Determinand	**SOP**	**Accred.**	**Units**				
Total Organic Carbon	2625	M	%	6.6	3	5	6
Loss On Ignition	2610	M	%	14	--	--	10
Total BTEX	2760	M	mg/kg	< 0.010	6	--	--
Total PCBs (7 Congeners)	2815	M	mg/kg	< 0.10	1	--	--
TPH Total WAC (Mineral Oil)	2670	M	mg/kg	27	500	--	--
Total (Of 17) PAH's	2700	N	mg/kg	18	100	--	--
pH	2010	M		7.8	--	>6	--
Acid Neutralisation Capacity	2015	N	mol/kg	< 0.0020	--	To evaluate	To evaluate
Eluate Analysis			**10:1 Eluate mg/l**	**10:1 Eluate mg/kg**	**Limit values for compliance leaching test using BS EN 12457 at L/S 10 l/kg**		
Arsenic	1455	U	0.0004	0.0040	0.5	2	25
Barium	1455	U	< 0.005	< 0.0005	20	100	300
Cadmium	1455	U	< 0.00012	< 0.0012	0.04	1	5
Chromium	1455	U	< 0.0005	< 0.0005	0.5	10	70
Copper	1455	U	0.0017	0.017	2	50	100
Mercury	1455	U	< 0.00005	< 0.00005	0.01	0.2	2
Molybdenum	1455	U	0.0003	0.0035	0.5	10	30
Nickel	1455	U	0.0008	0.0084	0.4	10	40
Lead	1455	U	0.0012	0.012	0.5	10	50
Antimony	1455	U	< 0.0005	< 0.0005	0.06	0.7	5
Selenium	1455	U	< 0.0005	< 0.0005	0.1	0.5	7
Zinc	1455	U	0.005	0.046	4	50	200
Chloride	1220	U	< 1.0	< 10	800	15000	25000
Fluoride	1220	U	0.11	1.1	10	150	500
Sulphate	1220	U	7.7	77	1000	20000	50000
Total Dissolved Solids	1020	N	600	6000	4000	60000	100000
Phenol Index	1920	U	< 0.030	< 0.30	1	-	-
Dissolved Organic Carbon	1610	U	5.9	59	500	800	1000

Solid Information	
Dry mass of test portion/kg	0.090
Moisture (%)	16

Waste Acceptance Criteria

Landfill WAC analysis (specifically leaching test results) must not be used for hazardous waste classification purposes. This analysis is only applicable for hazardous waste landfill acceptance and does not give any indication as to whether a waste may be hazardous or non-hazardous.

Results - Single Stage WAC

Project: QO463 Tylorstown Phase 4 GI

Chemtest Job No:	21-07126				**Landfill Waste Acceptance Criteria Limits**		
Chemtest Sample ID:	1155053						
Sample Ref:	2				**Inert Waste Landfill**	**Stable, Non-reactive hazardous waste in non-hazardous Landfill**	**Hazardous Waste Landfill**
Sample ID:	ES2						
Sample Location:	TP2						
Top Depth(m):	0.5						
Bottom Depth(m):							
Sampling Date:	04-Mar-2021						
Determinand	**SOP**	**Accred.**	**Units**				
Total Organic Carbon	2625	M	%	18	3	5	6
Loss On Ignition	2610	M	%	24	--	--	10
Total BTEX	2760	M	mg/kg	0.016	6	--	--
Total PCBs (7 Congeners)	2815	M	mg/kg	< 0.10	1	--	--
TPH Total WAC (Mineral Oil)	2670	M	mg/kg	< 10	500	--	--
Total (Of 17) PAH's	2700	N	mg/kg	< 2.0	100	--	--
pH	2010	M		7.3	--	>6	--
Acid Neutralisation Capacity	2015	N	mol/kg	< 0.0020	--	To evaluate	To evaluate
Eluate Analysis			**10:1 Eluate mg/l**	**10:1 Eluate mg/kg**	**Limit values for compliance leaching test using BS EN 12457 at L/S 10 l/kg**		
Arsenic	1455	U	0.0020	0.020	0.5	2	25
Barium	1455	U	< 0.005	< 0.0005	20	100	300
Cadmium	1455	U	< 0.00012	< 0.0012	0.04	1	5
Chromium	1455	U	< 0.0005	< 0.0005	0.5	10	70
Copper	1455	U	0.0015	0.015	2	50	100
Mercury	1455	U	< 0.00005	< 0.00005	0.01	0.2	2
Molybdenum	1455	U	0.0005	0.0052	0.5	10	30
Nickel	1455	U	0.0008	0.0081	0.4	10	40
Lead	1455	U	0.0009	0.0086	0.5	10	50
Antimony	1455	U	0.0009	0.0088	0.06	0.7	5
Selenium	1455	U	< 0.0005	< 0.0005	0.1	0.5	7
Zinc	1455	U	0.003	0.032	4	50	200
Chloride	1220	U	1.9	19	800	15000	25000
Fluoride	1220	U	0.27	2.7	10	150	500
Sulphate	1220	U	4.9	49	1000	20000	50000
Total Dissolved Solids	1020	N	14	140	4000	60000	100000
Phenol Index	1920	U	< 0.030	< 0.30	1	-	-
Dissolved Organic Carbon	1610	U	6.1	61	500	800	1000

Solid Information	
Dry mass of test portion/kg	0.090
Moisture (%)	26

Waste Acceptance Criteria

Landfill WAC analysis (specifically leaching test results) must not be used for hazardous waste classification purposes. This analysis is only applicable for hazardous waste landfill acceptance and does not give any indication as to whether a waste may be hazardous or non-hazardous.

Results - Topsoil Report

BS3882:2015

Chemtest Job No.: 21-07126
Chemtest Sample ID.: 1155052
Client Sample Ref.: 1
Sample Location: TP2
Client Sample ID.: ES1
Top Depth (m): 0.2
Bottom Depth (m):
Date Sampled: 04-Mar-2021
Time Sampled:

Parameter	Units	Multipurpose Range			Result	Compliant with Multipurpose Range? (Y/N)	Compliant with Specific Purpose Range? (Y/N)		
Texture							**Acid**	**Low F**	**Calc.**
Clay content	%				19				
Silt content	%				15				
Sand content	%				66				
Soil texture class		See Attached Chart			Sandy Clay Loam	YES			
Mass Loss on Ignition									
Clay 5-20%		3.0-20			8.9	YES	YES	YES	YES
Clay 20-35%		5.0-20							
Stone Content	**% m/m**								
>2mm		0-30			16	YES			
>20mm		0-10			< 0.020	YES			
>50mm		0			< 0.020	YES			
Soil pH value		5.5-8.5			7.6	YES	NO	YES	YES
Carbonate (Calcareous only)	%				0.60				NO
Electrical Conductivity	µS/cm	If >3300 do ESP			2000	YES			
Available Nutrient Content									
Nitrogen %		>0.15			0.010	NO	NO		NO
Extractable phosphorus	mg/l	16-140			2.9	NO	NO	YES	NO
Extractable potassium	mg/l	121-1500			70	NO	NO		NO
Extractable magnesium	mg/l	51-600			160	YES	YES		YES
Carbon : Nitrogen Ratio		<20:1			521.5/1	NO	NO	NO	NO
Exchangeable sodium	**%**	<15			1.2				
Available Calcium	mg/l				60				
Available Sodium	mg/l				8.0				
Phytotoxic Contaminants (by soil pH)		**< 6.0**	**6.0-7.0**	**> 7.0**					
Zinc (Nitric Acid extract)	mg/kg	<200	<200	<300	44	YES			
Copper (Nitric Acid extract)	mg/kg	<100	<135	<200	35	YES			
Nickel (Nitric Acid extract)	mg/kg	<60	<75	<110	26	YES			
Visible Contaminants	**% mm**								
>2mm		<0.5			0.000	YES			
….. of which plastics		<0.25			0.000	YES			
….. man-made sharps		zero in 1kg			0.000	YES			

Results - Topsoil Report

BS3882:2015

Chemtest Job No.: 21-07126
Chemtest Sample ID.: 1155055
Client Sample Ref.: 1
Sample Location: TP3
Client Sample ID.: ES1
Top Depth (m): 0.2
Bottom Depth (m):
Date Sampled: 04-Mar-2021
Time Sampled:

Parameter	Units	Multipurpose Range			Result	Compliant with Multipurpose Range? (Y/N)	Compliant with Specific Purpose Range? (Y/N)		
Texture							**Acid**	**Low F**	**Calc.**
Clay content	%				16				
Silt content	%				15				
Sand content	%				69				
Soil texture class		See Attached Chart			Sandy Loam	YES			
Mass Loss on Ignition									
Clay 5-20%		3.0-20			6.2	YES	YES	YES	YES
Clay 20-35%		5.0-20							
Stone Content	**% m/m**								
>2mm		0-30			27	YES			
>20mm		0-10			< 0.020	YES			
>50mm		0			< 0.020	YES			
Soil pH value		5.5-8.5			5.4	NO	YES	YES	NO
Carbonate (Calcareous only)	%				0.55				NO
Electrical Conductivity	µS/cm	If >3300 do ESP			720	YES			
Available Nutrient Content									
Nitrogen %		>0.15			0.010	NO	NO		NO
Extractable phosphorus	mg/l	16-140			< 0.50	NO	NO	NO	NO
Extractable potassium	mg/l	121-1500			12	NO	NO		NO
Extractable magnesium	mg/l	51-600			11	NO	NO		NO
Carbon : Nitrogen Ratio		<20:1			365.5/1	NO	NO	NO	NO
Exchangeable sodium	**%**	<15			8.2				
Available Calcium	mg/l				< 20				
Available Sodium	mg/l				9.5				
Phytotoxic Contaminants (by soil pH)		**< 6.0**	**6.0-7.0**	**> 7.0**					
Zinc (Nitric Acid extract)	mg/kg	<200	<200	<300	31	YES			
Copper (Nitric Acid extract)	mg/kg	<100	<135	<200	5.9	YES			
Nickel (Nitric Acid extract)	mg/kg	<60	<75	<110	18	YES			
Visible Contaminants	**% mm**								
>2mm		<0.5			0.000	YES			
….. of which plastics		<0.25			0.000	YES			
….. man-made sharps		zero in 1kg			0.000	YES			

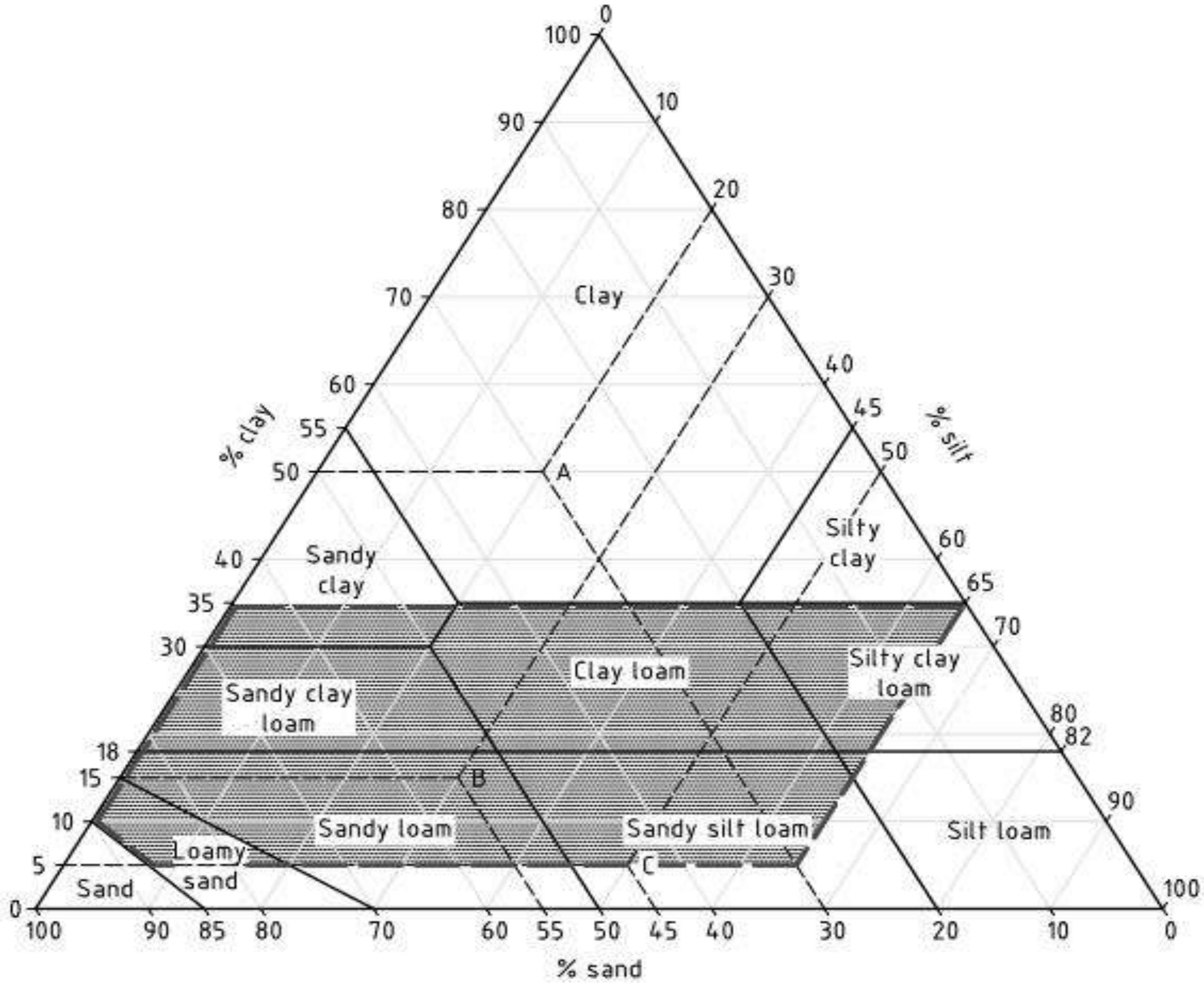
Results - Topsoil Report

BS3882:2015

Chemtest Job No.: 21-07126
Chemtest Sample ID.: 1155057
Client Sample Ref.: 1
Sample Location: TP4
Client Sample ID.: ES1
Top Depth (m): 0.2
Bottom Depth (m):
Date Sampled: 04-Mar-2021
Time Sampled:

Parameter	Units	Multipurpose Range			Result	Compliant with Multipurpose Range? (Y/N)	Compliant with Specific Purpose Range? (Y/N)		
Texture							**Acid**	**Low F**	**Calc.**
Clay content	%				13				
Silt content	%				15				
Sand content	%				73				
Soil texture class		See Attached Chart			Sandy Loam	YES			
Mass Loss on Ignition									
Clay 5-20%		3.0-20			26	NO	YES	NO	NO
Clay 20-35%		5.0-20							
Stone Content	**% m/m**								
>2mm		0-30			8.4	YES			
>20mm		0-10			< 0.020	YES			
>50mm		0			< 0.020	YES			
Soil pH value		5.5-8.5			4.8	NO	YES	YES	NO
Carbonate (Calcareous only)	%				< 0.10				NO
Electrical Conductivity	µS/cm	If >3300 do ESP			1700	YES			
Available Nutrient Content									
Nitrogen %		>0.15			0.52	YES	YES		YES
Extractable phosphorus	mg/l	16-140			0.78	NO	NO	YES	NO
Extractable potassium	mg/l	121-1500			210	YES	YES		YES
Extractable magnesium	mg/l	51-600			170	YES	YES		YES
Carbon : Nitrogen Ratio		<20:1			29.1/1	NO	NO	YES	NO
Exchangeable sodium	**%**	<15			7.0				
Available Calcium	mg/l				75				
Available Sodium	mg/l				65				
Phytotoxic Contaminants (by soil pH)		**< 6.0**	**6.0-7.0**	**> 7.0**					
Zinc (Nitric Acid extract)	mg/kg	<200	<200	<300	13	YES			
Copper (Nitric Acid extract)	mg/kg	<100	<135	<200	14	YES			
Nickel (Nitric Acid extract)	mg/kg	<60	<75	<110	< 5.0	YES			
Visible Contaminants	**% mm**								
>2mm		<0.5			0.000	YES			
….. of which plastics		<0.25			0.000	YES			
….. man-made sharps		zero in 1kg			0.000	YES			

Topsoil: Texture Classification Chart



Key

Area within which the texture of topsoil is required to fall

NOTE Examples of textural classification are as follows.

- *Soil A with 30% sand, 20% silt and 50% clay is in the "clay" textural class.*
- *Soil B with 55% sand, 30% silt and 15% clay is in the "sandy loam" textural class.*
- *Soil C with 45% sand, 50% silt and 5% clay is in the "sandy silt loam" textural class.*

Test Methods

SOP	Title	Parameters included	Method summary
1010	pH Value of Waters	pH	pH Meter
1020	Electrical Conductivity and Total Dissolved Solids (TDS) in Waters	Electrical Conductivity and Total Dissolved Solids (TDS) in Waters	Conductivity Meter
1220	Anions, Alkalinity & Ammonium in Waters	Fluoride; Chloride; Nitrite; Nitrate; Total; Oxidisable Nitrogen (TON); Sulfate; Phosphate; Alkalinity; Ammonium	Automated colorimetric analysis using 'Aquakem 600' Discrete Analyser.
1300	Cyanides & Thiocyanate in Waters	Free (or easy liberatable) Cyanide; total Cyanide; complex Cyanide; Thiocyanate	Continuous Flow Analysis.
1415	Cations in Waters by ICP-MS	Sodium; Potassium; Calcium; Magnesium	Direct determination by inductively coupled plasma - mass spectrometry (ICP-MS).
1455	Metals in Waters by ICP-MS	Metals, including: Antimony; Arsenic; Barium; Beryllium; Boron; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Tin; Vanadium; Zinc	Filtration of samples followed by direct determination by inductively coupled plasma mass spectrometry (ICP-MS).
1610	Total/Dissolved Organic Carbon in Waters	Organic Carbon	TOC Analyser using Catalytic Oxidation
1675	TPH Aliphatic/Aromatic split in Waters by GC-FID(cf. Texas Method 1006 / TPH CWG)	Aliphatics: >C5–C6, >C6–C8, >C8– C10, >C10–C12, >C12–C16, >C16–C21, >C21–C35, >C35– C44Aromatics: >C5–C7, >C7–C8, >C8– C10, >C10–C12, >C12–C16, >C16– C21, >C21– C35, >C35– C44	Pentane extraction / GCxGC FID detection
1700	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Waters by GC-FID	Acenaphthene; Acenaphthylene; Anthracene; Benzo[a]Anthracene; Benzo[a]Pyrene; Benzo[b]Fluoranthene; Benzo[ghi]Perylene; Benzo[k]Fluoranthene; Chrysene; Dibenz[ah]Anthracene; Fluoranthene; Fluorene; Indeno[123cd]Pyrene; Naphthalene; Phenanthrene; Pyrene	Dichloromethane extraction / GC-FID (GC-FID detection is non-selective and can be subject to interference from co-eluting compounds)
1920	Phenols in Waters by HPLC	Phenolic compounds including: Phenol, Cresols, Xylenols, Trimethylphenols Note: Chlorophenols are excluded.	Determination by High Performance Liquid Chromatography (HPLC) using electrochemical detection.
2010	pH Value of Soils	pH	pH Meter
2015	Acid Neutralisation Capacity	Acid Reserve	Titration
2020	Electrical Conductivity	Electrical conductivity (EC) of aqueous extract or calcium sulphate solution for topsoil	Measurement of the electrical resistance of a 2:1 water/soil extract.
2030	Moisture and Stone Content of Soils(Requirement of MCERTS)	Moisture content	Determination of moisture content of soil as a percentage of its as received mass obtained at <37°C.
2040	Soil Description(Requirement of MCERTS)	Soil description	As received soil is described based upon BS5930
2115	Total Nitrogen in Soils	Nitrogen	Determination by elemental analyser
2120	Water Soluble Boron, Sulphate, Magnesium & Chromium	Boron; Sulphate; Magnesium; Chromium	Aqueous extraction / ICP-OES
2140	Calorific Value	Calorific Value	Bomb Calorimeter
2192	Asbestos	Asbestos	Polarised light microscopy / Gravimetry
2260	Carbonate	Carbonate	Titration
2300	Cyanides & Thiocyanate in Soils	Free (or easy liberatable) Cyanide; total Cyanide; complex Cyanide; Thiocyanate	Allkaline extraction followed by colorimetric determination using Automated Flow Injection Analyser.
2400	Cations	Cations	ICP-MS
2420	Phosphate	Phosphate	Spectrophotometry - Discrete analyser
2430	Total Sulphate in soils	Total Sulphate	Acid digestion followed by determination of sulphate in extract by ICP-OES.

Test Methods

SOP	Title	Parameters included	Method summary
2450	Acid Soluble Metals in Soils	Metals, including: Arsenic; Barium; Beryllium; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Vanadium; Zinc	Acid digestion followed by determination of metals in extract by ICP-MS.
2490	Hexavalent Chromium in Soils	Chromium [VI]	Soil extracts are prepared by extracting dried and ground soil samples into boiling water. Chromium [VI] is determined by 'Aquakem 600' Discrete Analyser using 1,5-diphenylcarbazide.
2610	Loss on Ignition	loss on ignition (LOI)	Determination of the proportion by mass that is lost from a soil by ignition at 550°C.
2620	LOI 440	LOI 440 Trommel Fines	Determination of the proportion by mass that is lost from a soil by ignition at 440°C.
2625	Total Organic Carbon in Soils	Total organic Carbon (TOC)	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.
2670	Total Petroleum Hydrocarbons (TPH) in Soils by GC-FID	TPH (C6–C40); optional carbon banding, e.g. 3-band – GRO, DRO & LRO*TPH C8–C40	Dichloromethane extraction / GC-FID
2680	TPH A/A Split	Aliphatics: >C5–C6, >C6–C8,>C8–C10, >C10–C12, >C12–C16, >C16–C21, >C21–C35, >C35– C44Aromatics: >C5–C7, >C7–C8, >C8– C10, >C10–C12, >C12–C16, >C16– C21, >C21– C35, >C35– C44	Dichloromethane extraction / GCxGC FID detection
2700	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Soil by GC-FID	Acenaphthene; Acenaphthylene; Anthracene; Benzo[a]Anthracene; Benzo[a]Pyrene; Benzo[b]Fluoranthene; Benzo[ghi]Perylene; Benzo[k]Fluoranthene; Chrysene; Dibenz[ah]Anthracene; Fluoranthene; Fluorene; Indeno[123cd]Pyrene; Naphthalene; Phenanthrene; Pyrene	Dichloromethane extraction / GC-FID (GC-FID detection is non-selective and can be subject to interference from co-eluting compounds)
2760	Volatile Organic Compounds (VOCs) in Soils by Headspace GC-MS	Volatile organic compounds, including BTEX and halogenated Aliphatic/Aromatics.(cf. USEPA Method 8260)*please refer to UKAS schedule	Automated headspace gas chromatographic (GC) analysis of a soil sample, as received, with mass spectrometric (MS) detection of volatile organic compounds.
2815	Polychlorinated Biphenyls (PCB) ICES7Congeners in Soils by GC-MS	ICES7 PCB congeners	Acetone/Hexane extraction / GC-MS
2920	Phenols in Soils by HPLC	Phenolic compounds including Resorcinol, Phenol, Methylphenols, Dimethylphenols, 1-Naphthol and TrimethylphenolsNote: chlorophenols are excluded.	60:40 methanol/water mixture extraction, followed by HPLC determination using electrochemical detection.
640	Characterisation of Waste (Leaching C10)	Waste material including soil, sludges and granular waste	ComplianceTest for Leaching of Granular Waste Material and Sludge

Report Information

Key

U	UKAS accredited
M	MCERTS and UKAS accredited
N	Unaccredited
S	This analysis has been subcontracted to a UKAS accredited laboratory that is accredited for this analysis
SN	This analysis has been subcontracted to a UKAS accredited laboratory that is not accredited for this analysis
T	This analysis has been subcontracted to an unaccredited laboratory
I/S	Insufficient Sample
U/S	Unsuitable Sample
N/E	not evaluated
<	"less than"
>	"greater than"
SOP	Standard operating procedure
LOD	Limit of detection

Comments or interpretations are beyond the scope of UKAS accreditation
The results relate only to the items tested
Uncertainty of measurement for the determinands tested are available upon request
None of the results in this report have been recovery corrected
All results are expressed on a dry weight basis

The following tests were analysed on samples as received and the results subsequently corrected to a dry weight basis TPH, BTEX, VOCs, SVOCs, PCBs, Phenols

For all other tests the samples were dried at < 37°C prior to analysis
All Asbestos testing is performed at the indicated laboratory
Issue numbers are sequential starting with 1 all subsequent reports are incremented by 1

Sample Deviation Codes

A - Date of sampling not supplied
B - Sample age exceeds stability time (sampling to extraction)
C - Sample not received in appropriate containers
D - Broken Container
E - Insufficient Sample (Applies to LOI in Trommel Fines Only)

Sample Retention and Disposal

All soil samples will be retained for a period of 45 days from the date of receipt
All water samples will be retained for 14 days from the date of receipt
Charges may apply to extended sample storage

If you require extended retention of samples, please email your requirements to:
customerservices@chemtest.com

Eurofins Chemtest Ltd
Depot Road
Newmarket
CB8 0AL
Tel: 01638 606070
Email: info@chemtest.com

2183

Final Report

Report No.:	21-07128-1
Initial Date of Issue:	19-Mar-2021
Client	Quantum Geotechnic Ltd
Client Address:	Plas Newydd Llanedi Pontarddulais Swansea SA4 0FQ
Contact(s):	Steffan Picton
Project	Q0463 Tylorstown Phase 4 GI

Quotation No.:	Q21-22667	**Date Received:**	08-Mar-2021
Order No.:		**Date Instructed:**	15-Mar-2021
No. of Samples:	4		
Turnaround (Wkdays):	5	**Results Due:**	19-Mar-2021
Date Approved:	19-Mar-2021		

Approved By:

Details: Glynn Harvey, Technical Manager

Eurofins Chemtest Ltd
Depot Road
Newmarket
CB8 0AL
Tel: 01638 606070
Email: info@chemtest.com

UKAS TESTING 2183

Final Report

Report No.:	21-07311-1		
Initial Date of Issue:	19-Mar-2021		
Client	Quantum Geotechnic Ltd		
Client Address:	Plas Newydd Llanedi Pontarddulais Swansea SA4 0FQ		
Contact(s):	Steffan Picton		
Project	Q0463 Tylorstown Phase 4 GI		
Quotation No.:	Q21-22667	**Date Received:**	09-Mar-2021
Order No.:		**Date Instructed:**	15-Mar-2021
No. of Samples:	2		
Turnaround (Wkdays):	5	**Results Due:**	19-Mar-2021
Date Approved:	19-Mar-2021		

Approved By:

Details: Glynn Harvey, Technical Manager

Results - Leachate

Project: Q0463 Tylorstown Phase 4 GI

Client: Quantum Geotechnic Ltd					**Chemtest Job No.:**	21-07311
Quotation No.: Q21-22667					**Chemtest Sample ID.:**	1156053
Order No.:					Client Sample Ref.:	1
					Client Sample ID.:	ES1
					Sample Location:	BH2
					Sample Type:	SOIL
					Top Depth (m):	0.10
					Date Sampled:	05-Mar-2021
Determinand	**Accred.**	**SOP**	**Type**	**Units**	**LOD**	
pH	U	1010	10:1		N/A	7.7
Sulphate	U	1220	10:1	mg/l	1.0	1.4
Cyanide (Total)	U	1300	10:1	mg/l	0.050	< 0.050
Calcium	U	1455	10:1	mg/l	2.00	< 2.0
Hardness	N	1415	10:1	mg/l	1.0	< 1.0
Aluminium (Dissolved)	N	1455	10:1	µg/l	5.0	190
Arsenic (Dissolved)	U	1455	10:1	µg/l	0.20	1.5
Boron (Dissolved)	U	1455	10:1	µg/l	10.0	< 10
Cadmium (Dissolved)	U	1455	10:1	µg/l	0.12	< 0.12
Copper (Dissolved)	U	1455	10:1	µg/l	0.50	5.4
Mercury (Dissolved)	U	1455	10:1	µg/l	0.05	< 0.05
Manganese (Dissolved)	U	1455	10:1	µg/l	0.50	4.5
Nickel (Dissolved)	U	1455	10:1	µg/l	0.50	0.88
Lead (Dissolved)	U	1455	10:1	µg/l	0.50	3.2
Antimony (Dissolved)	U	1455	10:1	µg/l	0.50	< 0.50
Selenium (Dissolved)	U	1455	10:1	µg/l	0.50	< 0.50
Zinc (Dissolved)	U	1455	10:1	µg/l	3.0	4.5
Chromium (Total)	U	1455	10:1	µg/l	0.50	0.70
Iron (Dissolved)	N	1455	10:1	µg/l	5.0	1100
Dissolved Organic Carbon Low Level	N	1610	10:1	mg/l	N/A	10
Aliphatic TPH >C5-C6	N	1675	10:1	µg/l	0.010	< 0.010
Aliphatic TPH >C6-C8	N	1675	10:1	µg/l	0.010	< 0.010
Aliphatic TPH >C8-C10	N	1675	10:1	µg/l	0.10	< 0.10
Aliphatic TPH >C10-C12	N	1675	10:1	µg/l	0.10	< 0.10
Aliphatic TPH >C12-C16	N	1675	10:1	µg/l	0.10	< 0.10
Aliphatic TPH >C16-C21	N	1675	10:1	µg/l	0.10	< 0.10
Aliphatic TPH >C21-C35	N	1675	10:1	µg/l	0.10	< 0.10
Aliphatic TPH >C35-C44	N	1675	10:1	µg/l	0.10	< 0.10
Total Aliphatic Hydrocarbons	N	1675	10:1	µg/l	1.0	< 1.0
Aromatic TPH >C5-C7	N	1675	10:1	µg/l	0.010	< 0.010
Aromatic TPH >C7-C8	N	1675	10:1	µg/l	0.010	< 0.010
Aromatic TPH >C8-C10	N	1675	10:1	µg/l	0.10	< 0.10
Aromatic TPH >C10-C12	N	1675	10:1	µg/l	0.10	< 0.10
Aromatic TPH >C12-C16	N	1675	10:1	µg/l	0.10	< 0.10
Aromatic TPH >C16-C21	N	1675	10:1	µg/l	0.10	< 0.10
Aromatic TPH >C21-C35	N	1675	10:1	µg/l	0.10	< 0.10
Aromatic TPH >C35-C44	N	1675	10:1	µg/l	0.10	< 0.10
Total Aromatic Hydrocarbons	N	1675	10:1	µg/l	1.0	< 1.0

Results - Leachate

Project: Q0463 Tylorstown Phase 4 GI

Client: Quantum Geotechnic Ltd					**Chemtest Job No.:**	21-07311
Quotation No.: Q21-22667					**Chemtest Sample ID.:**	1156053
Order No.:					Client Sample Ref.:	1
					Client Sample ID.:	ES1
					Sample Location:	BH2
					Sample Type:	SOIL
					Top Depth (m):	0.10
					Date Sampled:	05-Mar-2021
Determinand	**Accred.**	**SOP**	**Type**	**Units**	**LOD**	
Total Petroleum Hydrocarbons	N	1675	10:1	µg/l	2.0	< 2.0
Naphthalene	U	1700	10:1	µg/l	0.10	< 0.10
Acenaphthylene	U	1700	10:1	µg/l	0.10	< 0.10
Acenaphthene	U	1700	10:1	µg/l	0.10	< 0.10
Fluorene	U	1700	10:1	µg/l	0.10	< 0.10
Phenanthrene	U	1700	10:1	µg/l	0.10	< 0.10
Anthracene	U	1700	10:1	µg/l	0.10	< 0.10
Fluoranthene	U	1700	10:1	µg/l	0.10	< 0.10
Pyrene	U	1700	10:1	µg/l	0.10	< 0.10
Benzo[a]anthracene	U	1700	10:1	µg/l	0.10	< 0.10
Chrysene	N	1700	10:1	µg/l	0.10	< 0.10
Benzo[b]fluoranthene	U	1700	10:1	µg/l	0.10	< 0.10
Benzo[k]fluoranthene	U	1700	10:1	µg/l	0.10	< 0.10
Benzo[a]pyrene	U	1700	10:1	µg/l	0.10	< 0.10
Indeno(1,2,3-c,d)Pyrene	U	1700	10:1	µg/l	0.10	< 0.10
Dibenz(a,h)Anthracene	U	1700	10:1	µg/l	0.10	< 0.10
Benzo[g,h,i]perylene	U	1700	10:1	µg/l	0.10	< 0.10
Total Of 16 PAH's	N	1700	10:1	µg/l	2.0	< 2.0
Total Phenols	U	1920	10:1	mg/l	0.030	< 0.030

Results - Soil

Project: Q0463 Tylorstown Phase 4 GI

Client: Quantum Geotechnic Ltd				**Chemtest Job No.:**	21-07311	21-07311
Quotation No.: Q21-22667				**Chemtest Sample ID.:**	1156053	1156054
Order No.:				Client Sample Ref.:	1	2
				Client Sample ID.:	ES1	ES2
				Sample Location:	BH2	BH2
				Sample Type:	SOIL	SOIL
				Top Depth (m):	0.10	0.50
				Date Sampled:	05-Mar-2021	05-Mar-2021
				Asbestos Lab:	DURHAM	DURHAM
Determinand	**Accred.**	**SOP**	**Units**	**LOD**		
ACM Type	U	2192		N/A	-	-
Asbestos Identification	U	2192		N/A	No Asbestos Detected	No Asbestos Detected
ACM Detection Stage	U	2192		N/A	-	-
Moisture	N	2030	%	0.020	34	22
pH	U	2010		4.0	5.0	5.3
Boron (Hot Water Soluble)	U	2120	mg/kg	0.40	0.43	0.63
Sulphate (2:1 Water Soluble) as SO4	U	2120	g/l	0.010	< 0.010	0.020
Cyanide (Total)	U	2300	mg/kg	0.50	< 0.50	0.50
Aluminium (Total)	N	2430	mg/kg	100	3500	8600
Arsenic	U	2450	mg/kg	1.0	19	6.8
Cadmium	U	2450	mg/kg	0.10	0.14	< 0.10
Chromium	U	2450	mg/kg	1.0	7.9	17
Manganese	U	2450	mg/kg	5.0	100	270
Antimony	N	2450	mg/kg	2.0	< 2.0	< 2.0
Copper	U	2450	mg/kg	0.50	15	6.9
Mercury	U	2450	mg/kg	0.10	0.11	< 0.10
Nickel	U	2450	mg/kg	0.50	6.0	17
Lead	U	2450	mg/kg	0.50	58	17
Selenium	U	2450	mg/kg	0.20	1.4	1.2
Zinc	U	2450	mg/kg	0.50	15	36
Chromium (Hexavalent)	N	2490	mg/kg	0.50	< 0.50	< 0.50
Organic Matter	U	2625	%	0.40	24	2.6
Aliphatic TPH >C5-C6	N	2680	mg/kg	0.010	< 0.010	< 0.010
Aliphatic TPH >C6-C8	N	2680	mg/kg	0.010	< 0.010	< 0.010
Aliphatic TPH >C8-C10	N	2680	mg/kg	0.10	< 0.10	< 0.10
Aliphatic TPH >C10-C12	N	2680	mg/kg	0.10	< 0.10	< 0.10
Aliphatic TPH >C12-C16	N	2680	mg/kg	0.10	< 0.10	< 0.10
Aliphatic TPH >C16-C21	N	2680	mg/kg	0.10	< 0.10	< 0.10
Aliphatic TPH >C21-C35	N	2680	mg/kg	0.10	< 0.10	< 0.10
Aliphatic TPH >C35-C44	N	2680	mg/kg	0.10	< 0.10	< 0.10
Total Aliphatic Hydrocarbons	N	2680	mg/kg	1.0	< 1.0	< 1.0
Aromatic TPH >C5-C7	N	2680	mg/kg	0.010	< 0.010	< 0.010
Aromatic TPH >C7-C8	N	2680	mg/kg	0.010	< 0.010	< 0.010
Aromatic TPH >C8-C10	N	2680	mg/kg	0.10	< 0.10	< 0.10
Aromatic TPH >C10-C12	N	2680	mg/kg	0.10	< 0.10	< 0.10
Aromatic TPH >C12-C16	N	2680	mg/kg	0.10	< 0.10	< 0.10

Results - Soil

Project: Q0463 Tylorstown Phase 4 GI

Client: Quantum Geotechnic Ltd				**Chemtest Job No.:**	21-07311	21-07311
Quotation No.: Q21-22667				**Chemtest Sample ID.:**	1156053	1156054
Order No.:				Client Sample Ref.:	1	2
				Client Sample ID.:	ES1	ES2
				Sample Location:	BH2	BH2
				Sample Type:	SOIL	SOIL
				Top Depth (m):	0.10	0.50
				Date Sampled:	05-Mar-2021	05-Mar-2021
				Asbestos Lab:	DURHAM	DURHAM
Determinand	**Accred.**	**SOP**	**Units**	**LOD**		
Aromatic TPH >C16-C21	N	2680	mg/kg	0.10	< 0.10	< 0.10
Aromatic TPH >C21-C35	N	2680	mg/kg	0.10	< 0.10	< 0.10
Aromatic TPH >C35-C44	N	2680	mg/kg	0.10	< 0.10	< 0.10
Total Aromatic Hydrocarbons	N	2680	mg/kg	1.0	< 1.0	< 1.0
Total Petroleum Hydrocarbons	N	2680	mg/kg	2.0	< 2.0	< 2.0
Naphthalene	U	2700	mg/kg	0.10	< 0.10	< 0.10
Acenaphthylene	U	2700	mg/kg	0.10	< 0.10	< 0.10
Acenaphthene	U	2700	mg/kg	0.10	< 0.10	< 0.10
Fluorene	U	2700	mg/kg	0.10	< 0.10	< 0.10
Phenanthrene	U	2700	mg/kg	0.10	< 0.10	< 0.10
Anthracene	U	2700	mg/kg	0.10	< 0.10	< 0.10
Fluoranthene	U	2700	mg/kg	0.10	0.33	< 0.10
Pyrene	U	2700	mg/kg	0.10	0.28	< 0.10
Benzo[a]anthracene	U	2700	mg/kg	0.10	< 0.10	< 0.10
Chrysene	U	2700	mg/kg	0.10	< 0.10	< 0.10
Benzo[b]fluoranthene	U	2700	mg/kg	0.10	< 0.10	< 0.10
Benzo[k]fluoranthene	U	2700	mg/kg	0.10	< 0.10	< 0.10
Benzo[a]pyrene	U	2700	mg/kg	0.10	< 0.10	< 0.10
Indeno(1,2,3-c,d)Pyrene	U	2700	mg/kg	0.10	< 0.10	< 0.10
Dibenz(a,h)Anthracene	U	2700	mg/kg	0.10	< 0.10	< 0.10
Benzo[g,h,i]perylene	U	2700	mg/kg	0.10	< 0.10	< 0.10
Total Of 16 PAH's	U	2700	mg/kg	2.0	< 2.0	< 2.0
Total Phenols	U	2920	mg/kg	0.30	< 0.30	< 0.30

Test Methods

SOP	Title	Parameters included	Method summary
1010	pH Value of Waters	pH	pH Meter
1220	Anions, Alkalinity & Ammonium in Waters	Fluoride; Chloride; Nitrite; Nitrate; Total; Oxidisable Nitrogen (TON); Sulfate; Phosphate; Alkalinity; Ammonium	Automated colorimetric analysis using 'Aquakem 600' Discrete Analyser.
1300	Cyanides & Thiocyanate in Waters	Free (or easy liberatable) Cyanide; total Cyanide; complex Cyanide; Thiocyanate	Continuous Flow Analysis.
1415	Cations in Waters by ICP-MS	Sodium; Potassium; Calcium; Magnesium	Direct determination by inductively coupled plasma - mass spectrometry (ICP-MS).
1455	Metals in Waters by ICP-MS	Metals, including: Antimony; Arsenic; Barium; Beryllium; Boron; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Tin; Vanadium; Zinc	Filtration of samples followed by direct determination by inductively coupled plasma mass spectrometry (ICP-MS).
1610	Total/Dissolved Organic Carbon in Waters	Organic Carbon	TOC Analyser using Catalytic Oxidation
1675	TPH Aliphatic/Aromatic split in Waters by GC-FID(cf. Texas Method 1006 / TPH CWG)	Aliphatics: >C5–C6, >C6–C8, >C8– C10, >C10–C12, >C12–C16, >C16–C21, >C21–C35, >C35– C44Aromatics: >C5–C7, >C7–C8, >C8– C10, >C10–C12, >C12–C16, >C16– C21, >C21– C35, >C35– C44	Pentane extraction / GCxGC FID detection
1700	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Waters by GC-FID	Acenaphthene; Acenaphthylene; Anthracene; Benzo[a]Anthracene; Benzo[a]Pyrene; Benzo[b]Fluoranthene; Benzo[ghi]Perylene; Benzo[k]Fluoranthene; Chrysene; Dibenz[ah]Anthracene; Fluoranthene; Fluorene; Indeno[123cd]Pyrene; Naphthalene; Phenanthrene; Pyrene	Dichloromethane extraction / GC-FID (GC-FID detection is non-selective and can be subject to interference from co-eluting compounds)
1920	Phenols in Waters by HPLC	Phenolic compounds including: Phenol, Cresols, Xylenols, Trimethylphenols Note: Chlorophenols are excluded.	Determination by High Performance Liquid Chromatography (HPLC) using electrochemical detection.
2010	pH Value of Soils	pH	pH Meter
2030	Moisture and Stone Content of Soils(Requirement of MCERTS)	Moisture content	Determination of moisture content of soil as a percentage of its as received mass obtained at <37°C.
2040	Soil Description(Requirement of MCERTS)	Soil description	As received soil is described based upon BS5930
2120	Water Soluble Boron, Sulphate, Magnesium & Chromium	Boron; Sulphate; Magnesium; Chromium	Aqueous extraction / ICP-OES
2192	Asbestos	Asbestos	Polarised light microscopy / Gravimetry
2300	Cyanides & Thiocyanate in Soils	Free (or easy liberatable) Cyanide; total Cyanide; complex Cyanide; Thiocyanate	Allkaline extraction followed by colorimetric determination using Automated Flow Injection Analyser.
2430	Total Sulphate in soils	Total Sulphate	Acid digestion followed by determination of sulphate in extract by ICP-OES.
2450	Acid Soluble Metals in Soils	Metals, including: Arsenic; Barium; Beryllium; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Vanadium; Zinc	Acid digestion followed by determination of metals in extract by ICP-MS.
2490	Hexavalent Chromium in Soils	Chromium [VI]	Soil extracts are prepared by extracting dried and ground soil samples into boiling water. Chromium [VI] is determined by 'Aquakem 600' Discrete Analyser using 1,5-diphenylcarbazide.
2625	Total Organic Carbon in Soils	Total organic Carbon (TOC)	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.

Test Methods

SOP	Title	Parameters included	Method summary
2680	TPH A/A Split	Aliphatics: >C5–C6, >C6–C8,>C8–C10, >C10–C12, >C12–C16, >C16–C21, >C21–C35, >C35– C44Aromatics: >C5–C7, >C7–C8, >C8– C10, >C10–C12, >C12–C16, >C16– C21, >C21– C35, >C35– C44	Dichloromethane extraction / GCxGC FID detection
2700	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Soil by GC-FID	Acenaphthene; Acenaphthylene; Anthracene; Benzo[a]Anthracene; Benzo[a]Pyrene; Benzo[b]Fluoranthene; Benzo[ghi]Perylene; Benzo[k]Fluoranthene; Chrysene; Dibenz[ah]Anthracene; Fluoranthene; Fluorene; Indeno[123cd]Pyrene; Naphthalene; Phenanthrene; Pyrene	Dichloromethane extraction / GC-FID (GC-FID detection is non-selective and can be subject to interference from co-eluting compounds)
2920	Phenols in Soils by HPLC	Phenolic compounds including Resorcinol, Phenol, Methylphenols, Dimethylphenols, 1-Naphthol and TrimethylphenolsNote: chlorophenols are excluded.	60:40 methanol/water mixture extraction, followed by HPLC determination using electrochemical detection.
640	Characterisation of Waste (Leaching C10)	Waste material including soil, sludges and granular waste	ComplianceTest for Leaching of Granular Waste Material and Sludge

Report Information

Key

U	UKAS accredited
M	MCERTS and UKAS accredited
N	Unaccredited
S	This analysis has been subcontracted to a UKAS accredited laboratory that is accredited for this analysis
SN	This analysis has been subcontracted to a UKAS accredited laboratory that is not accredited for this analysis
T	This analysis has been subcontracted to an unaccredited laboratory
I/S	Insufficient Sample
U/S	Unsuitable Sample
N/E	not evaluated
<	"less than"
>	"greater than"
SOP	Standard operating procedure
LOD	Limit of detection

Comments or interpretations are beyond the scope of UKAS accreditation
The results relate only to the items tested
Uncertainty of measurement for the determinands tested are available upon request
None of the results in this report have been recovery corrected
All results are expressed on a dry weight basis

The following tests were analysed on samples as received and the results subsequently corrected to a dry weight basis TPH, BTEX, VOCs, SVOCs, PCBs, Phenols

For all other tests the samples were dried at < 37°C prior to analysis
All Asbestos testing is performed at the indicated laboratory
Issue numbers are sequential starting with 1 all subsequent reports are incremented by 1

Sample Deviation Codes

A - Date of sampling not supplied
B - Sample age exceeds stability time (sampling to extraction)
C - Sample not received in appropriate containers
D - Broken Container
E - Insufficient Sample (Applies to LOI in Trommel Fines Only)

Sample Retention and Disposal

All soil samples will be retained for a period of 45 days from the date of receipt
All water samples will be retained for 14 days from the date of receipt
Charges may apply to extended sample storage

If you require extended retention of samples, please email your requirements to:
customerservices@chemtest.com

Results - Leachate

Project: Q0463 Tylorstown Phase 4 GI

Client: Quantum Geotechnic Ltd					**Chemtest Job No.:**	21-07128
Quotation No.: Q21-22667					**Chemtest Sample ID.:**	1155067
Order No.:					Client Sample Ref.:	1
					Client Sample ID.:	ES1
					Sample Location:	TP6
					Sample Type:	SOIL
					Top Depth (m):	0.2
					Bottom Depth (m):	0.3
					Date Sampled:	04-Mar-2021
Determinand	**Accred.**	**SOP**	**Type**	**Units**	**LOD**	
pH	U	1010	10:1		N/A	7.8
Sulphate	U	1220	10:1	mg/l	1.0	2.1
Cyanide (Total)	U	1300	10:1	mg/l	0.050	< 0.050
Calcium	U	1455	10:1	mg/l	2.00	< 2.0
Hardness	N	1415	10:1	mg/l	1.0	< 1.0
Aluminium (Dissolved)	N	1455	10:1	µg/l	5.0	230
Arsenic (Dissolved)	U	1455	10:1	µg/l	0.20	1.6
Boron (Dissolved)	U	1455	10:1	µg/l	10.0	< 10
Cadmium (Dissolved)	U	1455	10:1	µg/l	0.12	< 0.12
Copper (Dissolved)	U	1455	10:1	µg/l	0.50	2.8
Mercury (Dissolved)	U	1455	10:1	µg/l	0.05	< 0.05
Manganese (Dissolved)	U	1455	10:1	µg/l	0.50	3.8
Nickel (Dissolved)	U	1455	10:1	µg/l	0.50	0.75
Lead (Dissolved)	U	1455	10:1	µg/l	0.50	2.8
Antimony (Dissolved)	U	1455	10:1	µg/l	0.50	< 0.50
Selenium (Dissolved)	U	1455	10:1	µg/l	0.50	< 0.50
Zinc (Dissolved)	U	1455	10:1	µg/l	3.0	3.0
Chromium (Total)	U	1455	10:1	µg/l	0.50	0.71
Iron (Dissolved)	N	1455	10:1	µg/l	5.0	1200
Dissolved Organic Carbon Low Level	N	1610	10:1	mg/l	N/A	8.0
Aliphatic TPH >C5-C6	N	1675	10:1	µg/l	0.010	< 0.010
Aliphatic TPH >C6-C8	N	1675	10:1	µg/l	0.010	< 0.010
Aliphatic TPH >C8-C10	N	1675	10:1	µg/l	0.10	< 0.10
Aliphatic TPH >C10-C12	N	1675	10:1	µg/l	0.10	< 0.10
Aliphatic TPH >C12-C16	N	1675	10:1	µg/l	0.10	< 0.10
Aliphatic TPH >C16-C21	N	1675	10:1	µg/l	0.10	< 0.10
Aliphatic TPH >C21-C35	N	1675	10:1	µg/l	0.10	< 0.10
Aliphatic TPH >C35-C44	N	1675	10:1	µg/l	0.10	< 0.10
Total Aliphatic Hydrocarbons	N	1675	10:1	µg/l	1.0	< 1.0
Aromatic TPH >C5-C7	N	1675	10:1	µg/l	0.010	< 0.010
Aromatic TPH >C7-C8	N	1675	10:1	µg/l	0.010	< 0.010
Aromatic TPH >C8-C10	N	1675	10:1	µg/l	0.10	< 0.10
Aromatic TPH >C10-C12	N	1675	10:1	µg/l	0.10	< 0.10
Aromatic TPH >C12-C16	N	1675	10:1	µg/l	0.10	< 0.10
Aromatic TPH >C16-C21	N	1675	10:1	µg/l	0.10	< 0.10
Aromatic TPH >C21-C35	N	1675	10:1	µg/l	0.10	< 0.10
Aromatic TPH >C35-C44	N	1675	10:1	µg/l	0.10	< 0.10

Results - Leachate

Project: Q0463 Tylorstown Phase 4 GI

Client: Quantum Geotechnic Ltd					**Chemtest Job No.:**	21-07128
Quotation No.: Q21-22667					**Chemtest Sample ID.:**	1155067
Order No.:					Client Sample Ref.:	1
					Client Sample ID.:	ES1
					Sample Location:	TP6
					Sample Type:	SOIL
					Top Depth (m):	0.2
					Bottom Depth (m):	0.3
					Date Sampled:	04-Mar-2021
Determinand	**Accred.**	**SOP**	**Type**	**Units**	**LOD**	
Total Aromatic Hydrocarbons	N	1675	10:1	µg/l	1.0	< 1.0
Total Petroleum Hydrocarbons	N	1675	10:1	µg/l	2.0	< 2.0
Naphthalene	U	1700	10:1	µg/l	0.10	< 0.10
Acenaphthylene	U	1700	10:1	µg/l	0.10	< 0.10
Acenaphthene	U	1700	10:1	µg/l	0.10	< 0.10
Fluorene	U	1700	10:1	µg/l	0.10	< 0.10
Phenanthrene	U	1700	10:1	µg/l	0.10	< 0.10
Anthracene	U	1700	10:1	µg/l	0.10	< 0.10
Fluoranthene	U	1700	10:1	µg/l	0.10	< 0.10
Pyrene	U	1700	10:1	µg/l	0.10	< 0.10
Benzo[a]anthracene	U	1700	10:1	µg/l	0.10	< 0.10
Chrysene	N	1700	10:1	µg/l	0.10	< 0.10
Benzo[b]fluoranthene	U	1700	10:1	µg/l	0.10	< 0.10
Benzo[k]fluoranthene	U	1700	10:1	µg/l	0.10	< 0.10
Benzo[a]pyrene	U	1700	10:1	µg/l	0.10	< 0.10
Indeno(1,2,3-c,d)Pyrene	U	1700	10:1	µg/l	0.10	< 0.10
Dibenz(a,h)Anthracene	U	1700	10:1	µg/l	0.10	< 0.10
Benzo[g,h,i]perylene	U	1700	10:1	µg/l	0.10	< 0.10
Total Of 16 PAH's	N	1700	10:1	µg/l	2.0	< 2.0
Total Phenols	U	1920	10:1	mg/l	0.030	< 0.030

Results - Soil

Project: Q0463 Tylorstown Phase 4 GI

Client: Quantum Geotechnic Ltd				**Chemtest Job No.:**	21-07128	21-07128	21-07128	21-07128
Quotation No.: Q21-22667				**Chemtest Sample ID.:**	1155067	1155069	1155070	1155073
Order No.:				Client Sample Ref.:	1	1	2	1
				Client Sample ID.:	ES1	ES1	ES2	ES1
				Sample Location:	TP6	TP5	TP5	TP7
				Sample Type:	SOIL	SOIL	SOIL	SOIL
				Top Depth (m):	0.2	0.2	0.5	0.2
				Bottom Depth (m):	0.3			
				Date Sampled:	04-Mar-2021	04-Mar-2021	04-Mar-2021	04-Mar-2021
				Asbestos Lab:	DURHAM	DURHAM	DURHAM	DURHAM
Determinand	**Accred.**	**SOP**	**Units**	**LOD**				
ACM Type	U	2192		N/A	-	-	-	-
Asbestos Identification	U	2192		N/A	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected
ACM Detection Stage	U	2192		N/A	-	-	-	-
Moisture	N	2030	%	0.020	22	14	18	22
pH	U	2010		4.0	5.5	5.2	5.4	4.9
Boron (Hot Water Soluble)	U	2120	mg/kg	0.40	< 0.40	< 0.40	< 0.40	< 0.40
Sulphate (2:1 Water Soluble) as SO4	U	2120	g/l	0.010	< 0.010	< 0.010	< 0.010	< 0.010
Cyanide (Total)	U	2300	mg/kg	0.50	< 0.50	< 0.50	< 0.50	< 0.50
Aluminium (Total)	N	2430	mg/kg	100	9400	1500	9500	3700
Arsenic	U	2450	mg/kg	1.0	13	13	6.4	18
Cadmium	U	2450	mg/kg	0.10	0.13	0.16	< 0.10	0.10
Chromium	U	2450	mg/kg	1.0	17	4.4	18	7.0
Manganese	U	2450	mg/kg	5.0	310	190	410	170
Antimony	N	2450	mg/kg	2.0	< 2.0	< 2.0	< 2.0	< 2.0
Copper	U	2450	mg/kg	0.50	4.6	2.9	4.8	9.2
Mercury	U	2450	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Nickel	U	2450	mg/kg	0.50	16	3.9	15	3.4
Lead	U	2450	mg/kg	0.50	11	6.1	8.1	26
Selenium	U	2450	mg/kg	0.20	1.2	0.29	0.84	0.79
Zinc	U	2450	mg/kg	0.50	30	11	35	9.1
Chromium (Hexavalent)	N	2490	mg/kg	0.50	< 0.50	< 0.50	< 0.50	< 0.50
Organic Matter	U	2625	%	0.40	2.4	1.7	1.1	3.5
Aliphatic TPH >C5-C6	N	2680	mg/kg	0.010	< 0.010	< 0.010	< 0.010	< 0.010
Aliphatic TPH >C6-C8	N	2680	mg/kg	0.010	< 0.010	< 0.010	< 0.010	< 0.010
Aliphatic TPH >C8-C10	N	2680	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Aliphatic TPH >C10-C12	N	2680	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Aliphatic TPH >C12-C16	N	2680	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Aliphatic TPH >C16-C21	N	2680	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Aliphatic TPH >C21-C35	N	2680	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Aliphatic TPH >C35-C44	N	2680	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Total Aliphatic Hydrocarbons	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C5-C7	N	2680	mg/kg	0.010	< 0.010	< 0.010	< 0.010	< 0.010
Aromatic TPH >C7-C8	N	2680	mg/kg	0.010	< 0.010	< 0.010	< 0.010	< 0.010
Aromatic TPH >C8-C10	N	2680	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Aromatic TPH >C10-C12	N	2680	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10

Eurofins Chemtest Ltd
Depot Road
Newmarket
CB8 0AL
Tel: 01638 606070
Email: info@chemtest.com

UKAS TESTING 2183

Final Report

Report No.:	21-08677-1
Initial Date of Issue:	24-Mar-2021
Client	Quantum Geotechnic Ltd
Client Address:	Plas Newydd Llanedi Pontarddulais Swansea SA4 0FQ
Contact(s):	Steffan Picton
Project	Q0463 Tylorstown Phase 4 GI

Quotation No.:		**Date Received:**	18-Mar-2021
Order No.:		**Date Instructed:**	18-Mar-2021
No. of Samples:	1		
Turnaround (Wkdays):	5	**Results Due:**	24-Mar-2021
Date Approved:	24-Mar-2021		

Approved By:

Details: Glynn Harvey, Technical Manager

Results - Leachate

Project: Q0463 Tylorstown Phase 4 GI

Client: Quantum Geotechnic Ltd					**Chemtest Job No.:**	21-08677
Quotation No.:					**Chemtest Sample ID.:**	1162776
					Client Sample ID.:	1
					Sample Location:	WS01
					Sample Type:	SOIL
					Top Depth (m):	2
					Date Sampled:	16-Mar-2021
Determinand	**Accred.**	**SOP**	**Type**	**Units**	**LOD**	
pH	U	1010	10:1		N/A	8.5
Sulphate	U	1220	10:1	mg/l	1.0	19
Cyanide (Total)	U	1300	10:1	mg/l	0.050	< 0.050
Calcium	U	1455	10:1	mg/l	2.00	3.5
Hardness	N	1415	10:1	mg/l	1.0	13
Aluminium (Dissolved)	N	1455	10:1	µg/l	5.0	89
Arsenic (Dissolved)	U	1455	10:1	µg/l	0.20	1.5
Boron (Dissolved)	U	1455	10:1	µg/l	10.0	16
Cadmium (Dissolved)	U	1455	10:1	µg/l	0.12	< 0.12
Copper (Dissolved)	U	1455	10:1	µg/l	0.50	< 0.50
Mercury (Dissolved)	U	1455	10:1	µg/l	0.05	< 0.05
Manganese (Dissolved)	U	1455	10:1	µg/l	0.50	3.8
Nickel (Dissolved)	U	1455	10:1	µg/l	0.50	< 0.50
Lead (Dissolved)	U	1455	10:1	µg/l	0.50	< 0.50
Antimony (Dissolved)	U	1455	10:1	µg/l	0.50	< 0.50
Selenium (Dissolved)	U	1455	10:1	µg/l	0.50	0.64
Zinc (Dissolved)	U	1455	10:1	µg/l	3.0	< 3.0
Chromium (Total)	U	1455	10:1	µg/l	0.50	< 0.50
Iron (Dissolved)	N	1455	10:1	µg/l	5.0	120
Dissolved Organic Carbon Low Level	N	1610	10:1	mg/l	N/A	7.8
Aliphatic TPH >C5-C6	N	1675	10:1	µg/l	0.010	< 0.010
Aliphatic TPH >C6-C8	N	1675	10:1	µg/l	0.010	< 0.010
Aliphatic TPH >C8-C10	N	1675	10:1	µg/l	0.10	< 0.10
Aliphatic TPH >C10-C12	N	1675	10:1	µg/l	0.10	< 0.10
Aliphatic TPH >C12-C16	N	1675	10:1	µg/l	0.10	< 0.10
Aliphatic TPH >C16-C21	N	1675	10:1	µg/l	0.10	< 0.10
Aliphatic TPH >C21-C35	N	1675	10:1	µg/l	0.10	830
Aliphatic TPH >C35-C44	N	1675	10:1	µg/l	0.10	< 0.10
Total Aliphatic Hydrocarbons	N	1675	10:1	µg/l	1.0	830
Aromatic TPH >C5-C7	N	1675	10:1	µg/l	0.010	< 0.010
Aromatic TPH >C7-C8	N	1675	10:1	µg/l	0.010	< 0.010
Aromatic TPH >C8-C10	N	1675	10:1	µg/l	0.10	< 0.10
Aromatic TPH >C10-C12	N	1675	10:1	µg/l	0.10	< 0.10
Aromatic TPH >C12-C16	N	1675	10:1	µg/l	0.10	< 0.10
Aromatic TPH >C16-C21	N	1675	10:1	µg/l	0.10	< 0.10
Aromatic TPH >C21-C35	N	1675	10:1	µg/l	0.10	< 0.10
Aromatic TPH >C35-C44	N	1675	10:1	µg/l	0.10	< 0.10
Total Aromatic Hydrocarbons	N	1675	10:1	µg/l	1.0	< 1.0
Total Petroleum Hydrocarbons	N	1675	10:1	µg/l	2.0	830

Results - Leachate

Project: Q0463 Tylorstown Phase 4 GI

Client: Quantum Geotechnic Ltd					**Chemtest Job No.:**	21-08677
Quotation No.:					**Chemtest Sample ID.:**	1162776
					Client Sample ID.:	1
					Sample Location:	WS01
					Sample Type:	SOIL
					Top Depth (m):	2
					Date Sampled:	16-Mar-2021
Determinand	**Accred.**	**SOP**	**Type**	**Units**	**LOD**	
Naphthalene	U	1700	10:1	µg/l	0.10	< 0.10
Acenaphthylene	U	1700	10:1	µg/l	0.10	< 0.10
Acenaphthene	U	1700	10:1	µg/l	0.10	< 0.10
Fluorene	U	1700	10:1	µg/l	0.10	< 0.10
Phenanthrene	U	1700	10:1	µg/l	0.10	< 0.10
Anthracene	U	1700	10:1	µg/l	0.10	< 0.10
Fluoranthene	U	1700	10:1	µg/l	0.10	< 0.10
Pyrene	U	1700	10:1	µg/l	0.10	< 0.10
Benzo[a]anthracene	U	1700	10:1	µg/l	0.10	< 0.10
Chrysene	N	1700	10:1	µg/l	0.10	< 0.10
Benzo[b]fluoranthene	U	1700	10:1	µg/l	0.10	< 0.10
Benzo[k]fluoranthene	U	1700	10:1	µg/l	0.10	< 0.10
Benzo[a]pyrene	U	1700	10:1	µg/l	0.10	< 0.10
Indeno(1,2,3-c,d)Pyrene	U	1700	10:1	µg/l	0.10	< 0.10
Dibenz(a,h)Anthracene	U	1700	10:1	µg/l	0.10	< 0.10
Benzo[g,h,i]perylene	U	1700	10:1	µg/l	0.10	< 0.10
Total Of 16 PAH's	N	1700	10:1	µg/l	2.0	< 2.0
Total Phenols	U	1920	10:1	mg/l	0.030	< 0.030

Results - Soil

Project: Q0463 Tylorstown Phase 4 GI

Client: Quantum Geotechnic Ltd				**Chemtest Job No.:**	21-08677
Quotation No.:				**Chemtest Sample ID.:**	1162776
				Client Sample ID.:	1
				Sample Location:	WS01
				Sample Type:	SOIL
				Top Depth (m):	2
				Date Sampled:	16-Mar-2021
				Asbestos Lab:	DURHAM
Determinand	**Accred.**	**SOP**	**Units**	**LOD**	
ACM Type	U	2192		N/A	-
Asbestos Identification	U	2192		N/A	No Asbestos Detected
ACM Detection Stage	U	2192		N/A	-
Moisture	N	2030	%	0.020	8.1
pH	U	2010		4.0	8.9
Boron (Hot Water Soluble)	U	2120	mg/kg	0.40	0.59
Sulphate (2:1 Water Soluble) as SO4	U	2120	g/l	0.010	0.047
Cyanide (Total)	U	2300	mg/kg	0.50	< 0.50
Aluminium (Total)	N	2430	mg/kg	100	5900
Arsenic	U	2450	mg/kg	1.0	8.2
Cadmium	U	2450	mg/kg	0.10	0.23
Chromium	U	2450	mg/kg	1.0	12
Manganese	U	2450	mg/kg	5.0	1400
Antimony	N	2450	mg/kg	2.0	< 2.0
Copper	U	2450	mg/kg	0.50	12
Mercury	U	2450	mg/kg	0.10	< 0.10
Nickel	U	2450	mg/kg	0.50	39
Lead	U	2450	mg/kg	0.50	31
Selenium	U	2450	mg/kg	0.20	0.47
Zinc	U	2450	mg/kg	0.50	60
Chromium (Hexavalent)	N	2490	mg/kg	0.50	< 0.50
Organic Matter	U	2625	%	0.40	< 0.40
Aliphatic TPH >C5-C6	N	2680	mg/kg	0.010	< 0.010
Aliphatic TPH >C6-C8	N	2680	mg/kg	0.010	< 0.010
Aliphatic TPH >C8-C10	N	2680	mg/kg	0.10	< 0.10
Aliphatic TPH >C10-C12	N	2680	mg/kg	0.10	< 0.10
Aliphatic TPH >C12-C16	N	2680	mg/kg	0.10	< 0.10
Aliphatic TPH >C16-C21	N	2680	mg/kg	0.10	< 0.10
Aliphatic TPH >C21-C35	N	2680	mg/kg	0.10	< 0.10
Aliphatic TPH >C35-C44	N	2680	mg/kg	0.10	< 0.10
Total Aliphatic Hydrocarbons	N	2680	mg/kg	1.0	< 1.0
Aromatic TPH >C5-C7	N	2680	mg/kg	0.010	< 0.010
Aromatic TPH >C7-C8	N	2680	mg/kg	0.010	< 0.010
Aromatic TPH >C8-C10	N	2680	mg/kg	0.10	< 0.10
Aromatic TPH >C10-C12	N	2680	mg/kg	0.10	< 0.10
Aromatic TPH >C12-C16	N	2680	mg/kg	0.10	< 0.10
Aromatic TPH >C16-C21	N	2680	mg/kg	0.10	< 0.10

Results - Soil

Project: Q0463 Tylorstown Phase 4 GI

Client: Quantum Geotechnic Ltd				**Chemtest Job No.:**	21-08677
Quotation No.:				**Chemtest Sample ID.:**	1162776
				Client Sample ID.:	1
				Sample Location:	WS01
				Sample Type:	SOIL
				Top Depth (m):	2
				Date Sampled:	16-Mar-2021
				Asbestos Lab:	DURHAM
Determinand	**Accred.**	**SOP**	**Units**	**LOD**	
Aromatic TPH >C21-C35	N	2680	mg/kg	0.10	< 0.10
Aromatic TPH >C35-C44	N	2680	mg/kg	0.10	< 0.10
Total Aromatic Hydrocarbons	N	2680	mg/kg	1.0	< 1.0
Total Petroleum Hydrocarbons	N	2680	mg/kg	2.0	< 2.0
Naphthalene	U	2700	mg/kg	0.10	< 0.10
Acenaphthylene	U	2700	mg/kg	0.10	< 0.10
Acenaphthene	U	2700	mg/kg	0.10	< 0.10
Fluorene	U	2700	mg/kg	0.10	< 0.10
Phenanthrene	U	2700	mg/kg	0.10	< 0.10
Anthracene	U	2700	mg/kg	0.10	< 0.10
Fluoranthene	U	2700	mg/kg	0.10	< 0.10
Pyrene	U	2700	mg/kg	0.10	< 0.10
Benzo[a]anthracene	U	2700	mg/kg	0.10	< 0.10
Chrysene	U	2700	mg/kg	0.10	< 0.10
Benzo[b]fluoranthene	U	2700	mg/kg	0.10	< 0.10
Benzo[k]fluoranthene	U	2700	mg/kg	0.10	< 0.10
Benzo[a]pyrene	U	2700	mg/kg	0.10	< 0.10
Indeno(1,2,3-c,d)Pyrene	U	2700	mg/kg	0.10	< 0.10
Dibenz(a,h)Anthracene	U	2700	mg/kg	0.10	< 0.10
Benzo[g,h,i]perylene	U	2700	mg/kg	0.10	< 0.10
Total Of 16 PAH's	U	2700	mg/kg	2.0	< 2.0
Total Phenols	U	2920	mg/kg	0.30	< 0.30

Test Methods

SOP	Title	Parameters included	Method summary
1010	pH Value of Waters	pH	pH Meter
1220	Anions, Alkalinity & Ammonium in Waters	Fluoride; Chloride; Nitrite; Nitrate; Total; Oxidisable Nitrogen (TON); Sulfate; Phosphate; Alkalinity; Ammonium	Automated colorimetric analysis using 'Aquakem 600' Discrete Analyser.
1300	Cyanides & Thiocyanate in Waters	Free (or easy liberatable) Cyanide; total Cyanide; complex Cyanide; Thiocyanate	Continuous Flow Analysis.
1415	Cations in Waters by ICP-MS	Sodium; Potassium; Calcium; Magnesium	Direct determination by inductively coupled plasma - mass spectrometry (ICP-MS).
1455	Metals in Waters by ICP-MS	Metals, including: Antimony; Arsenic; Barium; Beryllium; Boron; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Tin; Vanadium; Zinc	Filtration of samples followed by direct determination by inductively coupled plasma mass spectrometry (ICP-MS).
1610	Total/Dissolved Organic Carbon in Waters	Organic Carbon	TOC Analyser using Catalytic Oxidation
1675	TPH Aliphatic/Aromatic split in Waters by GC-FID(cf. Texas Method 1006 / TPH CWG)	Aliphatics: >C5–C6, >C6–C8, >C8– C10, >C10–C12, >C12–C16, >C16–C21, >C21–C35, >C35– C44Aromatics: >C5–C7, >C7–C8, >C8– C10, >C10–C12, >C12–C16, >C16– C21, >C21– C35, >C35– C44	Pentane extraction / GCxGC FID detection
1700	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Waters by GC-FID	Acenaphthene; Acenaphthylene; Anthracene; Benzo[a]Anthracene; Benzo[a]Pyrene; Benzo[b]Fluoranthene; Benzo[ghi]Perylene; Benzo[k]Fluoranthene; Chrysene; Dibenz[ah]Anthracene; Fluoranthene; Fluorene; Indeno[123cd]Pyrene; Naphthalene; Phenanthrene; Pyrene	Dichloromethane extraction / GC-FID (GC-FID detection is non-selective and can be subject to interference from co-eluting compounds)
1920	Phenols in Waters by HPLC	Phenolic compounds including: Phenol, Cresols, Xylenols, Trimethylphenols Note: Chlorophenols are excluded.	Determination by High Performance Liquid Chromatography (HPLC) using electrochemical detection.
2010	pH Value of Soils	pH	pH Meter
2030	Moisture and Stone Content of Soils(Requirement of MCERTS)	Moisture content	Determination of moisture content of soil as a percentage of its as received mass obtained at <37°C.
2040	Soil Description(Requirement of MCERTS)	Soil description	As received soil is described based upon BS5930
2120	Water Soluble Boron, Sulphate, Magnesium & Chromium	Boron; Sulphate; Magnesium; Chromium	Aqueous extraction / ICP-OES
2192	Asbestos	Asbestos	Polarised light microscopy / Gravimetry
2300	Cyanides & Thiocyanate in Soils	Free (or easy liberatable) Cyanide; total Cyanide; complex Cyanide; Thiocyanate	Allkaline extraction followed by colorimetric determination using Automated Flow Injection Analyser.
2430	Total Sulphate in soils	Total Sulphate	Acid digestion followed by determination of sulphate in extract by ICP-OES.
2450	Acid Soluble Metals in Soils	Metals, including: Arsenic; Barium; Beryllium; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Vanadium; Zinc	Acid digestion followed by determination of metals in extract by ICP-MS.
2490	Hexavalent Chromium in Soils	Chromium [VI]	Soil extracts are prepared by extracting dried and ground soil samples into boiling water. Chromium [VI] is determined by 'Aquakem 600' Discrete Analyser using 1,5-diphenylcarbazide.
2625	Total Organic Carbon in Soils	Total organic Carbon (TOC)	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.

Test Methods

SOP	Title	Parameters included	Method summary
2680	TPH A/A Split	Aliphatics: >C5–C6, >C6–C8,>C8–C10, >C10–C12, >C12–C16, >C16–C21, >C21–C35, >C35– C44Aromatics: >C5–C7, >C7–C8, >C8– C10, >C10–C12, >C12–C16, >C16– C21, >C21– C35, >C35– C44	Dichloromethane extraction / GCxGC FID detection
2700	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Soil by GC-FID	Acenaphthene; Acenaphthylene; Anthracene; Benzo[a]Anthracene; Benzo[a]Pyrene; Benzo[b]Fluoranthene; Benzo[ghi]Perylene; Benzo[k]Fluoranthene; Chrysene; Dibenz[ah]Anthracene; Fluoranthene; Fluorene; Indeno[123cd]Pyrene; Naphthalene; Phenanthrene; Pyrene	Dichloromethane extraction / GC-FID (GC-FID detection is non-selective and can be subject to interference from co-eluting compounds)
2920	Phenols in Soils by HPLC	Phenolic compounds including Resorcinol, Phenol, Methylphenols, Dimethylphenols, 1-Naphthol and TrimethylphenolsNote: chlorophenols are excluded.	60:40 methanol/water mixture extraction, followed by HPLC determination using electrochemical detection.
640	Characterisation of Waste (Leaching C10)	Waste material including soil, sludges and granular waste	ComplianceTest for Leaching of Granular Waste Material and Sludge

Report Information

Key	
U	UKAS accredited
M	MCERTS and UKAS accredited
N	Unaccredited
S	This analysis has been subcontracted to a UKAS accredited laboratory that is accredited for this analysis
SN	This analysis has been subcontracted to a UKAS accredited laboratory that is not accredited for this analysis
T	This analysis has been subcontracted to an unaccredited laboratory
I/S	Insufficient Sample
U/S	Unsuitable Sample
N/E	not evaluated
<	"less than"
>	"greater than"
SOP	Standard operating procedure
LOD	Limit of detection

Comments or interpretations are beyond the scope of UKAS accreditation
The results relate only to the items tested
Uncertainty of measurement for the determinands tested are available upon request
None of the results in this report have been recovery corrected
All results are expressed on a dry weight basis

The following tests were analysed on samples as received and the results subsequently corrected to a dry weight basis TPH, BTEX, VOCs, SVOCs, PCBs, Phenols

For all other tests the samples were dried at < 37°C prior to analysis
All Asbestos testing is performed at the indicated laboratory
Issue numbers are sequential starting with 1 all subsequent reports are incremented by 1

Sample Deviation Codes

A - Date of sampling not supplied
B - Sample age exceeds stability time (sampling to extraction)
C - Sample not received in appropriate containers
D - Broken Container
E - Insufficient Sample (Applies to LOI in Trommel Fines Only)

Sample Retention and Disposal

All soil samples will be retained for a period of 45 days from the date of receipt
All water samples will be retained for 14 days from the date of receipt
Charges may apply to extended sample storage

If you require extended retention of samples, please email your requirements to:
customerservices@chemtest.com

Results - Soil

Project: Q0463 Tylorstown Phase 4 GI

Client: Quantum Geotechnic Ltd				**Chemtest Job No.:**	21-07128	21-07128	21-07128	21-07128
Quotation No.: Q21-22667				**Chemtest Sample ID.:**	1155067	1155069	1155070	1155073
Order No.:				Client Sample Ref.:	1	1	2	1
				Client Sample ID.:	ES1	ES1	ES2	ES1
				Sample Location:	TP6	TP5	TP5	TP7
				Sample Type:	SOIL	SOIL	SOIL	SOIL
				Top Depth (m):	0.2	0.2	0.5	0.2
				Bottom Depth (m):	0.3			
				Date Sampled:	04-Mar-2021	04-Mar-2021	04-Mar-2021	04-Mar-2021
				Asbestos Lab:	DURHAM	DURHAM	DURHAM	DURHAM
Determinand	**Accred.**	**SOP**	**Units**	**LOD**				
Aromatic TPH >C12-C16	N	2680	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Aromatic TPH >C16-C21	N	2680	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Aromatic TPH >C21-C35	N	2680	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Aromatic TPH >C35-C44	N	2680	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Total Aromatic Hydrocarbons	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Total Petroleum Hydrocarbons	N	2680	mg/kg	2.0	< 2.0	< 2.0	< 2.0	< 2.0
Naphthalene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Acenaphthylene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Acenaphthene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Fluorene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Phenanthrene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Anthracene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Fluoranthene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Pyrene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[a]anthracene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Chrysene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[b]fluoranthene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[k]fluoranthene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[a]pyrene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Indeno(1,2,3-c,d)Pyrene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Dibenz(a,h)Anthracene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[g,h,i]perylene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Total Of 16 PAH's	U	2700	mg/kg	2.0	< 2.0	< 2.0	< 2.0	< 2.0
Total Phenols	U	2920	mg/kg	0.30	< 0.30	< 0.30	< 0.30	< 0.30

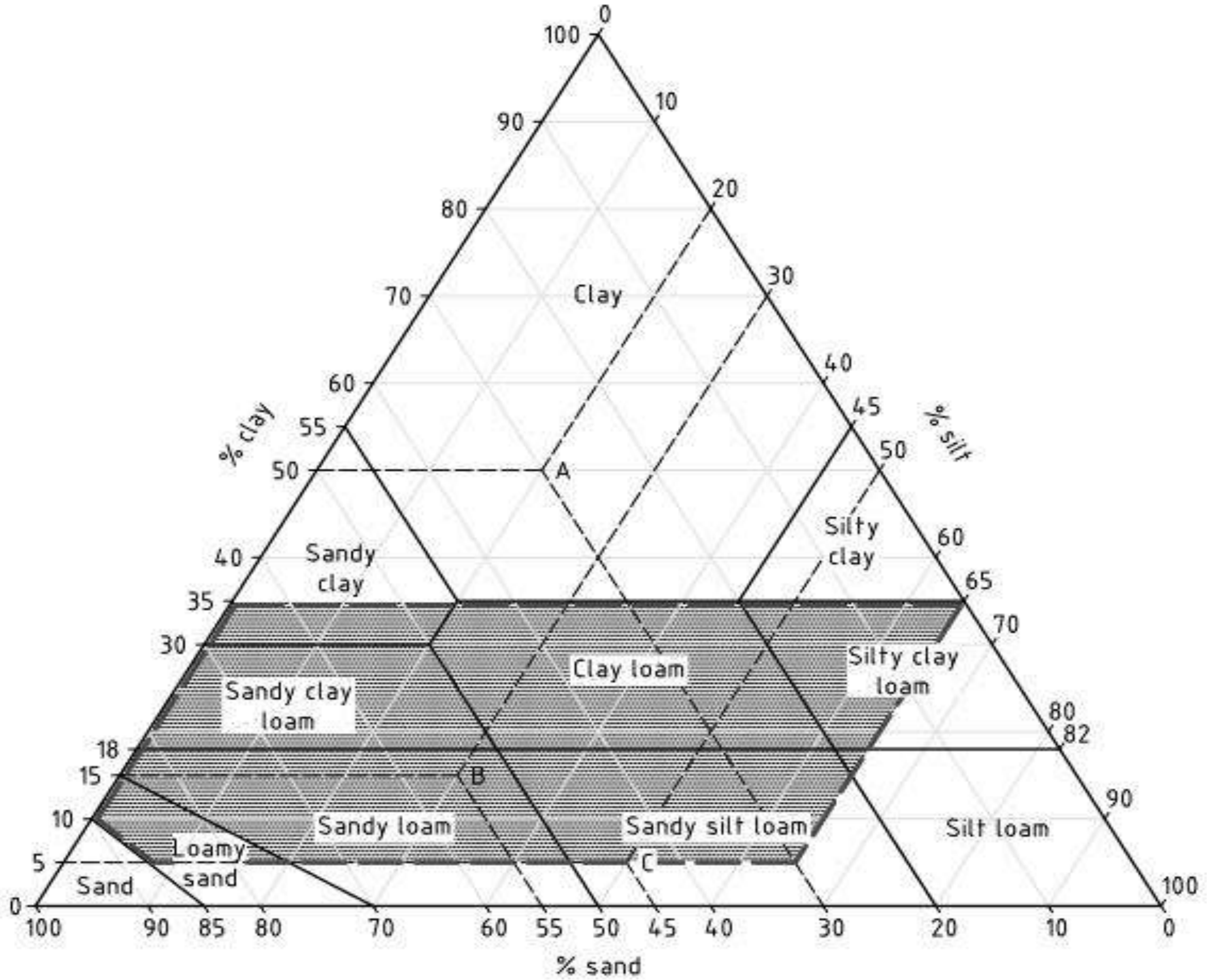
Results - Topsoil Report

BS3882:2015

Chemtest Job No.: 21-07128
Chemtest Sample ID.: 1155073
Client Sample Ref.: 1
Sample Location: TP7
Client Sample ID.: ES1
Top Depth (m): 0.2
Bottom Depth (m):
Date Sampled: 04-Mar-2021
Time Sampled:

Parameter	Units	Multipurpose Range			Result	Compliant with Multipurpose Range? (Y/N)	Compliant with Specific Purpose Range? (Y/N)		
Texture							**Acid**	**Low F**	**Calc.**
Clay content	%				19				
Silt content	%				15				
Sand content	%				66				
Soil texture class		See Attached Chart			Sandy Clay Loam	YES			
Mass Loss on Ignition									
Clay 5-20%		3.0-20			6.1	YES	YES	YES	YES
Clay 20-35%		5.0-20							
Stone Content	**% m/m**								
>2mm		0-30			26	YES			
>20mm		0-10			< 0.020	YES			
>50mm		0			< 0.020	YES			
Soil pH value		5.5-8.5			4.9	NO	YES	YES	NO
Carbonate (Calcareous only)	%				0.56				NO
Electrical Conductivity	µS/cm	If >3300 do ESP			2000	YES			
Available Nutrient Content									
Nitrogen %		>0.15			0.15	NO	NO		NO
Extractable phosphorus	mg/l	16-140			1.2	NO	NO	YES	NO
Extractable potassium	mg/l	121-1500			210	YES	YES		YES
Extractable magnesium	mg/l	51-600			70	YES	YES		YES
Carbon : Nitrogen Ratio		<20:1			24.0/1	NO	NO	YES	NO
Exchangeable sodium	**%**	<15			0.74				
Available Calcium	mg/l				330				
Available Sodium	mg/l				16				
Phytotoxic Contaminants (by soil pH)		**< 6.0**	**6.0-7.0**	**> 7.0**					
Zinc (Nitric Acid extract)	mg/kg	<200	<200	<300	16	YES			
Copper (Nitric Acid extract)	mg/kg	<100	<135	<200	10	YES			
Nickel (Nitric Acid extract)	mg/kg	<60	<75	<110	5.1	YES			
Visible Contaminants	**% mm**								
>2mm		<0.5			0.000	YES			
….. of which plastics		<0.25			0.000	YES			
….. man-made sharps		zero in 1kg			0.000	YES			

Topsoil:
Texture Classification Chart



Key

Area within which the texture of topsoil is required to fall

NOTE Examples of textural classification are as follows.

- *Soil A with 30% sand, 20% silt and 50% clay is in the "clay" textural class.*
- *Soil B with 55% sand, 30% silt and 15% clay is in the "sandy loam" textural class.*
- *Soil C with 45% sand, 50% silt and 5% clay is in the "sandy silt loam" textural class.*

Test Methods

SOP	Title	Parameters included	Method summary
1010	pH Value of Waters	pH	pH Meter
1220	Anions, Alkalinity & Ammonium in Waters	Fluoride; Chloride; Nitrite; Nitrate; Total; Oxidisable Nitrogen (TON); Sulfate; Phosphate; Alkalinity; Ammonium	Automated colorimetric analysis using 'Aquakem 600' Discrete Analyser.
1300	Cyanides & Thiocyanate in Waters	Free (or easy liberatable) Cyanide; total Cyanide; complex Cyanide; Thiocyanate	Continuous Flow Analysis.
1415	Cations in Waters by ICP-MS	Sodium; Potassium; Calcium; Magnesium	Direct determination by inductively coupled plasma - mass spectrometry (ICP-MS).
1455	Metals in Waters by ICP-MS	Metals, including: Antimony; Arsenic; Barium; Beryllium; Boron; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Tin; Vanadium; Zinc	Filtration of samples followed by direct determination by inductively coupled plasma mass spectrometry (ICP-MS).
1610	Total/Dissolved Organic Carbon in Waters	Organic Carbon	TOC Analyser using Catalytic Oxidation
1675	TPH Aliphatic/Aromatic split in Waters by GC-FID(cf. Texas Method 1006 / TPH CWG)	Aliphatics: >C5–C6, >C6–C8, >C8– C10, >C10–C12, >C12–C16, >C16–C21, >C21–C35, >C35– C44Aromatics: >C5–C7, >C7–C8, >C8– C10, >C10–C12, >C12–C16, >C16– C21, >C21– C35, >C35– C44	Pentane extraction / GCxGC FID detection
1700	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Waters by GC-FID	Acenaphthene; Acenaphthylene; Anthracene; Benzo[a]Anthracene; Benzo[a]Pyrene; Benzo[b]Fluoranthene; Benzo[ghi]Perylene; Benzo[k]Fluoranthene; Chrysene; Dibenz[ah]Anthracene; Fluoranthene; Fluorene; Indeno[123cd]Pyrene; Naphthalene; Phenanthrene; Pyrene	Dichloromethane extraction / GC-FID (GC-FID detection is non-selective and can be subject to interference from co-eluting compounds)
1920	Phenols in Waters by HPLC	Phenolic compounds including: Phenol, Cresols, Xylenols, Trimethylphenols Note: Chlorophenols are excluded.	Determination by High Performance Liquid Chromatography (HPLC) using electrochemical detection.
2010	pH Value of Soils	pH	pH Meter
2020	Electrical Conductivity	Electrical conductivity (EC) of aqueous extract or calcium sulphate solution for topsoil	Measurement of the electrical resistance of a 2:1 water/soil extract.
2030	Moisture and Stone Content of Soils(Requirement of MCERTS)	Moisture content	Determination of moisture content of soil as a percentage of its as received mass obtained at <37°C.
2040	Soil Description(Requirement of MCERTS)	Soil description	As received soil is described based upon BS5930
2115	Total Nitrogen in Soils	Nitrogen	Determination by elemental analyser
2120	Water Soluble Boron, Sulphate, Magnesium & Chromium	Boron; Sulphate; Magnesium; Chromium	Aqueous extraction / ICP-OES
2192	Asbestos	Asbestos	Polarised light microscopy / Gravimetry
2260	Carbonate	Carbonate	Titration
2300	Cyanides & Thiocyanate in Soils	Free (or easy liberatable) Cyanide; total Cyanide; complex Cyanide; Thiocyanate	Allkaline extraction followed by colorimetric determination using Automated Flow Injection Analyser.
2400	Cations	Cations	ICP-MS
2420	Phosphate	Phosphate	Spectrophotometry - Discrete analyser
2430	Total Sulphate in soils	Total Sulphate	Acid digestion followed by determination of sulphate in extract by ICP-OES.
2450	Acid Soluble Metals in Soils	Metals, including: Arsenic; Barium; Beryllium; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Vanadium; Zinc	Acid digestion followed by determination of metals in extract by ICP-MS.

Test Methods

SOP	Title	Parameters included	Method summary
2490	Hexavalent Chromium in Soils	Chromium [VI]	Soil extracts are prepared by extracting dried and ground soil samples into boiling water. Chromium [VI] is determined by 'Aquakem 600' Discrete Analyser using 1,5-diphenylcarbazide.
2620	LOI 440	LOI 440 Trommel Fines	Determination of the proportion by mass that is lost from a soil by ignition at 440°C.
2625	Total Organic Carbon in Soils	Total organic Carbon (TOC)	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.
2680	TPH A/A Split	Aliphatics: >C5–C6, >C6–C8,>C8–C10, >C10–C12, >C12–C16, >C16–C21, >C21–C35, >C35– C44Aromatics: >C5–C7, >C7–C8, >C8– C10, >C10–C12, >C12–C16, >C16– C21, >C21– C35, >C35– C44	Dichloromethane extraction / GCxGC FID detection
2700	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Soil by GC-FID	Acenaphthene; Acenaphthylene; Anthracene; Benzo[a]Anthracene; Benzo[a]Pyrene; Benzo[b]Fluoranthene; Benzo[ghi]Perylene; Benzo[k]Fluoranthene; Chrysene; Dibenz[ah]Anthracene; Fluoranthene; Fluorene; Indeno[123cd]Pyrene; Naphthalene; Phenanthrene; Pyrene	Dichloromethane extraction / GC-FID (GC-FID detection is non-selective and can be subject to interference from co-eluting compounds)
2920	Phenols in Soils by HPLC	Phenolic compounds including Resorcinol, Phenol, Methylphenols, Dimethylphenols, 1-Naphthol and TrimethylphenolsNote: chlorophenols are excluded.	60:40 methanol/water mixture extraction, followed by HPLC determination using electrochemical detection.
640	Characterisation of Waste (Leaching C10)	Waste material including soil, sludges and granular waste	ComplianceTest for Leaching of Granular Waste Material and Sludge

eurofins | Chemtest
Eurofins Chemtest Ltd
Depot Road
Newmarket
CB8 0AL
Tel: 01638 606070
Email: info@chemtest.com

UKAS TESTING 2183

Final Report

Report No.:	21-09064-1		
Initial Date of Issue:	29-Mar-2021		
Client	Quantum Geotechnic Ltd		
Client Address:	Plas Newydd Llanedi Pontarddulais Swansea SA4 0FQ		
Contact(s):	Steffan Picton		
Project	QO463 Tylorstown Phase 4 GI		
Quotation No.:		**Date Received:**	22-Mar-2021
Order No.:		**Date Instructed:**	22-Mar-2021
No. of Samples:	3		
Turnaround (Wkdays):	5	**Results Due:**	26-Mar-2021
Date Approved:	29-Mar-2021		
Approved By:			
Details:	Glynn Harvey, Technical Manager		

Results - Water

Project: QO463 Tylorstown Phase 4 GI

Client: Quantum Geotechnic Ltd				**Chemtest Job No.:**	21-09064	21-09064	21-09064
Quotation No.:				**Chemtest Sample ID.:**	1164539	1164540	1164541
				Client Sample ID.:	1	1	1
				Sample Location:	BH07	SW01	SW02
				Sample Type:	WATER	WATER	WATER
				Top Depth (m):	6.43	0	0
				Date Sampled:	19-Mar-2021	19-Mar-2021	19-Mar-2021
Determinand	**Accred.**	**SOP**	**Units**	**LOD**			
pH	U	1010		N/A	8.1	8.2	7.9
Electrical Conductivity	U	1020	µS/cm	1.0	580	260	130
Biochemical Oxygen Demand	N	1090	mg O2/l	4.0	[B] < 4.0	[B] < 4.0	[B] < 4.0
Chemical Oxygen Demand	U	1100	mg O2/l	10	13	14	15
Sulphur	N	1220	mg/l	1.0	25	6.3	4.0
Sulphate	U	1220	mg/l	1.0	75	19	12
Cyanide (Total)	U	1300	mg/l	0.050	< 0.050	< 0.050	< 0.050
Thiocyanate	U	1300	mg/l	0.50	< 0.50	< 0.50	< 0.50
Calcium	U	1455	mg/l	2.00		26	5.1
Total Hardness as CaCO3	U	1270	mg/l	15	110	100	33
Arsenic (Dissolved)	U	1455	µg/l	0.20	0.68	0.35	0.56
Boron (Dissolved)	U	1455	µg/l	10.0	27	18	23
Barium (Dissolved)	U	1455	µg/l	5.00	16	32	5.5
Beryllium (Dissolved)	U	1455	µg/l	1.00	< 1.0	< 1.0	< 1.0
Cadmium (Dissolved)	U	1455	µg/l	0.12	< 0.12	< 0.12	< 0.12
Chromium (Dissolved)	U	1455	µg/l	0.50	5.0	7.7	8.7
Copper (Dissolved)	U	1455	µg/l	0.50	1.5	5.7	3.6
Iron (Dissolved)	N	1455	µg/l	5.0	< 5.0	38	21
Mercury (Dissolved)	U	1455	µg/l	0.05	< 0.05	< 0.05	< 0.05
Nickel (Dissolved)	U	1455	µg/l	0.50	1.7	1.1	1.9
Lead (Dissolved)	U	1455	µg/l	0.50	< 0.50	< 0.50	< 0.50
Selenium (Dissolved)	U	1455	µg/l	0.50	2.5	< 0.50	0.54
Vanadium (Dissolved)	U	1455	µg/l	0.50	< 0.50	< 0.50	< 0.50
Zinc (Dissolved)	U	1455	µg/l	3.0	< 3.0	< 3.0	< 3.0
Chromium (Hexavalent)	U	1490	µg/l	20	< 20	< 20	< 20
Dissolved Organic Carbon	U	1610	mg/l	2.0	7.5	6.1	6.2
Total Organic Carbon	U	1610	mg/l	2.0	7.0	6.2	7.1
Aliphatic TPH >C5-C6	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10
Aliphatic TPH >C6-C8	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10
Aliphatic TPH >C8-C10	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10
Aliphatic TPH >C10-C12	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10
Aliphatic TPH >C12-C16	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10
Aliphatic TPH >C16-C21	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10
Aliphatic TPH >C21-C35	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10
Aliphatic TPH >C35-C44	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10
Total Aliphatic Hydrocarbons	N	1675	µg/l	5.0	< 5.0	< 5.0	< 5.0
Aromatic TPH >C5-C7	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10
Aromatic TPH >C7-C8	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10
Aromatic TPH >C8-C10	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10

Results - Water

Project: QO463 Tylorstown Phase 4 GI

Client: Quantum Geotechnic Ltd				**Chemtest Job No.:**	21-09064	21-09064	21-09064
Quotation No.:				**Chemtest Sample ID.:**	1164539	1164540	1164541
				Client Sample ID.:	1	1	1
				Sample Location:	BH07	SW01	SW02
				Sample Type:	WATER	WATER	WATER
				Top Depth (m):	6.43	0	0
				Date Sampled:	19-Mar-2021	19-Mar-2021	19-Mar-2021
Determinand	**Accred.**	**SOP**	**Units**	**LOD**			
Aromatic TPH >C10-C12	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10
Aromatic TPH >C12-C16	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10
Aromatic TPH >C16-C21	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10
Aromatic TPH >C21-C35	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10
Aromatic TPH >C35-C44	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10
Total Aromatic Hydrocarbons	N	1675	µg/l	5.0	< 5.0	< 5.0	< 5.0
Total Petroleum Hydrocarbons	N	1675	µg/l	10	< 10	< 10	< 10
Naphthalene	U	1700	µg/l	0.10	< 0.10	< 0.10	< 0.10
Acenaphthylene	U	1700	µg/l	0.10	< 0.10	< 0.10	< 0.10
Acenaphthene	U	1700	µg/l	0.10	< 0.10	< 0.10	< 0.10
Fluorene	U	1700	µg/l	0.10	< 0.10	< 0.10	< 0.10
Phenanthrene	U	1700	µg/l	0.10	< 0.10	< 0.10	< 0.10
Anthracene	U	1700	µg/l	0.10	< 0.10	< 0.10	< 0.10
Fluoranthene	U	1700	µg/l	0.10	< 0.10	< 0.10	< 0.10
Pyrene	U	1700	µg/l	0.10	< 0.10	< 0.10	< 0.10
Benzo[a]anthracene	U	1700	µg/l	0.10	< 0.10	< 0.10	< 0.10
Chrysene	N	1700	µg/l	0.10	< 0.10	< 0.10	< 0.10
Benzo[b]fluoranthene	U	1700	µg/l	0.10	< 0.10	< 0.10	< 0.10
Benzo[k]fluoranthene	U	1700	µg/l	0.10	< 0.10	< 0.10	< 0.10
Benzo[a]pyrene	U	1700	µg/l	0.10	< 0.10	< 0.10	< 0.10
Indeno(1,2,3-c,d)Pyrene	U	1700	µg/l	0.10	< 0.10	< 0.10	< 0.10
Dibenz(a,h)Anthracene	U	1700	µg/l	0.10	< 0.10	< 0.10	< 0.10
Benzo[g,h,i]perylene	U	1700	µg/l	0.10	< 0.10	< 0.10	< 0.10
Total Of 16 PAH's	N	1700	µg/l	2.0	< 2.0	< 2.0	< 2.0
Dichlorodifluoromethane	U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0
Chloromethane	U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0
Vinyl Chloride	N	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0
Bromomethane	U	1760	µg/l	5	< 5	< 5	< 5
Chloroethane	U	1760	µg/l	2.0	< 2.0	< 2.0	< 2.0
Trichlorofluoromethane	U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0
1,1-Dichloroethene	U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0
Trans 1,2-Dichloroethene	U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0
1,1-Dichloroethane	U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0
cis 1,2-Dichloroethene	U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0
Bromochloromethane	U	1760	µg/l	5	< 5	< 5	< 5
Trichloromethane	U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0
1,1,1-Trichloroethane	U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0
Tetrachloromethane	U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0
1,1-Dichloropropene	U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0

Results - Water

Project: QO463 Tylorstown Phase 4 GI

Client: Quantum Geotechnic Ltd				**Chemtest Job No.:**	21-09064	21-09064	21-09064
Quotation No.:				**Chemtest Sample ID.:**	1164539	1164540	1164541
				Client Sample ID.:	1	1	1
				Sample Location:	BH07	SW01	SW02
				Sample Type:	WATER	WATER	WATER
				Top Depth (m):	6.43	0	0
				Date Sampled:	19-Mar-2021	19-Mar-2021	19-Mar-2021
Determinand	**Accred.**	**SOP**	**Units**	**LOD**			
Benzene	U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0
1,2-Dichloroethane	U	1760	µg/l	2.0	< 2.0	< 2.0	< 2.0
Trichloroethene	N	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0
1,2-Dichloropropane	U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0
Dibromomethane	U	1760	µg/l	10	< 10	< 10	< 10
Bromodichloromethane	U	1760	µg/l	5	< 5	< 5	< 5
cis-1,3-Dichloropropene	N	1760	µg/l	10	< 10	< 10	< 10
Toluene	U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0
Trans-1,3-Dichloropropene	N	1760	µg/l	10	< 10	< 10	< 10
1,1,2-Trichloroethane	U	1760	µg/l	10	< 10	< 10	< 10
Tetrachloroethene	U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0
1,3-Dichloropropane	U	1760	µg/l	2.0	< 2.0	< 2.0	< 2.0
Dibromochloromethane	U	1760	µg/l	10	< 10	< 10	< 10
1,2-Dibromoethane	U	1760	µg/l	5	< 5	< 5	< 5
Chlorobenzene	N	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0
1,1,1,2-Tetrachloroethane	U	1760	µg/l	2.0	< 2.0	< 2.0	< 2.0
Ethylbenzene	U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0
m & p-Xylene	U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0
o-Xylene	U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0
Styrene	U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0
Tribromomethane	U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0
Isopropylbenzene	U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0
Bromobenzene	U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0
1,2,3-Trichloropropane	N	1760	µg/l	50	< 50	< 50	< 50
N-Propylbenzene	U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0
2-Chlorotoluene	U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0
1,3,5-Trimethylbenzene	U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0
4-Chlorotoluene	U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0
Tert-Butylbenzene	U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0
1,2,4-Trimethylbenzene	U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0
Sec-Butylbenzene	U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0
1,3-Dichlorobenzene	N	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0
4-Isopropyltoluene	U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0
1,4-Dichlorobenzene	U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0
N-Butylbenzene	U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0
1,2-Dichlorobenzene	U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0
1,2-Dibromo-3-Chloropropane	U	1760	µg/l	50	< 50	< 50	< 50
1,2,4-Trichlorobenzene	U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0
Hexachlorobutadiene	U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0

Results - Water

Project: QO463 Tylorstown Phase 4 GI

Client: Quantum Geotechnic Ltd				**Chemtest Job No.:**	21-09064	21-09064	21-09064
Quotation No.:				**Chemtest Sample ID.:**	1164539	1164540	1164541
				Client Sample ID.:	1	1	1
				Sample Location:	BH07	SW01	SW02
				Sample Type:	WATER	WATER	WATER
				Top Depth (m):	6.43	0	0
				Date Sampled:	19-Mar-2021	19-Mar-2021	19-Mar-2021
Determinand	**Accred.**	**SOP**	**Units**	**LOD**			
1,2,3-Trichlorobenzene	U	1760	µg/l	2.0	< 2.0	< 2.0	< 2.0
Methyl Tert-Butyl Ether	N	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0
N-Nitrosodimethylamine	N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50
Phenol	N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50
2-Chlorophenol	N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50
Bis-(2-Chloroethyl)Ether	N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50
1,3-Dichlorobenzene	N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50
1,4-Dichlorobenzene	N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50
1,2-Dichlorobenzene	N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50
2-Methylphenol (o-Cresol)	N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50
Bis(2-Chloroisopropyl)Ether	N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50
Hexachloroethane	N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50
N-Nitrosodi-n-propylamine	N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50
4-Methylphenol	N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50
Nitrobenzene	N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50
Isophorone	N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50
2-Nitrophenol	N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50
2,4-Dimethylphenol	N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50
Bis(2-Chloroethoxy)Methane	N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50
2,4-Dichlorophenol	N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50
1,2,4-Trichlorobenzene	N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50
Naphthalene	N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50
4-Chloroaniline	N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50
Hexachlorobutadiene	N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50
4-Chloro-3-Methylphenol	N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50
2-Methylnaphthalene	N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50
Hexachlorocyclopentadiene	N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50
2,4,6-Trichlorophenol	N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50
2,4,5-Trichlorophenol	N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50
2-Chloronaphthalene	N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50
2-Nitroaniline	N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50
Acenaphthylene	N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50
Dimethylphthalate	N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50
2,6-Dinitrotoluene	N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50
Acenaphthene	N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50
3-Nitroaniline	N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50
Dibenzofuran	N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50
4-Chlorophenylphenylether	N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50
2,4-Dinitrotoluene	N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50

Results - Water

Project: QO463 Tylorstown Phase 4 GI

Client: Quantum Geotechnic Ltd				**Chemtest Job No.:**	21-09064	21-09064	21-09064
Quotation No.:				**Chemtest Sample ID.:**	1164539	1164540	1164541
				Client Sample ID.:	1	1	1
				Sample Location:	BH07	SW01	SW02
				Sample Type:	WATER	WATER	WATER
				Top Depth (m):	6.43	0	0
				Date Sampled:	19-Mar-2021	19-Mar-2021	19-Mar-2021
Determinand	**Accred.**	**SOP**	**Units**	**LOD**			
Fluorene	N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50
Diethyl Phthalate	N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50
4-Nitroaniline	N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50
2-Methyl-4,6-Dinitrophenol	N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50
Azobenzene	N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50
4-Bromophenylphenyl Ether	N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50
Hexachlorobenzene	N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50
Pentachlorophenol	N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50
Phenanthrene	N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50
Anthracene	N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50
Carbazole	N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50
Di-N-Butyl Phthalate	N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50
Fluoranthene	N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50
Pyrene	N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50
Butylbenzyl Phthalate	N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50
Benzo[a]anthracene	N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50
Chrysene	N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50
Bis(2-Ethylhexyl)Phthalate	N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50
Di-N-Octyl Phthalate	N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50
Benzo[b]fluoranthene	N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50
Benzo[k]fluoranthene	N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50
Benzo[a]pyrene	N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50
Indeno(1,2,3-c,d)Pyrene	N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50
Dibenz(a,h)Anthracene	N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50
Benzo[g,h,i]perylene	N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50
4-Nitrophenol	N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50
Total Phenols	U	1920	mg/l	0.030	< 0.030	< 0.030	< 0.030

Deviations

In accordance with UKAS Policy on Deviating Samples TPS 63. Chemtest have a procedure to ensure 'upon receipt of each sample a competent laboratory shall assess whether the sample is suitable with regard to the requested test(s)'. This policy and the respective holding times applied, can be supplied upon request.The reason a sample is declared as deviating is detailed below. Where applicable the analysis remains UKAS/MCERTs accredited but the results may be compromised.

Sample:	Sample Ref:	Sample ID:	Sample Location:	Sampled Date:	Deviation Code(s):	Containers Received:
1164539		1	BH07	19-Mar-2021	B	Coloured Winchester 1000ml
1164539		1	BH07	19-Mar-2021	B	EPA Vial 40ml
1164539		1	BH07	19-Mar-2021	B	Plastic Bottle 1000ml
1164540		1	SW01	19-Mar-2021	B	Coloured Winchester 1000ml
1164540		1	SW01	19-Mar-2021	B	EPA Vial 40ml
1164540		1	SW01	19-Mar-2021	B	Plastic Bottle 1000ml
1164541		1	SW02	19-Mar-2021	B	Coloured Winchester 1000ml
1164541		1	SW02	19-Mar-2021	B	EPA Vial 40ml
1164541		1	SW02	19-Mar-2021	B	Plastic Bottle 1000ml

Test Methods

SOP	Title	Parameters included	Method summary
1010	pH Value of Waters	pH	pH Meter
1020	Electrical Conductivity and Total Dissolved Solids (TDS) in Waters	Electrical Conductivity and Total Dissolved Solids (TDS) in Waters	Conductivity Meter
1090	Biochemical Oxygen Demand	Biochemical Oxygen demand (BOD)	Colorimetric determination of dissolved oxygen in seeded sample after 5 days incubation at 20°C.
1100	Chemical Oxygen Demand	Chemical Oxygen demand (COD)	Dichromate oxidation of organic matter in sample followed by colorimetric determination of residual Cr[VI].
1220	Anions, Alkalinity & Ammonium in Waters	Fluoride; Chloride; Nitrite; Nitrate; Total; Oxidisable Nitrogen (TON); Sulfate; Phosphate; Alkalinity; Ammonium	Automated colorimetric analysis using 'Aquakem 600' Discrete Analyser.
1270	Total Hardness of Waters	Total hardness	Calculation applied to calcium and magnesium results, expressed as mg l-1 CaCO3 equivalent.
1300	Cyanides & Thiocyanate in Waters	Free (or easy liberatable) Cyanide; total Cyanide; complex Cyanide; Thiocyanate	Continuous Flow Analysis.
1455	Metals in Waters by ICP-MS	Metals, including: Antimony; Arsenic; Barium; Beryllium; Boron; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Tin; Vanadium; Zinc	Filtration of samples followed by direct determination by inductively coupled plasma mass spectrometry (ICP-MS).
1490	Hexavalent Chromium in Waters	Chromium [VI]	Automated colorimetric analysis by 'Aquakem 600' Discrete Analyser using 1,5-diphenylcarbazide.
1610	Total/Dissolved Organic Carbon in Waters	Organic Carbon	TOC Analyser using Catalytic Oxidation
1675	TPH Aliphatic/Aromatic split in Waters by GC-FID(cf. Texas Method 1006 / TPH CWG)	Aliphatics: >C5–C6, >C6–C8, >C8– C10, >C10–C12, >C12–C16, >C16–C21, >C21– C35, >C35– C44Aromatics: >C5–C7, >C7–C8, >C8– C10, >C10–C12, >C12–C16, >C16– C21, >C21– C35, >C35– C44	Pentane extraction / GCxGC FID detection
1700	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Waters by GC-FID	Acenaphthene; Acenaphthylene; Anthracene; Benzo[a]Anthracene; Benzo[a]Pyrene; Benzo[b]Fluoranthene; Benzo[ghi]Perylene; Benzo[k]Fluoranthene; Chrysene; Dibenz[ah]Anthracene; Fluoranthene; Fluorene; Indeno[123cd]Pyrene; Naphthalene; Phenanthrene; Pyrene	Dichloromethane extraction / GC-FID (GC-FID detection is non-selective and can be subject to interference from co-eluting compounds)
1760	Volatile Organic Compounds (VOCs) in Waters by Headspace GC-MS	Volatile organic compounds, including BTEX and halogenated Aliphatic/Aromatics. (cf. USEPA Method 8260)	Automated headspace gas chromatographic (GC) analysis of water samples with mass spectrometric (MS) detection of volatile organic compounds.
1790	Semi-Volatile Organic Compounds (SVOCs) in Waters by GC-MS	Semi-volatile organic compounds	Solvent extraction / GCMS detection
1920	Phenols in Waters by HPLC	Phenolic compounds including: Phenol, Cresols, Xylenols, Trimethylphenols Note: Chlorophenols are excluded.	Determination by High Performance Liquid Chromatography (HPLC) using electrochemical detection.

Report Information

Key

U	UKAS accredited
M	MCERTS and UKAS accredited
N	Unaccredited
S	This analysis has been subcontracted to a UKAS accredited laboratory that is accredited for this analysis
SN	This analysis has been subcontracted to a UKAS accredited laboratory that is not accredited for this analysis
T	This analysis has been subcontracted to an unaccredited laboratory
I/S	Insufficient Sample
U/S	Unsuitable Sample
N/E	not evaluated
<	"less than"
>	"greater than"
SOP	Standard operating procedure
LOD	Limit of detection

Comments or interpretations are beyond the scope of UKAS accreditation
The results relate only to the items tested
Uncertainty of measurement for the determinands tested are available upon request
None of the results in this report have been recovery corrected
All results are expressed on a dry weight basis

The following tests were analysed on samples as received and the results subsequently corrected to a dry weight basis TPH, BTEX, VOCs, SVOCs, PCBs, Phenols

For all other tests the samples were dried at < 37°C prior to analysis
All Asbestos testing is performed at the indicated laboratory
Issue numbers are sequential starting with 1 all subsequent reports are incremented by 1

Sample Deviation Codes

A - Date of sampling not supplied
B - Sample age exceeds stability time (sampling to extraction)
C - Sample not received in appropriate containers
D - Broken Container
E - Insufficient Sample (Applies to LOI in Trommel Fines Only)

Sample Retention and Disposal

All soil samples will be retained for a period of 45 days from the date of receipt
All water samples will be retained for 14 days from the date of receipt
Charges may apply to extended sample storage

If you require extended retention of samples, please email your requirements to:
customerservices@chemtest.com

Report Information

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If you require extended retention of samples, please email your requirements to:
customerservices@chemtest.com

Eurofins Chemtest Ltd
Depot Road
Newmarket
CB8 0AL
Tel: 01638 606070
Email: info@chemtest.com

UKAS TESTING 2183

Amended Report

Report No.:	21-09064-2		
Initial Date of Issue:	29-Mar-2021	**Date of Re-Issue:**	29-Mar-2021
Client	Quantum Geotechnic Ltd		
Client Address:	Plas Newydd Llanedi Pontarddulais Swansea SA4 0FQ		
Contact(s):	Steffan Picton		
Project	QO463 Tylorstown Phase 4 GI		
Quotation No.:		**Date Received:**	22-Mar-2021
Order No.:		**Date Instructed:**	22-Mar-2021
No. of Samples:	3		
Turnaround (Wkdays):	8	**Results Due:**	31-Mar-2021
Date Approved:	29-Mar-2021		
Approved By:			
Details:	Glynn Harvey, Technical Manager		

Results - Water

Project: QO463 Tylorstown Phase 4 GI

Client: Quantum Geotechnic Ltd				**Chemtest Job No.:**	21-09064	21-09064	21-09064
Quotation No.:				**Chemtest Sample ID.:**	1164539	1164540	1164541
				Client Sample ID.:	1	1	1
				Sample Location:	BH07	SW01	SW02
				Sample Type:	WATER	WATER	WATER
				Top Depth (m):	6.43	0	0
				Date Sampled:	19-Mar-2021	19-Mar-2021	19-Mar-2021
Determinand	**Accred.**	**SOP**	**Units**	**LOD**			
pH	U	1010		N/A	8.1	8.2	7.9
Electrical Conductivity	U	1020	µS/cm	1.0	580	260	130
Biochemical Oxygen Demand	N	1090	mg O2/l	4.0	[B] < 4.0	[B] < 4.0	[B] < 4.0
Chemical Oxygen Demand	U	1100	mg O2/l	10	13	14	15
Sulphur	N	1220	mg/l	1.0	25	6.3	4.0
Sulphate	U	1220	mg/l	1.0	75	19	12
Cyanide (Total)	U	1300	mg/l	0.050	< 0.050	< 0.050	< 0.050
Thiocyanate	U	1300	mg/l	0.50	< 0.50	< 0.50	< 0.50
Calcium	U	1455	mg/l	2.00		26	5.1
Total Hardness as CaCO3	U	1270	mg/l	15	110	100	33
Aluminium (Dissolved)	N	1455	µg/l	5.0	5.8	13	11
Arsenic (Dissolved)	U	1455	µg/l	0.20	0.68	0.35	0.56
Boron (Dissolved)	U	1455	µg/l	10.0	27	18	23
Barium (Dissolved)	U	1455	µg/l	5.00	16	32	5.5
Beryllium (Dissolved)	U	1455	µg/l	1.00	< 1.0	< 1.0	< 1.0
Cadmium (Dissolved)	U	1455	µg/l	0.12	< 0.12	< 0.12	< 0.12
Chromium (Dissolved)	U	1455	µg/l	0.50	5.0	7.7	8.7
Copper (Dissolved)	U	1455	µg/l	0.50	1.5	5.7	3.6
Iron (Dissolved)	N	1455	µg/l	5.0	< 5.0	38	21
Mercury (Dissolved)	U	1455	µg/l	0.05	< 0.05	< 0.05	< 0.05
Manganese (Dissolved)	U	1455	µg/l	0.50	240	31	180
Nickel (Dissolved)	U	1455	µg/l	0.50	1.7	1.1	1.9
Lead (Dissolved)	U	1455	µg/l	0.50	< 0.50	< 0.50	< 0.50
Antimony (Dissolved)	U	1455	µg/l	0.50	0.63	< 0.50	< 0.50
Selenium (Dissolved)	U	1455	µg/l	0.50	2.5	< 0.50	0.54
Vanadium (Dissolved)	U	1455	µg/l	0.50	< 0.50	< 0.50	< 0.50
Zinc (Dissolved)	U	1455	µg/l	3.0	< 3.0	< 3.0	< 3.0
Chromium (Hexavalent)	U	1490	µg/l	20	< 20	< 20	< 20
Dissolved Organic Carbon	U	1610	mg/l	2.0	7.5	6.1	6.2
Total Organic Carbon	U	1610	mg/l	2.0	7.0	6.2	7.1
Aliphatic TPH >C5-C6	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10
Aliphatic TPH >C6-C8	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10
Aliphatic TPH >C8-C10	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10
Aliphatic TPH >C10-C12	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10
Aliphatic TPH >C12-C16	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10
Aliphatic TPH >C16-C21	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10
Aliphatic TPH >C21-C35	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10
Aliphatic TPH >C35-C44	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10
Total Aliphatic Hydrocarbons	N	1675	µg/l	5.0	< 5.0	< 5.0	< 5.0

Results - Water

Project: QO463 Tylorstown Phase 4 GI

Client: Quantum Geotechnic Ltd				**Chemtest Job No.:**	21-09064	21-09064	21-09064
Quotation No.:				**Chemtest Sample ID.:**	1164539	1164540	1164541
				Client Sample ID.:	1	1	1
				Sample Location:	BH07	SW01	SW02
				Sample Type:	WATER	WATER	WATER
				Top Depth (m):	6.43	0	0
				Date Sampled:	19-Mar-2021	19-Mar-2021	19-Mar-2021
Determinand	**Accred.**	**SOP**	**Units**	**LOD**			
Aromatic TPH >C5-C7	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10
Aromatic TPH >C7-C8	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10
Aromatic TPH >C8-C10	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10
Aromatic TPH >C10-C12	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10
Aromatic TPH >C12-C16	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10
Aromatic TPH >C16-C21	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10
Aromatic TPH >C21-C35	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10
Aromatic TPH >C35-C44	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10
Total Aromatic Hydrocarbons	N	1675	µg/l	5.0	< 5.0	< 5.0	< 5.0
Total Petroleum Hydrocarbons	N	1675	µg/l	10	< 10	< 10	< 10
Naphthalene	U	1700	µg/l	0.10	< 0.10	< 0.10	< 0.10
Acenaphthylene	U	1700	µg/l	0.10	< 0.10	< 0.10	< 0.10
Acenaphthene	U	1700	µg/l	0.10	< 0.10	< 0.10	< 0.10
Fluorene	U	1700	µg/l	0.10	< 0.10	< 0.10	< 0.10
Phenanthrene	U	1700	µg/l	0.10	< 0.10	< 0.10	< 0.10
Anthracene	U	1700	µg/l	0.10	< 0.10	< 0.10	< 0.10
Fluoranthene	U	1700	µg/l	0.10	< 0.10	< 0.10	< 0.10
Pyrene	U	1700	µg/l	0.10	< 0.10	< 0.10	< 0.10
Benzo[a]anthracene	U	1700	µg/l	0.10	< 0.10	< 0.10	< 0.10
Chrysene	N	1700	µg/l	0.10	< 0.10	< 0.10	< 0.10
Benzo[b]fluoranthene	U	1700	µg/l	0.10	< 0.10	< 0.10	< 0.10
Benzo[k]fluoranthene	U	1700	µg/l	0.10	< 0.10	< 0.10	< 0.10
Benzo[a]pyrene	U	1700	µg/l	0.10	< 0.10	< 0.10	< 0.10
Indeno(1,2,3-c,d)Pyrene	U	1700	µg/l	0.10	< 0.10	< 0.10	< 0.10
Dibenz(a,h)Anthracene	U	1700	µg/l	0.10	< 0.10	< 0.10	< 0.10
Benzo[g,h,i]perylene	U	1700	µg/l	0.10	< 0.10	< 0.10	< 0.10
Total Of 16 PAH's	N	1700	µg/l	2.0	< 2.0	< 2.0	< 2.0
Dichlorodifluoromethane	U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0
Chloromethane	U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0
Vinyl Chloride	N	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0
Bromomethane	U	1760	µg/l	5	< 5	< 5	< 5
Chloroethane	U	1760	µg/l	2.0	< 2.0	< 2.0	< 2.0
Trichlorofluoromethane	U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0
1,1-Dichloroethene	U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0
Trans 1,2-Dichloroethene	U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0
1,1-Dichloroethane	U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0
cis 1,2-Dichloroethene	U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0
Bromochloromethane	U	1760	µg/l	5	< 5	< 5	< 5
Trichloromethane	U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0

Results - Water

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Quotation No.:				**Chemtest Sample ID.:**	1164539	1164540	1164541
				Client Sample ID.:	1	1	1
				Sample Location:	BH07	SW01	SW02
				Sample Type:	WATER	WATER	WATER
				Top Depth (m):	6.43	0	0
				Date Sampled:	19-Mar-2021	19-Mar-2021	19-Mar-2021
Determinand	**Accred.**	**SOP**	**Units**	**LOD**			
1,1,1-Trichloroethane	U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0
Tetrachloromethane	U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0
1,1-Dichloropropene	U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0
Benzene	U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0
1,2-Dichloroethane	U	1760	µg/l	2.0	< 2.0	< 2.0	< 2.0
Trichloroethene	N	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0
1,2-Dichloropropane	U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0
Dibromomethane	U	1760	µg/l	10	< 10	< 10	< 10
Bromodichloromethane	U	1760	µg/l	5	< 5	< 5	< 5
cis-1,3-Dichloropropene	N	1760	µg/l	10	< 10	< 10	< 10
Toluene	U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0
Trans-1,3-Dichloropropene	N	1760	µg/l	10	< 10	< 10	< 10
1,1,2-Trichloroethane	U	1760	µg/l	10	< 10	< 10	< 10
Tetrachloroethene	U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0
1,3-Dichloropropane	U	1760	µg/l	2.0	< 2.0	< 2.0	< 2.0
Dibromochloromethane	U	1760	µg/l	10	< 10	< 10	< 10
1,2-Dibromoethane	U	1760	µg/l	5	< 5	< 5	< 5
Chlorobenzene	N	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0
1,1,1,2-Tetrachloroethane	U	1760	µg/l	2.0	< 2.0	< 2.0	< 2.0
Ethylbenzene	U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0
m & p-Xylene	U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0
o-Xylene	U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0
Styrene	U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0
Tribromomethane	U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0
Isopropylbenzene	U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0
Bromobenzene	U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0
1,2,3-Trichloropropane	N	1760	µg/l	50	< 50	< 50	< 50
N-Propylbenzene	U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0
2-Chlorotoluene	U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0
1,3,5-Trimethylbenzene	U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0
4-Chlorotoluene	U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0
Tert-Butylbenzene	U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0
1,2,4-Trimethylbenzene	U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0
Sec-Butylbenzene	U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0
1,3-Dichlorobenzene	N	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0
4-Isopropyltoluene	U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0
1,4-Dichlorobenzene	U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0
N-Butylbenzene	U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0
1,2-Dichlorobenzene	U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0

Results - Water

Project: QO463 Tylorstown Phase 4 GI

Client: Quantum Geotechnic Ltd				**Chemtest Job No.:**	21-09064	21-09064	21-09064
Quotation No.:				**Chemtest Sample ID.:**	1164539	1164540	1164541
				Client Sample ID.:	1	1	1
				Sample Location:	BH07	SW01	SW02
				Sample Type:	WATER	WATER	WATER
				Top Depth (m):	6.43	0	0
				Date Sampled:	19-Mar-2021	19-Mar-2021	19-Mar-2021
Determinand	**Accred.**	**SOP**	**Units**	**LOD**			
1,2-Dibromo-3-Chloropropane	U	1760	µg/l	50	< 50	< 50	< 50
1,2,4-Trichlorobenzene	U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0
Hexachlorobutadiene	U	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0
1,2,3-Trichlorobenzene	U	1760	µg/l	2.0	< 2.0	< 2.0	< 2.0
Methyl Tert-Butyl Ether	N	1760	µg/l	1.0	< 1.0	< 1.0	< 1.0
N-Nitrosodimethylamine	N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50
Phenol	N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50
2-Chlorophenol	N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50
Bis-(2-Chloroethyl)Ether	N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50
1,3-Dichlorobenzene	N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50
1,4-Dichlorobenzene	N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50
1,2-Dichlorobenzene	N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50
2-Methylphenol (o-Cresol)	N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50
Bis(2-Chloroisopropyl)Ether	N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50
Hexachloroethane	N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50
N-Nitrosodi-n-propylamine	N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50
4-Methylphenol	N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50
Nitrobenzene	N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50
Isophorone	N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50
2-Nitrophenol	N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50
2,4-Dimethylphenol	N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50
Bis(2-Chloroethoxy)Methane	N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50
2,4-Dichlorophenol	N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50
1,2,4-Trichlorobenzene	N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50
Naphthalene	N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50
4-Chloroaniline	N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50
Hexachlorobutadiene	N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50
4-Chloro-3-Methylphenol	N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50
2-Methylnaphthalene	N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50
Hexachlorocyclopentadiene	N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50
2,4,6-Trichlorophenol	N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50
2,4,5-Trichlorophenol	N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50
2-Chloronaphthalene	N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50
2-Nitroaniline	N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50
Acenaphthylene	N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50
Dimethylphthalate	N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50
2,6-Dinitrotoluene	N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50
Acenaphthene	N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50
3-Nitroaniline	N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50

Results - Water

Project: QO463 Tylorstown Phase 4 GI

Client: Quantum Geotechnic Ltd				**Chemtest Job No.:**	21-09064	21-09064	21-09064
Quotation No.:				**Chemtest Sample ID.:**	1164539	1164540	1164541
				Client Sample ID.:	1	1	1
				Sample Location:	BH07	SW01	SW02
				Sample Type:	WATER	WATER	WATER
				Top Depth (m):	6.43	0	0
				Date Sampled:	19-Mar-2021	19-Mar-2021	19-Mar-2021
Determinand	**Accred.**	**SOP**	**Units**	**LOD**			
Dibenzofuran	N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50
4-Chlorophenylphenylether	N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50
2,4-Dinitrotoluene	N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50
Fluorene	N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50
Diethyl Phthalate	N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50
4-Nitroaniline	N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50
2-Methyl-4,6-Dinitrophenol	N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50
Azobenzene	N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50
4-Bromophenylphenyl Ether	N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50
Hexachlorobenzene	N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50
Pentachlorophenol	N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50
Phenanthrene	N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50
Anthracene	N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50
Carbazole	N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50
Di-N-Butyl Phthalate	N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50
Fluoranthene	N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50
Pyrene	N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50
Butylbenzyl Phthalate	N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50
Benzo[a]anthracene	N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50
Chrysene	N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50
Bis(2-Ethylhexyl)Phthalate	N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50
Di-N-Octyl Phthalate	N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50
Benzo[b]fluoranthene	N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50
Benzo[k]fluoranthene	N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50
Benzo[a]pyrene	N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50
Indeno(1,2,3-c,d)Pyrene	N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50
Dibenz(a,h)Anthracene	N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50
Benzo[g,h,i]perylene	N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50
4-Nitrophenol	N	1790	µg/l	0.50	< 0.50	< 0.50	< 0.50
Total Phenols	U	1920	mg/l	0.030	< 0.030	< 0.030	< 0.030

Deviations

In accordance with UKAS Policy on Deviating Samples TPS 63. Chemtest have a procedure to ensure 'upon receipt of each sample a competent laboratory shall assess whether the sample is suitable with regard to the requested test(s)'. This policy and the respective holding times applied, can be supplied upon request.The reason a sample is declared as deviating is detailed below. Where applicable the analysis remains UKAS/MCERTs accredited but the results may be compromised.

Sample:	Sample Ref:	Sample ID:	Sample Location:	Sampled Date:	Deviation Code(s):	Containers Received:
1164539		1	BH07	19-Mar-2021	B	Coloured Winchester 1000ml
1164539		1	BH07	19-Mar-2021	B	EPA Vial 40ml
1164539		1	BH07	19-Mar-2021	B	Plastic Bottle 1000ml
1164540		1	SW01	19-Mar-2021	B	Coloured Winchester 1000ml
1164540		1	SW01	19-Mar-2021	B	EPA Vial 40ml
1164540		1	SW01	19-Mar-2021	B	Plastic Bottle 1000ml
1164541		1	SW02	19-Mar-2021	B	Coloured Winchester 1000ml
1164541		1	SW02	19-Mar-2021	B	EPA Vial 40ml
1164541		1	SW02	19-Mar-2021	B	Plastic Bottle 1000ml

Test Methods

SOP	Title	Parameters included	Method summary
1010	pH Value of Waters	pH	pH Meter
1020	Electrical Conductivity and Total Dissolved Solids (TDS) in Waters	Electrical Conductivity and Total Dissolved Solids (TDS) in Waters	Conductivity Meter
1090	Biochemical Oxygen Demand	Biochemical Oxygen demand (BOD)	Colorimetric determination of dissolved oxygen in seeded sample after 5 days incubation at 20°C.
1100	Chemical Oxygen Demand	Chemical Oxygen demand (COD)	Dichromate oxidation of organic matter in sample followed by colorimetric determination of residual Cr[VI].
1220	Anions, Alkalinity & Ammonium in Waters	Fluoride; Chloride; Nitrite; Nitrate; Total; Oxidisable Nitrogen (TON); Sulfate; Phosphate; Alkalinity; Ammonium	Automated colorimetric analysis using ‘Aquakem 600’ Discrete Analyser.
1270	Total Hardness of Waters	Total hardness	Calculation applied to calcium and magnesium results, expressed as mg l-1 CaCO3 equivalent.
1300	Cyanides & Thiocyanate in Waters	Free (or easy liberatable) Cyanide; total Cyanide; complex Cyanide; Thiocyanate	Continuous Flow Analysis.
1455	Metals in Waters by ICP-MS	Metals, including: Antimony; Arsenic; Barium; Beryllium; Boron; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Tin; Vanadium; Zinc	Filtration of samples followed by direct determination by inductively coupled plasma mass spectrometry (ICP-MS).
1490	Hexavalent Chromium in Waters	Chromium [VI]	Automated colorimetric analysis by ‘Aquakem 600’ Discrete Analyser using 1,5-diphenylcarbazide.
1610	Total/Dissolved Organic Carbon in Waters	Organic Carbon	TOC Analyser using Catalytic Oxidation
1675	TPH Aliphatic/Aromatic split in Waters by GC-FID(cf. Texas Method 1006 / TPH CWG)	Aliphatics: >C5–C6, >C6–C8, >C8– C10, >C10–C12, >C12–C16, >C16–C21, >C21–C35, >C35– C44Aromatics: >C5–C7, >C7–C8, >C8– C10, >C10–C12, >C12–C16, >C16– C21, >C21– C35, >C35– C44	Pentane extraction / GCxGC FID detection
1700	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Waters by GC-FID	Acenaphthene; Acenaphthylene; Anthracene; Benzo[a]Anthracene; Benzo[a]Pyrene; Benzo[b]Fluoranthene; Benzo[ghi]Perylene; Benzo[k]Fluoranthene; Chrysene; Dibenz[ah]Anthracene; Fluoranthene; Fluorene; Indeno[123cd]Pyrene; Naphthalene; Phenanthrene; Pyrene	Dichloromethane extraction / GC-FID (GC-FID detection is non-selective and can be subject to interference from co-eluting compounds)
1760	Volatile Organic Compounds (VOCs) in Waters by Headspace GC-MS	Volatile organic compounds, including BTEX and halogenated Aliphatic/Aromatics. (cf. USEPA Method 8260)	Automated headspace gas chromatographic (GC) analysis of water samples with mass spectrometric (MS) detection of volatile organic compounds.
1790	Semi-Volatile Organic Compounds (SVOCs) in Waters by GC-MS	Semi-volatile organic compounds	Solvent extraction / GCMS detection
1920	Phenols in Waters by HPLC	Phenolic compounds including: Phenol, Cresols, Xylenols, Trimethylphenols Note: Chlorophenols are excluded.	Determination by High Performance Liquid Chromatography (HPLC) using electrochemical detection.

Report Information

Key	
U	UKAS accredited
M	MCERTS and UKAS accredited
N	Unaccredited
S	This analysis has been subcontracted to a UKAS accredited laboratory that is accredited for this analysis
SN	This analysis has been subcontracted to a UKAS accredited laboratory that is not accredited for this analysis
T	This analysis has been subcontracted to an unaccredited laboratory
I/S	Insufficient Sample
U/S	Unsuitable Sample
N/E	not evaluated
<	"less than"
>	"greater than"
SOP	Standard operating procedure
LOD	Limit of detection

Comments or interpretations are beyond the scope of UKAS accreditation
The results relate only to the items tested
Uncertainty of measurement for the determinands tested are available upon request
None of the results in this report have been recovery corrected
All results are expressed on a dry weight basis

The following tests were analysed on samples as received and the results subsequently corrected to a dry weight basis TPH, BTEX, VOCs, SVOCs, PCBs, Phenols

For all other tests the samples were dried at < 37°C prior to analysis
All Asbestos testing is performed at the indicated laboratory
Issue numbers are sequential starting with 1 all subsequent reports are incremented by 1

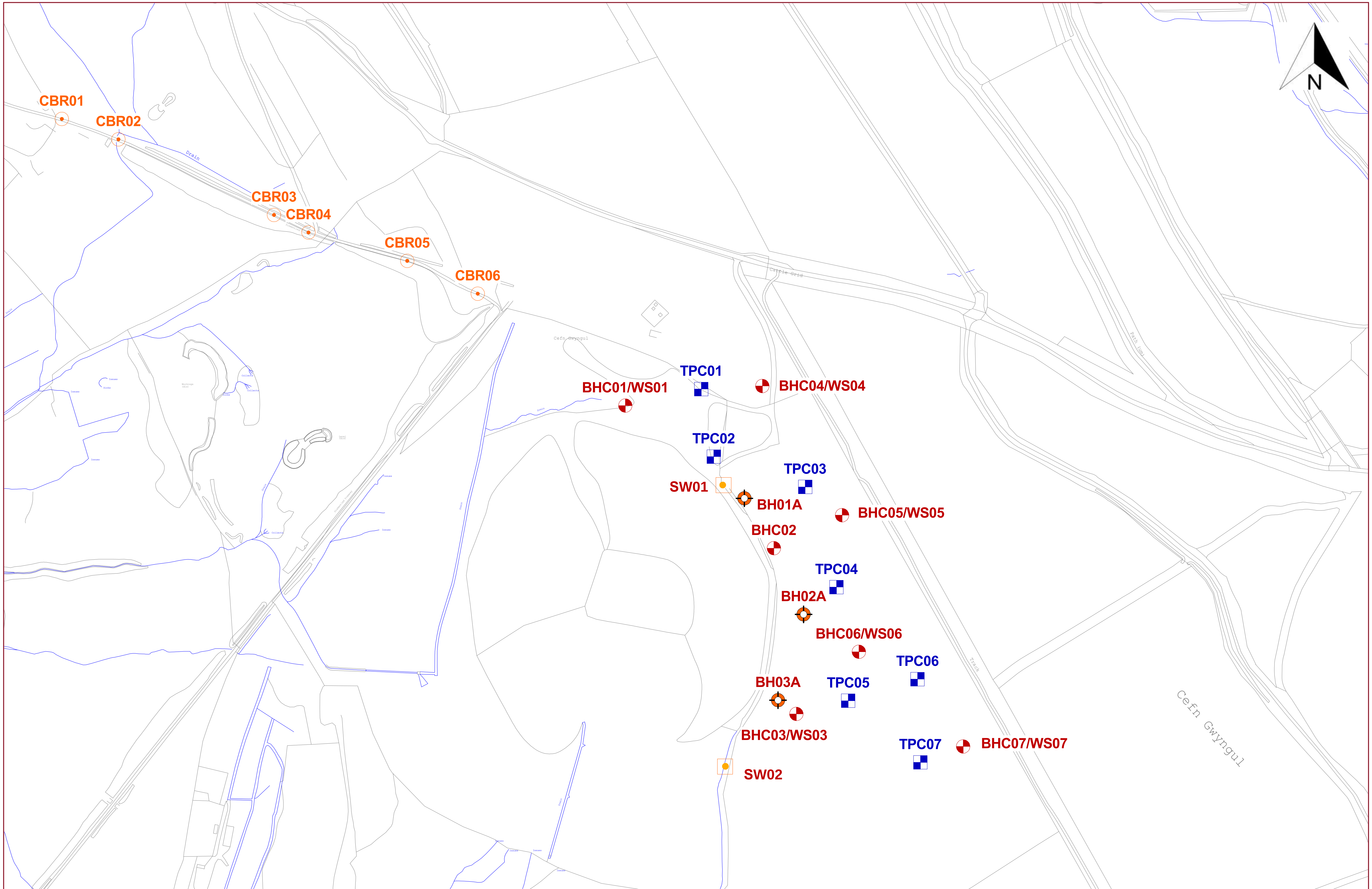
Sample Deviation Codes

A - Date of sampling not supplied
B - Sample age exceeds stability time (sampling to extraction)
C - Sample not received in appropriate containers
D - Broken Container
E - Insufficient Sample (Applies to LOI in Trommel Fines Only)

Sample Retention and Disposal

All soil samples will be retained for a period of 45 days from the date of receipt
All water samples will be retained for 14 days from the date of receipt
Charges may apply to extended sample storage

If you require extended retention of samples, please email your requirements to:
customerservices@chemtest.com



Quantum Geotech
Plas Newydd, Llanedi
SA4 0FQ
Tel:
Fax:
Email:

KEY

- Borehole
- Trial Pit
- Monitoring / Test Point
- Window Sample
- Dynamic Probe
- Historical Hole
- Sampling Point

PROJECT	DRAWING TITLE:	JOB NO.	FIGURE NO.
TYLORSTOWN PHASE 4 GI	EXPLORATORY HOLE LOCATION PLAN	Q0463	1
		DATE 13/04/21	SCALE 1:3500

Appendix C

Drawings

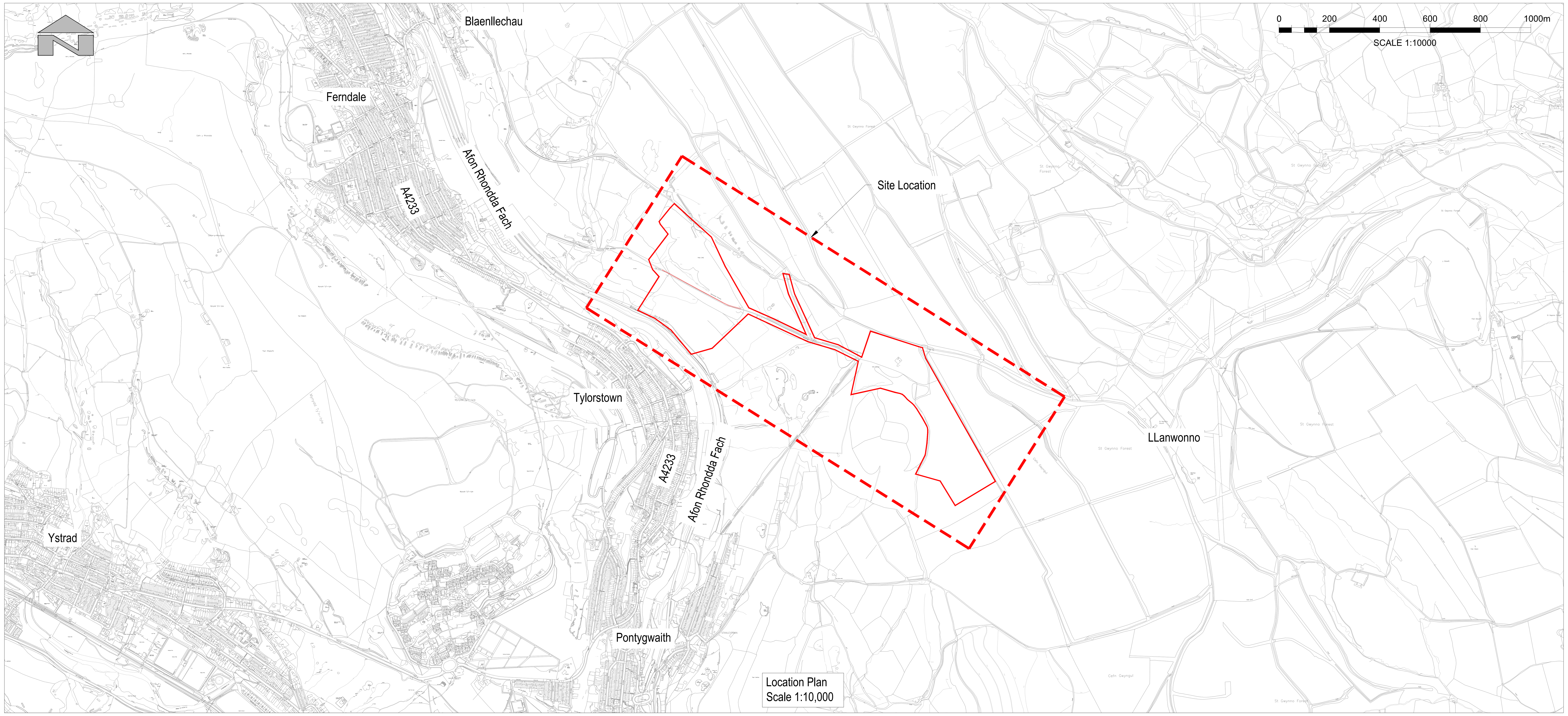
C.1 Location plan

Calculations

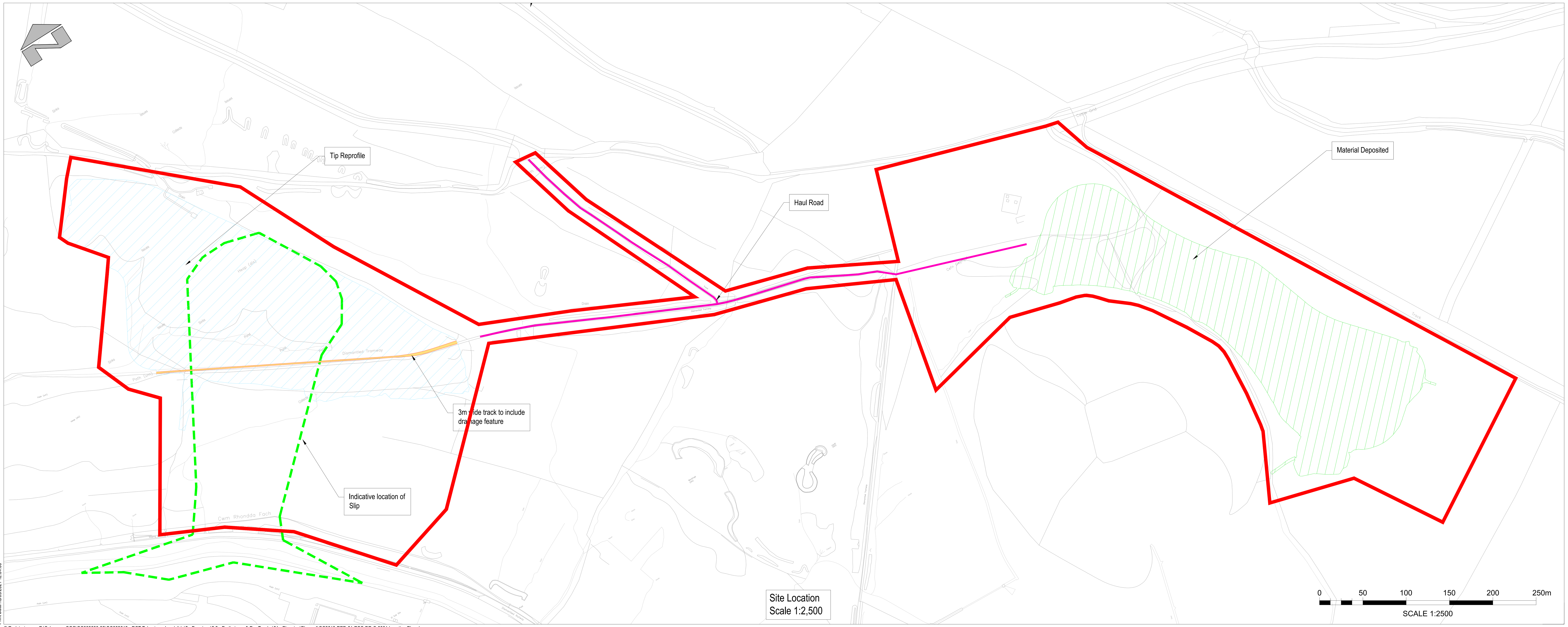
C.2 Greenfield run-off calculation (UKSuDS tool)

C.3 Spring flow estimation

C.4 Donor Site - Greenfield rate calculation - Flow output



Location Plan
Scale 1:10,000



Site Location
Scale 1:2,500

Key:

- Planning Boundary
- Proposed Tip Reprofile (including Tramway)
- Proposed Material deposit
- Proposed Haul Route
- Proposed 3m wide track to include drainage feature
- Indicative location of Slip

Notes:

1. For Tip Reprofile General Arrangement refer to drawing : GC3613-RED-61-RSC-DR-C-0002
2. For Receptor Site C General Arrangement refer to drawing : GC3613-RED-61-RSC-DR-C-0003
3. For cross sections of Tip Reprofile refer to drawings: GC3613-RED-61-RSC-DR-C-0004-0008
4. For cross sections of Receptor Site C refer to drawings: GC3613-RED-61-RSC-DR-C-0009-0013

Rev	Drwn	Chk'd	App'd	Description	Date

Purpose of Issue
D5 - Suitable for Planning

Classification
Public

Client
Rhondda Cynon Taf
County Borough Council

Project
Tylorstown Landslide

Drawing
Phase 4
Location Plan

Scale @ A1	Drawn	Checked	Approved
As Shown	MH	NG	PH

Project No.	Date
GC/3613	March 2021

Drawing Identifier — BS1192 Compliant
Project - Originator - Zone - Level - File Type - Role - Number — revision
GC3613-RED-61-RSC-DR-C-0001 — P02

REDSTART
St David's House, Pascal Close, St Mellons, Cardiff, CF3 0LW
www.redstartwales.com

Print Date:18/09/2021 12:54:06

 P:\Schemes_CGC\GC003600-99\GC003613 - RCT Tylorstown Landslide\2 - Drawings\2.3 - Preliminary & Pre-Tender\61 - Planning\Phase 4\GC3613-RED-61-RSC-DR-C-0001 Location Plan.dwg

HR Wallingford
Working with water

Greenfield runoff rate estimation for sites

www.uksuds.com | Greenfield runoff tool

Calculated by:	Jacques Calitz
Site name:	Tylorstown Ph4 - Receptor C
Site location:	Tylorstown Ph4 - Receptor C

This is an estimation of the greenfield runoff rates that are used to meet normal best practice criteria in line with Environment Agency guidance “Rainfall runoff management for developments”, SC030219 (2013) , the SuDS Manual C753 (Ciria, 2015) and the non-statutory standards for SuDS (Defra, 2015). This information on greenfield runoff rates may be
the basis for setting consents for the drainage of surface water runoff from sites.

Site Details

Latitude:	51.65110° N
Longitude:	3.41913° W
Reference:	1493243335
Date:	May 16 2021 11:54

Runoff estimation approach

IH124

Site characteristics

Total site area (ha): 1

Methodology

Q_{BAR} estimation method:	Calculate from SPR and SAAR
SPR estimation method:	Calculate from SOIL type

Soil characteristics

	Default	Edited
SOIL type:	3	3
HOST class:	N/A	N/A
SPR/SPRHOST:	0.37	0.37

Hydrological characteristics

	Default	Edited
SAAR (mm):	1920	1920
Hydrological region:	9	9
Growth curve factor 1 year:	0.88	0.88
Growth curve factor 30 years:	1.78	1.78
Growth curve factor 100 years:	2.18	2.18
Growth curve factor 200 years:	2.46	2.46

Notes

(1) Is Q_{BAR} < 2.0 l/s/ha?

When Q_{BAR} is < 2.0 l/s/ha then limiting discharge rates are set at 2.0 l/s/ha.

(2) Are flow rates < 5.0 l/s?

Where flow rates are less than 5.0 l/s consent for discharge is usually set at 5.0 l/s if blockage from vegetation and other materials is possible. Lower consent flow rates may be set where the blockage risk is addressed by using appropriate drainage elements.

(3) Is SPR/SPRHOST ≤ 0.3?

Where groundwater levels are low enough the use of soakaways to avoid discharge offsite would normally be preferred for disposal of surface water runoff.

Greenfield runoff rates

	Default	Edited
Q_{BAR} (l/s):	9.35	9.35
1 in 1 year (l/s):	8.23	8.23
1 in 30 years (l/s):	16.65	16.65
1 in 100 year (l/s):	20.39	20.39
1 in 200 years (l/s):	23.01	23.01

RCT Tylorstown Landslide Phase 4

Spring flow calculation

24 May 2021

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1. Spring/Groundwater flow estimation

1.1 Methods

Three different methods have been used to attempt to estimate the groundwater flow rates that the herringbone drainage system may receive.

1. Using estimated hydraulic gradients, hydraulic conductivities, and groundwater level heights above the argillaceous layers to obtain flow rates via Darcy's Law
2. Using the estimated catchment area of the herringbone drains combined with estimates of the groundwater recharge in the area; and
3. Using data from the 1971 report on flow rates of streams towards Old Smokey and applying a baseflow index common to much of the coalfield region.

By using three methods more confidence can be given in the ultimate estimate of the flow rates from groundwater to the drainage system, whilst giving some bounds on the degree of uncertainty of these rates. It has been assumed in each of these three methods that 4 herringbone systems will be used at the site. If fewer or more systems are used the flow rates should be factored accordingly to obtain a rate per system.

1.2 Method 1 - Darcy's Law

In order to apply Darcy's Law for the region of the drainage system then for each perched groundwater body on each of the argillaceous layers the relevant hydraulic conductivity, hydraulic gradient and saturated thickness of groundwater in each sandstone is required. It has been assumed, from the nomenclature used in the Capita Phase 4 PSSR, that there are two relevant sandstone units providing the groundwater; sandstone 4 and sandstone 5. The sandstone layer beneath the Daren Rhestyn and above the 1st Rhondda Rider are below the area that will provide flow to the herringbone drainage system or are too far above it respectively, and are assumed to flow to other parts of the drainage network.

The available historical reports have been analysed in detail and no set of individual groundwater levels over time have been found for the known historical boreholes. The relevant data found are the summary of groundwater levels in Table 2.1 of the 2004 Halcrow report, the geological cross sections of this 2004 report and piezeometer data and hydraulic conductivity data in the text of the 1971 Halcrow report.

The table below shows the data considered prior to the Darcy calculation.

Borehole	Screened Unit	Water strikes above underlying argillaceous layer from borehole log?	Hydraulic Conductivity value m/s	Halcrow cross section evidence for water level above next argillaceous layer
LWT1	Not relevant – below Daren Rhestyn	N/A	N/A	No evidence

Borehole	Screened Unit	Water strikes above underlying argillaceous layer from borehole log?	Hydraulic Conductivity value m/s	Halcrow cross section evidence for water level above next argillaceous layer
LWT2	In Sandstone 4 above 1st Rhondda Rider	Dry on drilling	N/A	5 m above 1st Rhondda Rider
LWT3	In Sandstone 4 above 1st Rhondda Rider	No evidence	N/A	No evidence
LWT4	In Sandstone 4 above 1st Rhondda Rider	No evidence	N/A	10 m above 1st Rhondda Rider
LWT5	In Sandstone 4 above 1st Rhondda Rider	4.5 m of groundwater from 16.2 m bgl water level for the layer at 20.75 m bgl.	N/A	No evidence
LWT6	In Sandstone 5 above 1st Rhondda Rider	No evidence – some water strikes but not obviously above argillaceous layer	N/A	No evidence
LWT7	In Sandstone 5 above 1st Rhondda Rider	Siltstone at 14.7 m bgl and water rises to 11.2 m bgl so potentially 3.5 m of groundwater.	N/A	No evidence
LWT8	Not relevant in lower tip.	Dry on drilling	N/A	No evidence
LWN1	Likely to be Sandstone 3 but have not seen log.	Not known.	2.12×10^{-7} – 7.74×10^{-6}	No evidence
LWN2	Not known.	Not known.	2.02×10^{-5} – 8.80×10^{-6}	No evidence
LWN3	Not known.	Not known.	2.45×10^{-6} – 2.94×10^{-6}	No evidence
LWN4	Not relevant – on lower tip	Not known.	6.50×10^{-6}	No evidence

The 1971 Halcrow Report does present other potentially relevant information on saturated thickness for BH9 where coal was encountered at 158’ depth and water rose to 145’ bgl. Hence there would have been 13’ of water or 3.96 m of water above the argillaceous aquitard. In BH8 the log indicates a massive sandstone overlying coal at 184’ bgl. Groundwater was encountered at 116’ bgl which corresponds to 68’ water or 20.7 m above the aquitard. This is likely to be sandstone 3 above the Brithdir and so potentially not applicable for the calculations here. Piezometer 1b is quoted in the 1971 report as having 3.7 m of water above the Brithdir Rider and piezometer 5b to have around 1.2 m. An average saturated thickness of 5 m has therefore been assumed.

To obtain the hydraulic gradient then data are required deeper into the hillside than the outcrop where interference from the groundwater with the superficial deposits and colliery spoil will occur.

There are only two obvious boreholes with piezometer tips screened in the same unit away from outcrop; LWN1 and LWT5 in sandstone 4. Very approximately from the cross section LWTR2/3, groundwater levels are ~312 m AOD in LWN1 and 299.89 m AOD in LWT5 which is ~ 50 m projected down hydraulic gradient. This produces an extremely steep gradient of 12/50 = 0.24. This approximately matches the topographic gradient and is much steeper than would be expected for a very permeable fractured sandstone. If the hydraulic gradient were to be this steep in groundwater, then a low hydraulic conductivity would be expected. Hydraulic conductivities from the variable head tests (1971 report) indicate between 0.018 m/day and 1.7 m/day, which although are very low for a fractured sandstone, and would need to be even lower to agree with extremely steep gradient calculated here.

However, the hydraulic gradient further away from “outcrop” into the hillside is likely to be much lower, but there is no evidence to suggest how much lower. The hydraulic conductivities for the variable head tests are unlikely to be representative of the aquifer as a whole which is known to be heavily fractured from both tension and compression movements due to the mining activities. A hydraulic conductivity of approximately 50 m/day would not be unreasonable for such a heavily fractured sandstone. If there is such a high hydraulic conductivity then the hydraulic gradient would be expected to be of the order of 0.001. From the table above and data from the 1971 report approximately 5 m of saturated thickness is assumed.

Flow per metre of outcrop length of aquifer would be

Q = KiA
50 x 0.001 x 5
0.25 m3/day or 2.9 x 10^{-3} *l/s.*

If 500 m of the site is of interest along topographic contours (i.e. across the hillside at the same height) beneath the herringbone drains and the drainage comprises 4 systems then this would be 0.4 l/s for each herringbone system. This is for each spring line and if it is assumed that there are two full length spring lines across the site that require capture then is equates to 0.8 l/s.

If the gradient were indeed to be 0.24 rather than 0.001 and a much lower hydraulic conductivity of 1 m/day is also applicable, then if:

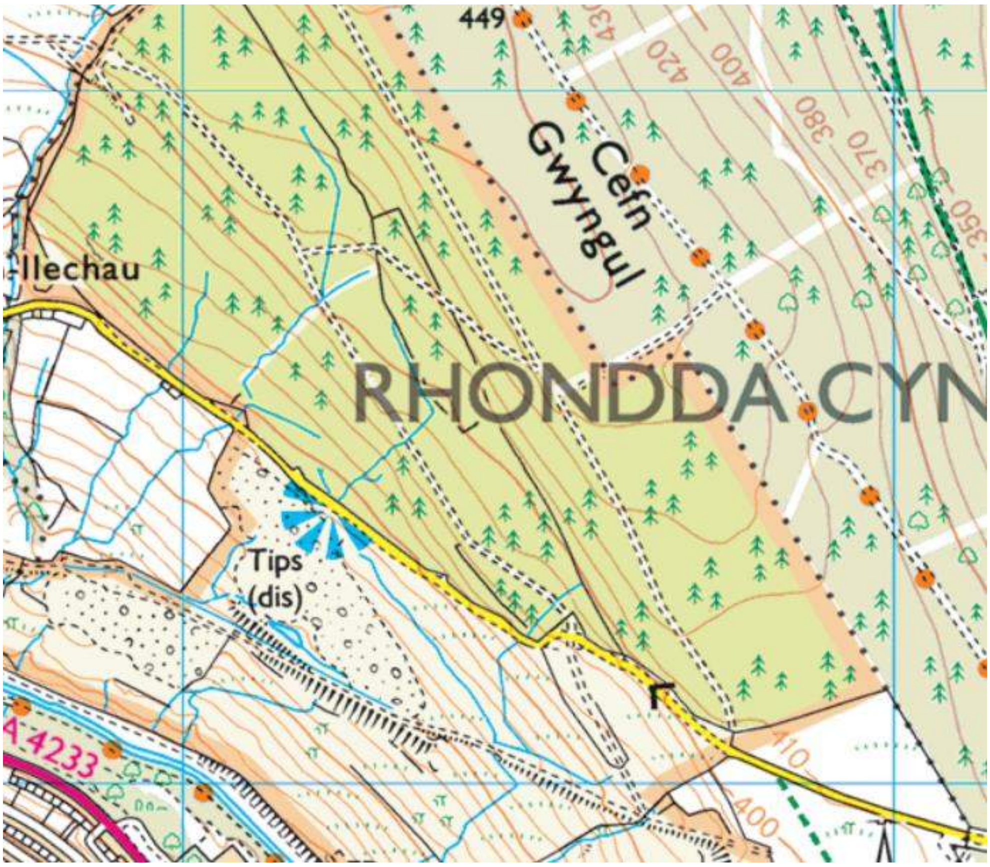
Q = KiA
1 x 0.24 x 5
1.2 m3/day this equates to 3.84 l/s on average for each of the 4 herringbone structures proposed.

1.3 Method 2 - Groundwater Recharge

Robins et al. (2008) suggests that rainfall in the region is approximately 1500 mm/year with 500 mm of evapotranspiration, 520 mm/year of runoff and rainfall recharge in the region of 480 mm/year. Assuming that groundwater is likely to follow topography, then the ridge along Cefyn Gwyng should be approximately the line of a groundwater divide (conjecture only – there is no evidence for this other than the surface water pattern and topography). Hence only the area that is south and west of there will contribute to the groundwater flowing into the herringbone drains. An assumption that the herringbone drain system covers a length perpendicular to groundwater flow of approximately 500 m and the dimension parallel to groundwater flow is about 800 m has been made (see map below).

Area x recharge = volume this area receives
800 x 500 x 0.48
192000 m³/year.

This is equivalent to 6.08 x 10^{-3} m^3/s or 6 l/s. This would mean on average 1.5 l/s would be received by each of the four herringbone drains from groundwater. However, there will be huge variability in flow; as noted in the 1971 report it is expected that due to the dip of the beds back into the hillside towards the northeast, only during extreme rainfall will the groundwater table in each of the sandstone units overtop the argillaceous beds in a significant manner leading to high spring flows down the hillside.



1.4 Method 2 - Baseflow Index

The 1971 report indicates that that the maximum flow from the issuing streams above the Brithdir Rider seam is 41.29 l/s and the Brithdir Seam is 10.2 l/s. Combined this is approximately 51.4 l/s. It is not exactly known what area/length this is considered over (diagrams from 1971 report not available) but is for streams issuing towards Old Smokey. Assuming roughly the same area is covered then if a baseflow index of 0.48 is applied (Robins et al., 2008 for major rivers traversing the coalfield) then 24.8 l/s is obtained. Dividing this between then four herringbone systems planned then 6 l/s is obtained, which is higher but the same order of magnitude as that from the recharge method and only twice as high as the method assuming approximate sandstone aquifer properties.

2. Summary

For each of the 4 herringbone structures planned it is envisaged that at low flows then 0.4 l/s may issue from groundwater but in higher flow conditions then 4 l/s per second may be more appropriate using the Darcy approach. The recharge approach gives a value in between these two values at 1.5 l/s for each of the 4 herringbone structures, supporting the Darcy range of values.

The value given from the baseflow index method should be treated with caution since the area is not thought to be specifically for the site in question and flows may be higher than those expected for the site. From the 1:25,000 Ordnance Survey map of the area, the number of springs in the vicinity of Old Smokey is higher than that of the Llanwonno Upper Tip.

UKCP18 climate change projections suggest that on average up to 18% more precipitation could occur for the 95th percentile predictions in Wales, with a worst case scenario of 60% more, so 1.6 x 3.84 = 6.1 l/s may be more appropriate to future proof any design on average. This is assuming that the extra rainfall is not associated with extreme events which would likely result in more overland flow rather than recharging groundwater levels. The impact of climate change on groundwater levels and quantities is an area of ongoing research and currently the evidence for the impacts of future climate change on UK groundwater recharge and levels is limited (Jackson et al, 2015). Jackson et al. (2015) suggest that reductions in annual and average summer groundwater levels may be seen, with increases in average winter levels overall, but that responses will be highly dependent on catchment and hydrogeological characteristics.

The possible range of flows (excluding extreme groundwater recharge events) is considered to be between 0.8 and 6.1 l/s, with an expected value of 3.8 l/s. It is therefore recommended that an uncertainty analysis be conducted on the herringbone design that examines the range of 0.8 to 6.1 l/s for groundwater flow into each of the 4 herringbone systems.

3. References

Jackson, C.R., Bloomfield, J.P., and Mackay, J.D., 2015. Evidence for changes in historic and future groundwater levels in the UK. *Progress in Physical Geography: Earth and Environment* 39(1) pp:49-67. doi:10.1177/0309133314550668.

Robins, N.S., Davies, J & Dumpleton, S., 2008. Groundwater flow in the South Wales coalfield: historical data informing 3D modelling. *Quarterly Journal of Engineering Geology and Hydrogeology*, 41, 477–486 1470-9236. DOI 10.1144/1470-9236/07-055

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St David's House
Pascal Close
St Mellons
Cardiff
CF3 0LW

www.redstartwales.com

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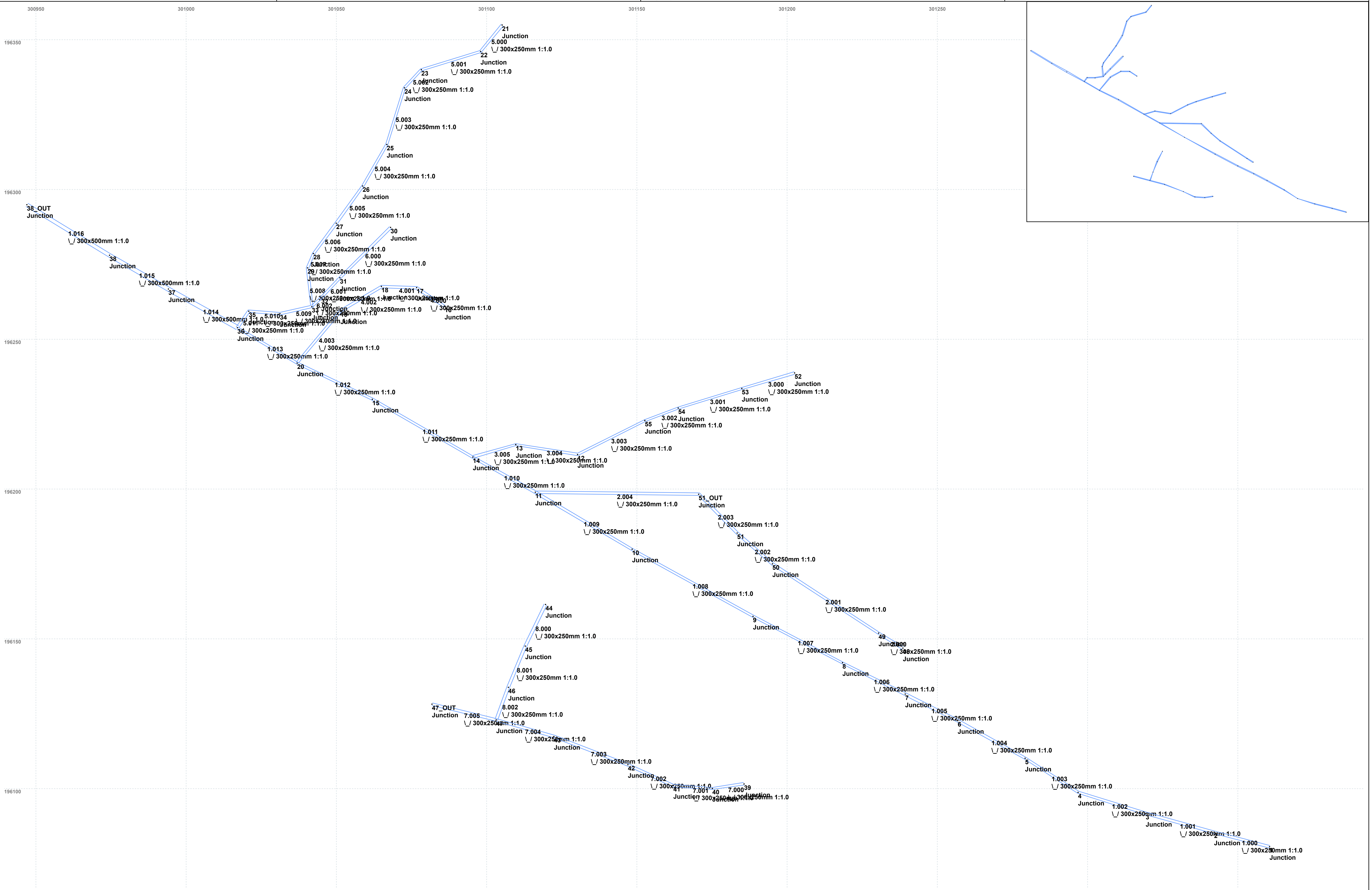
CAUSEWAY	Capita	File: GC3613-RED-05-RSC-CM-C-0501 - Flow model - Tylorstown Existing Slip 4 (no pon Network: Storm Network Jacques Calitz 24/05/2021	Page 1 Tylorstown Phase 4 Existing Tip Greenfield rate



Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	60.00
Return Period (years)	2	Maximum Rainfall (mm/hr)	50.0
Additional Flow (%)	0	Minimum Velocity (m/s)	1.00
FSR Region	England and Wales	Connection Type	Level Soffits
M5-60 (mm)	20.000	Minimum Backdrop Height (m)	0.200
Ratio-R	0.200	Preferred Cover Depth (m)	1.200
CV	0.750	Include Intermediate Ground	✓
Time of Entry (mins)	10.00	Enforce best practice design rules	x

Nodes

Name	Area (ha)	T of E (mins)	Add Inflow (l/s)	Cover Level (m)	Easting (m)	Northing (m)	Depth (m)
21	0.053	10.00	3.0	306.947	301105.156	196354.900	0.250
22	0.020	10.00		303.127	301097.981	196346.079	0.250
23				298.905	301078.275	196339.987	0.250
24				296.928	301072.659	196333.929	0.250
25	0.031	10.00		292.736	301066.760	196315.022	0.250
26				288.137	301058.729	196301.153	0.250
27				282.712	301049.945	196288.737	0.250
28				277.626	301042.340	196278.619	0.250
49	0.050	10.00	6.0	288.104	301230.459	196151.913	0.250
48	0.021	10.00		288.865	301238.536	196146.901	0.250
39		10.00		262.707	301185.669	196101.559	0.250
50				287.468	301195.118	196175.028	0.250
40				259.506	301175.123	196100.049	0.250
41				255.323	301162.147	196101.027	0.250
42				252.201	301147.020	196107.988	0.250
43				246.063	301122.390	196117.372	0.250
47				240.488	301103.205	196122.935	0.250
47_OUT				235.018	301081.810	196128.195	0.250
1		10.00		305.000	301360.569	196080.612	0.250
4	0.031	10.00		296.000	301296.835	196098.735	0.250
5				293.184	301279.209	196110.137	0.250
2	0.027	10.00		302.000	301342.107	196085.479	0.250
3	0.028	10.00		298.226	301319.363	196091.694	0.250
6	0.033	10.00		291.448	301256.777	196122.695	0.250
7	0.017	10.00		288.124	301239.311	196131.563	0.250
8	0.024	10.00		286.211	301218.432	196142.025	0.250
9	0.046	10.00		282.719	301188.656	196157.494	0.250
10	0.036	10.00		278.247	301148.422	196179.918	0.250
11	0.049	10.00		274.066	301116.195	196198.947	0.250
14	0.090	10.00		271.132	301095.419	196210.668	0.250
15	0.043	10.00	10.0	267.424	301061.961	196229.964	0.250
20	0.038	10.00		264.196	301036.949	196242.049	0.250
36	0.058	10.00		262.369	301017.062	196253.866	0.500
37	0.082	10.00		259.442	300994.099	196266.775	0.500
38	0.087	10.00		256.979	300974.492	196278.059	0.500
38_OUT				253.164	300947.000	196294.911	0.500
30	0.050	10.00	3.0	286.115	301068.031	196287.348	0.250

Nodes

Name	Area (ha)	T of E (mins)	Add Inflow (l/s)	Cover Level (m)	Easting (m)	Northing (m)	Depth (m)
31				276.625	301051.167	196270.525	0.250
32				273.384	301044.971	196263.850	0.250
33	0.018	10.00		271.523	301041.824	196260.892	0.250
29				275.504	301040.399	196273.829	0.250
17	0.026	10.00		284.547	301076.700	196267.245	0.250
18	0.057	10.00		281.543	301064.976	196267.651	0.250
16	0.039	10.00		286.516	301086.016	196260.991	0.250
19	0.026	10.00		274.860	301051.386	196259.493	0.250
34				268.777	301031.206	196258.552	0.250
35				266.489	301020.835	196259.352	0.250
51	0.048	10.00	6.0	287.230	301183.380	196185.316	0.250
51_OUT	0.026	10.00	3.0	285.617	301170.563	196198.262	0.250
12	0.018	10.00		285.732	301130.261	196211.518	0.250
13				278.592	301109.699	196214.844	0.250
52	0.042	10.00		305.129	301202.502	196238.764	0.250
53				298.364	301184.931	196233.583	0.250
54	0.013	10.00		291.544	301163.755	196227.050	0.250
55	0.076	10.00		287.778	301152.655	196222.882	0.250
44		10.00		262.144	301119.613	196161.470	0.250
45				253.929	301112.857	196147.582	0.250
46				245.665	301107.227	196133.820	0.250

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.016	38	38_OUT	32.246	0.040	256.479	252.664	3.815	8.5	500	30.99	22.7
1.015	37	38	22.622	0.040	258.942	256.479	2.463	9.2	500	30.83	22.7
1.014	36	37	26.343	0.040	261.869	258.942	2.927	9.0	500	30.71	22.8
5.011	35	36	6.658	0.040	266.239	262.119	4.120	1.6	250	20.23	27.8
1.013	20	36	23.133	0.040	263.946	262.119	1.827	12.7	250	30.57	22.8
1.012	15	20	27.779	0.040	267.174	263.946	3.228	8.6	250	30.36	22.9
4.003	19	20	22.643	0.040	274.610	263.946	10.664	2.1	250	10.27	37.7
4.002	18	19	15.851	0.040	281.293	274.610	6.683	2.4	250	10.19	37.8

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
1.016	3.259	1303.7	190.1	0.000	0.000	2.590	31.0	193	2.003
1.015	3.127	1250.6	173.1	0.000	0.000	2.306	31.0	187	1.892
1.014	3.159	1263.4	149.5	0.000	0.000	1.920	31.0	172	1.836
5.011	5.214	717.0	29.4	0.000	0.000	0.310	6.0	42	2.062
1.013	1.863	256.1	109.5	0.000	0.000	1.366	25.0	160	1.490
1.012	2.260	310.7	98.2	0.000	0.000	1.179	25.0	135	1.664
4.003	4.549	625.5	15.1	0.000	0.000	0.148	0.0	31	1.517
4.002	4.304	591.8	12.5	0.000	0.000	0.122	0.0	28	1.354

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
4.001	17	18	11.731	0.040	284.297	281.293	3.004	3.9	250	10.13	37.9
4.000	16	17	11.221	0.040	286.266	284.297	1.969	5.7	250	10.07	38.0
1.011	14	15	38.623	0.040	270.882	267.174	3.708	10.4	250	30.16	23.0
1.010	11	14	23.854	0.040	273.816	270.882	2.934	8.1	250	21.85	26.9
3.005	13	14	14.878	0.040	278.342	270.882	7.460	2.0	250	20.10	27.9
3.004	12	13	20.829	0.040	285.482	278.342	7.140	2.9	250	20.04	28.0
1.009	10	11	37.426	0.040	277.997	273.816	4.181	9.0	250	12.09	35.1
1.008	9	10	46.061	0.040	282.469	277.997	4.472	10.3	250	11.81	35.5
1.007	8	9	33.554	0.040	285.961	282.469	3.492	9.6	250	11.44	36.0
1.006	7	8	23.354	0.040	287.874	285.961	1.913	12.2	250	11.18	36.3
1.005	6	7	19.588	0.040	291.198	287.874	3.324	5.9	250	10.97	36.6
1.004	5	6	25.708	0.040	292.934	291.198	1.736	14.8	250	10.86	36.8
1.003	4	5	20.992	0.040	295.750	292.934	2.816	7.5	250	10.61	37.1
1.002	3	4	23.603	0.040	297.976	295.750	2.226	10.6	250	10.46	37.4
1.001	2	3	23.578	0.040	301.750	297.976	3.774	6.2	250	10.27	37.7
1.000	1	2	19.093	0.040	304.750	301.750	3.000	6.4	250	10.12	37.9
5.010	34	35	10.402	0.040	268.527	266.239	2.288	4.5	250	20.21	27.9
5.009	33	34	10.873	0.040	271.273	268.527	2.746	4.0	250	20.16	27.9
5.008	29	33	13.015	0.040	275.254	271.273	3.981	3.3	250	10.58	37.2
6.002	32	33	4.319	0.040	273.134	271.273	1.861	2.3	250	20.10	27.9
6.001	31	32	9.107	0.040	276.375	273.134	3.241	2.8	250	20.09	27.9
6.000	30	31	23.820	0.040	285.865	276.375	9.490	2.5	250	20.05	28.0
5.007	28	29	5.168	0.040	277.376	275.254	2.122	2.4	250	10.52	37.3
5.006	27	28	12.657	0.040	282.462	277.376	5.086	2.5	250	10.50	37.3

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
4.001	3.354	461.2	6.7	0.000	0.000	0.065	0.0	22	0.918
4.000	2.777	381.8	4.0	0.000	0.000	0.039	0.0	18	0.675
1.011	2.054	282.4	85.7	0.000	0.000	1.136	15.0	132	1.496
1.010	2.325	319.7	65.2	0.000	0.000	0.690	15.0	106	1.514
3.005	4.694	645.4	21.1	0.000	0.000	0.278	0.0	37	1.730
3.004	3.881	533.6	21.1	0.000	0.000	0.278	0.0	41	1.515
1.009	2.216	304.6	28.3	0.000	0.000	0.298	0.0	68	1.145
1.008	2.065	284.0	25.2	0.000	0.000	0.262	0.0	66	1.051
1.007	2.138	294.0	21.0	0.000	0.000	0.216	0.0	58	1.017
1.006	1.897	260.9	18.9	0.000	0.000	0.192	0.0	58	0.903
1.005	2.731	375.5	17.3	0.000	0.000	0.175	0.0	44	1.122
1.004	1.723	236.8	11.4	0.000	0.000	0.114	0.0	45	0.716
1.003	2.428	333.8	11.5	0.000	0.000	0.114	0.0	38	0.908
1.002	2.036	279.9	7.0	0.000	0.000	0.069	0.0	31	0.679
1.001	2.652	364.6	3.2	0.000	0.000	0.031	0.0	16	0.601
1.000	2.628	361.3	0.0	0.000	0.000	0.000	0.0	0	0.000
5.010	3.109	427.5	29.4	0.000	0.000	0.310	6.0	56	1.452
5.009	3.331	458.0	29.4	0.000	0.000	0.310	6.0	54	1.526
5.008	3.666	504.1	22.5	0.000	0.000	0.194	3.0	43	1.488
6.002	4.351	598.3	10.4	0.000	0.000	0.097	3.0	25	1.282
6.001	3.954	543.7	10.4	0.000	0.000	0.097	3.0	27	1.218
6.000	4.184	575.3	10.4	0.000	0.000	0.097	3.0	26	1.261
5.007	4.247	584.0	22.6	0.000	0.000	0.194	3.0	41	1.658
5.006	4.202	577.8	22.6	0.000	0.000	0.194	3.0	41	1.640

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
5.005	26	27	15.209	0.040	287.887	282.462	5.425	2.8	250	10.45	37.4
5.004	25	26	16.026	0.040	292.486	287.887	4.599	3.5	250	10.39	37.5
5.003	24	25	19.806	0.040	296.678	292.486	4.192	4.7	250	10.31	37.6
5.002	23	24	8.261	0.040	298.655	296.678	1.977	4.2	250	10.21	37.7
5.001	22	23	20.626	0.040	302.877	298.655	4.222	4.9	250	10.16	37.8
5.000	21	22	11.371	0.040	306.697	302.877	3.820	3.0	250	10.05	38.0
2.003	51	51_OUT	18.217	0.040	286.980	285.367	1.613	11.3	250	21.38	27.1
2.002	50	51	15.608	0.040	287.218	286.980	0.238	65.6	250	21.23	27.2
2.001	49	50	42.229	0.040	287.854	287.218	0.636	66.4	250	20.91	27.4
2.000	48	49	9.506	0.040	288.615	287.854	0.761	12.5	250	20.04	28.0
7.005	47	47_OUT	22.032	0.040	240.238	234.768	5.470	4.0	250	10.55	37.2
7.004	43	47	19.975	0.040	245.813	240.238	5.575	3.6	250	10.44	37.4
8.002	46	47	11.604	0.040	245.415	240.238	5.177	2.2	250	10.15	37.8
8.001	45	46	14.869	0.040	253.679	245.415	8.264	1.8	250	10.10	37.9
8.000	44	45	15.444	0.040	261.894	253.679	8.215	1.9	250	10.05	38.0
7.003	42	43	26.357	0.040	251.951	245.813	6.138	4.3	250	10.34	37.5
7.002	41	42	16.652	0.040	255.073	251.951	3.122	5.3	250	10.20	37.8
7.001	40	41	13.013	0.040	259.256	255.073	4.183	3.1	250	10.11	37.9
7.000	39	40	10.654	0.040	262.457	259.256	3.201	3.3	250	10.05	38.0
3.003	55	12	25.112	0.040	287.528	285.482	2.046	12.3	250	10.45	37.4
2.004	51_OUT	11	54.372	0.040	285.367	273.816	11.551	4.7	250	21.68	27.0
3.002	54	55	11.857	0.040	291.294	287.528	3.766	3.1	250	10.23	37.7
3.001	53	54	22.161	0.040	298.114	291.294	6.820	3.2	250	10.18	37.8

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
5.005	3.959	544.3	22.6	0.000	0.000	0.194	3.0	42	1.566
5.004	3.551	488.2	22.7	0.000	0.000	0.194	3.0	44	1.459
5.003	3.050	419.3	19.6	0.000	0.000	0.163	3.0	45	1.268
5.002	3.243	445.9	19.7	0.000	0.000	0.163	3.0	43	1.316
5.001	2.999	412.4	19.7	0.000	0.000	0.163	3.0	45	1.247
5.000	3.842	528.3	12.2	0.000	0.000	0.089	3.0	30	1.257
2.003	1.972	271.2	33.9	0.000	0.000	0.298	12.0	81	1.116
2.002	0.819	112.5	22.3	0.000	0.000	0.221	6.0	104	0.528
2.001	0.813	111.9	19.7	0.000	0.000	0.184	6.0	97	0.507
2.000	1.876	257.9	3.0	0.000	0.000	0.040	0.0	20	0.485
7.005	3.303	454.1	6.4	0.000	0.000	0.064	0.0	22	0.904
7.004	3.502	481.5	5.7	0.000	0.000	0.056	0.0	20	0.906
8.002	4.427	608.8	0.8	0.000	0.000	0.008	0.0	5	0.501
8.001	4.942	679.5	0.8	0.000	0.000	0.008	0.0	5	0.560
8.000	4.834	664.7	0.8	0.000	0.000	0.008	0.0	5	0.548
7.003	3.199	439.8	5.7	0.000	0.000	0.056	0.0	21	0.852
7.002	2.870	394.7	2.7	0.000	0.000	0.027	0.0	14	0.601
7.001	3.758	516.8	2.8	0.000	0.000	0.027	0.0	12	0.718
7.000	3.633	499.6	0.0	0.000	0.000	0.000	0.0	0	0.000
3.003	1.892	260.2	17.9	0.000	0.000	0.177	0.0	57	0.892
2.004	3.055	420.1	40.1	0.000	0.000	0.343	15.0	69	1.591
3.002	3.736	513.7	10.3	0.000	0.000	0.101	0.0	27	1.151
3.001	3.677	505.6	9.0	0.000	0.000	0.088	0.0	25	1.084

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
3.000	52	53	18.319	0.040	304.879	298.114	6.765	2.7	250	10.08	38.0

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
3.000	4.028	553.9	9.1	0.000	0.000	0.088	0.0	24	1.159

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.016	32.246	8.5	500	Swale trapezoidal	256.979	256.479	0.000	253.164	252.664	0.000
1.015	22.622	9.2	500	Swale trapezoidal	259.442	258.942	0.000	256.979	256.479	0.000
1.014	26.343	9.0	500	Swale trapezoidal	262.369	261.869	0.000	259.442	258.942	0.000
5.011	6.658	1.6	250	Swale trapezoidal	266.489	266.239	0.000	262.369	262.119	0.000
1.013	23.133	12.7	250	Swale trapezoidal	264.196	263.946	0.000	262.369	262.119	0.000
1.012	27.779	8.6	250	Swale trapezoidal	267.424	267.174	0.000	264.196	263.946	0.000
4.003	22.643	2.1	250	Swale trapezoidal	274.860	274.610	0.000	264.196	263.946	0.000
4.002	15.851	2.4	250	Swale trapezoidal	281.543	281.293	0.000	274.860	274.610	0.000
4.001	11.731	3.9	250	Swale trapezoidal	284.547	284.297	0.000	281.543	281.293	0.000
4.000	11.221	5.7	250	Swale trapezoidal	286.516	286.266	0.000	284.547	284.297	0.000
1.011	38.623	10.4	250	Swale trapezoidal	271.132	270.882	0.000	267.424	267.174	0.000
1.010	23.854	8.1	250	Swale trapezoidal	274.066	273.816	0.000	271.132	270.882	0.000
3.005	14.878	2.0	250	Swale trapezoidal	278.592	278.342	0.000	271.132	270.882	0.000
3.004	20.829	2.9	250	Swale trapezoidal	285.732	285.482	0.000	278.592	278.342	0.000
1.009	37.426	9.0	250	Swale trapezoidal	278.247	277.997	0.000	274.066	273.816	0.000
1.008	46.061	10.3	250	Swale trapezoidal	282.719	282.469	0.000	278.247	277.997	0.000
1.007	33.554	9.6	250	Swale trapezoidal	286.211	285.961	0.000	282.719	282.469	0.000
1.006	23.354	12.2	250	Swale trapezoidal	288.124	287.874	0.000	286.211	285.961	0.000
1.005	19.588	5.9	250	Swale trapezoidal	291.448	291.198	0.000	288.124	287.874	0.000

Link	US Node	Node Type	DS Node	Node Type
1.016	38	Junction	38_OUT	Junction
1.015	37	Junction	38	Junction
1.014	36	Junction	37	Junction
5.011	35	Junction	36	Junction
1.013	20	Junction	36	Junction
1.012	15	Junction	20	Junction
4.003	19	Junction	20	Junction
4.002	18	Junction	19	Junction
4.001	17	Junction	18	Junction
4.000	16	Junction	17	Junction
1.011	14	Junction	15	Junction
1.010	11	Junction	14	Junction
3.005	13	Junction	14	Junction
3.004	12	Junction	13	Junction
1.009	10	Junction	11	Junction
1.008	9	Junction	10	Junction
1.007	8	Junction	9	Junction
1.006	7	Junction	8	Junction
1.005	6	Junction	7	Junction

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.004	25.708	14.8	250	Swale trapezoidal	293.184	292.934	0.000	291.448	291.198	0.000
1.003	20.992	7.5	250	Swale trapezoidal	296.000	295.750	0.000	293.184	292.934	0.000
1.002	23.603	10.6	250	Swale trapezoidal	298.226	297.976	0.000	296.000	295.750	0.000
1.001	23.578	6.2	250	Swale trapezoidal	302.000	301.750	0.000	298.226	297.976	0.000
1.000	19.093	6.4	250	Swale trapezoidal	305.000	304.750	0.000	302.000	301.750	0.000
5.010	10.402	4.5	250	Swale trapezoidal	268.777	268.527	0.000	266.489	266.239	0.000
5.009	10.873	4.0	250	Swale trapezoidal	271.523	271.273	0.000	268.777	268.527	0.000
5.008	13.015	3.3	250	Swale trapezoidal	275.504	275.254	0.000	271.523	271.273	0.000
6.002	4.319	2.3	250	Swale trapezoidal	273.384	273.134	0.000	271.523	271.273	0.000
6.001	9.107	2.8	250	Swale trapezoidal	276.625	276.375	0.000	273.384	273.134	0.000
6.000	23.820	2.5	250	Swale trapezoidal	286.115	285.865	0.000	276.625	276.375	0.000
5.007	5.168	2.4	250	Swale trapezoidal	277.626	277.376	0.000	275.504	275.254	0.000
5.006	12.657	2.5	250	Swale trapezoidal	282.712	282.462	0.000	277.626	277.376	0.000
5.005	15.209	2.8	250	Swale trapezoidal	288.137	287.887	0.000	282.712	282.462	0.000
5.004	16.026	3.5	250	Swale trapezoidal	292.736	292.486	0.000	288.137	287.887	0.000
5.003	19.806	4.7	250	Swale trapezoidal	296.928	296.678	0.000	292.736	292.486	0.000
5.002	8.261	4.2	250	Swale trapezoidal	298.905	298.655	0.000	296.928	296.678	0.000
5.001	20.626	4.9	250	Swale trapezoidal	303.127	302.877	0.000	298.905	298.655	0.000
5.000	11.371	3.0	250	Swale trapezoidal	306.947	306.697	0.000	303.127	302.877	0.000
2.003	18.217	11.3	250	Swale trapezoidal	287.230	286.980	0.000	285.617	285.367	0.000
2.002	15.608	65.6	250	Swale trapezoidal	287.468	287.218	0.000	287.230	286.980	0.000
2.001	42.229	66.4	250	Swale trapezoidal	288.104	287.854	0.000	287.468	287.218	0.000
2.000	9.506	12.5	250	Swale trapezoidal	288.865	288.615	0.000	288.104	287.854	0.000
7.005	22.032	4.0	250	Swale trapezoidal	240.488	240.238	0.000	235.018	234.768	0.000
7.004	19.975	3.6	250	Swale trapezoidal	246.063	245.813	0.000	240.488	240.238	0.000

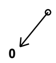
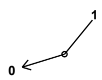
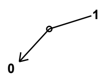
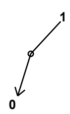
Link	US Node	Node Type	DS Node	Node Type
1.004	5	Junction	6	Junction
1.003	4	Junction	5	Junction
1.002	3	Junction	4	Junction
1.001	2	Junction	3	Junction
1.000	1	Junction	2	Junction
5.010	34	Junction	35	Junction
5.009	33	Junction	34	Junction
5.008	29	Junction	33	Junction
6.002	32	Junction	33	Junction
6.001	31	Junction	32	Junction
6.000	30	Junction	31	Junction
5.007	28	Junction	29	Junction
5.006	27	Junction	28	Junction
5.005	26	Junction	27	Junction
5.004	25	Junction	26	Junction
5.003	24	Junction	25	Junction
5.002	23	Junction	24	Junction
5.001	22	Junction	23	Junction
5.000	21	Junction	22	Junction
2.003	51	Junction	51_OUT	Junction
2.002	50	Junction	51	Junction
2.001	49	Junction	50	Junction
2.000	48	Junction	49	Junction
7.005	47	Junction	47_OUT	Junction
7.004	43	Junction	47	Junction

Pipeline Schedule

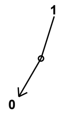
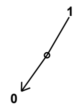
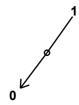
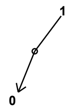
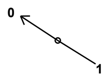
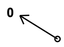
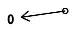
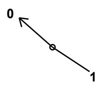
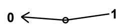
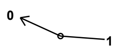
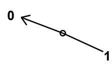
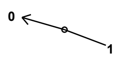
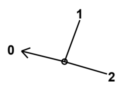
Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
8.002	11.604	2.2	250	Swale trapezoidal	245.665	245.415	0.000	240.488	240.238	0.000
8.001	14.869	1.8	250	Swale trapezoidal	253.929	253.679	0.000	245.665	245.415	0.000
8.000	15.444	1.9	250	Swale trapezoidal	262.144	261.894	0.000	253.929	253.679	0.000
7.003	26.357	4.3	250	Swale trapezoidal	252.201	251.951	0.000	246.063	245.813	0.000
7.002	16.652	5.3	250	Swale trapezoidal	255.323	255.073	0.000	252.201	251.951	0.000
7.001	13.013	3.1	250	Swale trapezoidal	259.506	259.256	0.000	255.323	255.073	0.000
7.000	10.654	3.3	250	Swale trapezoidal	262.707	262.457	0.000	259.506	259.256	0.000
3.003	25.112	12.3	250	Swale trapezoidal	287.778	287.528	0.000	285.732	285.482	0.000
2.004	54.372	4.7	250	Swale trapezoidal	285.617	285.367	0.000	274.066	273.816	0.000
3.002	11.857	3.1	250	Swale trapezoidal	291.544	291.294	0.000	287.778	287.528	0.000
3.001	22.161	3.2	250	Swale trapezoidal	298.364	298.114	0.000	291.544	291.294	0.000
3.000	18.319	2.7	250	Swale trapezoidal	305.129	304.879	0.000	298.364	298.114	0.000

Link	US Node	Node Type	DS Node	Node Type
8.002	46	Junction	47	Junction
8.001	45	Junction	46	Junction
8.000	44	Junction	45	Junction
7.003	42	Junction	43	Junction
7.002	41	Junction	42	Junction
7.001	40	Junction	41	Junction
7.000	39	Junction	40	Junction
3.003	55	Junction	12	Junction
2.004	51_OUT	Junction	11	Junction
3.002	54	Junction	55	Junction
3.001	53	Junction	54	Junction
3.000	52	Junction	53	Junction

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Connections		Link	IL (m)	Dia (mm)
21	301105.156	196354.900	306.947	0.250		0	5.000	306.697	250
22	301097.981	196346.079	303.127	0.250		1	5.000	302.877	250
						0	5.001	302.877	250
23	301078.275	196339.987	298.905	0.250		1	5.001	298.655	250
						0	5.002	298.655	250
24	301072.659	196333.929	296.928	0.250		1	5.002	296.678	250
						0	5.003	296.678	250

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Connections		Link	IL (m)	Dia (mm)
25	301066.760	196315.022	292.736	0.250		1	5.003	292.486	250
						0	5.004	292.486	250
26	301058.729	196301.153	288.137	0.250		1	5.004	287.887	250
						0	5.005	287.887	250
27	301049.945	196288.737	282.712	0.250		1	5.005	282.462	250
						0	5.006	282.462	250
28	301042.340	196278.619	277.626	0.250		1	5.006	277.376	250
						0	5.007	277.376	250
49	301230.459	196151.913	288.104	0.250		1	2.000	287.854	250
						0	2.001	287.854	250
48	301238.536	196146.901	288.865	0.250		0	2.000	288.615	250
39	301185.669	196101.559	262.707	0.250		0	7.000	262.457	250
50	301195.118	196175.028	287.468	0.250		1	2.001	287.218	250
						0	2.002	287.218	250
40	301175.123	196100.049	259.506	0.250		1	7.000	259.256	250
						0	7.001	259.256	250
41	301162.147	196101.027	255.323	0.250		1	7.001	255.073	250
						0	7.002	255.073	250
42	301147.020	196107.988	252.201	0.250		1	7.002	251.951	250
						0	7.003	251.951	250
43	301122.390	196117.372	246.063	0.250		1	7.003	245.813	250
						0	7.004	245.813	250
47	301103.205	196122.935	240.488	0.250		1	8.002	240.238	250
						2	7.004	240.238	250
						0	7.005	240.238	250

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Connections	Link	IL (m)	Dia (mm)
47_OUT	301081.810	196128.195	235.018	0.250	1	7.005	234.768	250
1	301360.569	196080.612	305.000	0.250				
					0	1.000	304.750	250
4	301296.835	196098.735	296.000	0.250	1	1.002	295.750	250
					0	1.003	295.750	250
5	301279.209	196110.137	293.184	0.250	1	1.003	292.934	250
					0	1.004	292.934	250
2	301342.107	196085.479	302.000	0.250	1	1.000	301.750	250
					0	1.001	301.750	250
3	301319.363	196091.694	298.226	0.250	1	1.001	297.976	250
					0	1.002	297.976	250
6	301256.777	196122.695	291.448	0.250	1	1.004	291.198	250
					0	1.005	291.198	250
7	301239.311	196131.563	288.124	0.250	1	1.005	287.874	250
					0	1.006	287.874	250
8	301218.432	196142.025	286.211	0.250	1	1.006	285.961	250
					0	1.007	285.961	250
9	301188.656	196157.494	282.719	0.250	1	1.007	282.469	250
					0	1.008	282.469	250
10	301148.422	196179.918	278.247	0.250	1	1.008	277.997	250
					0	1.009	277.997	250
11	301116.195	196198.947	274.066	0.250	1	2.004	273.816	250
					2	1.009	273.816	250
					0	1.010	273.816	250
14	301095.419	196210.668	271.132	0.250	1	3.005	270.882	250
					2	1.010	270.882	250
					0	1.011	270.882	250

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Connections	Link	IL (m)	Dia (mm)
15	301061.961	196229.964	267.424	0.250	1	1.011	267.174	250
					0	1.012	267.174	250
20	301036.949	196242.049	264.196	0.250	1	4.003	263.946	250
					2	1.012	263.946	250
					0	1.013	263.946	250
36	301017.062	196253.866	262.369	0.500	1	5.011	262.119	250
					2	1.013	262.119	250
					0	1.014	261.869	500
37	300994.099	196266.775	259.442	0.500	1	1.014	258.942	500
					0	1.015	258.942	500
38	300974.492	196278.059	256.979	0.500	1	1.015	256.479	500
					0	1.016	256.479	500
38_OUT	300947.000	196294.911	253.164	0.500	1	1.016	252.664	500
30	301068.031	196287.348	286.115	0.250	0	6.000	285.865	250
31	301051.167	196270.525	276.625	0.250	1	6.000	276.375	250
					0	6.001	276.375	250
32	301044.971	196263.850	273.384	0.250	1	6.001	273.134	250
					0	6.002	273.134	250
33	301041.824	196260.892	271.523	0.250	1	6.002	271.273	250
					2	5.008	271.273	250
					0	5.009	271.273	250
29	301040.399	196273.829	275.504	0.250	1	5.007	275.254	250
					0	5.008	275.254	250
17	301076.700	196267.245	284.547	0.250	1	4.000	284.297	250
					0	4.001	284.297	250
18	301064.976	196267.651	281.543	0.250	1	4.001	281.293	250
					0	4.002	281.293	250

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Connections	Link	IL (m)	Dia (mm)
16	301086.016	196260.991	286.516	0.250	0	4.000	286.266	250
19	301051.386	196259.493	274.860	0.250	1	4.002	274.610	250
					0	4.003	274.610	250
34	301031.206	196258.552	268.777	0.250	1	5.009	268.527	250
					0	5.010	268.527	250
35	301020.835	196259.352	266.489	0.250	1	5.010	266.239	250
					0	5.011	266.239	250
51	301183.380	196185.316	287.230	0.250	1	2.002	286.980	250
					0	2.003	286.980	250
51_OUT	301170.563	196198.262	285.617	0.250	1	2.003	285.367	250
					0	2.004	285.367	250
12	301130.261	196211.518	285.732	0.250	1	3.003	285.482	250
					0	3.004	285.482	250
13	301109.699	196214.844	278.592	0.250	1	3.004	278.342	250
					0	3.005	278.342	250
52	301202.502	196238.764	305.129	0.250	0	3.000	304.879	250
53	301184.931	196233.583	298.364	0.250	1	3.000	298.114	250
					0	3.001	298.114	250
54	301163.755	196227.050	291.544	0.250	1	3.001	291.294	250
					0	3.002	291.294	250
55	301152.655	196222.882	287.778	0.250	1	3.002	287.528	250
					0	3.003	287.528	250
44	301119.613	196161.470	262.144	0.250	0	8.000	261.894	250

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Connections	Link	IL (m)	Dia (mm)
45	301112.857	196147.582	253.929	0.250	1	8.000	253.679	250
					0	8.001	253.679	250
46	301107.227	196133.820	245.665	0.250	1	8.001	245.415	250
					0	8.002	245.415	250

Simulation Settings

Rainfall Methodology	FSR	Analysis Speed	Normal
FSR Region	England and Wales	Skip Steady State	x
M5-60 (mm)	20.000	Drain Down Time (mins)	240
Ratio-R	0.200	Additional Storage (m^3/ha)	20.0
Summer CV	0.750	Check Discharge Rate(s)	x
Winter CV	0.840	Check Discharge Volume	x

Storm Durations

15	30	60	120	180	240	360	480	600	720	960	1440

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
2	0	0	0
30	0	0	0
100	0	0	0
100	40	0	0
200	0	0	0

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
2 year 15 minute summer	112.777	31.912
2 year 15 minute winter	79.142	31.912
2 year 30 minute summer	81.416	23.038
2 year 30 minute winter	57.134	23.038
2 year 60 minute summer	61.301	16.200
2 year 60 minute winter	40.727	16.200
2 year 120 minute summer	42.559	11.247
2 year 120 minute winter	28.275	11.247
2 year 180 minute summer	35.121	9.038
2 year 180 minute winter	22.829	9.038
2 year 240 minute summer	29.197	7.716
2 year 240 minute winter	19.398	7.716
2 year 360 minute summer	23.988	6.173
2 year 360 minute winter	15.593	6.173
2 year 480 minute summer	19.942	5.270
2 year 480 minute winter	13.249	5.270
2 year 600 minute summer	17.030	4.658
2 year 600 minute winter	11.636	4.658
2 year 720 minute summer	15.715	4.212
2 year 720 minute winter	10.561	4.212
2 year 960 minute summer	13.650	3.594
2 year 960 minute winter	9.042	3.594
2 year 1440 minute summer	10.717	2.872
2 year 1440 minute winter	7.203	2.872
30 year 15 minute summer	212.586	60.154
30 year 15 minute winter	149.183	60.154
30 year 30 minute summer	155.010	43.862
30 year 30 minute winter	108.779	43.862
30 year 60 minute summer	116.589	30.811
30 year 60 minute winter	77.459	30.811
30 year 120 minute summer	78.946	20.863
30 year 120 minute winter	52.450	20.863
30 year 180 minute summer	63.479	16.335
30 year 180 minute winter	41.263	16.335
30 year 240 minute summer	51.899	13.715
30 year 240 minute winter	34.480	13.715
30 year 360 minute summer	41.522	10.685
30 year 360 minute winter	26.991	10.685

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)	Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
30 year 480 minute summer	33.795	8.931	100 year +40% CC 120 minute winter	96.105	38.228
30 year 480 minute winter	22.452	8.931	100 year +40% CC 180 minute summer	115.119	29.624
30 year 600 minute summer	28.377	7.762	100 year +40% CC 180 minute winter	74.831	29.624
30 year 600 minute winter	19.389	7.762	100 year +40% CC 240 minute summer	93.436	24.692
30 year 720 minute summer	25.804	6.916	100 year +40% CC 240 minute winter	62.077	24.692
30 year 720 minute winter	17.342	6.916	100 year +40% CC 360 minute summer	73.898	19.016
30 year 960 minute summer	21.860	5.756	100 year +40% CC 360 minute winter	48.036	19.016
30 year 960 minute winter	14.481	5.756	100 year +40% CC 480 minute summer	59.596	15.750
30 year 1440 minute summer	16.557	4.437	100 year +40% CC 480 minute winter	39.594	15.750
30 year 1440 minute winter	11.127	4.437	100 year +40% CC 600 minute summer	49.658	13.583
100 year 15 minute summer	273.602	77.420	100 year +40% CC 600 minute winter	33.930	13.583
100 year 15 minute winter	192.002	77.420	100 year +40% CC 720 minute summer	44.855	12.022
100 year 30 minute summer	202.154	57.203	100 year +40% CC 720 minute winter	30.145	12.022
100 year 30 minute winter	141.863	57.203	100 year +40% CC 960 minute summer	37.573	9.894
100 year 60 minute summer	153.288	40.510	100 year +40% CC 960 minute winter	24.889	9.894
100 year 60 minute winter	101.841	40.510	100 year +40% CC 1440 minute summer	27.987	7.501
100 year 120 minute summer	103.325	27.306	100 year +40% CC 1440 minute winter	18.809	7.501
100 year 120 minute winter	68.647	27.306	200 year 15 minute summer	316.381	89.525
100 year 180 minute summer	82.228	21.160	200 year 15 minute winter	222.022	89.525
100 year 180 minute winter	53.450	21.160	200 year 30 minute summer	235.547	66.652
100 year 240 minute summer	66.740	17.637	200 year 30 minute winter	165.296	66.652
100 year 240 minute winter	44.341	17.637	200 year 60 minute summer	179.445	47.422
100 year 360 minute summer	52.784	13.583	200 year 60 minute winter	119.219	47.422
100 year 360 minute winter	34.311	13.583	200 year 120 minute summer	120.640	31.882
100 year 480 minute summer	42.569	11.250	200 year 120 minute winter	80.151	31.882
100 year 480 minute winter	28.282	11.250	200 year 180 minute summer	95.439	24.560
100 year 600 minute summer	35.470	9.702	200 year 180 minute winter	62.038	24.560
100 year 600 minute winter	24.235	9.702	200 year 240 minute summer	77.139	20.386
100 year 720 minute summer	32.039	8.587	200 year 240 minute winter	51.249	20.386
100 year 720 minute winter	21.532	8.587	200 year 360 minute summer	60.605	15.596
100 year 960 minute summer	26.838	7.067	200 year 360 minute winter	39.395	15.596
100 year 960 minute winter	17.778	7.067	200 year 480 minute summer	48.619	12.848
100 year 1440 minute summer	19.990	5.358	200 year 480 minute winter	32.301	12.848
100 year 1440 minute winter	13.435	5.358	200 year 600 minute summer	40.332	11.032
100 year +40% CC 15 minute summer	383.043	108.388	200 year 600 minute winter	27.558	11.032
100 year +40% CC 15 minute winter	268.802	108.388	200 year 720 minute summer	36.291	9.726
100 year +40% CC 30 minute summer	283.016	80.084	200 year 720 minute winter	24.390	9.726
100 year +40% CC 30 minute winter	198.608	80.084	200 year 960 minute summer	30.202	7.953
100 year +40% CC 60 minute summer	214.603	56.713	200 year 960 minute winter	20.007	7.953
100 year +40% CC 60 minute winter	142.577	56.713	200 year 1440 minute summer	22.281	5.972
100 year +40% CC 120 minute summer	144.655	38.228	200 year 1440 minute winter	14.974	5.972

Results for 2 year Critical Storm Duration. Lowest mass balance: 99.98%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
30 minute winter	21	20	306.721	0.024	8.6	0.1006	0.0000	OK
30 minute winter	5.000:50%	20	304.816	0.029	12.4	0.0000	0.0000	PONDING
30 minute winter	22	20	302.915	0.038	14.5	0.0606	0.0000	OK
15 minute winter	5.001:50%	11	300.814	0.048	20.8	0.0000	0.0000	OK
15 minute winter	23	11	298.700	0.045	20.8	0.0000	0.0000	OK
15 minute winter	24	11	296.725	0.047	20.8	0.0000	0.0000	OK
15 minute winter	25	11	292.533	0.047	23.8	0.1153	0.0000	OK
15 minute winter	26	11	287.930	0.043	23.7	0.0000	0.0000	OK
15 minute winter	27	12	282.504	0.042	23.7	0.0000	0.0000	OK
15 minute winter	28	12	277.417	0.041	23.6	0.0000	0.0000	OK
30 minute winter	49	21	287.936	0.082	14.6	0.3249	0.0000	OK
30 minute winter	2.001:50%	21	287.646	0.110	24.3	0.3227	0.0000	OK
30 minute winter	48	20	288.631	0.016	2.2	0.0275	0.0000	OK
30 minute winter	2.000:50%	22	288.256	0.021	3.5	0.1123	0.0000	OK
15 minute summer	39	1	262.457	0.000	0.0	0.0000	0.0000	OK
30 minute winter	50	21	287.328	0.110	24.3	0.0000	0.0000	OK
30 minute winter	2.002:50%	26	287.211	0.112	26.9	2.1598	0.0000	PONDING
15 minute summer	40	1	259.256	0.000	0.0	0.0000	0.0000	OK
30 minute winter	7.001:50%	20	257.177	0.012	2.8	0.0017	0.0000	OK
30 minute winter	41	20	255.088	0.015	2.8	0.0000	0.0000	OK
30 minute winter	42	21	251.965	0.014	2.8	0.0000	0.0000	OK
30 minute winter	7.003:50%	21	248.903	0.021	5.8	0.0392	0.0000	OK
30 minute winter	43	21	245.833	0.020	5.8	0.0000	0.0000	OK
30 minute winter	47	21	240.260	0.022	6.6	0.0000	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
30 minute winter	21	5.000	5.000:50%	8.6	0.996	0.016	0.0491	
30 minute winter	21	5.000	22	12.4	1.108	0.023	0.0636	
30 minute winter	22	5.001	5.001:50%	14.4	1.018	0.035	0.1492	
15 minute winter	22	5.001	23	20.8	1.304	0.051	0.1648	
15 minute winter	23	5.002	24	20.8	1.319	0.047	0.1304	
15 minute winter	24	5.003	25	20.8	1.288	0.050	0.3202	
15 minute winter	25	5.004	26	23.7	1.529	0.049	0.2489	
15 minute winter	26	5.005	27	23.7	1.623	0.043	0.2218	
15 minute winter	27	5.006	28	23.6	1.679	0.041	0.1783	
15 minute winter	28	5.007	29	23.7	1.621	0.041	0.0756	
30 minute winter	49	2.001	2.001:50%	14.5	0.382	0.130	0.8074	
30 minute winter	49	2.001	50	24.3	0.540	0.218	0.9512	
30 minute winter	48	2.000	2.000:50%	2.2	0.375	0.009	0.0284	
30 minute winter	48	2.000	49	3.5	0.191	0.013	0.0905	
15 minute summer	39	7.000	40	0.0	0.000	0.000	0.0001	
30 minute winter	50	2.002	2.002:50%	24.3	0.543	0.215	0.3501	
30 minute winter	50	2.002	51	22.3	0.602	0.198	0.2932	
15 minute summer	40	7.001	7.001:50%	0.0	0.000	0.000	0.0113	
30 minute winter	40	7.001	41	2.8	0.664	0.005	0.0275	
30 minute winter	41	7.002	42	2.8	0.631	0.007	0.0740	
30 minute winter	42	7.003	7.003:50%	2.8	0.505	0.006	0.0732	
30 minute winter	42	7.003	43	5.8	0.879	0.013	0.0870	
30 minute winter	43	7.004	47	5.8	0.856	0.012	0.1353	
30 minute winter	47	7.005	47_OUT	6.6	0.917	0.015	0.1583	6.2

Results for 2 year Critical Storm Duration. Lowest mass balance: 99.98%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
30 minute winter	47_OUT	21	234.790	0.022	6.6	0.0000	0.0000	OK
15 minute summer	1	1	304.750	0.000	0.0	0.0000	0.0000	OK
30 minute winter	4	21	295.785	0.035	10.3	0.0872	0.0000	OK
30 minute winter	1.003:50%	21	294.380	0.038	11.9	0.0000	0.0000	OK
30 minute winter	5	21	292.982	0.048	11.9	0.0000	0.0000	OK
30 minute winter	2	21	301.765	0.015	2.8	0.0328	0.0000	OK
30 minute winter	1.001:50%	21	299.880	0.016	3.2	0.0000	0.0000	OK
30 minute winter	3	20	298.005	0.029	6.2	0.0649	0.0000	OK
30 minute winter	1.002:50%	21	296.894	0.031	7.2	0.0000	0.0000	OK
30 minute winter	6	21	291.239	0.041	15.2	0.1081	0.0000	OK
30 minute winter	1.005:50%	21	289.582	0.046	18.1	0.0049	0.0000	OK
30 minute winter	7	21	287.934	0.060	19.9	0.0817	0.0000	OK
30 minute winter	8	21	286.021	0.060	22.3	0.1142	0.0000	OK
30 minute winter	9	22	282.537	0.068	27.0	0.2520	0.0000	OK
30 minute winter	10	22	278.067	0.070	30.4	0.1999	0.0000	OK
30 minute winter	11	22	273.933	0.117	77.4	0.4552	0.0000	OK
30 minute winter	14	22	271.044	0.162	112.1	1.1659	0.0000	OK
60 minute winter	1.011:50%	48	269.147	0.119	104.8	32.3801	0.0000	PONDING
60 minute winter	15	46	267.297	0.123	82.7	0.4215	0.0000	OK
30 minute winter	20	23	264.096	0.150	98.0	0.4605	0.0000	OK
30 minute winter	36	21	262.035	0.166	139.4	0.3855	0.0000	OK
30 minute winter	1.014:50%	22	260.579	0.174	152.4	0.3390	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	1	1.000	2	0.0	0.000	0.000	0.0416	
30 minute winter	4	1.003	1.003:50%	10.4	0.839	0.031	0.1295	
30 minute winter	4	1.003	5	11.9	0.803	0.036	0.1552	
30 minute winter	5	1.004	6	11.8	0.771	0.050	0.3949	
30 minute winter	2	1.001	1.001:50%	2.8	0.560	0.008	0.0590	
30 minute winter	2	1.001	3	3.2	0.440	0.009	0.0863	
30 minute winter	3	1.002	1.002:50%	6.2	0.622	0.022	0.1167	
30 minute winter	3	1.002	4	7.1	0.645	0.026	0.1308	
30 minute winter	6	1.005	1.005:50%	15.2	1.020	0.040	0.1460	
30 minute winter	6	1.005	7	18.1	0.970	0.048	0.1831	
30 minute winter	7	1.006	8	19.8	0.921	0.076	0.5030	
30 minute winter	8	1.007	9	22.2	0.958	0.075	0.7804	
30 minute winter	9	1.008	10	26.9	1.054	0.095	1.1759	
30 minute winter	10	1.009	11	30.4	0.827	0.100	1.3948	
30 minute winter	11	1.010	14	77.4	1.269	0.242	1.4695	
30 minute winter	14	1.011	1.011:50%	112.3	1.864	0.398	1.1747	
60 minute winter	14	1.011	15	71.1	1.397	0.252	0.9842	
60 minute winter	15	1.012	20	82.7	1.444	0.266	1.6387	
30 minute winter	20	1.013	36	97.9	1.447	0.382	1.5654	
30 minute winter	36	1.014	1.014:50%	139.3	1.748	0.110	1.0508	
30 minute winter	36	1.014	37	152.4	1.807	0.121	1.1111	

Results for 2 year Critical Storm Duration. Lowest mass balance: 99.98%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
30 minute winter	37	22	259.122	0.180	160.5	0.5922	0.0000	OK
30 minute winter	1.015:50%	21	257.908	0.198	191.7	0.9608	0.0000	OK
30 minute winter	38	21	256.677	0.198	200.5	0.6867	0.0000	OK
30 minute winter	1.016:50%	21	254.780	0.208	220.8	3.3257	0.0000	OK
30 minute winter	38_OUT	21	252.872	0.208	220.0	0.0000	0.0000	OK
30 minute winter	30	20	285.887	0.022	8.3	0.0876	0.0000	OK
30 minute winter	6.000:50%	21	281.147	0.027	11.4	0.0000	0.0000	OK
30 minute winter	31	21	276.403	0.028	11.4	0.0000	0.0000	OK
30 minute winter	32	21	273.160	0.026	11.4	0.0000	0.0000	OK
30 minute winter	33	20	271.334	0.061	36.8	0.0898	0.0000	OK
15 minute winter	29	12	275.299	0.045	23.7	0.0000	0.0000	OK
30 minute winter	17	20	284.319	0.022	6.8	0.0467	0.0000	OK
30 minute winter	18	20	281.321	0.028	12.8	0.1287	0.0000	OK
30 minute winter	16	20	286.285	0.019	4.1	0.0574	0.0000	OK
30 minute winter	19	21	274.640	0.030	15.4	0.0620	0.0000	OK
30 minute winter	34	20	268.595	0.068	36.8	0.0000	0.0000	OK
30 minute winter	35	20	266.287	0.048	36.8	0.0000	0.0000	OK
30 minute winter	51	22	287.058	0.078	32.4	0.3021	0.0000	OK
30 minute winter	2.003:50%	22	286.258	0.084	35.2	0.0058	0.0000	OK
30 minute winter	51_OUT	22	285.436	0.069	40.8	0.1437	0.0000	OK
30 minute winter	2.004:50%	21	279.662	0.070	42.4	0.0000	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
30 minute winter	37	1.015	1.015:50%	160.6	1.743	0.128	1.0443	
30 minute winter	37	1.015	38	191.5	1.946	0.153	1.1136	
30 minute winter	38	1.016	1.016:50%	200.4	1.962	0.154	1.6468	
30 minute winter	38	1.016	38_OUT	220.0	2.083	0.169	1.7032	741.4
30 minute winter	30	6.000	6.000:50%	8.3	1.057	0.014	0.0935	
30 minute winter	30	6.000	31	11.4	1.265	0.020	0.1075	
30 minute winter	31	6.001	32	11.4	1.294	0.021	0.0804	
30 minute winter	32	6.002	33	11.4	0.783	0.019	0.0658	
30 minute winter	33	5.009	34	36.8	1.562	0.080	0.2565	
15 minute winter	29	5.008	33	23.7	1.283	0.047	0.2417	
30 minute winter	17	4.001	18	6.8	0.825	0.015	0.0962	
30 minute winter	18	4.002	19	12.7	1.342	0.021	0.1502	
30 minute winter	16	4.000	17	4.1	0.624	0.011	0.0734	
30 minute winter	19	4.003	20	15.4	0.446	0.025	0.8744	
30 minute winter	34	5.010	35	36.8	1.770	0.086	0.2173	
30 minute winter	35	5.011	36	36.8	2.297	0.051	0.1067	
30 minute winter	51	2.003	2.003:50%	32.4	1.051	0.119	0.2815	
30 minute winter	51	2.003	51_OUT	35.2	1.220	0.130	0.2632	
30 minute winter	51_OUT	2.004	2.004:50%	40.8	1.585	0.097	0.6991	
30 minute winter	51_OUT	2.004	11	42.4	1.198	0.101	1.0129	

Results for 2 year Critical Storm Duration. Lowest mass balance: 99.98%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
30 minute winter	12	21	285.521	0.039	20.3	0.0564	0.0000	OK
30 minute winter	3.004:50%	21	281.960	0.047	26.0	0.0351	0.0000	OK
30 minute winter	13	21	278.381	0.039	26.0	0.0000	0.0000	OK
30 minute winter	52	20	304.894	0.015	4.4	0.0517	0.0000	OK
30 minute winter	3.000:50%	20	301.521	0.024	9.2	0.0545	0.0000	OK
30 minute winter	53	20	298.139	0.025	9.2	0.0000	0.0000	OK
30 minute winter	54	21	291.321	0.027	10.5	0.0272	0.0000	OK
30 minute winter	55	21	287.589	0.061	18.4	0.3747	0.0000	OK
15 minute summer	44	1	261.894	0.000	0.0	0.0000	0.0000	OK
60 minute summer	8.000:50%	35	257.792	0.005	0.8	0.0005	0.0000	OK
30 minute winter	45	19	253.684	0.005	0.8	0.0000	0.0000	OK
30 minute winter	46	21	245.420	0.005	0.8	0.0000	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
30 minute winter	12	3.004	3.004:50%	20.3	1.366	0.038	0.1549	
30 minute winter	12	3.004	13	26.0	1.741	0.049	0.1556	
30 minute winter	13	3.005	14	26.0	0.647	0.040	0.6545	
30 minute winter	52	3.000	3.000:50%	4.4	0.703	0.008	0.0577	
30 minute winter	52	3.000	53	9.2	1.146	0.017	0.0734	
30 minute winter	53	3.001	54	9.2	1.075	0.018	0.1889	
30 minute winter	54	3.002	55	10.5	0.689	0.020	0.1837	
30 minute winter	55	3.003	12	18.4	1.046	0.071	0.4447	
15 minute summer	44	8.000	8.000:50%	0.0	0.000	0.000	0.0055	
60 minute summer	44	8.000	45	0.8	0.528	0.001	0.0117	
60 minute summer	45	8.001	46	0.8	0.525	0.001	0.0227	
30 minute winter	46	8.002	47	0.8	0.189	0.001	0.0510	

Results for 30 year Critical Storm Duration. Lowest mass balance: 99.98%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
30 minute winter	21	20	306.728	0.031	13.7	0.1329	0.0000	OK
30 minute winter	5.000:50%	20	304.827	0.040	20.9	0.0000	0.0000	PONDING
30 minute winter	22	20	302.929	0.052	24.9	0.0835	0.0000	OK
15 minute winter	5.001:50%	11	300.832	0.066	36.7	0.0000	0.0000	OK
15 minute winter	23	11	298.717	0.062	36.6	0.0000	0.0000	OK
15 minute winter	24	11	296.743	0.065	36.6	0.0000	0.0000	OK
15 minute winter	25	11	292.551	0.065	42.3	0.1618	0.0000	OK
15 minute winter	26	11	287.948	0.061	42.2	0.0000	0.0000	OK
30 minute winter	27	20	282.521	0.059	42.1	0.0000	0.0000	OK
30 minute winter	28	20	277.433	0.057	42.2	0.0000	0.0000	OK
30 minute winter	49	21	287.958	0.104	22.2	0.4141	0.0000	OK
30 minute winter	2.001:50%	21	287.682	0.146	40.9	0.5697	0.0000	OK
30 minute winter	48	20	288.639	0.024	4.2	0.0405	0.0000	OK
30 minute winter	2.000:50%	22	288.266	0.031	6.6	0.2419	0.0000	OK
15 minute summer	39	1	262.457	0.000	0.0	0.0000	0.0000	OK
30 minute winter	50	21	287.369	0.151	40.7	0.0000	0.0000	OK
60 minute winter	2.002:50%	46	287.226	0.127	40.6	11.5552	0.0000	PONDING
15 minute summer	40	1	259.256	0.000	0.0	0.0000	0.0000	OK
30 minute winter	7.001:50%	20	257.183	0.018	5.4	0.0037	0.0000	OK
30 minute winter	41	20	255.095	0.022	5.4	0.0000	0.0000	OK
30 minute winter	42	21	251.971	0.020	5.4	0.0000	0.0000	OK
30 minute winter	7.003:50%	21	248.914	0.032	11.1	0.0852	0.0000	OK
30 minute winter	43	21	245.842	0.029	11.1	0.0000	0.0000	OK
30 minute winter	47	21	240.271	0.033	12.7	0.0000	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
30 minute winter	21	5.000	5.000:50%	13.7	1.147	0.026	0.0679	
30 minute winter	21	5.000	22	20.9	1.311	0.039	0.0906	
30 minute winter	22	5.001	5.001:50%	24.8	1.199	0.060	0.2173	
15 minute winter	22	5.001	23	36.6	1.562	0.089	0.2420	
15 minute winter	23	5.002	24	36.6	1.582	0.082	0.1912	
15 minute winter	24	5.003	25	36.6	1.537	0.087	0.4715	
15 minute winter	25	5.004	26	42.2	1.838	0.086	0.3680	
30 minute winter	26	5.005	27	42.1	1.954	0.077	0.3279	
30 minute winter	27	5.006	28	42.2	2.027	0.073	0.2634	
30 minute winter	28	5.007	29	42.2	1.954	0.072	0.1117	
30 minute winter	49	2.001	2.001:50%	22.2	0.416	0.198	1.1358	
30 minute winter	49	2.001	50	40.7	0.611	0.364	1.4084	
30 minute winter	48	2.000	2.000:50%	4.2	0.475	0.016	0.0429	
30 minute winter	48	2.000	49	6.5	0.264	0.025	0.1248	
15 minute summer	39	7.000	40	0.0	0.000	0.000	0.0001	
30 minute winter	50	2.002	2.002:50%	40.6	0.690	0.361	0.4642	
60 minute winter	50	2.002	51	28.7	0.662	0.255	0.3444	
15 minute summer	40	7.001	7.001:50%	0.0	0.000	0.000	0.0165	
30 minute winter	40	7.001	41	5.4	0.845	0.010	0.0415	
30 minute winter	41	7.002	42	5.4	0.801	0.014	0.1117	
30 minute winter	42	7.003	7.003:50%	5.4	0.638	0.012	0.1110	
30 minute winter	42	7.003	43	11.1	1.107	0.025	0.1323	
30 minute winter	43	7.004	47	11.1	1.075	0.023	0.2066	
30 minute winter	47	7.005	47_OUT	12.7	1.155	0.028	0.2425	11.7

Results for 30 year Critical Storm Duration. Lowest mass balance: 99.98%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
30 minute winter	47_OUT	21	234.801	0.033	12.7	0.0000	0.0000	OK
15 minute summer	1	1	304.750	0.000	0.0	0.0000	0.0000	OK
30 minute winter	4	21	295.802	0.052	19.8	0.1279	0.0000	OK
30 minute winter	1.003:50%	21	294.398	0.056	22.6	0.0000	0.0000	OK
30 minute winter	5	21	293.004	0.070	22.6	0.0000	0.0000	OK
30 minute winter	2	20	301.773	0.022	5.4	0.0485	0.0000	OK
30 minute winter	1.001:50%	20	299.887	0.024	6.2	0.0000	0.0000	OK
30 minute winter	3	21	298.018	0.042	11.7	0.0954	0.0000	OK
30 minute winter	1.002:50%	21	296.909	0.046	13.6	0.0000	0.0000	OK
30 minute winter	6	21	291.259	0.060	29.1	0.1589	0.0000	OK
30 minute winter	1.005:50%	21	289.603	0.067	34.6	0.0105	0.0000	OK
30 minute winter	7	21	287.961	0.087	37.9	0.1190	0.0000	OK
30 minute winter	8	21	286.048	0.087	42.6	0.1666	0.0000	OK
30 minute winter	9	21	282.568	0.099	51.6	0.3658	0.0000	OK
30 minute winter	10	22	278.099	0.102	58.3	0.2904	0.0000	OK
30 minute winter	11	22	273.968	0.152	125.5	0.5940	0.0000	OK
30 minute winter	14	21	271.103	0.221	192.0	1.5947	0.0000	OK
60 minute winter	1.011:50%	52	269.163	0.135	178.1	105.9019	0.0000	PONDING
60 minute winter	15	48	267.311	0.137	100.7	0.4701	0.0000	OK
30 minute winter	20	22	264.121	0.175	129.2	0.5348	0.0000	OK
30 minute winter	36	21	262.072	0.203	203.7	0.4718	0.0000	OK
30 minute winter	1.014:50%	21	260.621	0.215	228.2	0.5190	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	1	1.000	2	0.0	0.000	0.000	0.0610	
30 minute winter	4	1.003	1.003:50%	19.7	1.038	0.059	0.1996	
30 minute winter	4	1.003	5	22.6	0.990	0.068	0.2409	
30 minute winter	5	1.004	6	22.6	0.949	0.096	0.6144	
30 minute winter	2	1.001	1.001:50%	5.4	0.708	0.015	0.0894	
30 minute winter	2	1.001	3	6.1	0.555	0.017	0.1317	
30 minute winter	3	1.002	1.002:50%	11.8	0.775	0.042	0.1790	
30 minute winter	3	1.002	4	13.6	0.799	0.049	0.2008	
30 minute winter	6	1.005	1.005:50%	29.2	1.260	0.078	0.2268	
30 minute winter	6	1.005	7	34.6	1.188	0.092	0.2859	
30 minute winter	7	1.006	8	37.9	1.121	0.145	0.7889	
30 minute winter	8	1.007	9	42.5	1.164	0.145	1.2270	
30 minute winter	9	1.008	10	51.3	1.279	0.181	1.8500	
30 minute winter	10	1.009	11	58.1	1.072	0.191	2.0533	
30 minute winter	11	1.010	14	125.3	1.380	0.392	2.1940	
30 minute winter	14	1.011	1.011:50%	191.9	2.367	0.679	1.6180	
60 minute winter	14	1.011	15	88.6	1.498	0.314	1.1433	
60 minute winter	15	1.012	20	100.7	1.527	0.324	1.9417	
30 minute winter	20	1.013	36	129.0	1.558	0.504	1.9160	
30 minute winter	36	1.014	1.014:50%	203.7	1.914	0.161	1.4019	
30 minute winter	36	1.014	37	227.9	1.997	0.180	1.5038	

Results for 30 year Critical Storm Duration. Lowest mass balance: 99.98%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
30 minute winter	37	21	259.166	0.224	244.1	0.7381	0.0000	OK
30 minute winter	1.015:50%	21	257.962	0.251	303.7	1.5511	0.0000	OK
30 minute winter	38	21	256.731	0.252	320.6	0.8763	0.0000	OK
30 minute winter	1.016:50%	21	254.839	0.268	359.3	5.4976	0.0000	OK
30 minute winter	38_OUT	21	252.931	0.267	358.3	0.0000	0.0000	OK
30 minute winter	30	20	285.894	0.029	13.1	0.1151	0.0000	OK
30 minute winter	6.000:50%	21	281.156	0.036	19.1	0.0000	0.0000	OK
30 minute winter	31	21	276.414	0.039	19.1	0.0000	0.0000	OK
30 minute winter	32	21	273.169	0.035	19.1	0.0000	0.0000	OK
30 minute winter	33	20	271.358	0.085	64.8	0.1247	0.0000	OK
30 minute winter	29	20	275.317	0.063	42.2	0.0000	0.0000	OK
30 minute winter	17	20	284.330	0.033	12.9	0.0687	0.0000	OK
30 minute winter	18	20	281.334	0.041	24.3	0.1891	0.0000	OK
30 minute winter	16	20	286.293	0.027	7.7	0.0839	0.0000	OK
30 minute winter	19	20	274.654	0.044	29.4	0.0912	0.0000	OK
30 minute winter	34	20	268.621	0.094	64.8	0.0000	0.0000	OK
30 minute winter	35	20	266.306	0.067	64.7	0.0000	0.0000	OK
30 minute winter	51	22	287.070	0.090	41.5	0.3485	0.0000	OK
30 minute winter	2.003:50%	22	286.273	0.099	46.9	0.0080	0.0000	OK
30 minute winter	51_OUT	22	285.449	0.082	54.8	0.1702	0.0000	OK
30 minute winter	2.004:50%	21	279.676	0.084	58.0	0.0000	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
30 minute winter	37	1.015	1.015:50%	244.0	1.913	0.195	1.4466	
30 minute winter	37	1.015	38	303.5	2.186	0.243	1.5707	
30 minute winter	38	1.016	1.016:50%	320.5	2.201	0.246	2.3492	
30 minute winter	38	1.016	38_OUT	358.3	2.362	0.275	2.4463	968.1
30 minute winter	30	6.000	6.000:50%	13.1	1.214	0.023	0.1285	
30 minute winter	30	6.000	31	19.1	1.510	0.033	0.1508	
30 minute winter	31	6.001	32	19.1	1.546	0.035	0.1127	
30 minute winter	32	6.002	33	19.1	0.905	0.032	0.0959	
30 minute winter	33	5.009	34	64.8	1.853	0.141	0.3804	
30 minute winter	29	5.008	33	42.2	1.530	0.084	0.3615	
30 minute winter	17	4.001	18	12.9	1.032	0.028	0.1465	
30 minute winter	18	4.002	19	24.2	1.670	0.041	0.2300	
30 minute winter	16	4.000	17	7.7	0.778	0.020	0.1109	
30 minute winter	19	4.003	20	29.4	0.669	0.047	1.1038	
30 minute winter	34	5.010	35	64.7	2.107	0.151	0.3215	
30 minute winter	35	5.011	36	64.7	2.751	0.090	0.1566	
30 minute winter	51	2.003	2.003:50%	41.5	1.117	0.153	0.3399	
30 minute winter	51	2.003	51_OUT	46.9	1.328	0.173	0.3223	
30 minute winter	51_OUT	2.004	2.004:50%	54.8	1.727	0.130	0.8642	
30 minute winter	51_OUT	2.004	11	58.1	1.312	0.138	1.3735	

Results for 30 year Critical Storm Duration. Lowest mass balance: 99.98%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
30 minute winter	12	21	285.539	0.057	38.6	0.0825	0.0000	OK
30 minute winter	3.004:50%	21	281.981	0.069	49.5	0.0749	0.0000	OK
30 minute winter	13	21	278.400	0.058	49.5	0.0000	0.0000	OK
30 minute winter	52	20	304.902	0.023	8.5	0.0767	0.0000	OK
30 minute winter	3.000:50%	20	301.532	0.035	17.6	0.1180	0.0000	OK
30 minute winter	53	20	298.151	0.037	17.5	0.0000	0.0000	OK
30 minute winter	54	21	291.334	0.040	20.0	0.0400	0.0000	OK
30 minute winter	55	21	287.617	0.089	35.1	0.5454	0.0000	OK
15 minute summer	44	1	261.894	0.000	0.0	0.0000	0.0000	OK
30 minute winter	8.000:50%	21	257.794	0.008	1.6	0.0012	0.0000	OK
30 minute winter	45	20	253.687	0.007	1.6	0.0000	0.0000	OK
30 minute winter	46	21	245.423	0.008	1.6	0.0000	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
30 minute winter	12	3.004	3.004:50%	38.6	1.681	0.072	0.2398	
30 minute winter	12	3.004	13	49.5	2.141	0.093	0.2411	
30 minute winter	13	3.005	14	49.5	0.807	0.077	1.0112	
30 minute winter	52	3.000	3.000:50%	8.5	0.888	0.015	0.0877	
30 minute winter	52	3.000	53	17.5	1.435	0.032	0.1118	
30 minute winter	53	3.001	54	17.5	1.343	0.035	0.2883	
30 minute winter	54	3.002	55	20.0	0.850	0.039	0.2860	
30 minute winter	55	3.003	12	35.1	1.283	0.135	0.6929	
15 minute summer	44	8.000	8.000:50%	0.0	0.000	0.000	0.0080	
30 minute winter	44	8.000	45	1.6	0.690	0.002	0.0179	
30 minute winter	45	8.001	46	1.6	0.685	0.002	0.0348	
30 minute winter	46	8.002	47	1.6	0.245	0.003	0.0781	

Results for 100 year Critical Storm Duration. Lowest mass balance: 99.98%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
30 minute winter	21	20	306.732	0.035	16.9	0.1507	0.0000	OK
30 minute winter	5.000:50%	20	304.833	0.046	26.2	0.0000	0.0000	PONDING
30 minute winter	22	20	302.937	0.060	31.4	0.0958	0.0000	OK
30 minute summer	5.001:50%	18	300.842	0.076	46.6	0.0000	0.0000	OK
30 minute summer	23	18	298.727	0.072	46.5	0.0000	0.0000	OK
30 minute summer	24	19	296.752	0.074	46.3	0.0000	0.0000	OK
30 minute winter	25	19	292.562	0.076	54.1	0.1869	0.0000	OK
30 minute winter	26	19	287.958	0.071	54.0	0.0000	0.0000	OK
30 minute summer	27	19	282.530	0.068	54.0	0.0000	0.0000	OK
30 minute summer	28	19	277.442	0.066	54.0	0.0000	0.0000	OK
30 minute winter	49	21	287.971	0.117	27.2	0.4643	0.0000	OK
30 minute winter	2.001:50%	21	287.702	0.166	51.5	0.7320	0.0000	OK
30 minute winter	48	20	288.643	0.028	5.5	0.0476	0.0000	OK
30 minute winter	2.000:50%	21	288.271	0.037	8.6	0.3310	0.0000	OK
15 minute summer	39	1	262.457	0.000	0.0	0.0000	0.0000	OK
30 minute winter	50	21	287.388	0.170	51.3	0.0000	0.0000	OK
60 minute winter	2.002:50%	47	287.235	0.136	51.5	19.9332	0.0000	PONDING
15 minute summer	40	1	259.256	0.000	0.0	0.0000	0.0000	OK
30 minute winter	7.001:50%	20	257.186	0.021	7.0	0.0050	0.0000	OK
30 minute winter	41	20	255.099	0.026	7.0	0.0000	0.0000	OK
30 minute winter	42	20	251.974	0.023	7.0	0.0000	0.0000	OK
30 minute winter	7.003:50%	20	248.919	0.037	14.4	0.1164	0.0000	OK
30 minute winter	43	21	245.847	0.034	14.4	0.0000	0.0000	OK
30 minute winter	47	21	240.277	0.039	16.5	0.0000	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
30 minute winter	21	5.000	5.000:50%	16.9	1.223	0.032	0.0786	
30 minute winter	21	5.000	22	26.2	1.408	0.050	0.1059	
30 minute winter	22	5.001	5.001:50%	31.3	1.289	0.076	0.2570	
30 minute summer	22	5.001	23	46.5	1.681	0.113	0.2852	
30 minute summer	23	5.002	24	46.3	1.703	0.104	0.2249	
30 minute summer	24	5.003	25	46.3	1.651	0.110	0.5566	
30 minute winter	25	5.004	26	54.0	1.984	0.111	0.4368	
30 minute summer	26	5.005	27	54.0	2.112	0.099	0.3889	
30 minute summer	27	5.006	28	54.0	2.191	0.093	0.3121	
30 minute winter	28	5.007	29	54.0	2.111	0.093	0.1324	
30 minute winter	49	2.001	2.001:50%	27.2	0.435	0.243	1.3317	
30 minute winter	49	2.001	50	51.3	0.652	0.458	1.6606	
30 minute winter	48	2.000	2.000:50%	5.5	0.518	0.021	0.0510	
30 minute winter	48	2.000	49	8.5	0.296	0.033	0.1452	
15 minute summer	39	7.000	40	0.0	0.000	0.000	0.0001	
30 minute winter	50	2.002	2.002:50%	51.2	0.775	0.455	0.5232	
60 minute winter	50	2.002	51	32.6	0.696	0.290	0.3744	
15 minute summer	40	7.001	7.001:50%	0.0	0.000	0.000	0.0194	
30 minute winter	40	7.001	41	7.0	0.927	0.014	0.0491	
30 minute winter	41	7.002	42	7.0	0.879	0.018	0.1321	
30 minute winter	42	7.003	7.003:50%	6.9	0.699	0.016	0.1316	
30 minute winter	42	7.003	43	14.4	1.210	0.033	0.1569	
30 minute winter	43	7.004	47	14.4	1.176	0.030	0.2451	
30 minute winter	47	7.005	47_OUT	16.5	1.262	0.036	0.2878	15.3

Results for 100 year Critical Storm Duration. Lowest mass balance: 99.98%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
30 minute winter	47_OUT	21	234.806	0.038	16.5	0.0000	0.0000	OK
15 minute summer	1	1	304.750	0.000	0.0	0.0000	0.0000	OK
30 minute winter	4	20	295.810	0.060	25.8	0.1495	0.0000	OK
30 minute winter	1.003:50%	21	294.407	0.065	29.5	0.0000	0.0000	OK
30 minute winter	5	21	293.016	0.082	29.4	0.0000	0.0000	OK
30 minute winter	2	20	301.776	0.026	7.0	0.0567	0.0000	OK
30 minute winter	1.001:50%	20	299.892	0.029	8.1	0.0000	0.0000	OK
30 minute winter	3	20	298.026	0.049	15.4	0.1119	0.0000	OK
30 minute winter	1.002:50%	21	296.917	0.054	17.8	0.0000	0.0000	OK
30 minute winter	6	21	291.269	0.071	37.9	0.1854	0.0000	OK
30 minute winter	1.005:50%	21	289.614	0.078	45.1	0.0143	0.0000	OK
30 minute winter	7	21	287.976	0.102	49.5	0.1387	0.0000	OK
30 minute winter	8	21	286.062	0.101	55.6	0.1940	0.0000	OK
30 minute winter	9	21	282.584	0.115	67.4	0.4256	0.0000	OK
30 minute winter	10	22	278.115	0.118	76.2	0.3373	0.0000	OK
30 minute winter	11	21	273.987	0.171	155.8	0.6674	0.0000	OK
30 minute winter	14	21	271.132	0.250	242.9	1.8028	0.3945	FLOOD
120 minute winter	1.011:50%	90	269.171	0.143	176.2	163.0816	0.0000	PONDING
120 minute winter	15	86	267.319	0.145	111.6	0.4973	0.0000	OK
30 minute winter	20	22	264.134	0.188	147.8	0.5748	0.0000	OK
30 minute winter	36	21	262.092	0.223	243.4	0.5180	0.0000	OK
30 minute winter	1.014:50%	21	260.643	0.237	275.3	0.6309	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	1	1.000	2	0.0	0.000	0.000	0.0720	
30 minute winter	4	1.003	1.003:50%	25.7	1.129	0.077	0.2391	
30 minute winter	4	1.003	5	29.4	1.075	0.088	0.2892	
30 minute winter	5	1.004	6	29.5	1.029	0.125	0.7380	
30 minute winter	2	1.001	1.001:50%	7.0	0.774	0.019	0.1061	
30 minute winter	2	1.001	3	8.0	0.609	0.022	0.1575	
30 minute winter	3	1.002	1.002:50%	15.4	0.847	0.055	0.2143	
30 minute winter	3	1.002	4	17.7	0.871	0.063	0.2405	
30 minute winter	6	1.005	1.005:50%	38.0	1.366	0.101	0.2724	
30 minute winter	6	1.005	7	45.1	1.286	0.120	0.3449	
30 minute winter	7	1.006	8	49.5	1.213	0.190	0.9532	
30 minute winter	8	1.007	9	55.5	1.257	0.189	1.4837	
30 minute winter	9	1.008	10	67.1	1.380	0.236	2.2397	
30 minute winter	10	1.009	11	75.8	1.179	0.249	2.4326	
30 minute winter	11	1.010	14	155.3	1.446	0.486	2.5998	
30 minute winter	14	1.011	1.011:50%	239.2	2.600	0.847	1.8597	
120 minute winter	14	1.011	15	98.9	1.548	0.350	1.2348	
120 minute winter	15	1.012	20	111.6	1.562	0.359	2.0558	
30 minute winter	20	1.013	36	147.7	1.615	0.577	2.1159	
30 minute winter	36	1.014	1.014:50%	243.4	1.998	0.193	1.6059	
30 minute winter	36	1.014	37	275.2	2.092	0.218	1.7326	

Results for 100 year Critical Storm Duration. Lowest mass balance: 99.98%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
30 minute winter	37	21	259.190	0.248	296.3	0.8156	0.0000	OK
30 minute winter	1.015:50%	21	257.989	0.279	374.0	1.9167	0.0000	OK
30 minute winter	38	21	256.760	0.281	396.1	0.9755	0.0000	OK
30 minute winter	1.016:50%	21	254.870	0.299	446.6	6.8455	0.0000	OK
30 minute winter	38_OUT	21	252.962	0.298	445.8	0.0000	0.0000	OK
30 minute winter	30	20	285.897	0.032	16.1	0.1303	0.0000	OK
30 minute winter	6.000:50%	21	281.162	0.042	24.0	0.0000	0.0000	OK
30 minute winter	31	21	276.419	0.044	24.0	0.0000	0.0000	OK
30 minute winter	32	21	273.174	0.040	24.0	0.0000	0.0000	OK
30 minute winter	33	20	271.371	0.098	82.6	0.1433	0.0000	OK
30 minute winter	29	20	275.326	0.072	54.0	0.0000	0.0000	OK
30 minute winter	17	20	284.335	0.038	16.9	0.0806	0.0000	OK
30 minute winter	18	20	281.341	0.048	31.7	0.2216	0.0000	OK
30 minute winter	16	20	286.298	0.032	10.1	0.0986	0.0000	OK
30 minute winter	19	20	274.661	0.051	38.4	0.1068	0.0000	OK
30 minute winter	34	20	268.635	0.108	82.6	0.0000	0.0000	OK
30 minute winter	35	20	266.317	0.077	82.6	0.0000	0.0000	OK
30 minute winter	51	22	287.076	0.096	46.9	0.3735	0.0000	OK
30 minute winter	2.003:50%	22	286.281	0.107	53.9	0.0093	0.0000	OK
30 minute winter	51_OUT	22	285.456	0.089	63.4	0.1847	0.0000	OK
30 minute winter	2.004:50%	21	279.684	0.092	67.6	0.0000	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
30 minute winter	37	1.015	1.015:50%	296.1	1.999	0.237	1.6803	
30 minute winter	37	1.015	38	373.8	2.303	0.299	1.8363	
30 minute winter	38	1.016	1.016:50%	396.0	2.317	0.304	2.7578	
30 minute winter	38	1.016	38_OUT	445.8	2.497	0.342	2.8790	1112.9
30 minute winter	30	6.000	6.000:50%	16.1	1.294	0.028	0.1483	
30 minute winter	30	6.000	31	24.0	1.630	0.042	0.1755	
30 minute winter	31	6.001	32	24.0	1.669	0.044	0.1311	
30 minute winter	32	6.002	33	24.0	0.967	0.040	0.1132	
30 minute winter	33	5.009	34	82.6	1.989	0.180	0.4519	
30 minute winter	29	5.008	33	54.1	1.654	0.107	0.4289	
30 minute winter	17	4.001	18	16.8	1.129	0.036	0.1751	
30 minute winter	18	4.002	19	31.6	1.824	0.053	0.2751	
30 minute winter	16	4.000	17	10.1	0.854	0.026	0.1324	
30 minute winter	19	4.003	20	38.4	0.778	0.061	1.2334	
30 minute winter	34	5.010	35	82.6	2.265	0.193	0.3817	
30 minute winter	35	5.011	36	82.6	2.965	0.115	0.1855	
30 minute winter	51	2.003	2.003:50%	46.9	1.150	0.173	0.3727	
30 minute winter	51	2.003	51_OUT	53.8	1.382	0.199	0.3557	
30 minute winter	51_OUT	2.004	2.004:50%	63.3	1.799	0.151	0.9591	
30 minute winter	51_OUT	2.004	11	67.6	1.363	0.161	1.5844	

Results for 100 year Critical Storm Duration. Lowest mass balance: 99.98%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
30 minute winter	12	21	285.549	0.067	50.3	0.0964	0.0000	OK
30 minute winter	3.004:50%	21	281.993	0.081	64.6	0.1020	0.0000	OK
30 minute winter	13	21	278.410	0.068	64.6	0.0000	0.0000	OK
30 minute winter	52	20	304.905	0.026	11.0	0.0896	0.0000	OK
30 minute winter	3.000:50%	20	301.538	0.041	22.9	0.1618	0.0000	OK
30 minute winter	53	20	298.158	0.044	22.8	0.0000	0.0000	OK
30 minute winter	54	20	291.341	0.046	26.1	0.0468	0.0000	OK
30 minute winter	55	21	287.632	0.104	45.9	0.6347	0.0000	OK
15 minute summer	44	1	261.894	0.000	0.0	0.0000	0.0000	OK
30 minute winter	8.000:50%	20	257.795	0.009	2.1	0.0016	0.0000	OK
30 minute winter	45	20	253.688	0.009	2.1	0.0000	0.0000	OK
30 minute winter	46	21	245.424	0.009	2.1	0.0000	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
30 minute winter	12	3.004	3.004:50%	50.4	1.826	0.094	0.2884	
30 minute winter	12	3.004	13	64.6	2.324	0.121	0.2899	
30 minute winter	13	3.005	14	64.6	0.887	0.100	1.2076	
30 minute winter	52	3.000	3.000:50%	11.0	0.970	0.020	0.1043	
30 minute winter	52	3.000	53	22.8	1.568	0.041	0.1333	
30 minute winter	53	3.001	54	22.8	1.467	0.045	0.3444	
30 minute winter	54	3.002	55	26.0	0.923	0.051	0.3441	
30 minute winter	55	3.003	12	45.7	1.390	0.176	0.8348	
15 minute summer	44	8.000	8.000:50%	0.0	0.000	0.000	0.0094	
30 minute winter	44	8.000	45	2.1	0.765	0.003	0.0211	
30 minute winter	45	8.001	46	2.1	0.757	0.003	0.0406	
30 minute winter	46	8.002	47	2.1	0.266	0.003	0.0924	

Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 99.98%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
30 minute winter	21	20	306.739	0.042	22.5	0.1788	0.0000	OK
30 minute winter	5.000:50%	20	304.842	0.055	35.6	0.0000	0.0000	PONDING
30 minute winter	22	20	302.949	0.072	42.8	0.1150	0.0000	OK
30 minute summer	5.001:50%	18	300.858	0.092	64.1	0.0000	0.0000	OK
30 minute summer	23	18	298.741	0.086	63.9	0.0000	0.0000	OK
30 minute summer	24	18	296.767	0.089	63.7	0.0000	0.0000	OK
30 minute winter	25	19	292.577	0.091	74.7	0.2250	0.0000	OK
30 minute winter	26	19	287.972	0.085	74.6	0.0000	0.0000	OK
30 minute winter	27	20	282.544	0.082	74.5	0.0000	0.0000	OK
30 minute winter	28	20	277.456	0.080	74.5	0.0000	0.0000	OK
30 minute winter	49	21	287.990	0.136	35.7	0.5399	0.0000	OK
30 minute winter	2.001:50%	21	287.731	0.195	69.7	1.0150	0.0000	OK
30 minute winter	48	20	288.649	0.034	7.7	0.0582	0.0000	OK
30 minute winter	2.000:50%	21	288.279	0.045	12.0	0.4918	0.0000	OK
15 minute summer	39	1	262.457	0.000	0.0	0.0000	0.0000	OK
30 minute winter	50	21	287.413	0.195	69.6	0.0000	0.0000	OK
60 minute winter	2.002:50%	48	287.247	0.148	69.7	35.6143	0.0000	PONDING
15 minute summer	40	1	259.256	0.000	0.0	0.0000	0.0000	OK
30 minute winter	7.001:50%	20	257.190	0.026	9.8	0.0075	0.0000	OK
30 minute winter	41	20	255.104	0.031	9.8	0.0000	0.0000	OK
30 minute winter	42	20	251.980	0.029	9.8	0.0000	0.0000	OK
30 minute winter	7.003:50%	21	248.927	0.045	20.2	0.1737	0.0000	OK
30 minute winter	43	21	245.855	0.042	20.2	0.0000	0.0000	OK
30 minute winter	47	21	240.285	0.047	23.0	0.0000	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
30 minute winter	21	5.000	5.000:50%	22.5	1.335	0.043	0.0960	
30 minute winter	21	5.000	22	35.5	1.549	0.067	0.1309	
30 minute winter	22	5.001	5.001:50%	42.8	1.413	0.104	0.3199	
30 minute summer	22	5.001	23	63.9	1.850	0.155	0.3565	
30 minute summer	23	5.002	24	63.7	1.874	0.143	0.2810	
30 minute summer	24	5.003	25	63.6	1.815	0.152	0.6959	
30 minute winter	25	5.004	26	74.6	2.185	0.153	0.5473	
30 minute winter	26	5.005	27	74.5	2.329	0.137	0.4866	
30 minute winter	27	5.006	28	74.5	2.416	0.129	0.3902	
30 minute winter	28	5.007	29	74.5	2.327	0.128	0.1656	
30 minute winter	49	2.001	2.001:50%	35.7	0.462	0.319	1.6488	
30 minute winter	49	2.001	50	69.6	0.719	0.622	2.0414	
30 minute winter	48	2.000	2.000:50%	7.7	0.583	0.030	0.0637	
30 minute winter	48	2.000	49	11.9	0.340	0.046	0.1776	
15 minute summer	39	7.000	40	0.0	0.000	0.000	0.0001	
30 minute winter	50	2.002	2.002:50%	69.3	0.912	0.616	0.6068	
60 minute winter	50	2.002	51	38.8	0.742	0.345	0.4186	
15 minute summer	40	7.001	7.001:50%	0.0	0.000	0.000	0.0241	
30 minute winter	40	7.001	41	9.8	1.044	0.019	0.0610	
30 minute winter	41	7.002	42	9.8	0.989	0.025	0.1642	
30 minute winter	42	7.003	7.003:50%	9.7	0.784	0.022	0.1642	
30 minute winter	42	7.003	43	20.2	1.354	0.046	0.1963	
30 minute winter	43	7.004	47	20.2	1.316	0.042	0.3066	
30 minute winter	47	7.005	47_OUT	23.1	1.410	0.051	0.3602	21.4

Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 99.98%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
30 minute winter	47_OUT	21	234.815	0.047	23.1	0.0000	0.0000	OK
15 minute summer	1	1	304.750	0.000	0.0	0.0000	0.0000	OK
30 minute winter	4	20	295.823	0.073	36.1	0.1820	0.0000	OK
30 minute winter	1.003:50%	20	294.421	0.079	41.3	0.0000	0.0000	OK
30 minute winter	5	21	293.033	0.099	41.2	0.0000	0.0000	OK
30 minute winter	2	20	301.782	0.032	9.8	0.0694	0.0000	OK
30 minute winter	1.001:50%	20	299.898	0.035	11.3	0.0000	0.0000	OK
30 minute winter	3	20	298.036	0.060	21.6	0.1363	0.0000	OK
30 minute winter	1.002:50%	20	296.929	0.066	24.9	0.0000	0.0000	OK
30 minute winter	6	21	291.284	0.086	53.1	0.2253	0.0000	OK
30 minute winter	1.005:50%	21	289.631	0.095	63.0	0.0210	0.0000	OK
30 minute winter	7	21	287.997	0.123	69.2	0.1674	0.0000	OK
30 minute winter	8	21	286.084	0.123	77.9	0.2346	0.0000	OK
30 minute winter	9	21	282.608	0.139	94.4	0.5139	0.0000	OK
30 minute winter	10	21	278.140	0.143	107.0	0.4073	0.0000	OK
30 minute winter	11	21	274.015	0.199	207.5	0.7778	0.0000	OK
30 minute winter	14	17	271.132	0.250	330.0	1.8028	34.8950	FLOOD
120 minute winter	1.011:50%	94	269.184	0.156	236.5	274.2649	0.0000	PONDING
120 minute winter	15	88	267.331	0.157	128.9	0.5380	0.0000	OK
30 minute winter	20	22	264.152	0.206	175.9	0.6295	0.0000	OK
30 minute winter	36	21	262.121	0.252	308.4	0.5852	0.0000	OK
30 minute winter	1.014:50%	21	260.675	0.269	353.2	0.8139	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	1	1.000	2	0.0	0.000	0.000	0.0897	
30 minute winter	4	1.003	1.003:50%	36.0	1.252	0.108	0.3018	
30 minute winter	4	1.003	5	41.2	1.189	0.123	0.3657	
30 minute winter	5	1.004	6	41.3	1.137	0.174	0.9341	
30 minute winter	2	1.001	1.001:50%	9.8	0.872	0.027	0.1322	
30 minute winter	2	1.001	3	11.3	0.680	0.031	0.1971	
30 minute winter	3	1.002	1.002:50%	21.5	0.941	0.077	0.2695	
30 minute winter	3	1.002	4	24.8	0.967	0.089	0.3031	
30 minute winter	6	1.005	1.005:50%	53.1	1.511	0.142	0.3447	
30 minute winter	6	1.005	7	63.1	1.418	0.168	0.4376	
30 minute winter	7	1.006	8	69.3	1.334	0.265	1.2127	
30 minute winter	8	1.007	9	77.8	1.382	0.265	1.8922	
30 minute winter	9	1.008	10	94.2	1.516	0.332	2.8630	
30 minute winter	10	1.009	11	106.5	1.322	0.350	3.0454	
30 minute winter	11	1.010	14	207.1	1.758	0.648	2.8258	
60 minute winter	14	1.011	1.011:50%	245.5	2.584	0.869	1.9522	
120 minute winter	14	1.011	15	115.5	1.622	0.409	1.3773	
120 minute winter	15	1.012	20	128.9	1.620	0.415	2.3112	
30 minute winter	20	1.013	36	175.5	1.690	0.685	2.4023	
30 minute winter	36	1.014	1.014:50%	308.5	2.115	0.244	1.9244	
30 minute winter	36	1.014	37	353.2	2.224	0.280	2.0919	

Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 99.98%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
30 minute winter	37	21	259.224	0.282	382.8	0.9289	0.0000	OK
30 minute winter	1.015:50%	21	258.030	0.320	491.8	2.5205	0.0000	OK
30 minute winter	38	21	256.802	0.323	523.0	1.1204	0.0000	OK
30 minute winter	1.016:50%	21	254.916	0.344	593.8	9.0765	0.0000	OK
30 minute winter	38_OUT	21	253.007	0.343	593.3	0.0000	0.0000	OK
30 minute winter	30	20	285.903	0.038	21.4	0.1544	0.0000	OK
30 minute winter	6.000:50%	21	281.170	0.050	32.4	0.0000	0.0000	OK
30 minute winter	31	21	276.428	0.053	32.4	0.0000	0.0000	OK
30 minute winter	32	21	273.182	0.048	32.4	0.0000	0.0000	OK
30 minute winter	33	20	271.390	0.117	113.4	0.1714	0.0000	OK
30 minute winter	29	20	275.341	0.087	74.5	0.0000	0.0000	OK
30 minute winter	17	20	284.344	0.047	23.6	0.0984	0.0000	OK
30 minute winter	18	20	281.352	0.059	44.4	0.2704	0.0000	OK
30 minute winter	16	20	286.305	0.039	14.1	0.1204	0.0000	OK
30 minute winter	19	20	274.672	0.062	53.9	0.1303	0.0000	OK
30 minute winter	34	20	268.656	0.129	113.4	0.0000	0.0000	OK
30 minute winter	35	20	266.332	0.093	113.4	0.0000	0.0000	OK
30 minute winter	51	22	287.086	0.106	55.5	0.4112	0.0000	OK
30 minute winter	2.003:50%	22	286.293	0.119	65.3	0.0116	0.0000	OK
30 minute winter	51_OUT	21	285.467	0.099	77.5	0.2071	0.0000	OK
30 minute winter	2.004:50%	21	279.695	0.104	83.6	0.0000	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
30 minute winter	37	1.015	1.015:50%	382.7	2.117	0.306	2.0490	
30 minute winter	37	1.015	38	491.8	2.465	0.393	2.2568	
30 minute winter	38	1.016	1.016:50%	523.0	2.478	0.401	3.4057	
30 minute winter	38	1.016	38_OUT	593.3	2.683	0.455	3.5657	1327.2
30 minute winter	30	6.000	6.000:50%	21.4	1.414	0.037	0.1803	
30 minute winter	30	6.000	31	32.4	1.798	0.056	0.2148	
30 minute winter	31	6.001	32	32.4	1.842	0.060	0.1604	
30 minute winter	32	6.002	33	32.4	1.055	0.054	0.1411	
30 minute winter	33	5.009	34	113.4	2.176	0.248	0.5670	
30 minute winter	29	5.008	33	74.6	1.822	0.148	0.5375	
30 minute winter	17	4.001	18	23.5	1.259	0.051	0.2197	
30 minute winter	18	4.002	19	44.4	2.032	0.075	0.3461	
30 minute winter	16	4.000	17	14.1	0.956	0.037	0.1654	
30 minute winter	19	4.003	20	53.8	0.933	0.086	1.4303	
30 minute winter	34	5.010	35	113.4	2.483	0.265	0.4783	
30 minute winter	35	5.011	36	113.3	3.260	0.158	0.2316	
30 minute winter	51	2.003	2.003:50%	55.5	1.197	0.205	0.4241	
30 minute winter	51	2.003	51_OUT	65.3	1.460	0.241	0.4085	
30 minute winter	51_OUT	2.004	2.004:50%	77.4	1.902	0.184	1.1102	
30 minute winter	51_OUT	2.004	11	83.5	1.429	0.199	1.9213	

Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 99.98%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
30 minute winter	12	21	285.563	0.081	70.5	0.1173	0.0000	OK
30 minute winter	3.004:50%	21	282.010	0.098	90.5	0.1504	0.0000	OK
30 minute winter	13	21	278.424	0.082	90.5	0.0000	0.0000	OK
30 minute winter	52	20	304.911	0.032	15.5	0.1100	0.0000	OK
30 minute winter	3.000:50%	20	301.547	0.051	32.2	0.2419	0.0000	OK
30 minute winter	53	20	298.167	0.053	32.0	0.0000	0.0000	OK
30 minute winter	54	20	291.351	0.057	36.6	0.0571	0.0000	OK
30 minute winter	55	21	287.654	0.126	64.3	0.7669	0.0000	OK
15 minute summer	44	1	261.894	0.000	0.0	0.0000	0.0000	OK
30 minute winter	8.000:50%	20	257.797	0.011	2.9	0.0024	0.0000	OK
30 minute winter	45	20	253.690	0.011	2.9	0.0000	0.0000	OK
30 minute winter	46	20	245.426	0.011	2.9	0.0000	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
30 minute winter	12	3.004	3.004:50%	70.6	2.021	0.132	0.3655	
30 minute winter	12	3.004	13	90.5	2.571	0.170	0.3674	
30 minute winter	13	3.005	14	90.5	1.169	0.140	1.2565	
30 minute winter	52	3.000	3.000:50%	15.5	1.091	0.028	0.1307	
30 minute winter	52	3.000	53	32.0	1.753	0.058	0.1675	
30 minute winter	53	3.001	54	32.0	1.638	0.063	0.4328	
30 minute winter	54	3.002	55	36.5	1.024	0.071	0.4365	
30 minute winter	55	3.003	12	64.0	1.535	0.246	1.0602	
15 minute summer	44	8.000	8.000:50%	0.0	0.000	0.000	0.0117	
30 minute winter	44	8.000	45	2.9	0.865	0.004	0.0258	
30 minute winter	45	8.001	46	2.9	0.856	0.004	0.0498	
30 minute winter	46	8.002	47	2.8	0.299	0.005	0.1152	

Results for 200 year Critical Storm Duration. Lowest mass balance: 99.98%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
30 minute winter	21	20	306.735	0.038	19.2	0.1627	0.0000	OK
30 minute winter	5.000:50%	20	304.837	0.050	30.1	0.0000	0.0000	PONDING
30 minute winter	22	20	302.942	0.065	36.2	0.1042	0.0000	OK
30 minute summer	5.001:50%	18	300.849	0.083	53.9	0.0000	0.0000	OK
30 minute summer	23	18	298.733	0.078	53.7	0.0000	0.0000	OK
30 minute summer	24	19	296.759	0.081	53.6	0.0000	0.0000	OK
30 minute winter	25	19	292.568	0.082	62.6	0.2032	0.0000	OK
30 minute summer	26	19	287.964	0.077	62.4	0.0000	0.0000	OK
30 minute summer	27	19	282.536	0.074	62.4	0.0000	0.0000	OK
30 minute winter	28	20	277.448	0.072	62.5	0.0000	0.0000	OK
30 minute winter	49	21	287.979	0.125	30.7	0.4965	0.0000	OK
30 minute winter	2.001:50%	21	287.715	0.179	59.0	0.8474	0.0000	OK
30 minute winter	48	20	288.646	0.031	6.4	0.0521	0.0000	OK
30 minute winter	2.000:50%	22	288.275	0.040	10.0	0.3967	0.0000	OK
15 minute summer	39	1	262.457	0.000	0.0	0.0000	0.0000	OK
30 minute winter	50	21	287.399	0.181	58.8	0.0000	0.0000	OK
60 minute winter	2.002:50%	48	287.241	0.142	59.2	26.4437	0.0000	PONDING
15 minute summer	40	1	259.256	0.000	0.0	0.0000	0.0000	OK
30 minute winter	7.001:50%	20	257.188	0.023	8.1	0.0060	0.0000	OK
30 minute winter	41	20	255.101	0.028	8.1	0.0000	0.0000	OK
30 minute winter	42	20	251.977	0.026	8.1	0.0000	0.0000	OK
30 minute winter	7.003:50%	20	248.922	0.040	16.9	0.1396	0.0000	OK
30 minute winter	43	21	245.850	0.037	16.8	0.0000	0.0000	OK
30 minute winter	47	21	240.281	0.042	19.2	0.0000	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
30 minute winter	21	5.000	5.000:50%	19.2	1.271	0.036	0.0860	
30 minute winter	21	5.000	22	30.1	1.470	0.057	0.1166	
30 minute winter	22	5.001	5.001:50%	36.1	1.343	0.088	0.2835	
30 minute summer	22	5.001	23	53.7	1.757	0.130	0.3155	
30 minute summer	23	5.002	24	53.6	1.779	0.120	0.2488	
30 minute summer	24	5.003	25	53.5	1.724	0.128	0.6158	
30 minute winter	25	5.004	26	62.5	2.073	0.128	0.4833	
30 minute summer	26	5.005	27	62.4	2.207	0.115	0.4302	
30 minute winter	27	5.006	28	62.5	2.290	0.108	0.3452	
30 minute winter	28	5.007	29	62.5	2.207	0.107	0.1465	
30 minute winter	49	2.001	2.001:50%	30.7	0.447	0.274	1.4640	
30 minute winter	49	2.001	50	58.8	0.680	0.525	1.8241	
30 minute winter	48	2.000	2.000:50%	6.4	0.547	0.025	0.0563	
30 minute winter	48	2.000	49	9.9	0.315	0.038	0.1588	
15 minute summer	39	7.000	40	0.0	0.000	0.000	0.0001	
30 minute winter	50	2.002	2.002:50%	58.6	0.832	0.521	0.5600	
60 minute winter	50	2.002	51	35.3	0.717	0.314	0.3939	
15 minute summer	40	7.001	7.001:50%	0.0	0.000	0.000	0.0213	
30 minute winter	40	7.001	41	8.1	0.976	0.016	0.0540	
30 minute winter	41	7.002	42	8.1	0.926	0.020	0.1453	
30 minute winter	42	7.003	7.003:50%	8.1	0.735	0.018	0.1453	
30 minute winter	42	7.003	43	16.8	1.274	0.038	0.1734	
30 minute winter	43	7.004	47	16.8	1.237	0.035	0.2709	
30 minute winter	47	7.005	47_OUT	19.2	1.327	0.042	0.3184	17.8

Results for 200 year Critical Storm Duration. Lowest mass balance: 99.98%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
30 minute winter	47_OUT	21	234.810	0.042	19.2	0.0000	0.0000	OK
15 minute summer	1	1	304.750	0.000	0.0	0.0000	0.0000	OK
30 minute winter	4	21	295.816	0.066	30.1	0.1638	0.0000	OK
30 minute winter	1.003:50%	21	294.414	0.072	34.4	0.0000	0.0000	OK
30 minute winter	5	21	293.024	0.090	34.5	0.0000	0.0000	OK
30 minute winter	2	20	301.779	0.029	8.2	0.0624	0.0000	OK
30 minute winter	1.001:50%	20	299.895	0.032	9.5	0.0000	0.0000	OK
30 minute winter	3	20	298.030	0.054	18.0	0.1226	0.0000	OK
30 minute winter	1.002:50%	21	296.922	0.059	20.7	0.0000	0.0000	OK
30 minute winter	6	21	291.275	0.077	44.3	0.2029	0.0000	OK
30 minute winter	1.005:50%	21	289.621	0.085	52.6	0.0170	0.0000	OK
30 minute winter	7	21	287.985	0.111	57.7	0.1513	0.0000	OK
30 minute winter	8	21	286.072	0.111	64.8	0.2117	0.0000	OK
30 minute winter	9	21	282.595	0.126	78.6	0.4643	0.0000	OK
30 minute winter	10	21	278.126	0.129	89.0	0.3679	0.0000	OK
30 minute winter	11	21	273.999	0.183	177.5	0.7156	0.0000	OK
30 minute winter	14	18	271.132	0.250	279.2	1.8028	11.1019	FLOOD
120 minute winter	1.011:50%	92	269.177	0.149	201.7	208.6641	0.0000	PONDING
120 minute winter	15	88	267.324	0.150	119.0	0.5152	0.0000	OK
30 minute winter	20	22	264.142	0.196	159.6	0.5988	0.0000	OK
30 minute winter	36	21	262.104	0.235	270.7	0.5473	0.0000	OK
30 minute winter	1.014:50%	21	260.657	0.251	308.0	0.7078	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	1	1.000	2	0.0	0.000	0.000	0.0792	
30 minute winter	4	1.003	1.003:50%	30.0	1.184	0.090	0.2664	
30 minute winter	4	1.003	5	34.5	1.125	0.103	0.3227	
30 minute winter	5	1.004	6	34.5	1.079	0.146	0.8229	
30 minute winter	2	1.001	1.001:50%	8.2	0.819	0.022	0.1177	
30 minute winter	2	1.001	3	9.4	0.642	0.026	0.1748	
30 minute winter	3	1.002	1.002:50%	17.9	0.890	0.064	0.2380	
30 minute winter	3	1.002	4	20.7	0.913	0.074	0.2674	
30 minute winter	6	1.005	1.005:50%	44.3	1.431	0.118	0.3035	
30 minute winter	6	1.005	7	52.6	1.346	0.140	0.3846	
30 minute winter	7	1.006	8	57.7	1.267	0.221	1.0641	
30 minute winter	8	1.007	9	64.8	1.313	0.220	1.6584	
30 minute winter	9	1.008	10	78.4	1.441	0.276	2.5066	
30 minute winter	10	1.009	11	88.6	1.244	0.291	2.6940	
30 minute winter	11	1.010	14	176.9	1.581	0.553	2.6962	
60 minute winter	14	1.011	1.011:50%	242.4	2.564	0.858	1.9061	
120 minute winter	14	1.011	15	106.1	1.582	0.376	1.2972	
120 minute winter	15	1.012	20	119.0	1.588	0.383	2.1668	
30 minute winter	20	1.013	36	159.6	1.648	0.623	2.2397	
30 minute winter	36	1.014	1.014:50%	270.8	2.049	0.214	1.7417	
30 minute winter	36	1.014	37	307.8	2.151	0.244	1.8856	

Results for 200 year Critical Storm Duration. Lowest mass balance: 99.98%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
30 minute winter	37	21	259.205	0.263	332.4	0.8650	0.0000	OK
30 minute winter	1.015:50%	21	258.007	0.297	423.1	2.1699	0.0000	OK
30 minute winter	38	21	256.778	0.299	448.9	1.0386	0.0000	OK
30 minute winter	1.016:50%	21	254.890	0.318	507.7	7.7788	0.0000	OK
30 minute winter	38_OUT	21	252.982	0.318	507.1	0.0000	0.0000	OK
30 minute winter	30	20	285.900	0.035	18.3	0.1406	0.0000	OK
30 minute winter	6.000:50%	21	281.165	0.045	27.5	0.0000	0.0000	OK
30 minute winter	31	21	276.423	0.048	27.5	0.0000	0.0000	OK
30 minute winter	32	21	273.177	0.043	27.5	0.0000	0.0000	OK
30 minute winter	33	20	271.379	0.106	95.3	0.1554	0.0000	OK
30 minute winter	29	20	275.333	0.079	62.5	0.0000	0.0000	OK
30 minute winter	17	20	284.339	0.042	19.6	0.0882	0.0000	OK
30 minute winter	18	20	281.346	0.053	37.0	0.2426	0.0000	OK
30 minute winter	16	20	286.301	0.035	11.7	0.1078	0.0000	OK
30 minute winter	19	20	274.666	0.056	44.8	0.1169	0.0000	OK
30 minute winter	34	20	268.644	0.117	95.3	0.0000	0.0000	OK
30 minute winter	35	20	266.323	0.084	95.3	0.0000	0.0000	OK
30 minute winter	51	22	287.081	0.101	50.5	0.3896	0.0000	OK
30 minute winter	2.003:50%	22	286.286	0.112	58.6	0.0103	0.0000	OK
30 minute winter	51_OUT	21	285.460	0.093	69.3	0.1943	0.0000	OK
30 minute winter	2.004:50%	21	279.689	0.097	74.2	0.0000	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
30 minute winter	37	1.015	1.015:50%	332.3	2.050	0.266	1.8371	
30 minute winter	37	1.015	38	423.0	2.375	0.338	2.0148	
30 minute winter	38	1.016	1.016:50%	448.9	2.388	0.344	3.0325	
30 minute winter	38	1.016	38_OUT	507.1	2.579	0.389	3.1700	1205.0
30 minute winter	30	6.000	6.000:50%	18.3	1.348	0.032	0.1620	
30 minute winter	30	6.000	31	27.5	1.705	0.048	0.1923	
30 minute winter	31	6.001	32	27.5	1.745	0.051	0.1436	
30 minute winter	32	6.002	33	27.5	1.006	0.046	0.1250	
30 minute winter	33	5.009	34	95.3	2.072	0.208	0.5004	
30 minute winter	29	5.008	33	62.6	1.728	0.124	0.4748	
30 minute winter	17	4.001	18	19.6	1.185	0.042	0.1939	
30 minute winter	18	4.002	19	36.9	1.916	0.062	0.3052	
30 minute winter	16	4.000	17	11.7	0.898	0.031	0.1462	
30 minute winter	19	4.003	20	44.7	0.845	0.071	1.3177	
30 minute winter	34	5.010	35	95.3	2.362	0.223	0.4224	
30 minute winter	35	5.011	36	95.2	3.096	0.133	0.2049	
30 minute winter	51	2.003	2.003:50%	50.5	1.171	0.186	0.3943	
30 minute winter	51	2.003	51_OUT	58.6	1.415	0.216	0.3779	
30 minute winter	51_OUT	2.004	2.004:50%	69.2	1.843	0.165	1.0235	
30 minute winter	51_OUT	2.004	11	74.3	1.393	0.177	1.7280	

Results for 200 year Critical Storm Duration. Lowest mass balance: 99.98%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
30 minute winter	12	21	285.555	0.073	58.8	0.1055	0.0000	OK
30 minute winter	3.004:50%	21	282.001	0.089	75.4	0.1221	0.0000	OK
30 minute winter	13	21	278.416	0.074	75.4	0.0000	0.0000	OK
30 minute winter	52	20	304.908	0.029	12.9	0.0985	0.0000	OK
30 minute winter	3.000:50%	20	301.542	0.045	26.8	0.1948	0.0000	OK
30 minute winter	53	20	298.162	0.048	26.7	0.0000	0.0000	OK
30 minute winter	54	21	291.345	0.051	30.4	0.0513	0.0000	OK
30 minute winter	55	21	287.641	0.113	53.6	0.6926	0.0000	OK
15 minute summer	44	1	261.894	0.000	0.0	0.0000	0.0000	OK
30 minute winter	8.000:50%	21	257.796	0.010	2.4	0.0019	0.0000	OK
30 minute winter	45	20	253.689	0.010	2.4	0.0000	0.0000	OK
30 minute winter	46	21	245.425	0.010	2.4	0.0000	0.0000	OK

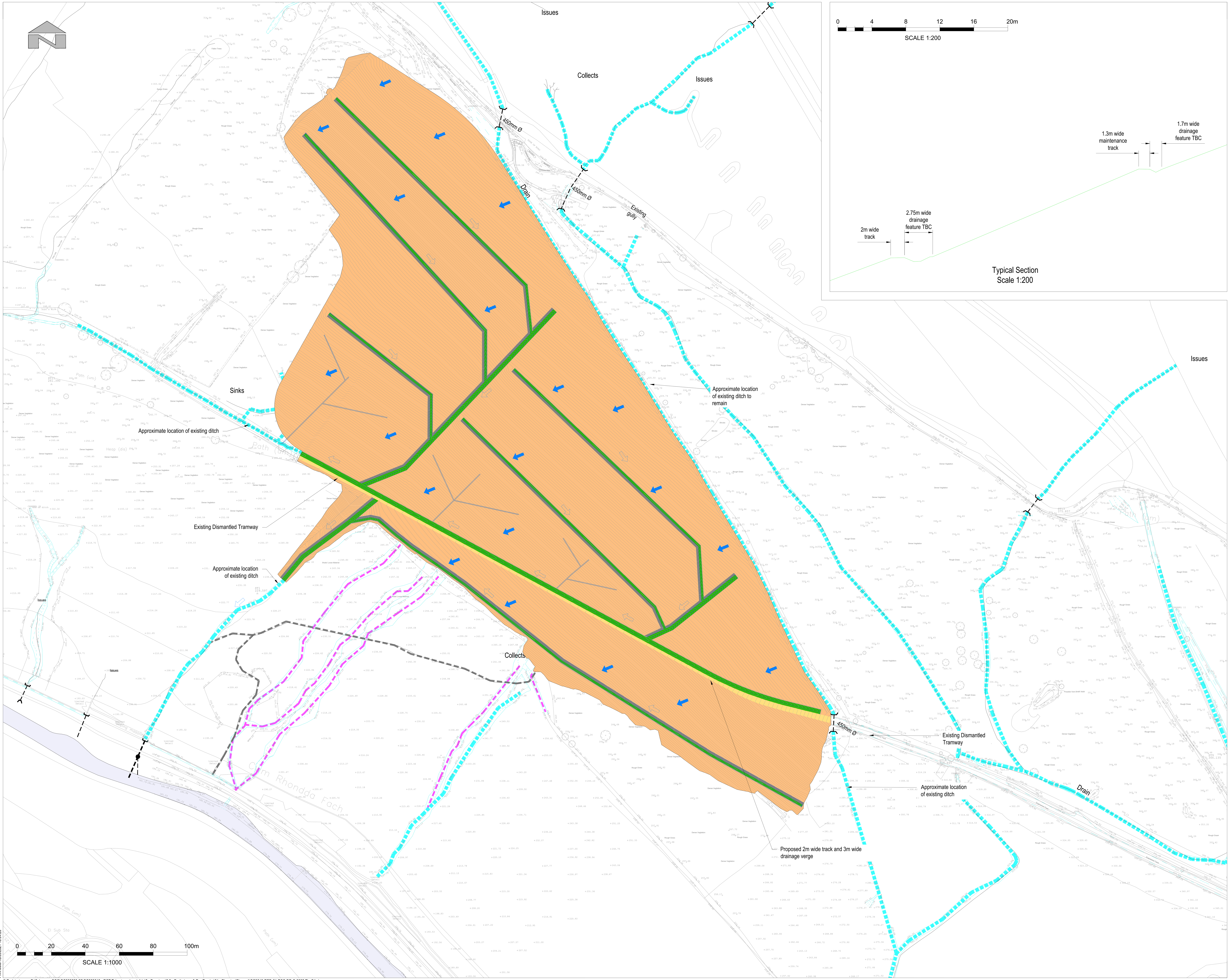
Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
30 minute winter	12	3.004	3.004:50%	58.8	1.914	0.110	0.3215	
30 minute winter	12	3.004	13	75.4	2.435	0.141	0.3232	
30 minute winter	13	3.005	14	75.4	1.008	0.117	1.2286	
30 minute winter	52	3.000	3.000:50%	12.9	1.025	0.023	0.1157	
30 minute winter	52	3.000	53	26.7	1.651	0.048	0.1481	
30 minute winter	53	3.001	54	26.6	1.544	0.053	0.3824	
30 minute winter	54	3.002	55	30.4	0.969	0.059	0.3839	
30 minute winter	55	3.003	12	53.4	1.455	0.205	0.9314	
15 minute summer	44	8.000	8.000:50%	0.0	0.000	0.000	0.0101	
30 minute winter	44	8.000	45	2.4	0.806	0.004	0.0230	
30 minute winter	45	8.001	46	2.4	0.799	0.004	0.0447	
30 minute winter	46	8.002	47	2.4	0.283	0.004	0.1022	

Appendix D

Drawings

D.1 Proposed tip reprofile and receptor site C general arrangements

D.2 Proposed cross sections of both the tip reprofile and receptor site C



Key:

- Proposed Tip Reprofile (including Tramway)
- Proposed 2m wide track and 3m wide drainage feature
- Existing drainage ditch
- Proposed drainage ditch/swale
- Proposed maintenance track/path

Notes:

1. For Location Plan refer to drawing : GC3613-RED-61-RSC-DR-C-0001
2. For Receptor Site C General Arrangement refer to drawing : GC3613-RED-61-RSC-DR-C-0003
3. For cross sections of Tip Reprofile refer to drawings: GC3613-RED-61-RSC-DR-C-0004-0010
4. For Receptor Site C Cross Sections refer to drawings: GC3613-RED-61-RSC-DR-C-0009-0013

Rev	Drwn	Chk'd	App'd	Description	Date
P02	JC	PH	NG	For information	17/08/2021

Purpose of Issue
D5 - Suitable for Planning

Classification
Public

Client
Rhondda Cynon Taf County Borough Council

Project
Tylorstown Landslide

Drawing
Phase 4
General Arangement
Tip Reprofile

Scale @ A1	Drawn	Checked	Approved
As Shown	JC	JS	PH

Project No. GC/3613
Date March 2021

Drawing Identifier
Project - Originator - Zone - Level - File Type - Role - Number
BS1192 Compliant
GC3613-RED-61-RSC-DR-C-0002
revision P02

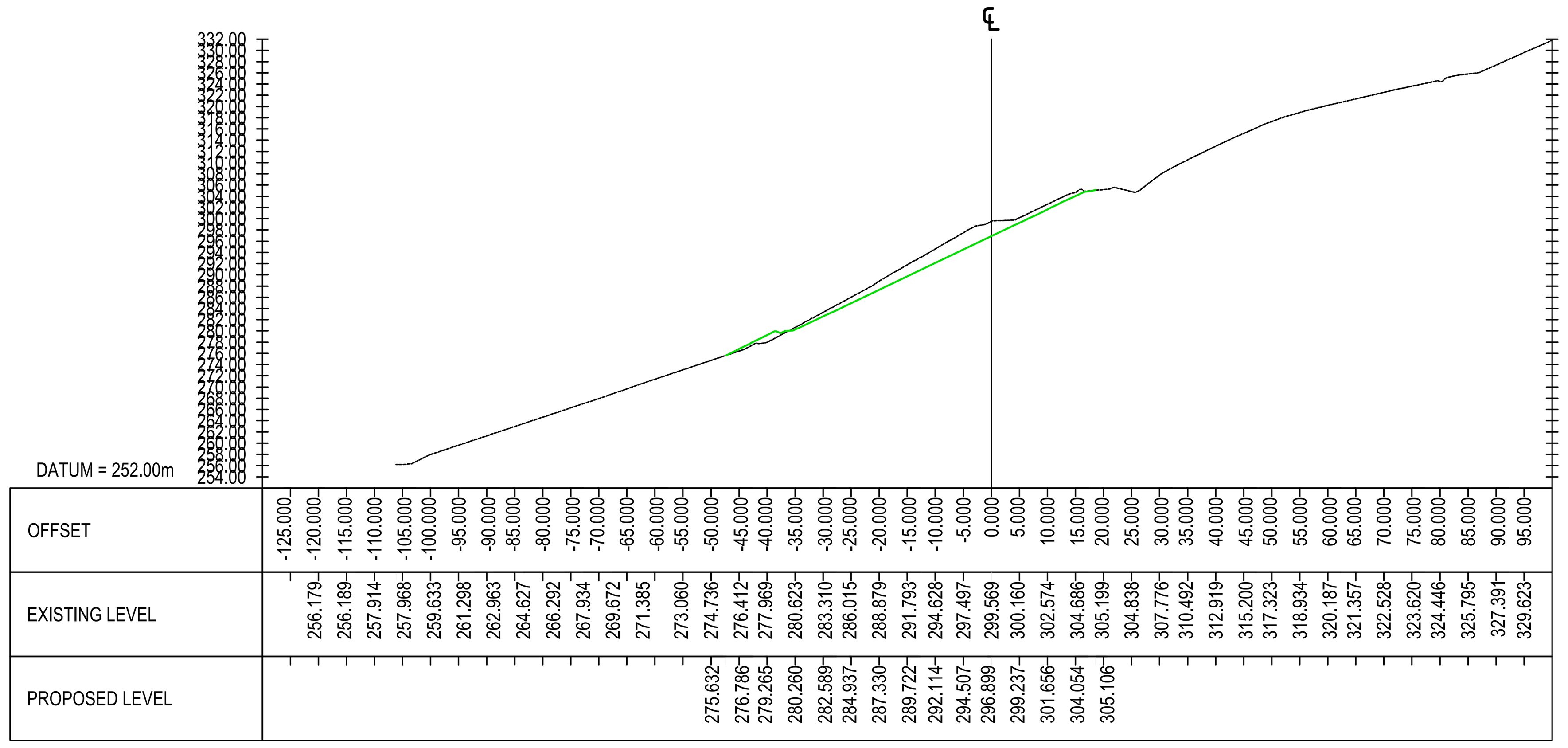
REDSTART

St David's House, Pascal Close, St Mellons, Cardiff, CF3 0LW
www.redstartwales.com

Key:

Proposed Levels

Existing Levels



PHASE 4 - TIP REPROFILE - CH20.000
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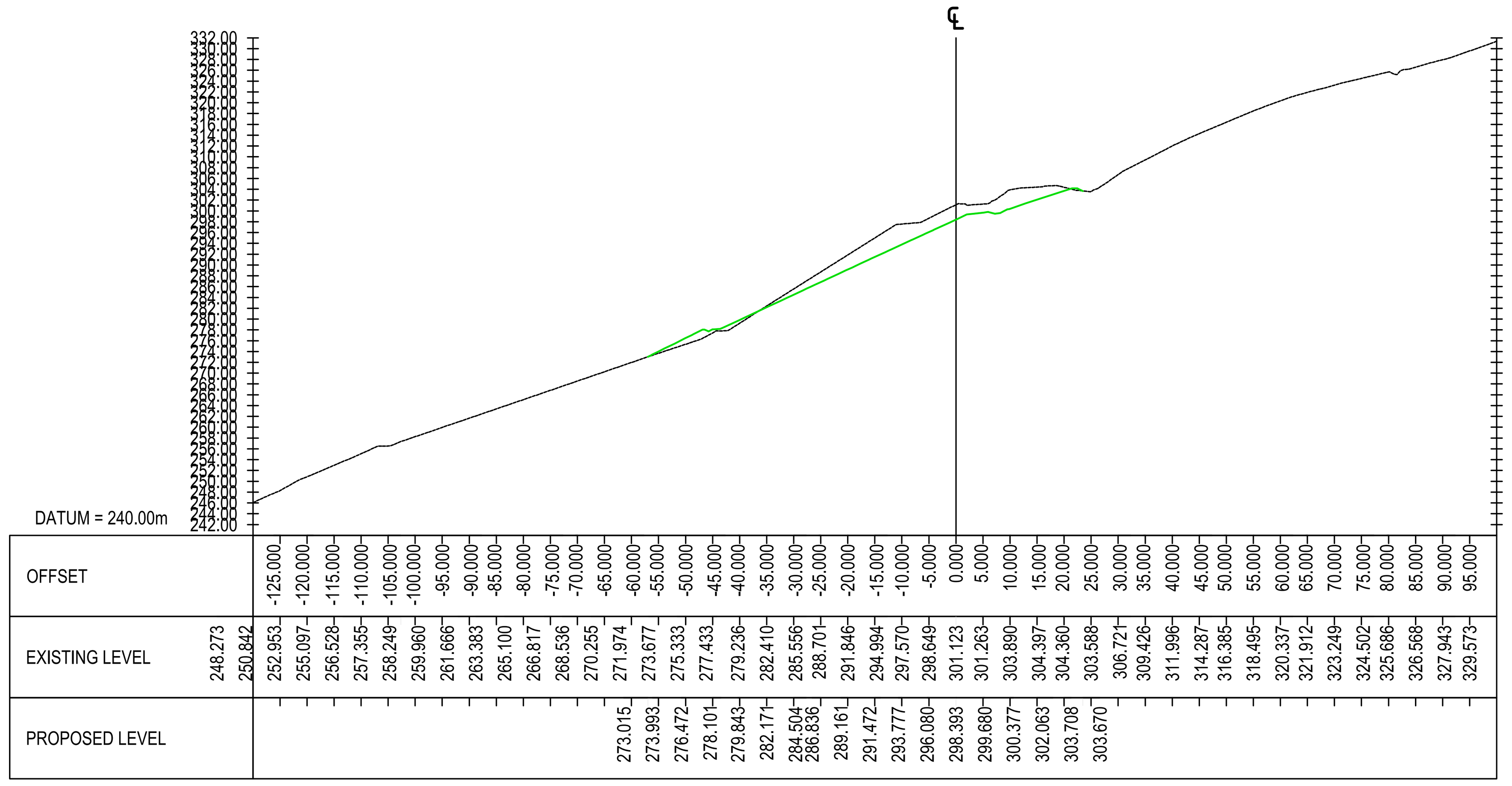

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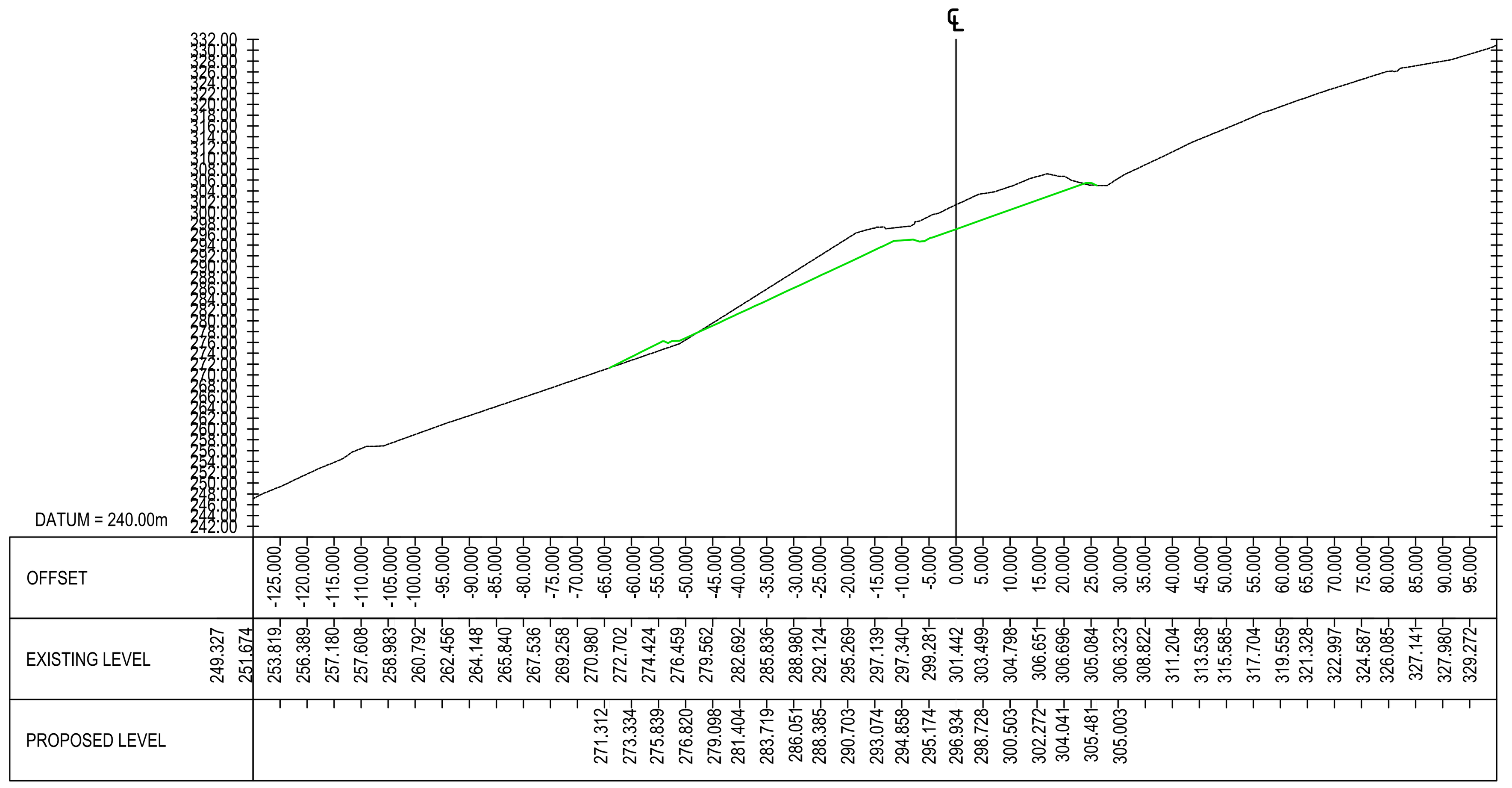

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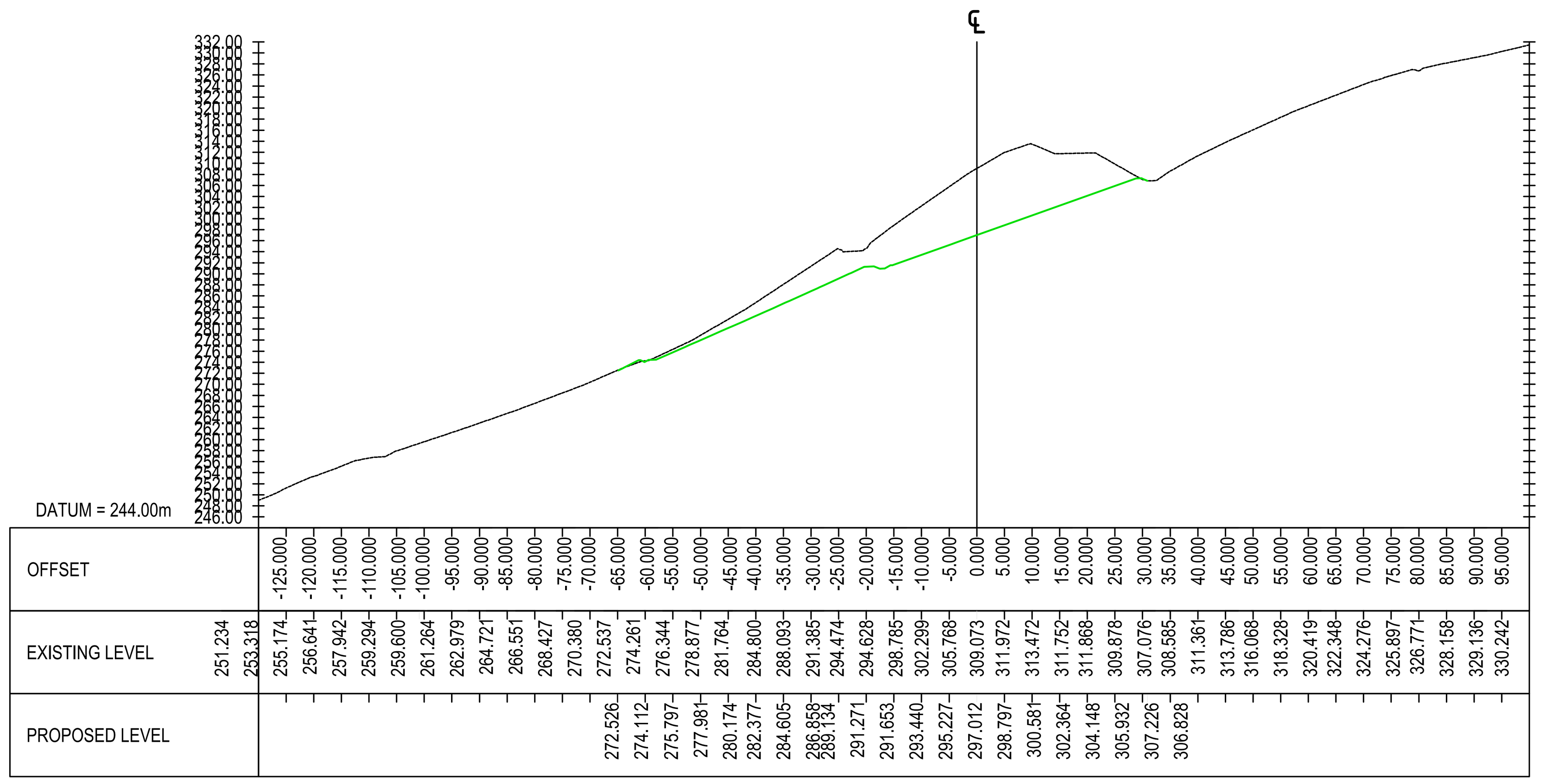

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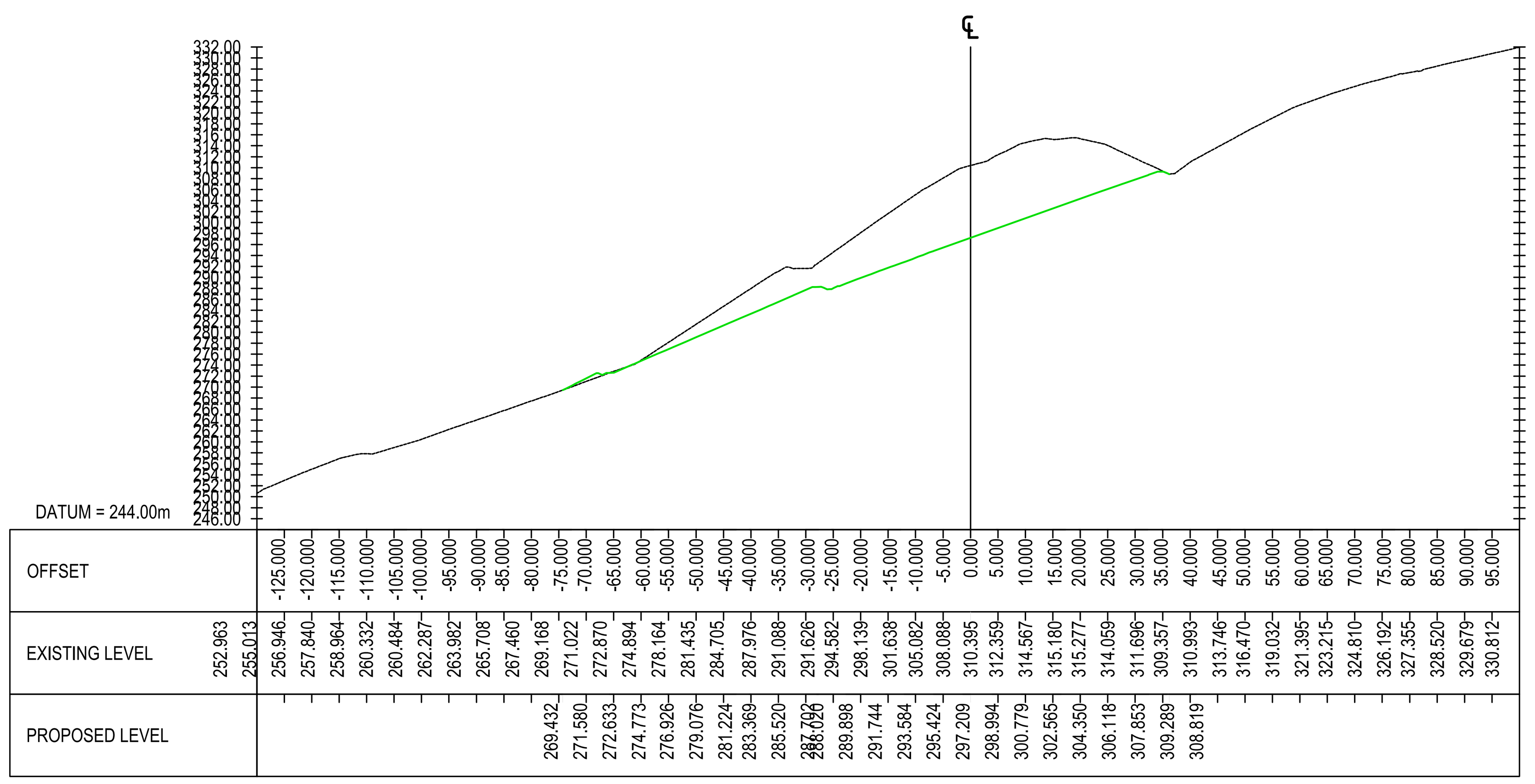

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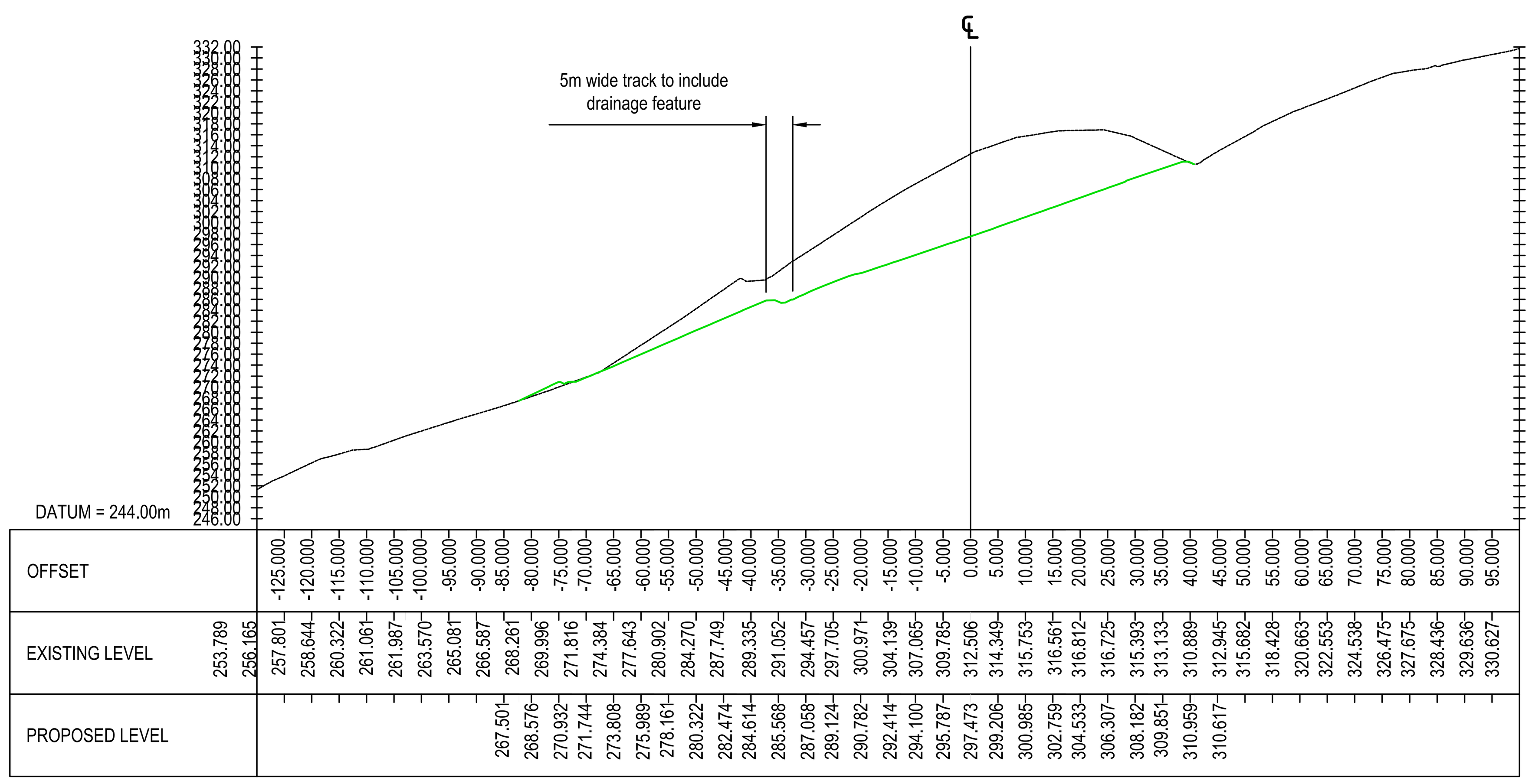

PHASE 4 - TIP REPROFILE - CH120.000
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SCALE 1:1000

Notes:

1. For cross sections markers refer to drawing: GC3613-RED-61-RSC-DR-C-0002
2. For Location Plan refer to drawing: GC3613-RED-61-RSC-DR-C-0001
3. For General Arrangement Plan of Receptor Site C refer to drawing: GC3613-RED-61-RSC-DR-C-0003
4. For Cross Sections of Receptor Site C refer to drawing: GC3613-RED-61-RSC-DR-C-0009-0013

Rev	Drwn	Chk'd	App'd	Description	Date
P02	JC	PH	NG	For information	17/08/2021

Purpose of Issue
D5 - Suitable for Planning

Classification
Public

Client
Rhondda Cynon Taf County Borough Council

Project
Tylorstown Landslide

Drawing
Phase 4
Cross Sections - Tip Reprofile
Sheet 1 of 5

Scale @ A1	Drawn	Checked	Approved
1:1000	MH	NG	PH

Project No.
GC/3613

Date
March 2021

Drawing Identifier
Project - Originator - Zone - Level - File Type - Role - Number
BS1192 Compliant
revision
GC3613-RED-61-RSC-DR-C-0004 P02

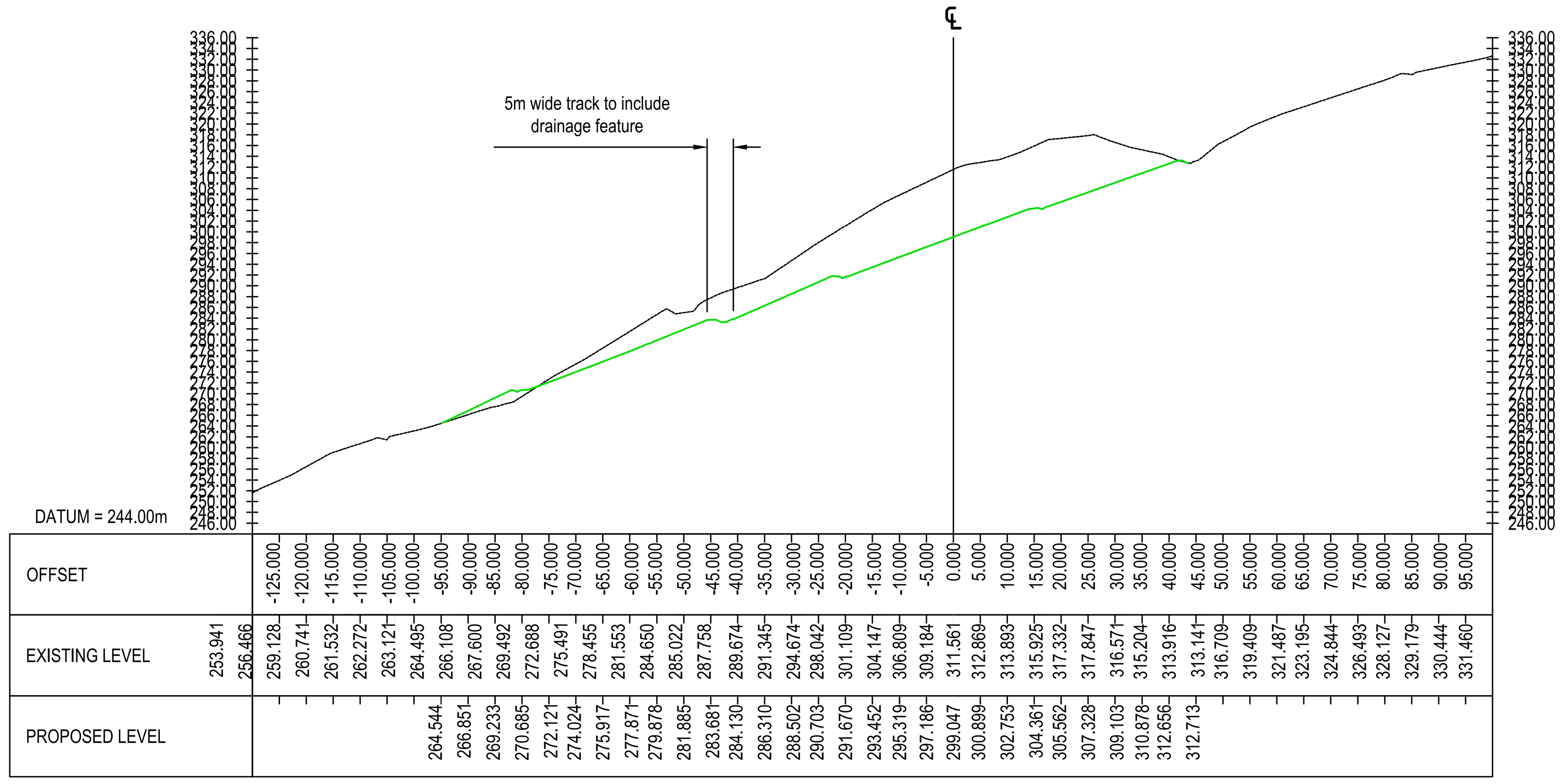
REDSTART

St David's House, Pascal Close, St Mellons, Cardiff, CF3 0LW
www.redstartwales.com

Key:

Proposed Levels

Existing Levels



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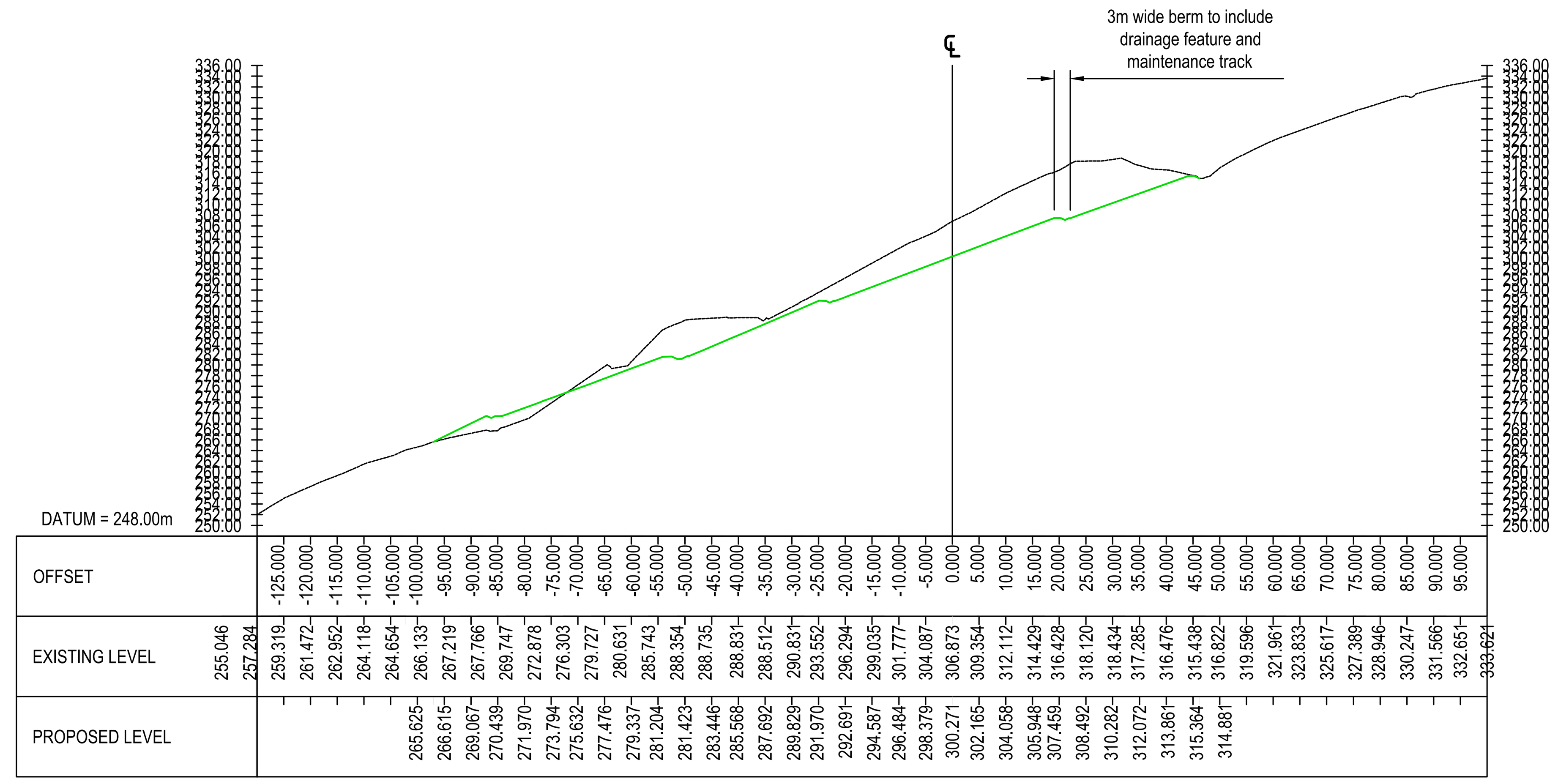

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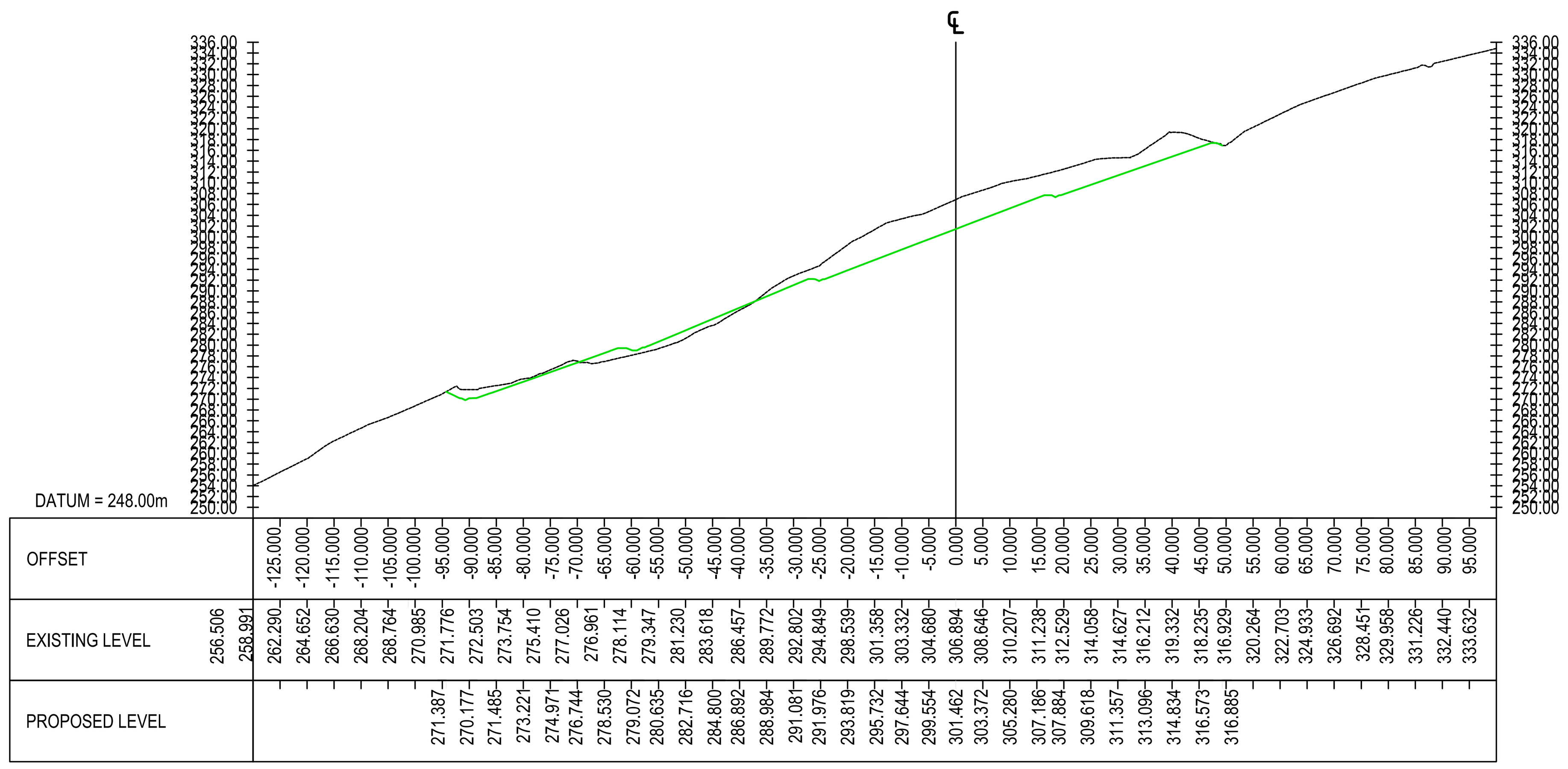

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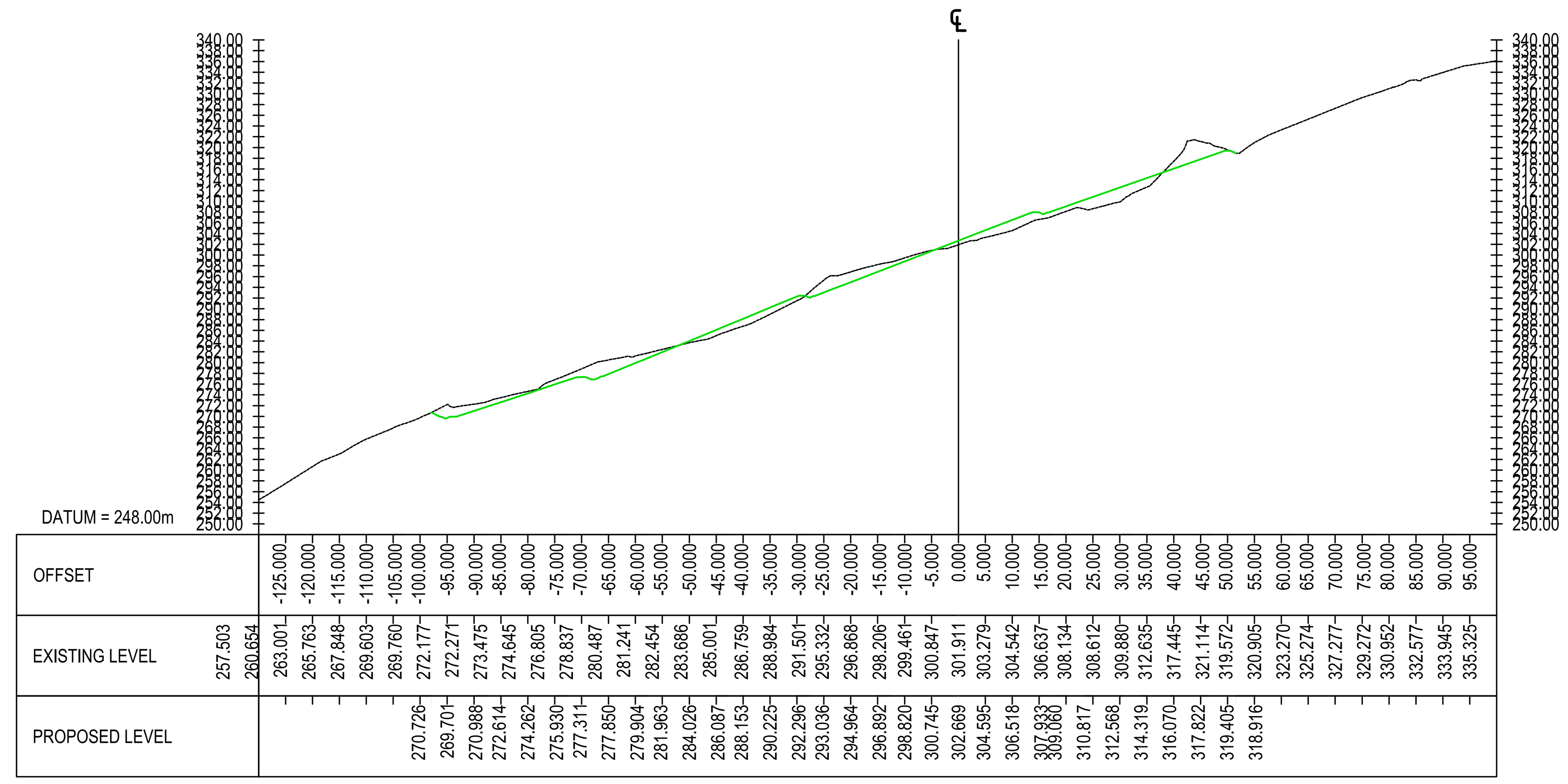

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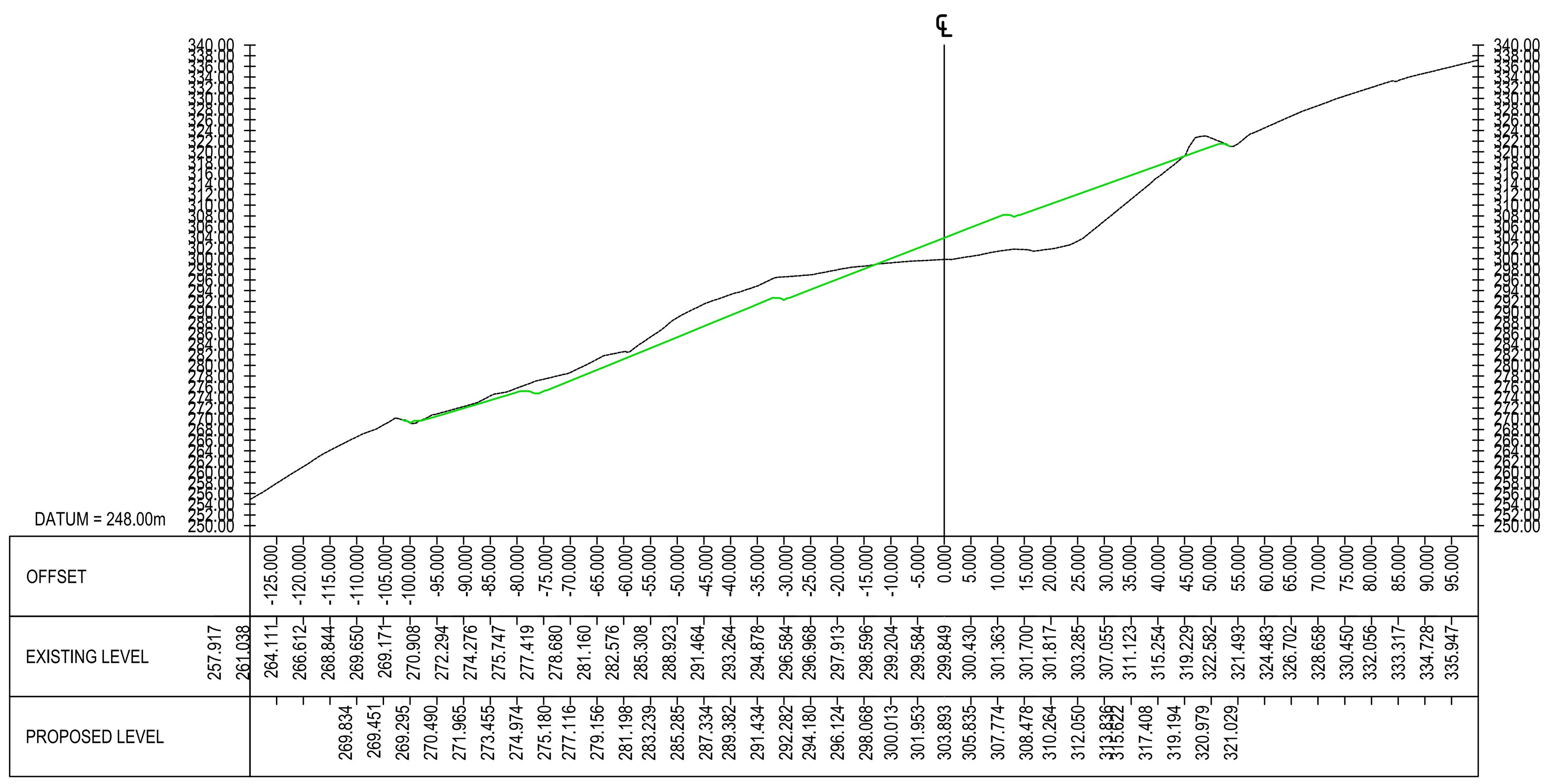

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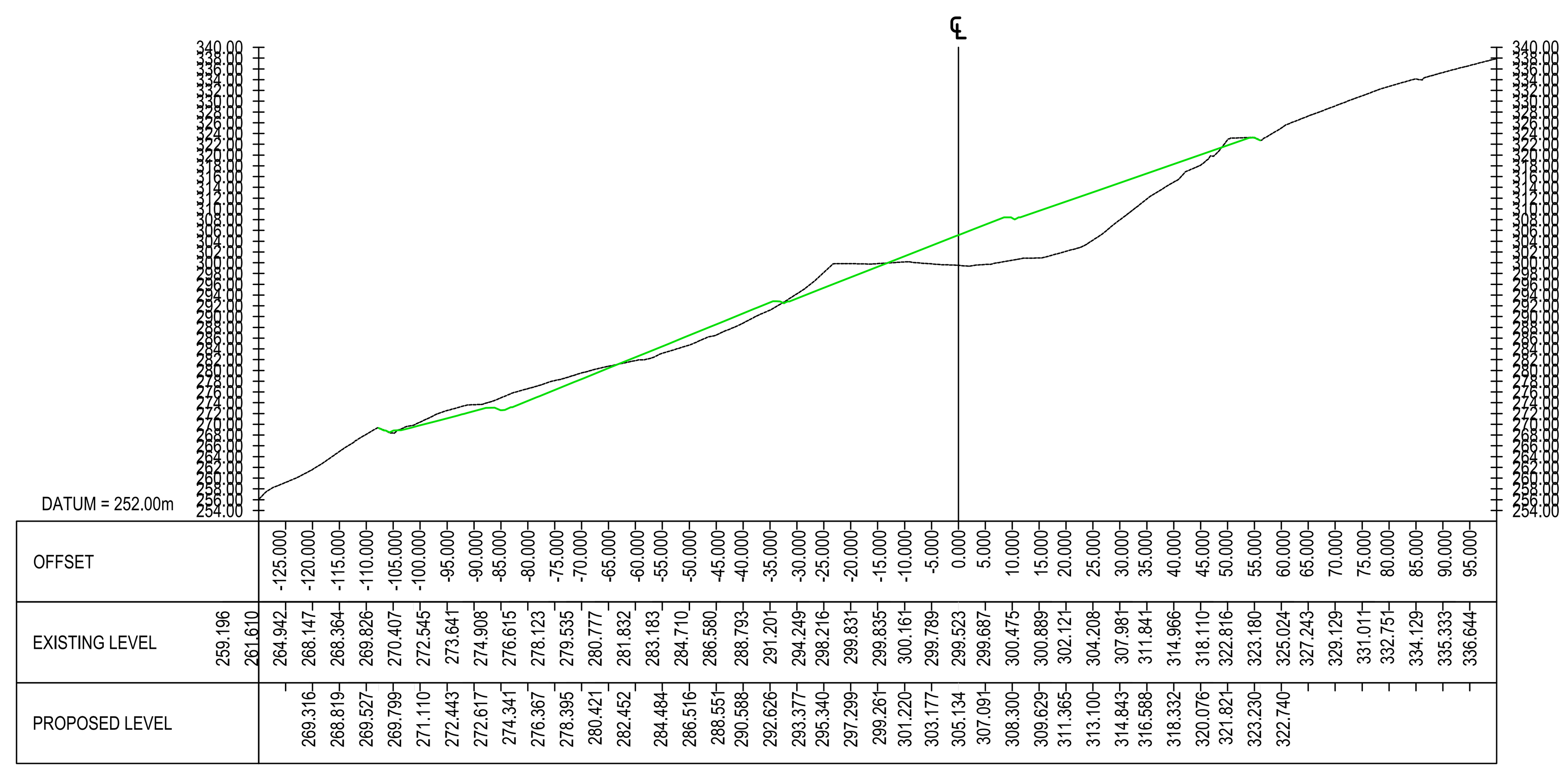

PHASE 4 - TIP REPROFILE - CH240.000

SCALE 1:1000

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SCALE 1:1000

Notes:

1. For cross sections markers refer to drawing: GC3613-RED-61-RSC-DR-C-0002
2. For Location Plan refer to drawing: GC3613-RED-61-RSC-DR-C-0001
3. For General Arrangement Plan of Receptor Site C refer to drawing: GC3613-RED-61-RSC-DR-C-0003
4. For Cross Sections of Receptor Site C refer to drawing: GC3613-RED-61-RSC-DR-C-0009-0013

Rev	Drwn	Chk'd	App'd	Description	Date
P02	JC	PH	NG	For information	17/08/2021

Purpose of Issue

D5 - Suitable for Planning

Classification

Public

Client

Rhondda Cynon Taf County Borough Council

Project

Tylorstown Landslide

Drawing

Phase 4 Cross Sections - Tip Reprofile Sheet 2 of 5

Scale @ A1	Drawn	Checked	Approved
1:1000	MH	NG	PH

Project No. GC/3613

Date March 2021

Drawing Identifier (BS1192 Compliant)
Project - Originator - Zone - Level - File Type - Role - Number

GC3613-RED-61-RSC-DR-C-0005 — revision P02

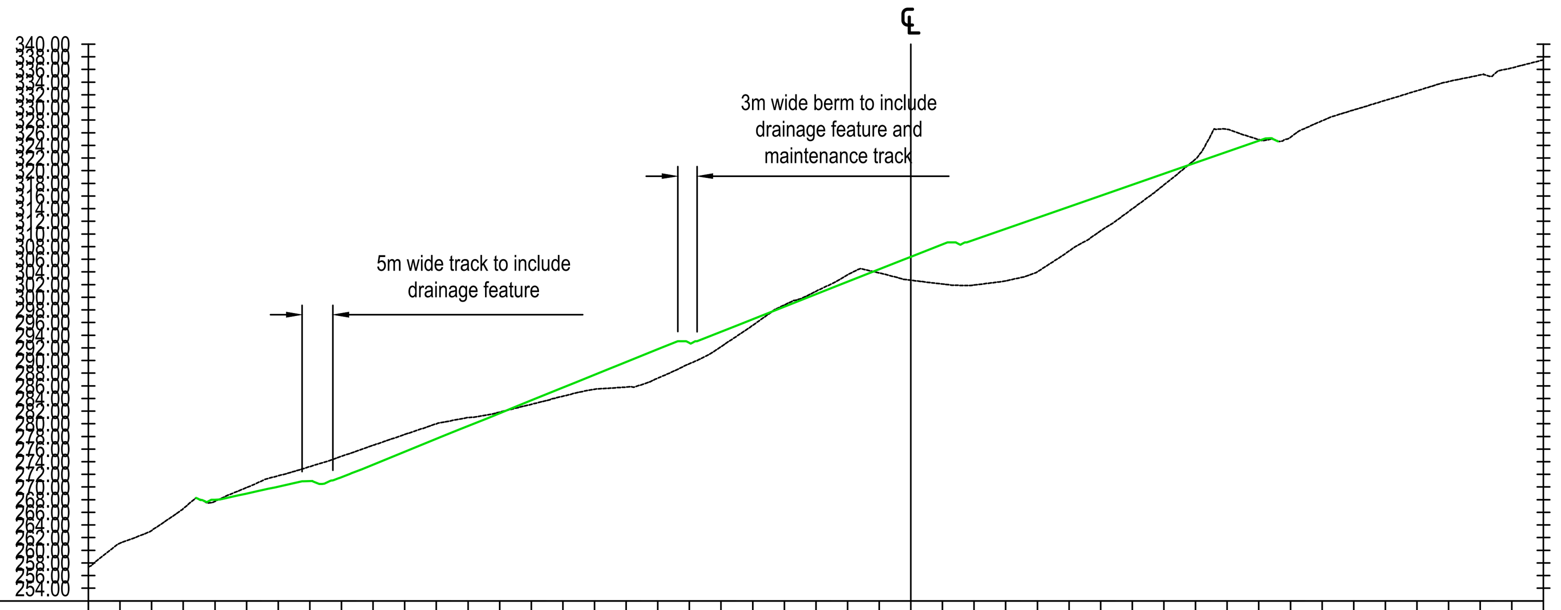
REDSTART

St David's House, Pascal Close, St Mellons, Cardiff, CF3 0LW
www.redstartwales.com

Key:

Proposed Levels

Existing Levels



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PHASE 4 - TIP REPROFILE - CH260.000
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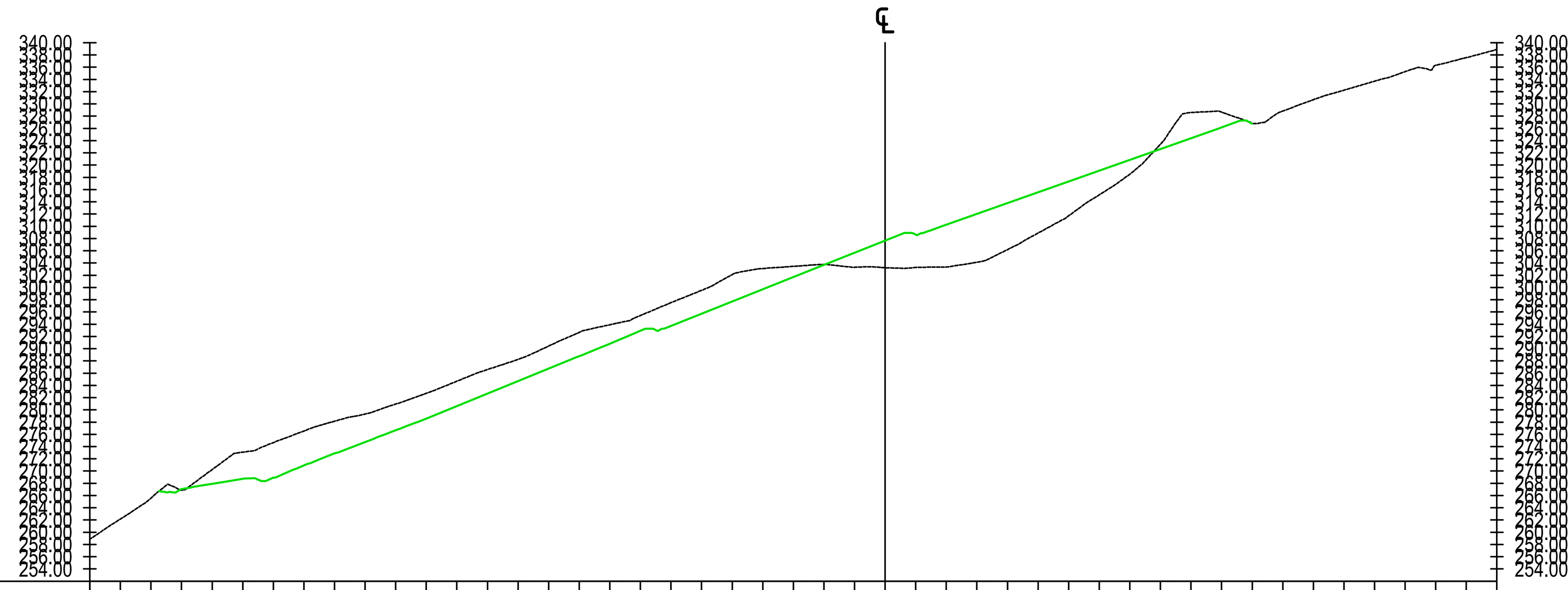

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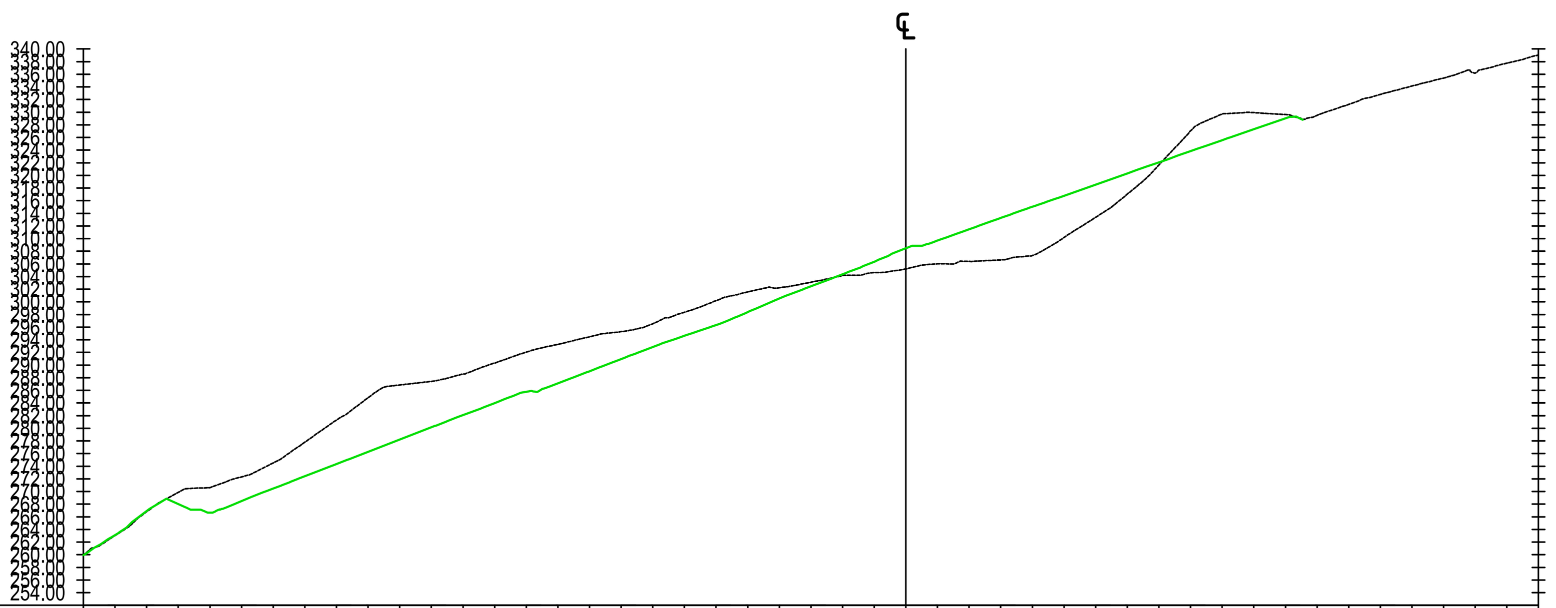
PROPOSED LEVEL: 266.710, 267.032, 267.908, 268.732, 268.921, 268.922, 270.922, 272.911, 274.743, 276.658, 278.592, 280.630, 282.668, 284.705, 286.743, 288.770, 290.802, 292.926, 293.699, 295.702, 297.704, 299.700, 301.695, 303.686, 305.676, 307.667, 308.634, 310.246, 312.016, 313.785, 315.554, 317.323, 319.093, 320.862, 322.631, 324.400, 326.179, 326.791

PHASE 4 - TIP REPROFILE - CH280.000
SCALE 1:1000

Notes:

1. For cross sections markers refer to drawing: GC3613-RED-61-RSC-DR-C-0002
2. For Location Plan refer to drawing: GC3613-RED-61-RSC-DR-C-0001
3. For General Arrangement Plan of Receptor Site C refer to drawing: GC3613-RED-61-RSC-DR-C-0003
4. For Cross Sections of Receptor Site C refer to drawing: GC3613-RED-61-RSC-DR-C-0009-0013



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PROPOSED LEVEL: 259.91, 263.107, 266.901, 267.997, 266.653, 268.479, 270.424, 270.473, 272.401, 274.331, 276.267, 278.204, 280.141, 282.075, 283.985, 285.761, 287.106, 289.025, 290.960, 292.866, 294.632, 296.337, 298.375, 300.524, 302.442, 304.348, 306.319, 308.475, 309.685, 311.488, 313.269, 315.040, 316.778, 318.547, 320.316, 322.072, 323.839, 325.572, 327.306, 329.041, 328.813

PHASE 4 - TIP REPROFILE - CH300.000
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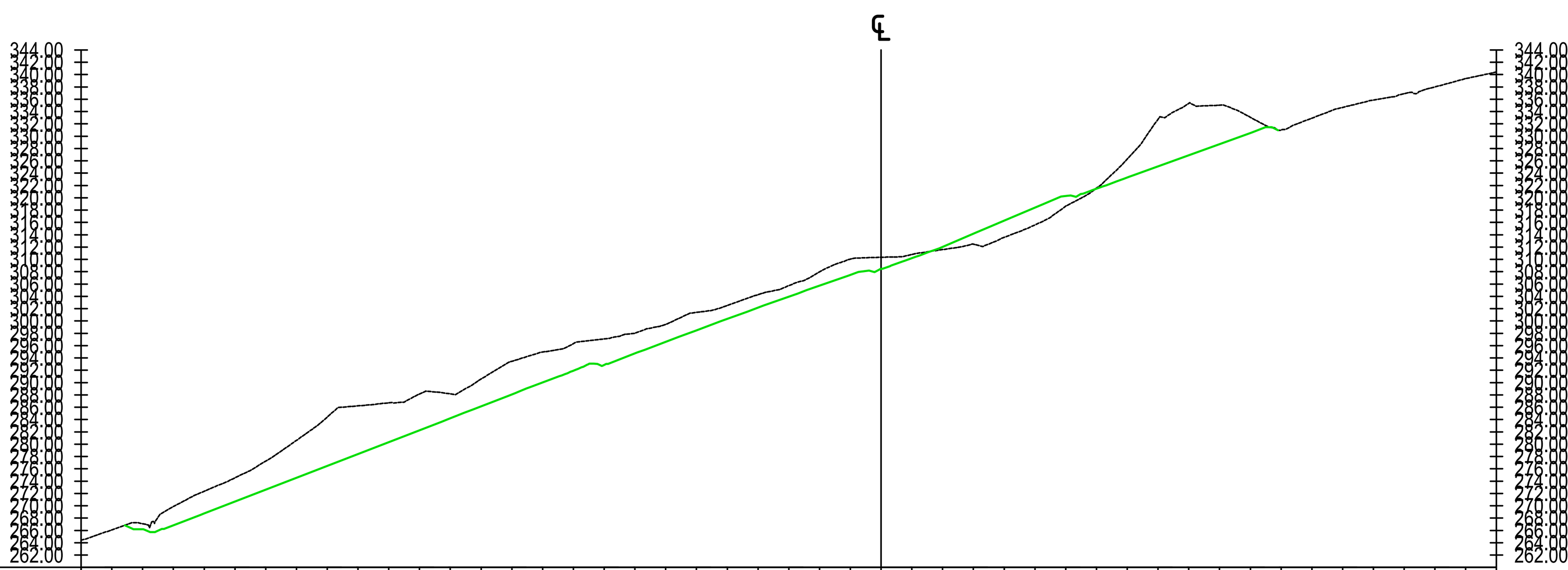

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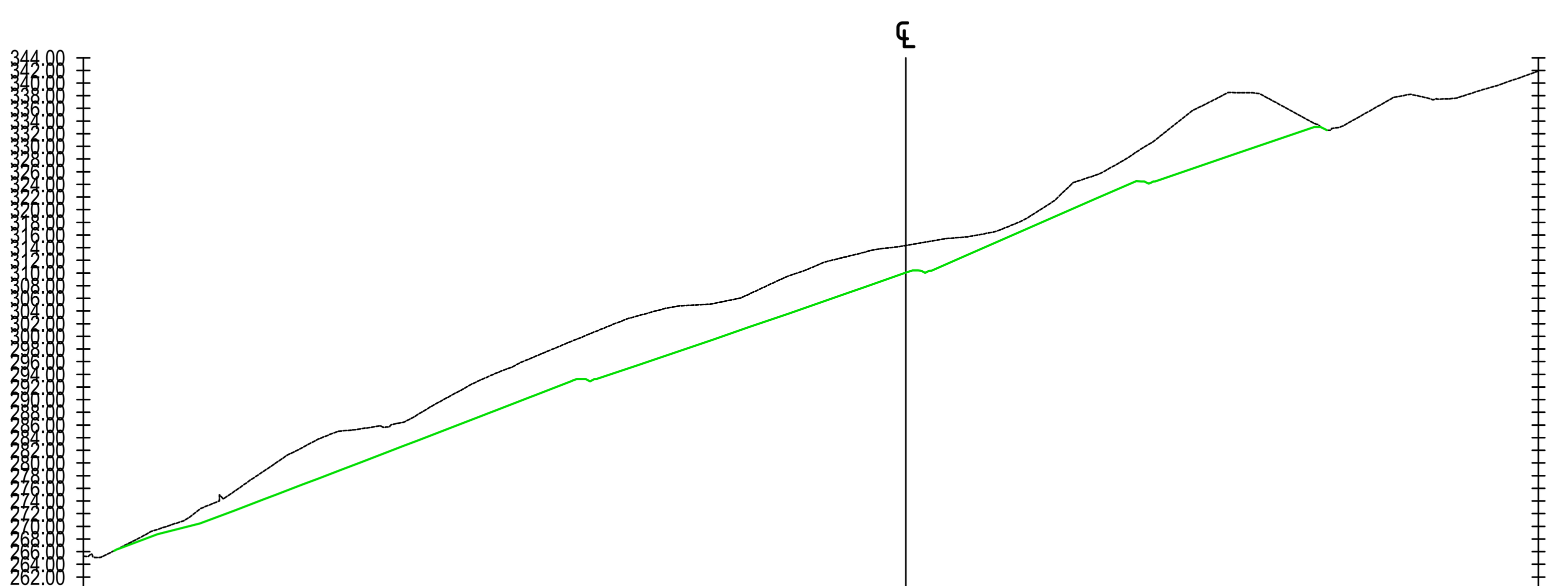

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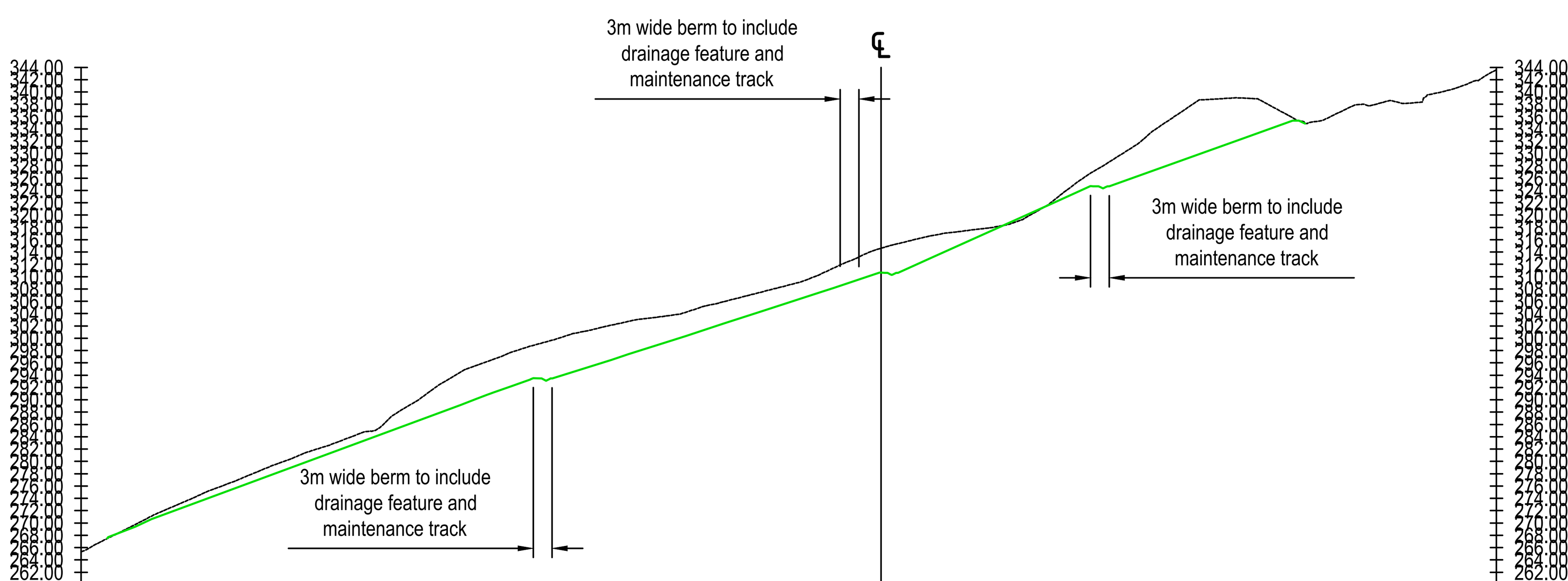
PHASE 4 - TIP REPROFILE - CH340.000
SCALE 1:1000



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PROPOSED LEVEL: 267.469, 267.941, 269.948, 270.607, 271.925, 273.770, 275.616, 277.462, 279.308, 281.153, 282.999, 284.845, 286.691, 288.536, 290.430, 292.254, 293.378, 294.549, 296.131, 297.739, 299.331, 300.938, 302.568, 304.169, 305.811, 307.454, 309.088, 310.647, 311.639, 313.894, 316.142, 318.390, 320.641, 322.890, 324.682, 325.720, 327.509, 329.298, 331.087, 332.875, 334.658, 334.859

PHASE 4 - TIP REPROFILE - CH360.000
SCALE 1:1000

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SCALE 1:1000

Rev	Drwn	Chk'd	App'd	Description	Date
P02	JC	PH	NG	For information	17/08/2021

Purpose of Issue
D5 - Suitable for Planning

Classification
Public

Client
Rhondda Cynon Taf County Borough Council

Project
Tylorstown Landslide

Drawing
Phase 4
Cross Sections - Tip Reprofile
Sheet 3 of 5

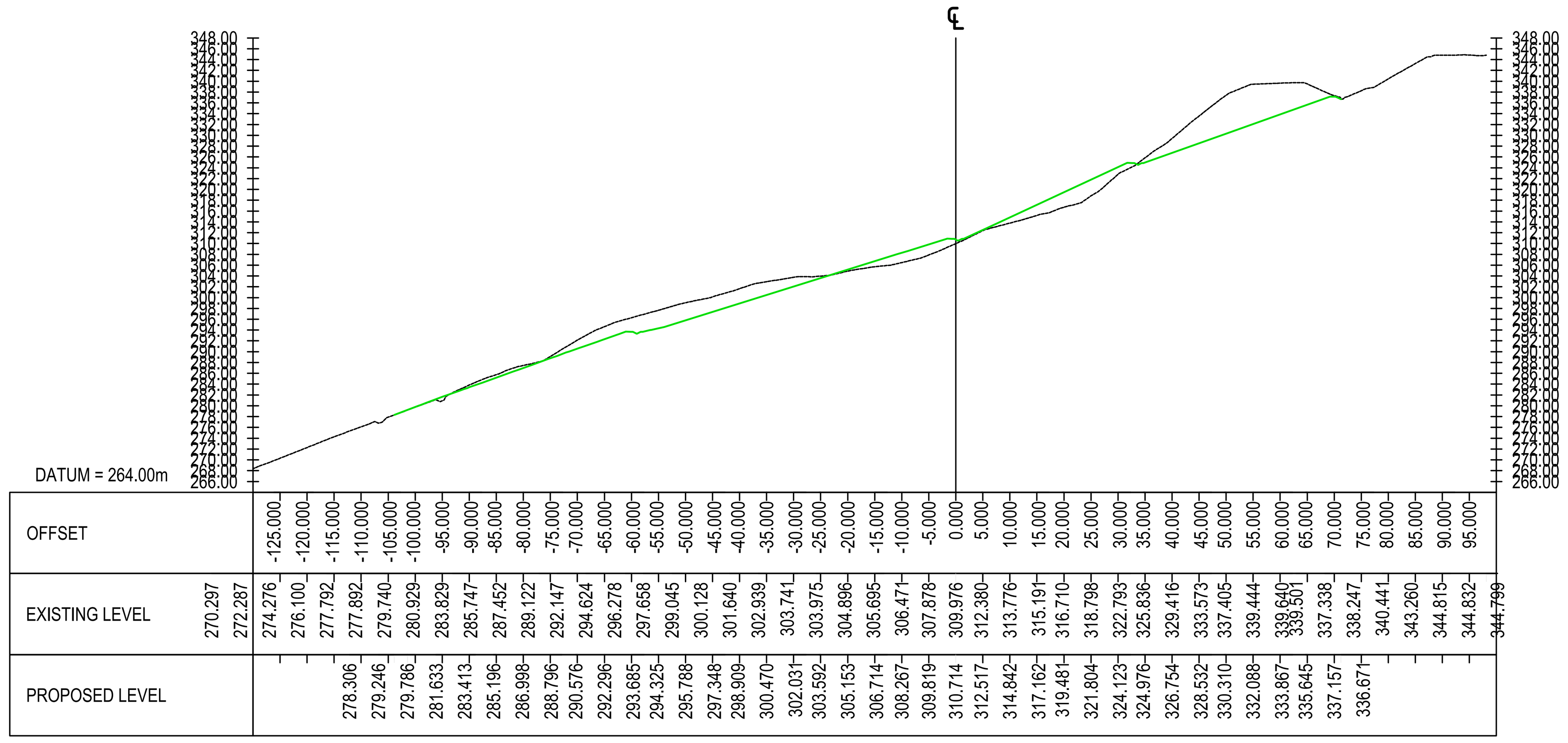
Scale @ A1	Drawn	Checked	Approved
1:1000	MH	NG	PH

Project No. GC/3613
Date March 2021

Drawing Identifier (BS1192 Compliant)
Project - Originator - Zone - Level - File Type - Role - Number
GC3613-RED-61-RSC-DR-C-0006 — revision P02

REDSTART
St David's House, Pascal Close, St Mellons, Cardiff, CF3 0LW
www.redstartwales.com

P:\Schemes_CGC\GC003600-99\GC003613 - RCT Tylorstown Landslide\2 - Drawings\2.3 - Preliminary & Pre-Tender\61 - Planning\Phase 4\GC3613-RED-61-RSC-DR-C-0004 - 0008 Cross Sections Tip Reprofile.dwg
Print Date 18/08/2021 17:07:01



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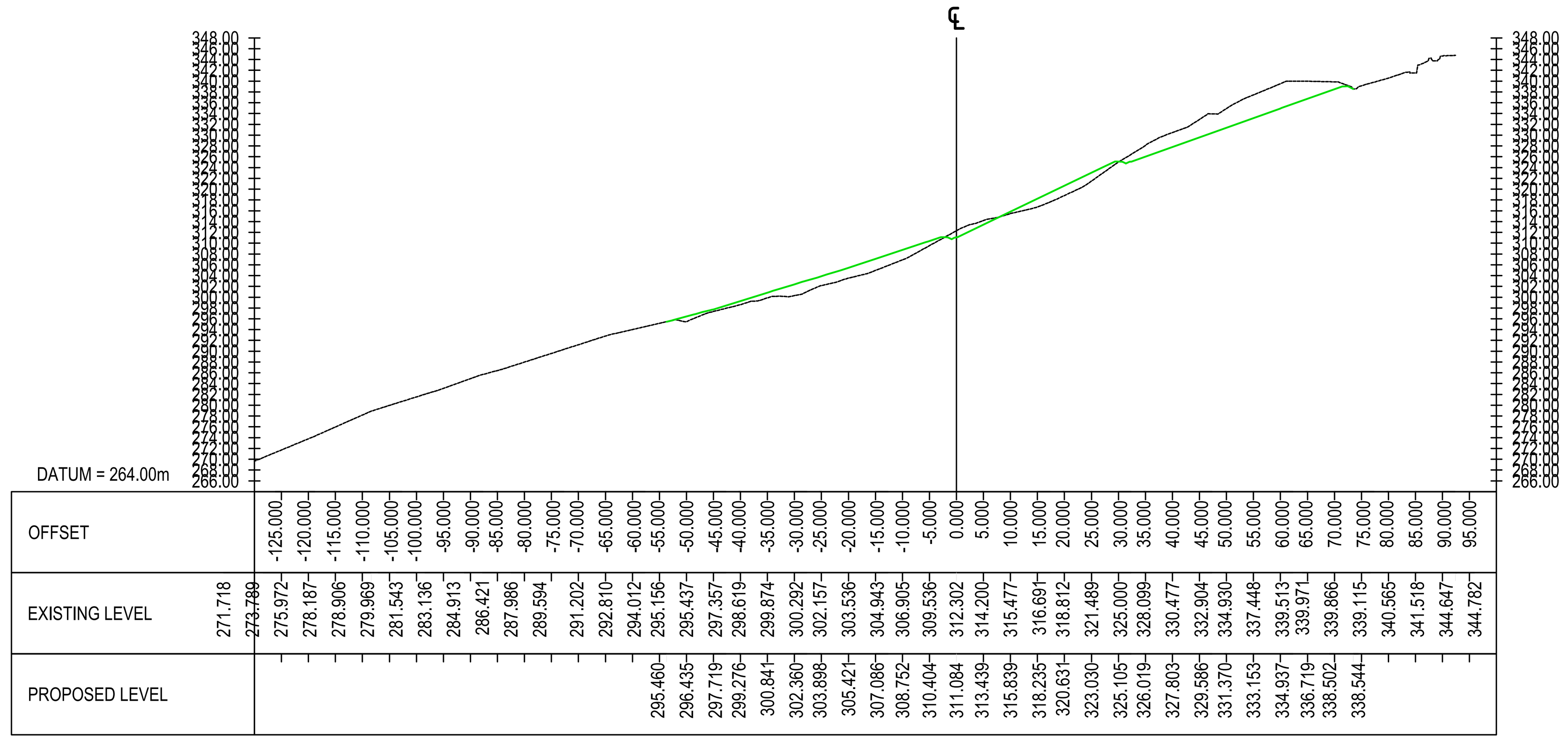
SCALE 1:1000



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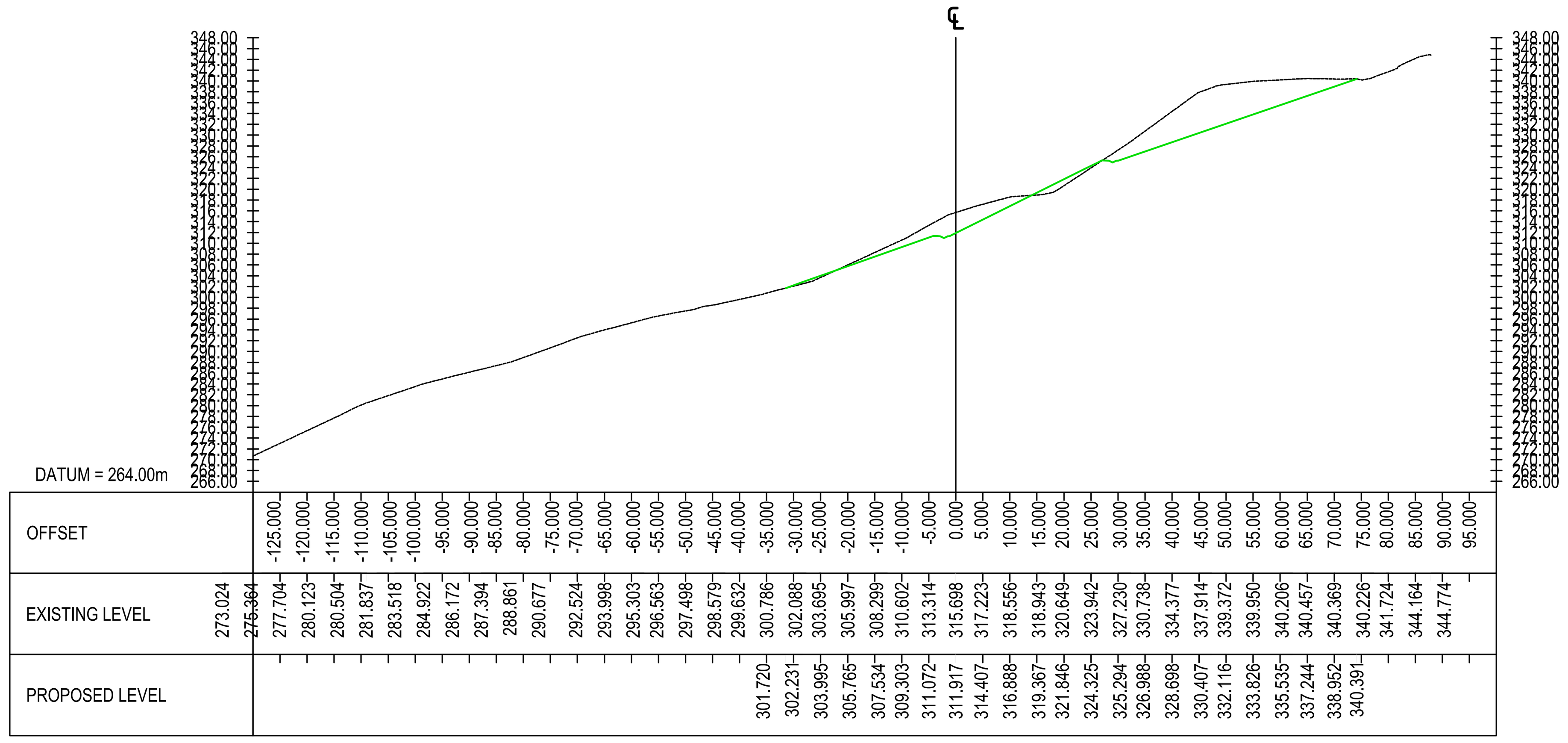

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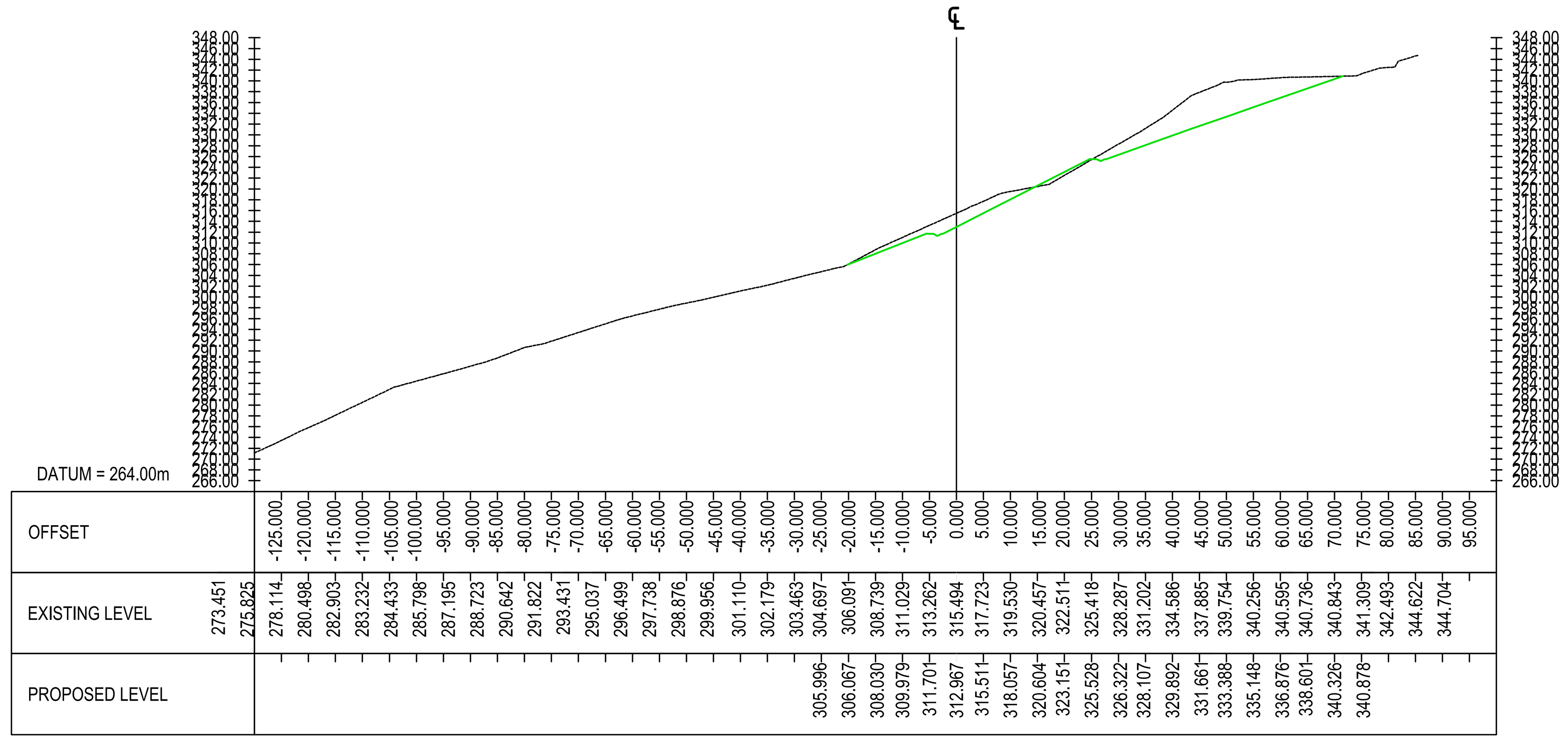

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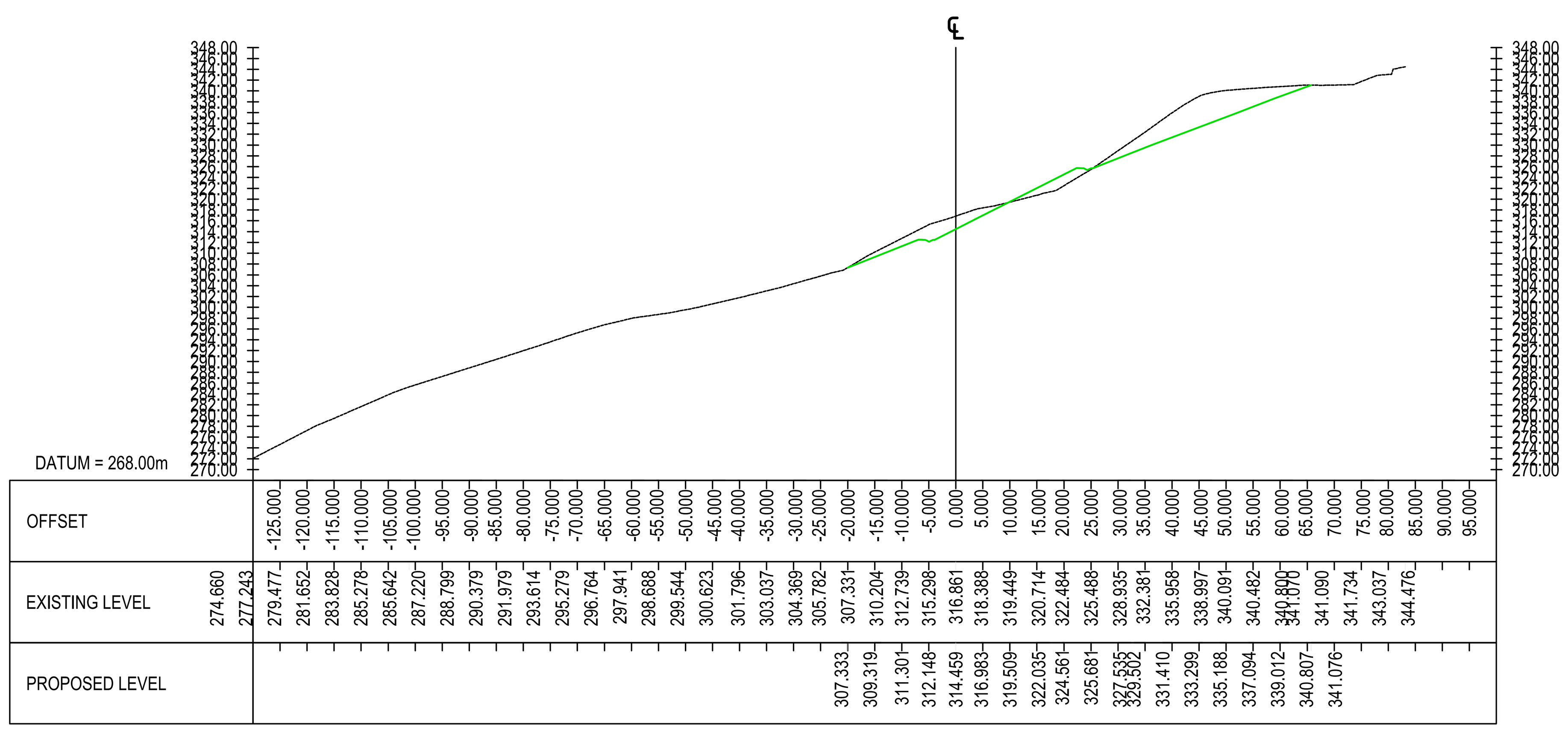

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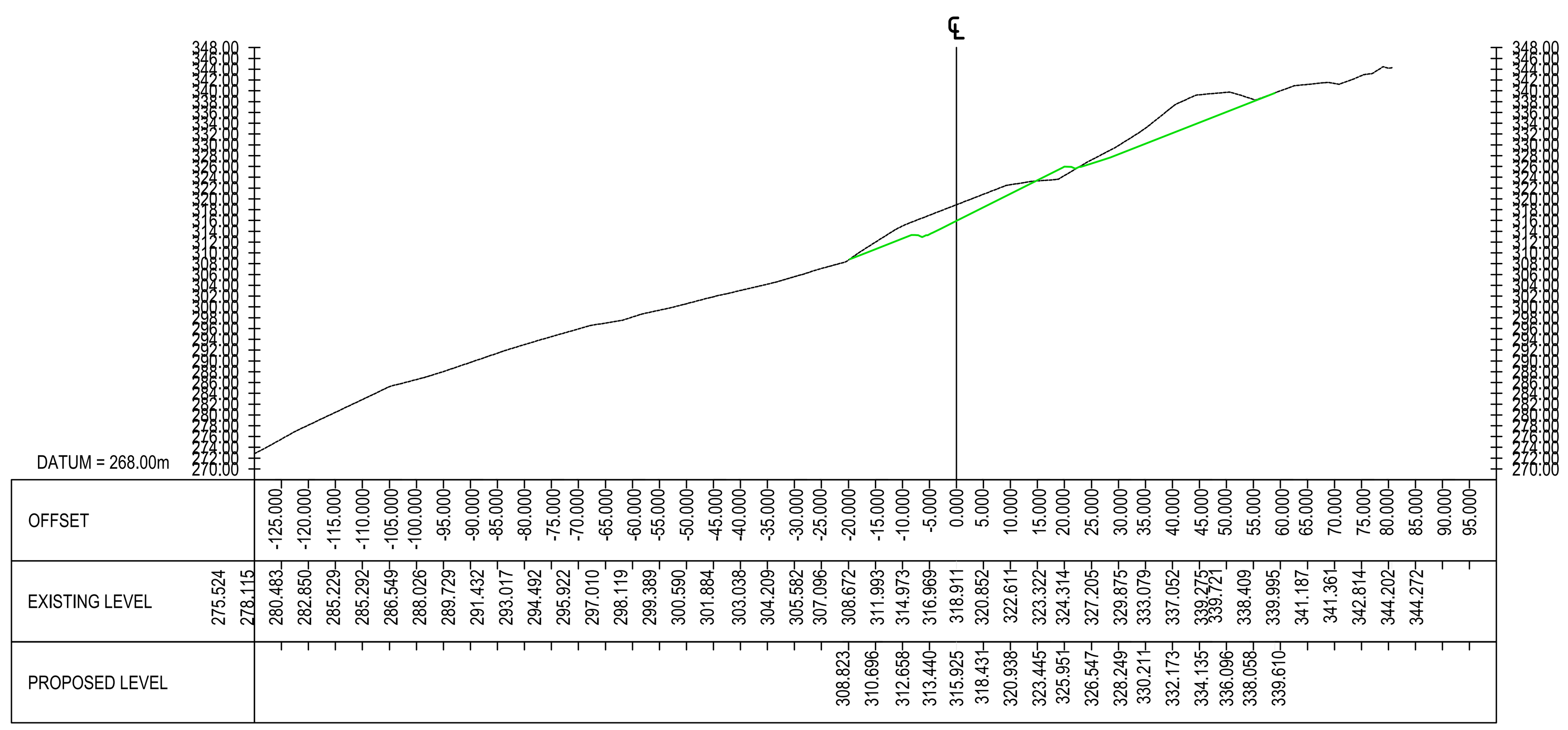

PHASE 4 - TIP REPROFILE - CH480.000
SCALE 1:1000

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SCALE 1:1000

Key:

Proposed Levels
Existing Levels

Notes:

1. For cross sections markers refer to drawing: GC3613-RED-61-RSC-DR-C-0002
2. For Location Plan refer to drawing: GC3613-RED-61-RSC-DR-C-0001
3. For General Arrangement Plan of Receptor Site C refer to drawing: GC3613-RED-61-RSC-DR-C-0003
4. For Cross Sections of Receptor Site C refer to drawing: GC3613-RED-61-RSC-DR-C-0009-0013

Rev	Drwn	Chk'd	App'd	Description	Date
P02	JC	PH	NG	For information	17/08/2021

Purpose of Issue
D5 - Suitable for Planning

Classification
Public

Client
Rhondda Cynon Taf County Borough Council

Project
Tylorstown Landslide

Drawing
Phase 4
Cross Sections - Tip Reprofile
Sheet 4 of 5

Scale @ A1	Drawn	Checked	Approved
1:1000	MH	NG	PH

Project No.	Date
GC/3613	March 2021

Drawing Identifier — BS1192 Compliant
Project - Originator - Zone - Level - File Type - Role - Number — revision
GC3613-RED-61-RSC-DR-C-0007 — P02

REDSTART
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 P:\Schemes_CGC\GC003600-99\GC003613 - RCT Tylorstown Landslide\2 - Drawings\2.3 - Preliminary & Pre-Tender\61 - Planning\Phase 4\GC3613-RED-61-RSC-DR-C-0004 - 0008 Cross Sections Tip Reprofile.dwg
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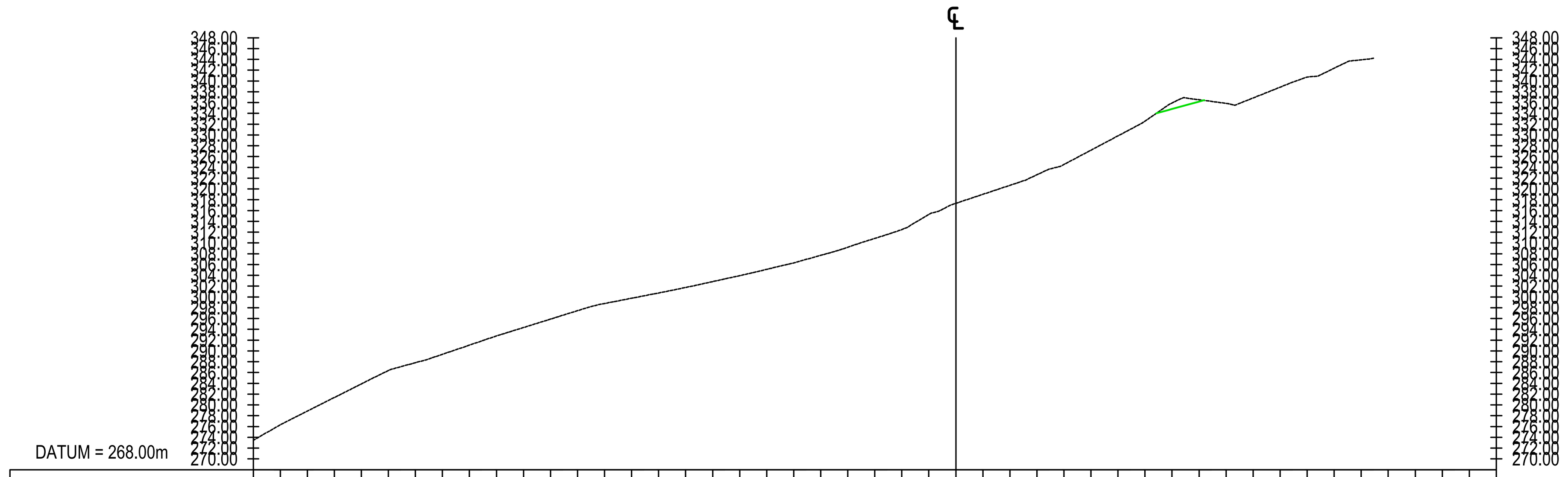

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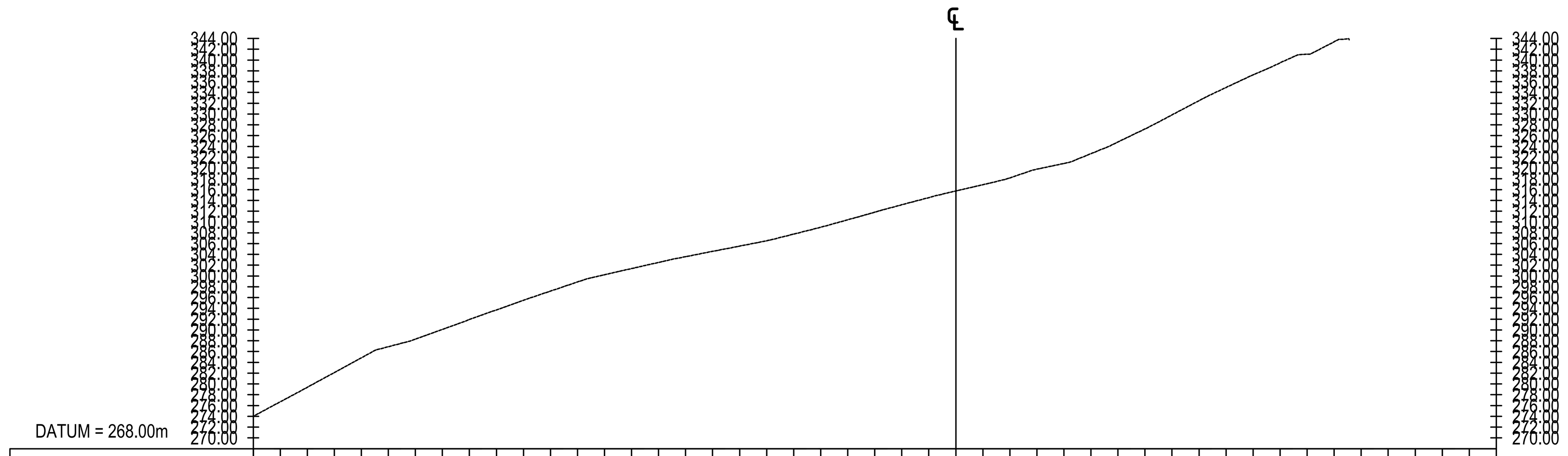
PROPOSED LEVEL: 334.030, 334.819, 336.182, 336.452

PHASE 4 - TIP REPROFILE - CH500.000

SCALE 1:1000



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EXISTING LEVEL: 276.691, 279.378, 282.108, 284.839, 286.890, 288.199, 288.288, 290.108, 291.927, 293.720, 295.486, 297.203, 298.893, 300.223, 301.375, 302.514, 303.576, 304.569, 305.538, 306.523, 307.757, 309.024, 310.410, 311.816, 313.192, 314.527, 315.740, 316.914, 318.173, 319.789, 320.843, 322.657, 324.827, 327.226, 329.850, 332.480, 334.924, 337.251, 339.490, 341.101, 343.388, 343.752

PROPOSED LEVEL

PHASE 4 - TIP REPROFILE - CH520.000

SCALE 1:1000

Key:

Proposed Levels

Existing Levels

Notes:

1. For cross sections markers refer to drawing: GC3613-RED-61-RSC-DR-C-0002
2. For Location Plan refer to drawing: GC3613-RED-61-RSC-DR-C-0001
3. For General Arrangement Plan of Receptor Site C refer to drawing: GC3613-RED-61-RSC-DR-C-0003
4. For Cross Sections of Receptor Site C refer to drawing: GC3613-RED-61-RSC-DR-C-0009-0013

Rev	Drwn	Chk'd	App'd	Description	Date
P02	JC	PH	NG	For information	17/08/2021

Purpose of Issue

D5 - Suitable for Planning

Classification

Public

Client

Rhondda Cynon Taf County Borough Council

Project

Tylorstown Landslide

Drawing

Phase 4
Cross Sections - Tip Reprofile
Sheet 5 of 5

Scale @ A1	Drawn	Checked	Approved
1:1000	MH	NG	PH

Project No.	Date
GC/3613	March 2021

Drawing Identifier
Project - Originator - Zone - Level - File Type - Role - Number

BS1192 Compliant revision

GC3613-RED-61-RSC-DR-C-0008 P02

0 20 40 60 80 100m

SCALE 1:1000

REDSTART.

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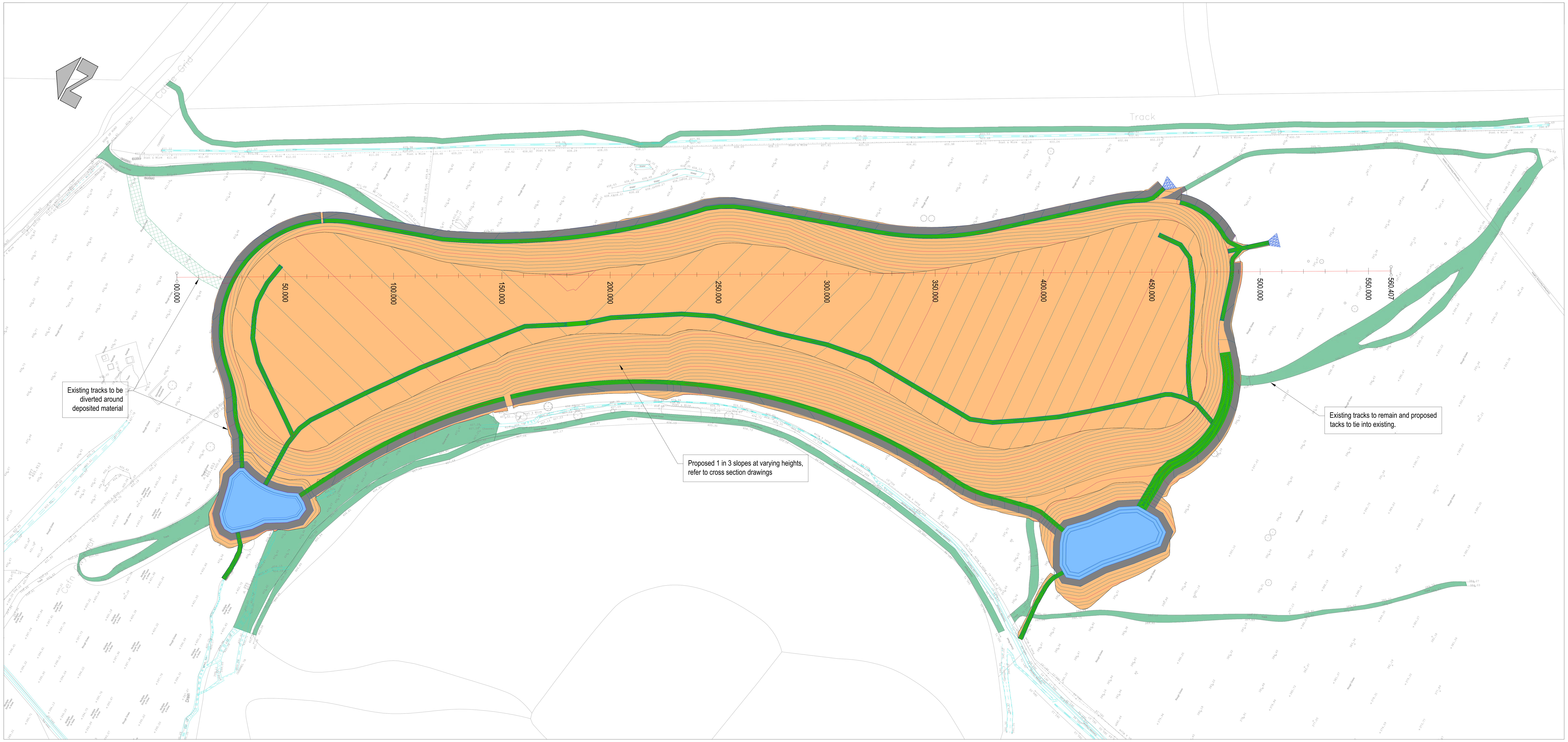
 P:\Schemes_CGC\GC003600-99\GC003613 - RCT Tylorstown Landslide\2 - Drawings\2.3 - Preliminary & Pre-Tender\61 - Planning\Phase 4\GC3613-RED-61-RSC-DR-C-0004 - 0008 Cross Sections Tip Reprofile.dwg

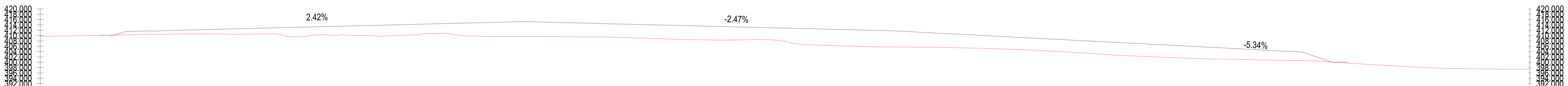


Key:

- Proposed Deposited Material
- Proposed Attenuation Ponds
- Proposed Drainage Features
- Existing Tracks
- Proposed Tracks
- Proposed Contour Major (2.5m intervals)
- Proposed Contour Minor (0.5m intervals)
- Existing Drainage Channels

Key:

- Existing Ground survey
- Proposed Ground



Long Section through Receptor Site C CHAINAGE	20.000	40.000	60.000	80.000	100.000	100.532	120.000	140.000	160.000	180.000	200.000	201.186		220.000	240.000	260.000
EXISTING LEVELS	410.054	410.385	410.596	410.547	409.702	409.713	409.968	410.194	409.906	409.693	409.540		409.470	409.236	408.568	408.345
PROPOSED LEVELS		411.698	412.184	412.681	413.183	413.197	413.686	414.189	414.692	415.195	414.781	414.751		414.286	413.792	413.297
LEVEL DIFFERENCE		1.313	1.588	2.134	3.481		3.718	3.994	4.786	5.502	5.240			5.050	5.224	4.952

Long Section through Receptor Site C CHAINAGE	280.000	300.000	301.716		320.000	340.000	360.000	380.000	400.000	401.918	420.000		440.000	460.000	480.000	500.000	520.000		540.000	560.000
EXISTING LEVELS	407.804	406.197		405.902	405.736	405.572	405.022	404.172	402.960		401.999	401.637	401.218	400.844	400.449	399.192	398.043	397.667	397.519	397.440
PROPOSED LEVELS	412.803	412.308	412.266		411.812	410.787	409.752	408.716	407.679	407.580	406.643		405.607	404.570	402.077					
LEVEL DIFFERENCE	4.998	6.111			6.077	5.215	4.730	4.544	4.719		4.644		4.388	3.727	1.628					

HORIZONTAL GEOMETRY: L =560.407

Long Section through Receptor Site C
SCALE: H 1:1000, V 1:1000

0 20 40 60 80 100m
SCALE 1:1000

Notes:

1. For Location Plan refer to drawing : GC3613-RED-61-RSC-DR-C-0001
2. For Tip Reprofile General Arrangement refer to drawing : GC3613-RED-61-RSC-DR-C-0002
3. For cross sections of Tip Reprofile refer to drawings: GC3613-RED-61-RSC-DR-C-0004-0008
4. For cross sections of Receptor Site C refer to drawings: GC3613-RED-61-RSC-DR-C-0009-0013

Rev	Drwn	Chk'd	App'd	Description	Date
P02	JC	PH	NG	For information	17/08/2021

Purpose of Issue
D5 - Suitable for Planning

Classification
Public

Client
Rhondda Cynon Taf
County Borough Council

Project
Tylorstown Landslide

Drawing
Phase 4
General Arrangement
Receptor Site C

Scale @ A1	Drawn	Checked	Approved
As Shown	MH	NG	PH

Project No. GC/3613
Date March 2021

Drawing Identifier — BS1192 Compliant
Project - Originator - Zone - Level - File Type - Role - Number
GC3613-RED-61-RSC-DR-C-0003 — revision P02

REDSTART
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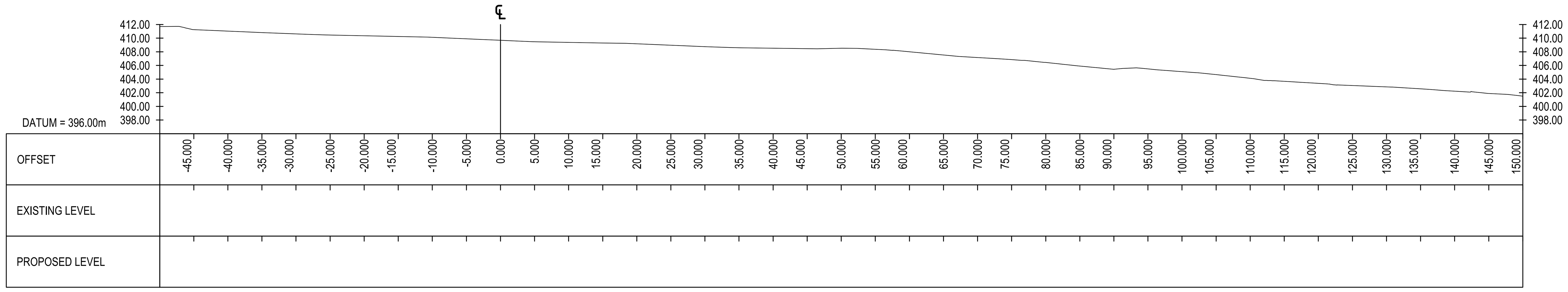
Key:

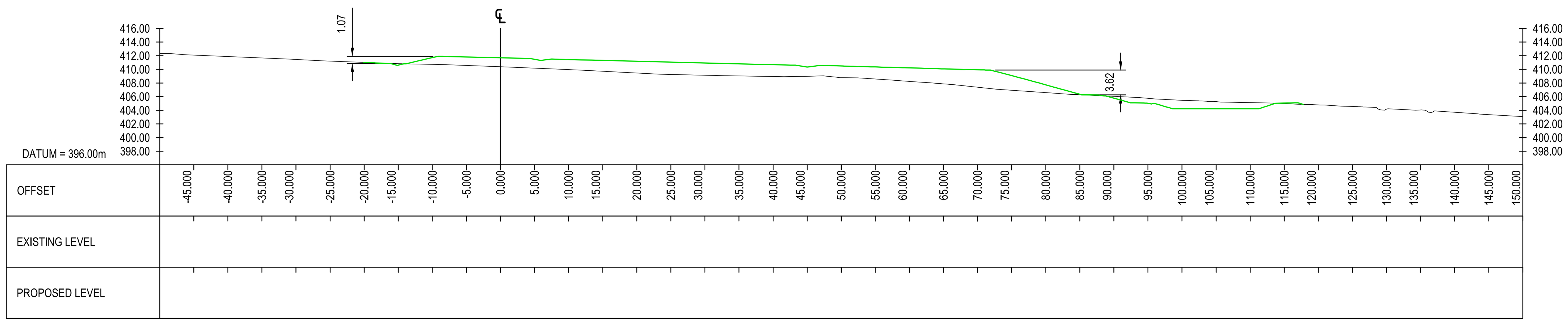
Proposed Levels

Existing Levels



PHASE 4 - MATERIAL DEPOSIT - CH0.000

SCALE 1:500



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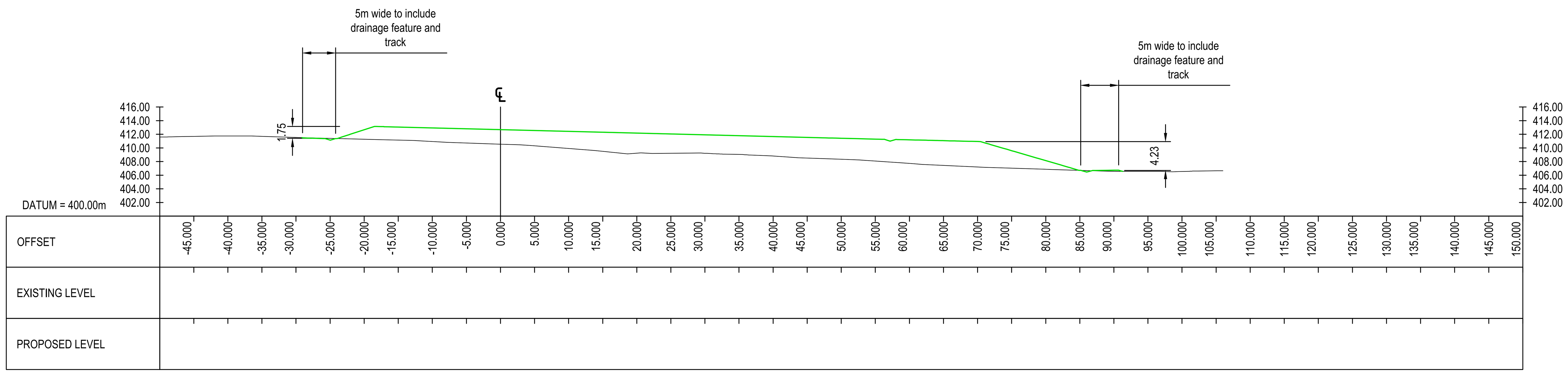
SCALE 1:500



PHASE 4 - MATERIAL DEPOSIT - CH80.000

SCALE 1:500

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SCALE 1:1000

Notes:

1. For cross section markers refer to the Receptor Site C General Arrangement drawing : GC3613-RED-61-RSC-DR-C-0003
2. For Location Plan refer to drawing: GC3613-RED-61-RSC-DR-C-0001
3. For Tip Reprofile General Arrangement refer to drawing : GC3613-RED-61-RSC-DR-C-0002
4. For cross sections of Tip Reprofile refer to drawings: GC3613-RED-61-RSC-DR-C-0004-0008

Rev	Drwn	Chk'd	App'd	Description	Date
P02	JC	PH	NG	For information	17/08/2021

Purpose of Issue

D5 - Suitable for Planning

Classification

Public

Client

Rhondda Cynon Taf
County Borough Council

Project

Tylorstown Landslide

Drawing

Phase 4
Receptor Site C - Cross Sections
Sheet 1 of 5

Scale @ A1	Drawn	Checked	Approved
1:500	MH	NG	PH

Project No.	Date
GC/3613	March 2021

Drawing Identifier — BS1192 Compliant

Project - Originator - Zone - Level - File Type - Role - Number — revision

GC3613-RED-61-RSC-DR-C-0009 P02

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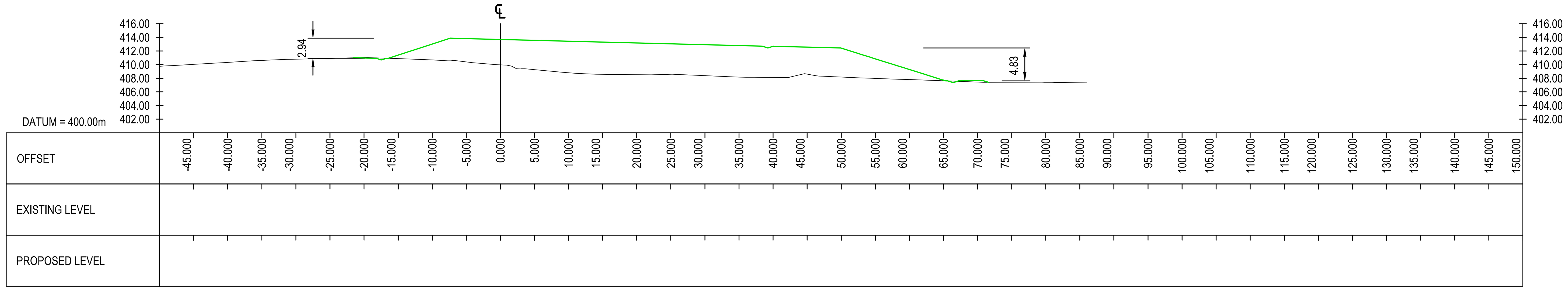
P:\Schemes_CGC\GC003600-99\GC003613 - RCT Tylorstown Landslide\2 - Drawings\2.3 - Preliminary & Pre-Tender\61 - Planning\Phase 4\GC3613-RED-61-RSC-DR-C-0009 - 0013 Receptor Site C Cross Sections.dwg

Print Date:18/08/2021 14:20:39

Key:

Proposed Levels

Existing Levels



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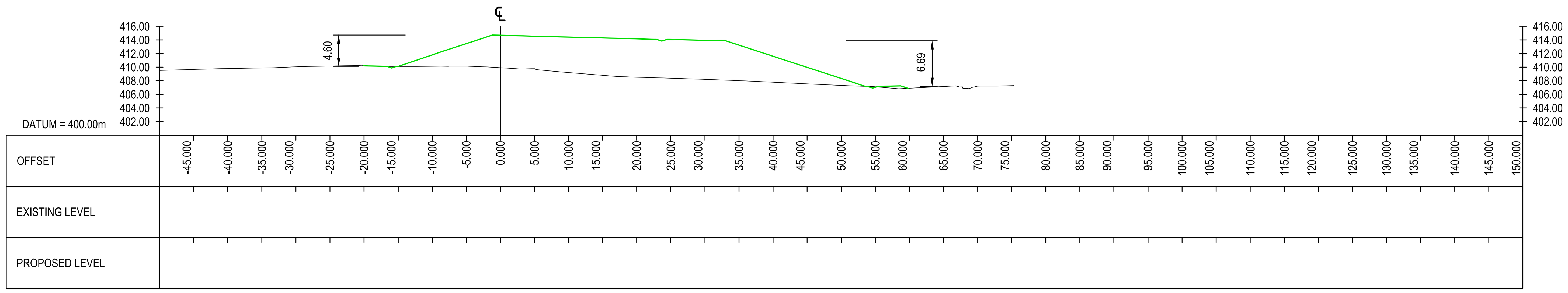

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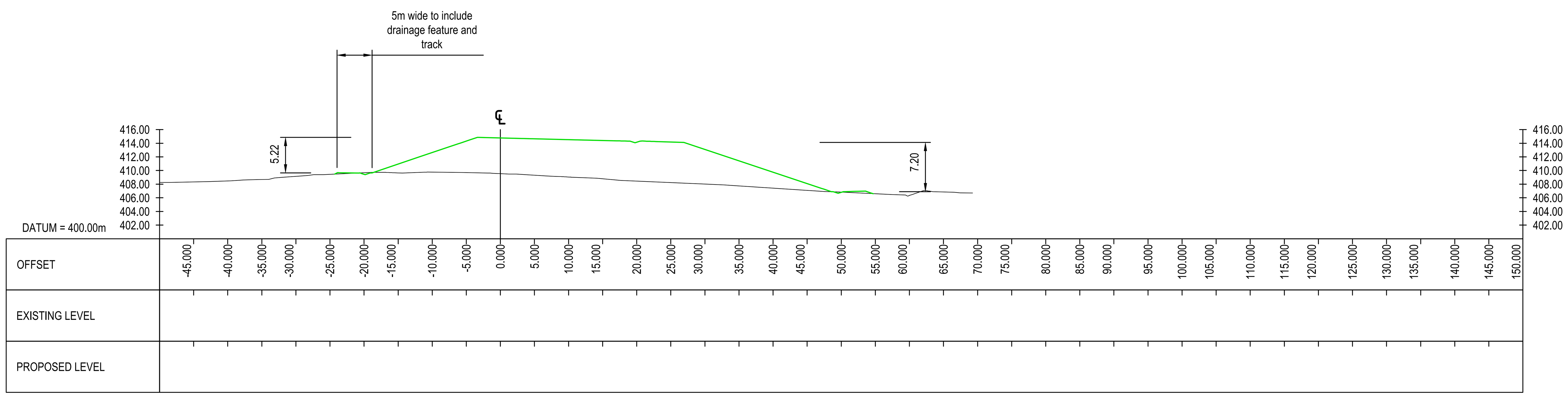
SCALE 1:500



PHASE 4 - MATERIAL DEPOSIT - CH200.000

SCALE 1:500

0 20 40 60 80 100m

SCALE 1:1000

Notes:

1. For cross section markers refer to the Receptor Site C General Arrangement drawing : GC3613-RED-61-RSC-DR-C-0003
2. For Location Plan refer to drawing: GC3613-RED-61-RSC-DR-C-0001
3. For Tip Reprofile General Arrangement refer to drawing : GC3613-RED-61-RSC-DR-C-0002
4. For cross sections of Tip Reprofile refer to drawings: GC3613-RED-61-RSC-DR-C-0004-0008

Rev	Drwn	Chk'd	App'd	Description	Date
P02	JC	PH	NG	For information	17/08/2021

Purpose of Issue

D5 - Suitable for Planning

Classification

Public

Client

Rhondda Cynon Taf County Borough Council

Project

Tylorstown Landslide

Drawing

Phase 4
Receptor Site C - Cross Sections
Sheet 2 of 5

Scale @ A1	Drawn	Checked	Approved
1:500	MH	NG	PH

Project No.	Date
GC/3613	March 2021

Drawing Identifier
Project - Originator - Zone - Level - File Type - Role - Number

BS1192 Compliant

revision

GC3613-RED-61-RSC-DR-C-0010 P02

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 P:\Schemes_CGC\GC003600-99\GC003613 - RCT Tylorstown Landslide\2 - Drawings\2.3 - Preliminary & Pre-Tender\61 - Planning\Phase 4\GC3613-RED-61-RSC-DR-C-0009 - 0013 Receptor Site C Cross Sections.dwg

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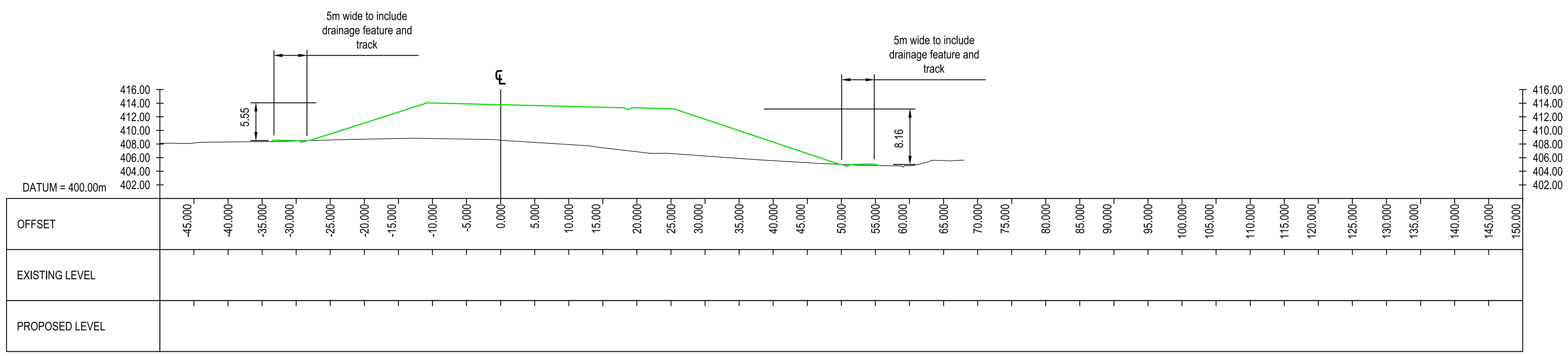

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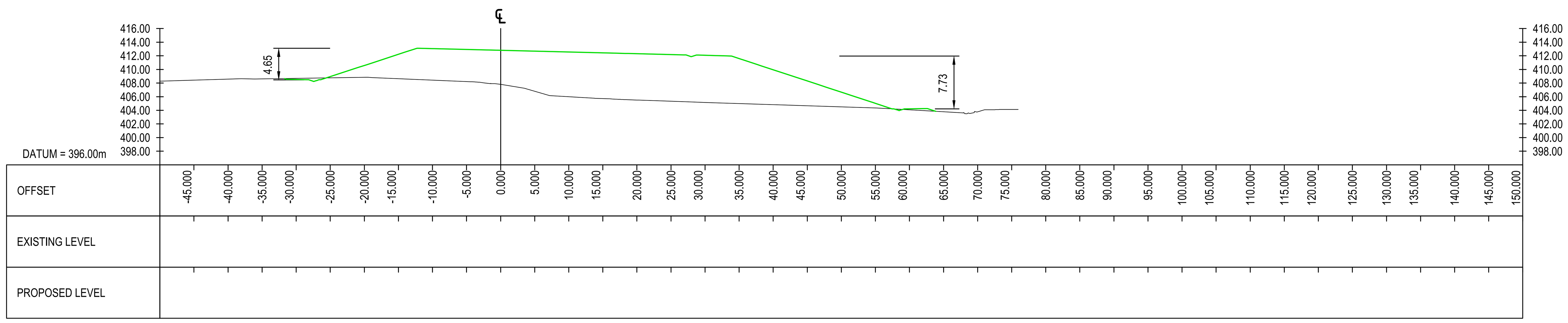

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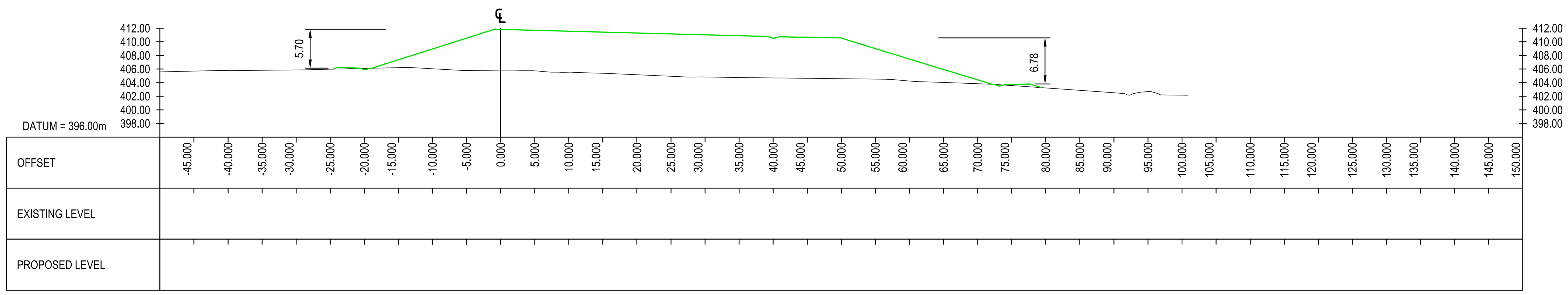

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SCALE 1:500

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SCALE 1:1000

Key:

Proposed Levels
Existing Levels

Notes:

1. For cross section markers refer to the Receptor Site C General Arrangement drawing : GC3613-RED-61-RSC-DR-C-0003
2. For Location Plan refer to drawing: GC3613-RED-61-RSC-DR-C-0001
3. For Tip Reprofile General Arrangement refer to drawing : GC3613-RED-61-RSC-DR-C-0002
4. For cross sections of Tip Reprofile refer to drawings: GC3613-RED-61-RSC-DR-C-0004-0008

Rev	Drwn	Chk'd	App'd	Description	Date
P02	JC	PH	NG	For information	17/08/2021

Purpose of Issue
D5 - Suitable for Planning

Classification
Public

Client
Rhondda Cynon Taf County Borough Council

Project
Tylorstown Landslide

Drawing
Phase 4
Receptor Site C - Cross Sections
Sheet 3 of 5

Scale @ A1	Drawn	Checked	Approved
1:500	MH	NG	PH

Project No. GC/3613
Date March 2021

Drawing Identifier BS1192 Compliant
Project - Originator - Zone - Level - File Type - Role - Number
GC3613-RED-61-RSC-DR-C-0011 revision P02

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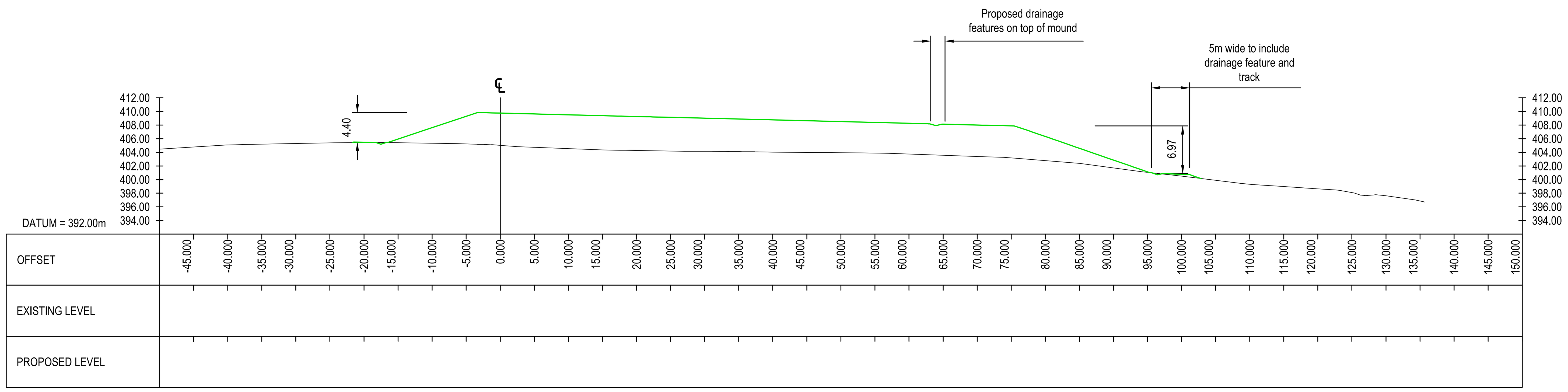

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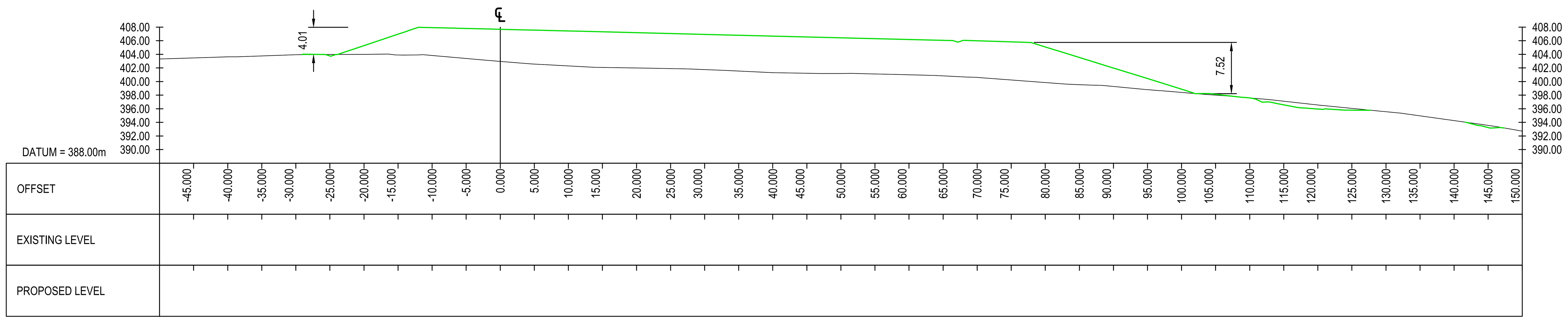

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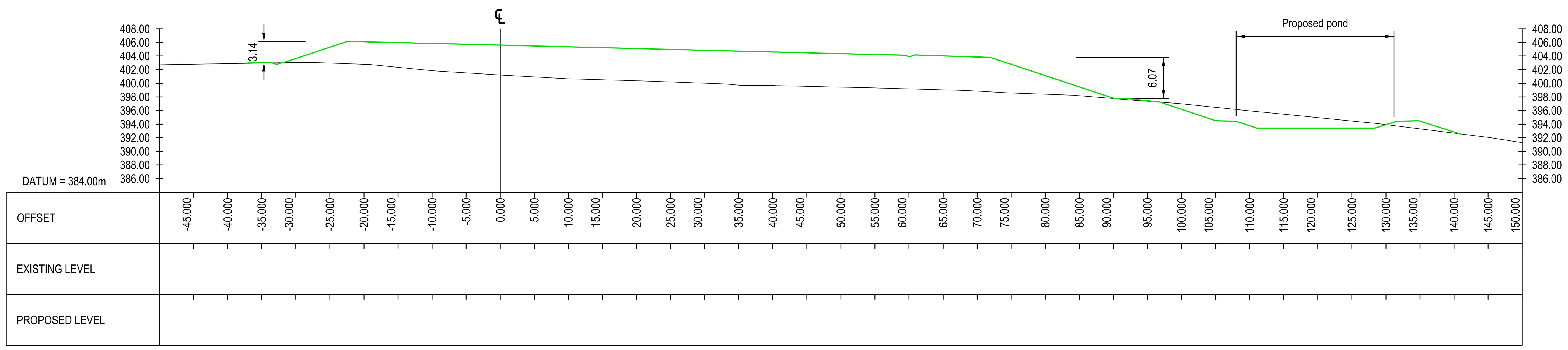

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SCALE 1:1000

Key:

Proposed Levels

Existing Levels

Notes:

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2. For Location Plan refer to drawing: GC3613-RED-61-RSC-DR-C-0001
3. For Tip Reprofile General Arrangement refer to drawing : GC3613-RED-61-RSC-DR-C-0002
4. For cross sections of Tip Reprofile refer to drawings: GC3613-RED-61-RSC-DR-C-0004-0008

Rev	Drwn	Chk'd	App'd	Description	Date
P02	JC	PH	NG	For information	17/08/2021

Purpose of Issue
D5 - Suitable for Planning

Classification
Public

Client
Rhondda Cynon Taf County Borough Council

Project
Tylorstown Landslide

Drawing
Phase 4
Receptor Site C - Cross Sections
Sheet 4 of 5

Scale @ A1	Drawn	Checked	Approved
1:500	MH	NG	PH

Project No.	Date
GC/3613	March 2021

Drawing Identifier — BS1192 Compliant
Project - Originator - Zone - Level - File Type - Role - Number — revision
GC3613-RED-61-RSC-DR-C-0012 — P02

REDSTART
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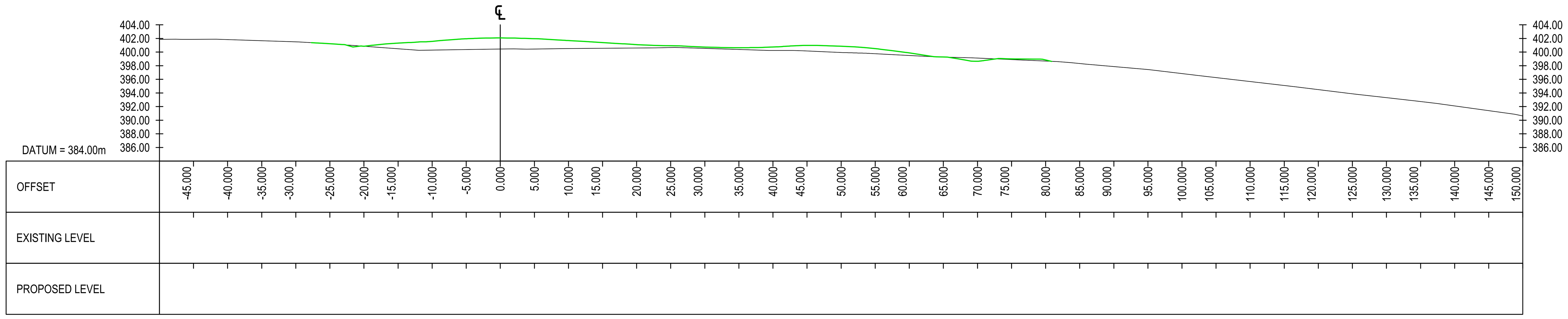

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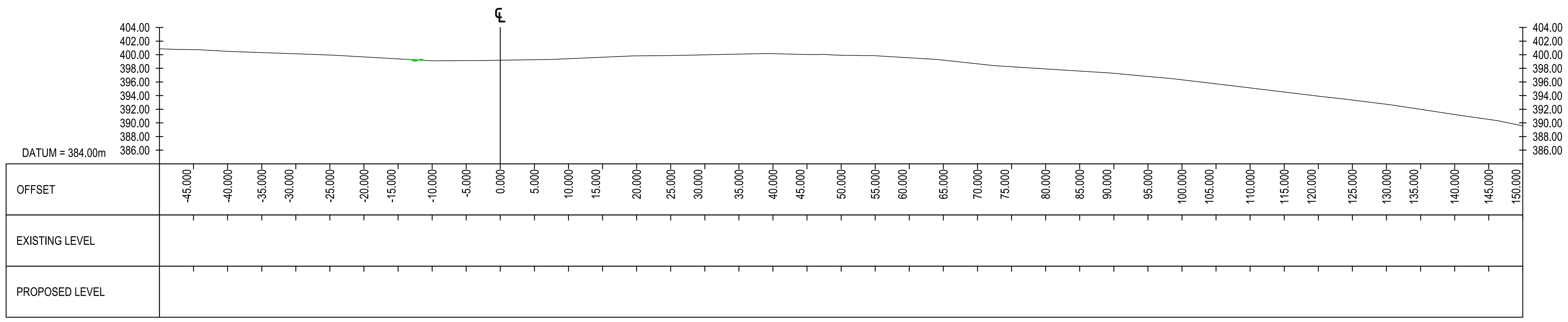

PHASE 4 - MATERIAL DEPOSIT - CH500.000
SCALE 1:500

0 20 40 60 80 100m
SCALE 1:1000

Key:

Proposed Levels
Existing Levels

Notes:

1. For cross section markers refer to the Receptor Site C General Arrangement drawing : GC3613-RED-61-RSC-DR-C-0003
2. For Location Plan refer to drawing: GC3613-RED-61-RSC-DR-C-0001
3. For Tip Reprofile General Arrangement refer to drawing : GC3613-RED-61-RSC-DR-C-0002
4. For cross sections of Tip Reprofile refer to drawings: GC3613-RED-61-RSC-DR-C-0004-0008

Rev	Drwn	Chk'd	App'd	Description	Date
P02	JC	PH	NG	For information	17/08/2021

Purpose of Issue
D5 - Suitable for Planning

Classification
Public

Client
Rhondda Cynon Taf
County Borough Council

Project
Tylorstown Landslide

Drawing
Phase 4
Receptor Site C - Cross Sections
Sheet 5 of 5

Scale @ A1	Drawn	Checked	Approved
1:500	MH	NG	PH

Project No.	Date
GC/3613	March 2021

Drawing Identifier BS1192 Compliant
Project - Originator - Zone - Level - File Type - Role - Number revision
GC3613-RED-61-RSC-DR-C-0013 P02

REDSTART
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 P:\Schemes_CGC\GC003600-99\GC003613 - RCT Tylorstown Landslide\2 - Drawings\2.3 - Preliminary & Pre-Tender\61 - Planning\Phase 4\GC3613-RED-61-RSC-DR-C-0009 - 0013 Receptor Site C Cross Sections.dwg
Print Date:18/08/2021 14:22:50

Appendix E

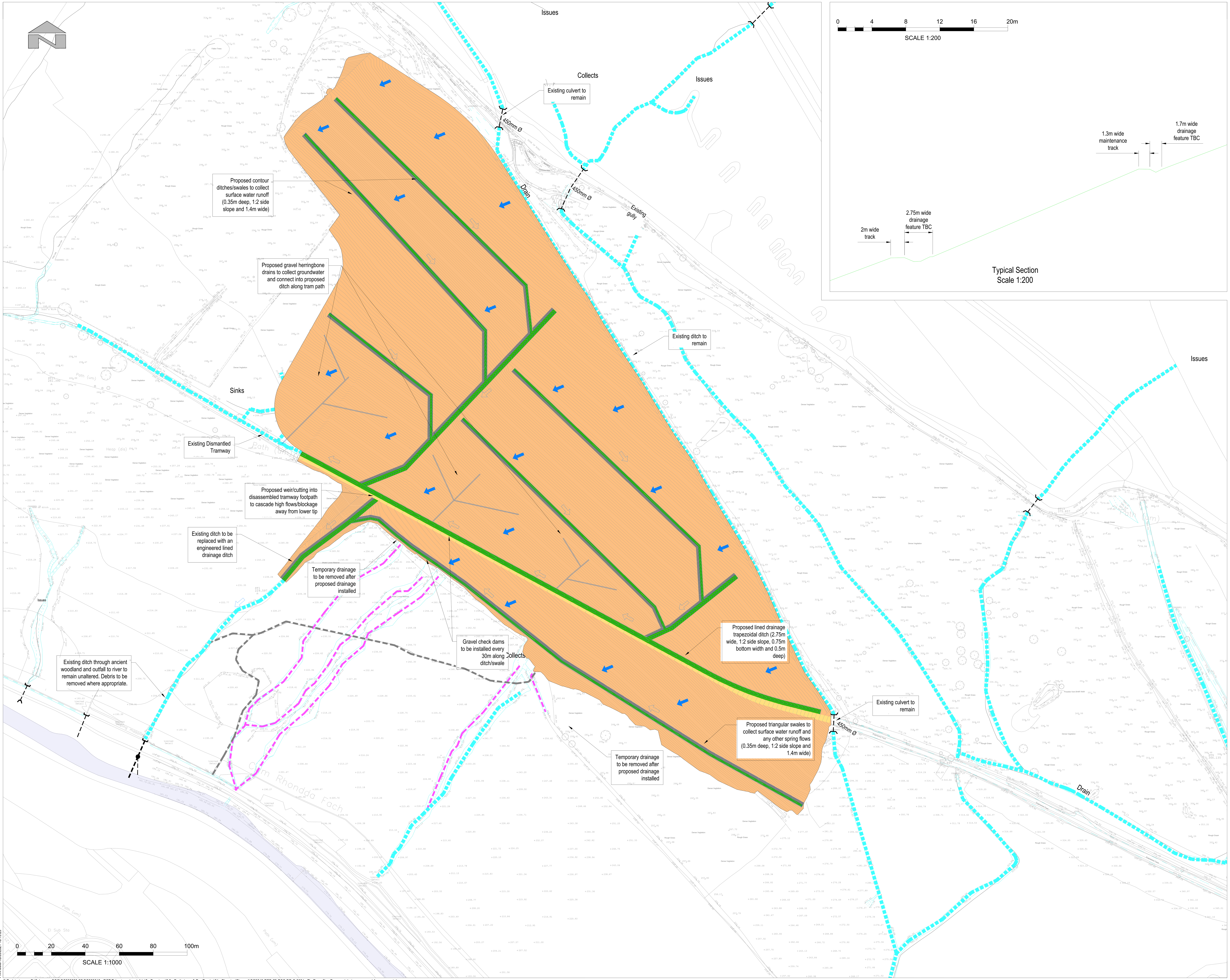
Drawings

E.1 Proposed surface water drainage layouts (receptor site C and reprofiled tip)

Calculations

E.2 Proposed surface water drainage strategy calculations – Flow output

E.3 Schedule of maintenance



Key:

- Proposed Tip Reprofile (including Tramway)
- Proposed 2m wide track and 3m wide drainage feature
- Existing drainage ditch
- Proposed lined drainage ditch/swale
- Proposed maintenance track/path
- Proposed herringbone drains
- Culverts
- Overland flow paths
- Drainage flow paths

Notes:

1. For Location Plan refer to drawing : GC3613-RED-61-RSC-DR-C-0001
2. For Receptor Site C General Arrangement refer to drawing : GC3613-RED-61-RSC-DR-C-0003
3. For cross sections of Tip Reprofile refer to drawings: GC3613-RED-61-RSC-DR-C-0004-0010
4. For Receptor Site C Cross Sections refer to drawings: GC3613-RED-61-RSC-DR-C-0009-0013

Rev	Drwn	Chk'd	App'd	Description	Date
P02	JC	PH	NG	For information	17/08/2021

Purpose of Issue
D5 - Suitable for Planning

Classification
Public

Client
Rhondda Cynon Taf County Borough Council

Project
Tylorstown Landslide

Drawing
Phase 4 Proposed drainage layout Tip Reprofile

Scale @ A1	Drawn	Checked	Approved
As Shown	JC	JS	PH

Project No.	Date
GC/3613	March 2021

Drawing Identifier
Project - Originator - Zone - Level - File Type - Role - Number
BS1192 Compliant
GC3613-RED-73-RSC-DR-C-0501
revision P02

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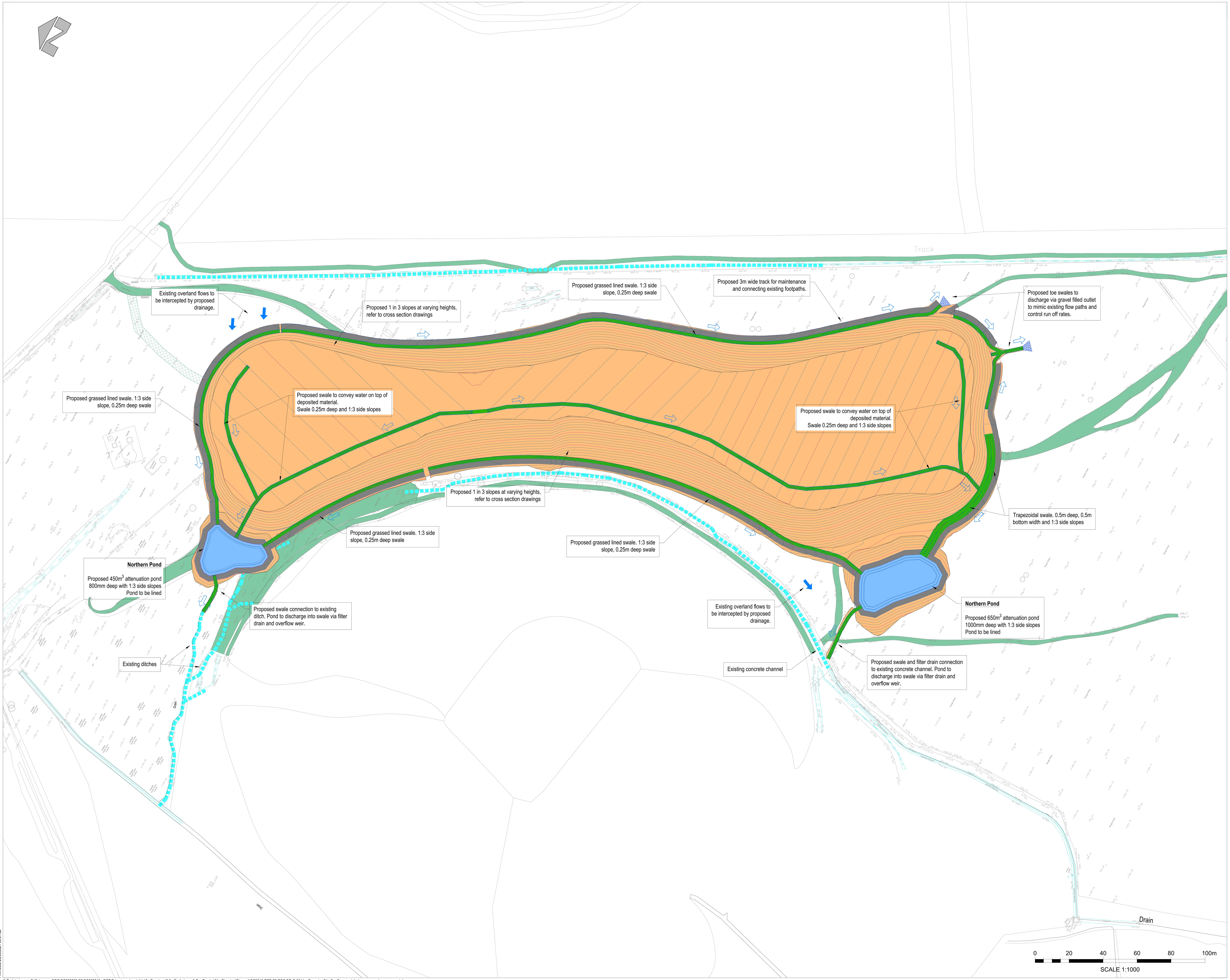


Key:

- Proposed Deposited Material
- Proposed Attenuation Ponds
- Proposed Drainage Features (Swales)
- Existing Tracks
- Proposed Tracks
- Proposed Contour Major (2.5m intervals)
- Proposed Contour Minor (0.5m intervals)
- Overland flow paths
- Drainage flow paths
- Existing Drainage Channels

Notes:

1. For Location Plan refer to drawing : GC3613-RED-61-RSC-DR-C-0001
2. For Tip Reprofile General Arrangement refer to drawing : GC3613-RED-61-RSC-DR-C-0002
3. For cross sections of Tip Reprofile refer to drawings: GC3613-RED-61-RSC-DR-C-0004-0008
4. For cross sections of Receptor Site C refer to drawings: GC3613-RED-61-RSC-DR-C-0009-0013

Rev	Drwn	Chk'd	App'd	Description	Date
P02	JC	PH	NG	For information	17/08/2021

Purpose of Issue
D5 - Suitable for Planning

Classification
Public

Client
Rhondda Cynon Taf
County Borough Council

Project
Tylorstown Landslide

Drawing
Phase 4
Proposed drainage layout
Receptor Site C

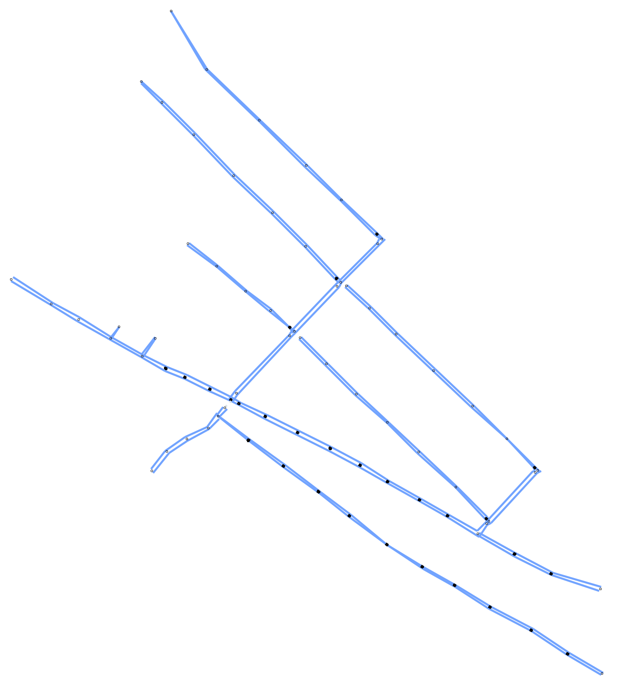
Scale @ A1	Drawn	Checked	Approved
As Shown	JC	JS	PH

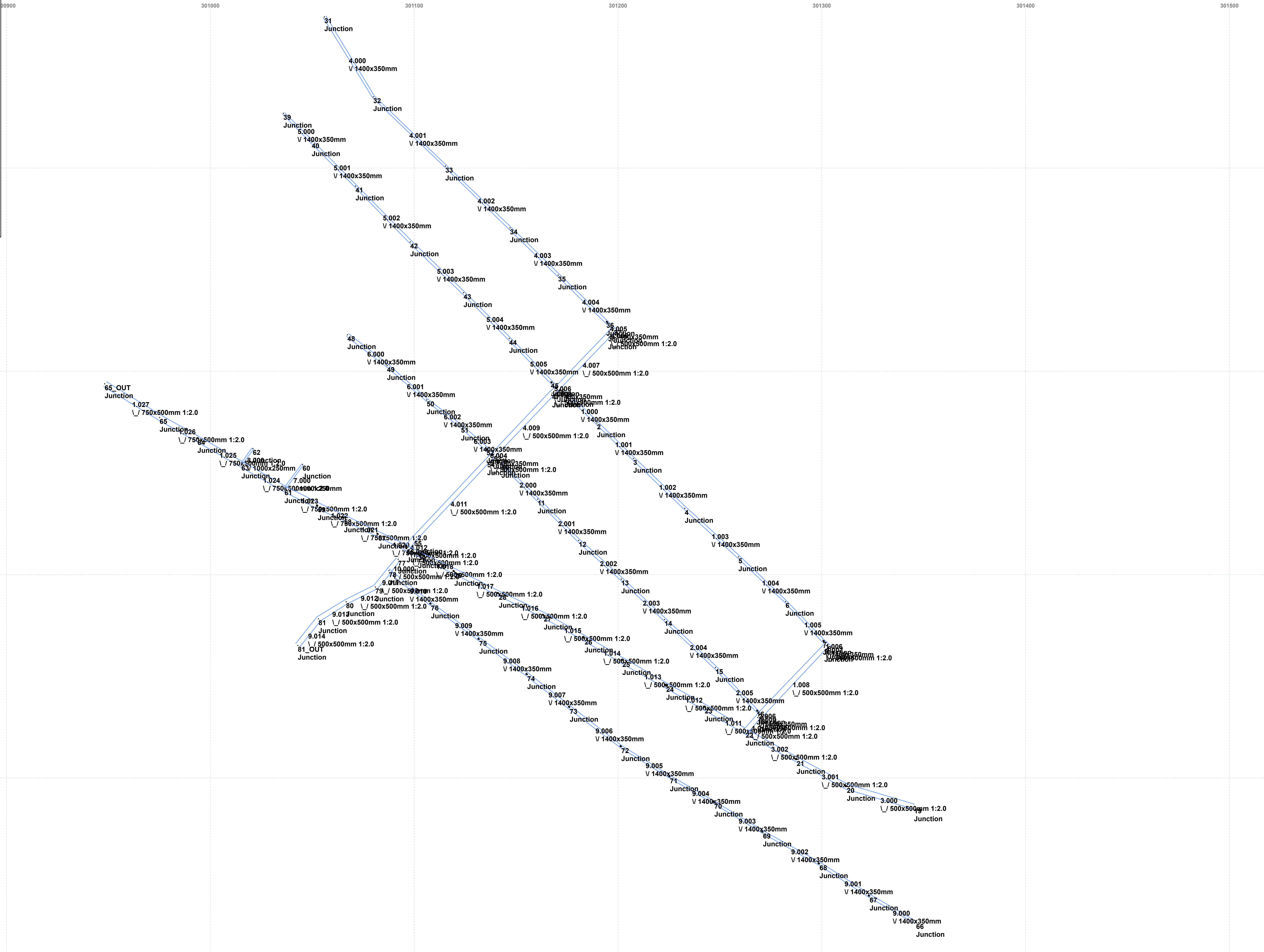
Project No.	Date
GC/3613	March 2021

Drawing Identifier BS1192 Compliant
Project - Originator - Zone - Level - File Type - Role - Number
GC3613-RED-73-RSC-DR-C-0511 revision P02

REDSTART
St David's House, Pascal Close, St Mellons, Cardiff, CF3 0LW
www.redstartwales.com

CAUSEWAY	Capita	File: Proposed model FSR - option 3.pfd Network: Storm Network Jacques Calitz 24/05/2021	Page 1 Tylorstown Phase 4 Existing tip Reprofile





Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	100	Maximum Rainfall (mm/hr)	50.0
Additional Flow (%)	0	Minimum Velocity (m/s)	1.00
FSR Region	England and Wales	Connection Type	Level Soffits
M5-60 (mm)	20.000	Minimum Backdrop Height (m)	0.200
Ratio-R	0.200	Preferred Cover Depth (m)	1.200
CV	0.750	Include Intermediate Ground	✓
Time of Entry (mins)	5.00	Enforce best practice design rules	x

Nodes

Name	Area (ha)	T of E (mins)	Add Inflow (l/s)	Cover Level (m)	Easting (m)	Northing (m)	Depth (m)
31	0.067	5.00		326.104	301055.947	196474.370	0.350
32	0.076	5.00		325.400	301079.974	196435.042	0.350
37				323.745	301197.914	196321.002	0.500
48	0.025	5.00		293.455	301067.270	196317.940	0.350
53				292.530	301138.995	196258.979	0.500
46				308.730	301170.237	196291.867	0.500
39	0.057	5.00		310.646	301035.850	196426.929	0.350
56	0.036	5.00		268.003	301096.312	196213.138	0.500
1	0.023	5.00		308.686	301174.036	196289.567	0.350
8				306.897	301302.967	196165.496	0.500
17				290.683	301270.067	196131.275	0.500
22	0.014	5.00		286.500	301262.636	196122.897	0.500
10	0.024	5.00		292.469	301142.813	196254.689	0.350
19	0.033	5.00		301.269	301345.263	196085.730	0.500
20	0.028	5.00		294.671	301312.300	196095.760	0.500
26	0.028	5.00	6.0	278.587	301183.626	196168.705	0.500
33	0.061	5.00		324.914	301115.327	196400.931	0.350
21	0.030	5.00		289.845	301287.682	196109.016	0.500
79				259.595	301080.978	196193.883	0.500
35	0.046	5.00		324.124	301170.656	196347.331	0.350
78				266.614	301087.610	196201.918	0.500
66	0.044	10.00		282.566	301346.293	196028.882	0.350
72	0.036	7.50		270.074	301201.655	196115.312	0.350
76	0.013	5.00		267.342	301108.271	196185.495	0.350
41	0.053	5.00		310.086	301071.236	196391.133	0.350
43	0.044	5.00		309.386	301124.260	196338.685	0.350
50	0.021	5.00		292.951	301106.166	196285.949	0.350
3	0.029	5.00		308.220	301207.543	196257.132	0.350
5	0.034	5.00		307.740	301259.126	196208.718	0.350
12	0.024	5.00		291.933	301180.742	196216.787	0.350
14	0.032	5.00		291.360	301222.816	196177.884	0.350
68	0.042	10.00		278.615	301298.894	196057.715	0.350
70	0.031	7.50		272.743	301247.311	196087.973	0.350
74	0.027	5.00		269.631	301155.512	196150.795	0.350
24	0.024	5.00	6.0	282.550	301223.663	196145.414	0.500
28	0.027	5.00	6.0	273.692	301141.532	196190.712	0.500
80				251.120	301066.595	196186.624	0.500
81				244.007	301053.072	196178.233	0.500
81_OUT				236.893	301042.922	196165.140	0.500
58	0.020	5.00		266.422	301065.580	196227.882	0.500
61	0.023	5.00		263.892	301036.396	196242.239	0.500

Nodes

Name	Area (ha)	T of E (mins)	Add Inflow (l/s)	Cover Level (m)	Easting (m)	Northing (m)	Depth (m)
23	0.018	5.00		284.526	301242.578	196134.767	0.500
63	0.092	5.00		261.375	301015.256	196254.329	0.500
64	0.053	5.00		258.612	300993.688	196266.918	0.500
38				322.679	301195.173	196317.869	0.500
47				307.521	301167.700	196289.284	0.500
62	0.021	5.00		267.131	301020.833	196262.040	0.250
54				291.338	301135.833	196255.964	0.500
9				306.640	301301.236	196164.158	0.500
18				290.024	301268.576	196129.672	0.500
65	0.086	5.00		256.471	300975.116	196277.348	0.500
65_OUT				253.051	300948.150	196293.853	0.500
30				268.687	301101.956	196210.213	0.919
55				270.194	301099.954	196217.358	0.500
77		5.00		267.400	301092.140	196207.556	0.500
34	0.051	5.00		324.530	301146.992	196370.522	0.350
60	0.034	5.00	6.0	270.390	301045.240	196254.239	0.250
40	0.056	5.00		310.429	301049.747	196412.857	0.350
42	0.054	5.00		309.597	301098.098	196363.610	0.350
44	0.059	5.00		309.068	301146.628	196316.155	0.350
2	0.026	5.00		308.470	301189.690	196274.591	0.350
4	0.029	5.00		307.868	301232.789	196232.543	0.350
6	0.024	5.00		307.508	301282.195	196186.741	0.350
11	0.026	5.00		292.219	301160.600	196237.137	0.350
13	0.028	5.00		291.651	301201.603	196197.801	0.350
15	0.031	5.00		291.039	301247.828	196154.242	0.350
25	0.028	5.00		280.358	301202.157	196157.709	0.500
27	0.062	5.00		276.511	301163.608	196180.027	0.500
29	0.031	5.00		270.995	301119.745	196201.548	0.500
57	0.024	5.00		267.358	301082.401	196219.858	0.500
59				265.581	301052.733	196233.848	0.500
45				308.773	301167.105	196294.867	0.350
36				323.814	301194.282	196324.579	0.350
52				292.572	301135.517	196261.880	0.350
7				306.929	301300.593	196167.599	0.350
16				290.725	301268.038	196133.300	0.350
49	0.079	5.00		293.403	301086.711	196302.800	0.350
51	0.064	5.00		292.931	301122.992	196272.987	0.350
67	0.040	10.00		280.410	301323.475	196041.816	0.350
69	0.038	10.00		275.290	301271.143	196073.324	0.350
71	0.031	7.50		270.590	301225.519	196100.462	0.350
73	0.027	5.00		269.685	301176.356	196134.680	0.350
75	0.020	5.00		268.300	301131.934	196168.135	0.350

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.027	65	65_OUT	31.616	0.040	255.971	252.551	3.420	9.2	750	16.37	50.0
1.026	64	65	21.300	0.040	258.112	255.971	2.141	9.9	750	16.22	50.0
1.025	63	64	24.973	0.040	260.875	258.112	2.763	9.0	750	16.12	50.0
1.024	61	63	24.353	0.040	263.392	260.875	2.517	9.7	750	16.01	50.0
8.000	62	63	9.516	0.040	266.881	261.125	5.756	1.7	1000	5.04	50.0
1.023	59	61	18.366	0.040	265.081	263.392	1.689	10.9	750	15.89	50.0
7.000	60	61	14.907	0.040	270.140	263.642	6.498	2.3	1000	10.03	50.0
1.022	58	59	14.165	0.040	265.922	265.081	0.841	16.8	750	15.80	50.0
1.021	57	58	18.637	0.040	266.858	265.922	0.936	19.9	750	15.71	50.0
1.020	56	57	15.449	0.040	267.503	266.858	0.645	24.0	750	15.59	50.0
4.012	55	56	5.574	0.040	269.694	267.503	2.191	2.5	500	13.18	50.0
1.019	30	56	6.357	0.040	267.768	267.503	0.265	24.0	500	15.47	50.0
1.018	29	30	19.787	0.040	270.495	268.187	2.308	8.6	500	15.42	50.0
1.017	28	29	24.333	0.040	273.192	270.495	2.697	9.0	500	15.33	50.0
1.016	27	28	24.526	0.040	276.011	273.192	2.819	8.7	500	15.22	50.0
1.015	26	27	22.998	0.040	278.087	276.011	2.076	11.1	500	15.10	50.0
1.014	25	26	21.548	0.040	279.858	278.087	1.771	12.2	500	14.98	50.0
1.013	24	25	24.772	0.040	282.050	279.858	2.192	11.3	500	14.86	50.0
1.012	23	24	21.706	0.040	284.026	282.050	1.976	11.0	500	14.73	50.0
1.011	22	23	23.307	0.040	286.000	284.026	1.974	11.8	500	14.62	50.0
3.002	21	22	28.635	0.040	289.345	286.000	3.345	8.6	500	10.30	50.0
1.010	18	22	9.010	0.040	289.524	286.000	3.524	2.6	500	14.49	50.0
1.009	17	18	2.189	0.040	290.183	289.524	0.659	3.3	500	14.47	50.0
2.006	16	17	2.867	0.040	290.375	290.333	0.042	68.3	1400	13.78	50.0

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
1.027	3.627	3174.0	403.5	0.000	0.000	2.800	24.0	176	2.070
1.026	3.497	3059.6	381.7	0.000	0.000	2.639	24.0	174	1.984
1.025	3.669	3210.0	352.3	0.000	0.000	2.422	24.0	163	2.005
1.024	3.546	3102.6	317.8	0.000	0.000	2.168	24.0	157	1.899
8.000	4.512	564.0	2.9	0.000	0.000	0.021	0.0	35	1.209
1.023	3.345	2926.6	298.6	0.000	0.000	2.070	18.0	157	1.792
7.000	3.831	478.8	16.2	0.000	0.000	0.075	6.0	70	1.637
1.022	2.687	2351.5	295.7	0.000	0.000	2.049	18.0	175	1.529
1.021	2.472	2162.7	290.4	0.000	0.000	2.010	18.0	182	1.436
1.020	2.254	1971.9	284.3	0.000	0.000	1.965	18.0	189	1.335
4.012	6.614	4960.4	122.3	0.000	0.000	0.902	0.0	78	2.403
1.019	2.153	1615.0	154.9	0.419	0.000	1.010	18.0	162	1.163
1.018	3.603	2702.2	154.9	0.000	0.000	1.010	18.0	124	1.685
1.017	3.512	2634.1	147.4	0.000	0.000	0.955	18.0	122	1.629
1.016	3.577	2682.4	135.3	0.000	0.000	0.910	12.0	115	1.608
1.015	3.170	2377.2	125.0	0.000	0.000	0.834	12.0	118	1.444
1.014	3.024	2268.3	115.2	0.000	0.000	0.806	6.0	116	1.366
1.013	3.138	2353.6	111.5	0.000	0.000	0.778	6.0	111	1.385
1.012	3.183	2387.2	102.2	0.000	0.000	0.754	0.0	105	1.364
1.011	3.070	2302.6	99.8	0.000	0.000	0.736	0.0	106	1.322
3.002	3.606	2704.2	20.1	0.000	0.000	0.149	0.0	40	0.894
1.010	6.598	4948.1	77.8	0.000	0.000	0.574	0.0	60	2.078
1.009	5.788	4341.0	77.8	0.000	0.000	0.574	0.0	65	1.905
2.006	0.879	215.3	42.1	0.000	0.000	0.311	0.0	190	0.584

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.008	9	17	45.308	0.040	306.140	290.183	15.957	2.8	500	14.46	50.0
1.007	8	9	2.188	0.040	306.397	306.140	0.257	8.5	500	14.34	50.0
1.006	7	8	3.172	0.040	306.579	306.547	0.032	99.1	1400	14.33	50.0
1.005	6	7	26.550	0.040	307.158	306.579	0.579	45.9	1400	14.26	50.0
1.004	5	6	31.862	0.040	307.390	307.158	0.232	137.3	1400	13.85	50.0
1.003	4	5	35.514	0.040	307.518	307.390	0.128	277.5	1400	12.99	50.0
1.002	3	4	35.242	0.040	307.870	307.518	0.352	100.1	1400	11.63	50.0
1.001	2	3	24.971	0.040	308.120	307.870	0.250	99.9	1400	10.82	50.0
1.000	1	2	21.664	0.040	308.336	308.120	0.216	100.3	1400	10.25	50.0
2.005	15	16	29.103	0.040	290.689	290.375	0.314	92.7	1400	13.72	50.0
2.004	14	15	34.417	0.040	291.010	290.689	0.321	107.2	1400	13.08	50.0
2.003	13	14	29.098	0.040	291.301	291.010	0.291	100.0	1400	12.26	50.0
2.002	12	13	28.207	0.040	291.583	291.301	0.282	100.0	1400	11.59	50.0
2.001	11	12	28.633	0.040	291.869	291.583	0.286	100.1	1400	10.94	50.0
2.000	10	11	24.989	0.040	292.119	291.869	0.250	100.0	1400	10.29	50.0
3.001	20	21	27.960	0.040	294.171	289.345	4.826	5.8	500	10.17	50.0
3.000	19	20	34.455	0.040	300.769	294.171	6.598	5.2	500	10.06	50.0
4.011	54	55	52.704	0.040	290.838	269.694	21.144	2.5	500	13.17	50.0
4.010	53	54	4.369	0.040	292.030	290.838	1.192	3.7	500	13.03	50.0
4.009	47	53	41.742	0.040	307.021	292.030	14.991	2.8	500	9.85	50.0
6.004	52	53	4.529	0.040	292.222	292.180	0.042	107.8	1400	13.02	50.0
6.003	51	52	16.740	0.040	292.581	292.222	0.359	46.6	1400	12.91	50.0
6.002	50	51	21.240	0.040	292.601	292.581	0.020	1062.0	1400	12.65	50.0
6.001	49	50	25.738	0.040	293.053	292.601	0.452	56.9	1400	11.06	50.0

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
1.008	6.261	4695.5	35.6	0.000	0.000	0.263	0.0	40	1.552
1.007	3.616	2711.8	35.6	0.000	0.000	0.263	0.0	54	1.075
1.006	0.729	178.7	35.6	0.000	0.000	0.263	0.0	191	0.487
1.005	1.072	262.7	35.6	0.000	0.000	0.263	0.0	166	0.652
1.004	0.620	151.8	32.4	0.000	0.000	0.239	0.0	196	0.421
1.003	0.436	106.8	27.8	0.000	0.000	0.205	0.0	212	0.312
1.002	0.726	177.8	21.0	0.000	0.000	0.155	0.0	157	0.425
1.001	0.727	178.0	13.1	0.000	0.000	0.097	0.0	132	0.378
1.000	0.725	177.6	6.3	0.000	0.000	0.046	0.0	100	0.315
2.005	0.754	184.8	42.1	0.000	0.000	0.311	0.0	201	0.522
2.004	0.701	171.8	34.0	0.000	0.000	0.251	0.0	190	0.467
2.003	0.726	177.9	26.1	0.000	0.000	0.193	0.0	171	0.450
2.002	0.726	177.9	18.9	0.000	0.000	0.140	0.0	151	0.415
2.001	0.726	177.8	12.9	0.000	0.000	0.095	0.0	131	0.377
2.000	0.726	177.9	6.0	0.000	0.000	0.044	0.0	98	0.311
3.001	4.383	3287.1	12.1	0.000	0.000	0.089	0.0	26	0.845
3.000	4.616	3462.3	5.8	0.000	0.000	0.043	0.0	16	0.665
4.011	6.682	5011.4	122.3	0.000	0.000	0.902	0.0	78	2.428
4.010	5.510	4132.7	122.3	0.000	0.000	0.902	0.0	86	2.124
4.009	6.322	4741.6	84.5	0.000	0.000	0.623	0.0	65	2.081
6.004	0.699	171.3	37.8	0.000	0.000	0.279	0.0	199	0.479
6.003	1.063	260.5	37.8	0.000	0.000	0.279	0.0	170	0.657
6.002	0.223	54.6	26.3	0.000	0.000	0.194	0.0	266	0.186
6.001	0.962	235.7	21.2	0.000	0.000	0.156	0.0	142	0.527

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
6.000	48	49	24.641	0.040	293.105	293.053	0.052	473.9	1400	10.62	50.0
4.008	46	47	3.621	0.040	308.230	307.021	1.209	3.0	500	9.74	50.0
4.007	38	46	36.026	0.040	322.179	308.230	13.949	2.6	500	9.73	50.0
5.006	45	46	4.337	0.040	308.423	308.380	0.043	100.9	1400	9.47	50.0
5.005	44	45	29.538	0.040	308.718	308.423	0.295	100.1	1400	9.37	50.0
5.004	43	44	31.748	0.040	309.036	308.718	0.318	99.8	1400	8.69	50.0
5.003	42	43	36.135	0.040	309.247	309.036	0.211	171.3	1400	7.96	50.0
5.002	41	42	38.459	0.040	309.736	309.247	0.489	78.6	1400	6.88	50.0
5.001	40	41	30.557	0.040	310.079	309.736	0.343	89.1	1400	6.10	50.0
5.000	39	40	19.777	0.040	310.296	310.079	0.217	91.1	1400	5.43	50.0
4.006	37	38	4.163	0.040	323.245	322.179	1.066	3.9	500	9.64	50.0
4.005	36	37	5.098	0.040	323.464	323.395	0.069	73.9	1400	9.63	50.0
4.004	35	36	32.800	0.040	323.774	323.464	0.310	105.8	1400	9.53	50.0
4.003	34	35	33.133	0.040	324.180	323.774	0.406	81.6	1400	8.75	50.0
4.002	33	34	43.902	0.040	324.564	324.180	0.384	114.3	1400	8.07	50.0
4.001	32	33	49.126	0.040	325.050	324.564	0.486	101.1	1400	6.99	50.0
4.000	31	32	46.087	0.040	325.754	325.050	0.704	65.5	1400	5.86	50.0
9.014	81	81_OUT	16.567	0.040	243.507	236.393	7.114	2.3	500	14.78	50.0
9.013	80	81	15.915	0.040	250.620	243.507	7.113	2.2	500	14.74	50.0
9.012	79	80	16.111	0.040	259.095	250.620	8.475	1.9	500	14.70	50.0
9.011	78	79	10.418	0.040	266.114	259.095	7.019	1.5	500	14.66	50.0
9.010	76	78	26.393	0.040	266.992	266.264	0.728	36.3	1400	14.64	50.0
10.000	77	78	7.232	0.040	266.900	266.114	0.786	9.2	500	5.03	50.0
9.009	75	76	29.348	0.040	267.950	266.992	0.958	30.6	1400	14.28	50.0

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
6.000	0.334	81.7	6.8	0.000	0.000	0.050	0.0	138	0.179
4.008	6.096	4572.1	84.5	0.000	0.000	0.623	0.0	66	2.023
4.007	6.564	4923.2	40.7	0.000	0.000	0.301	0.0	42	1.674
5.006	0.723	177.1	43.7	0.000	0.000	0.323	0.0	207	0.510
5.005	0.726	177.8	43.7	0.000	0.000	0.323	0.0	207	0.511
5.004	0.727	178.0	35.8	0.000	0.000	0.264	0.0	192	0.487
5.003	0.555	135.9	29.8	0.000	0.000	0.220	0.0	198	0.379
5.002	0.819	200.6	22.5	0.000	0.000	0.166	0.0	154	0.474
5.001	0.769	188.5	15.2	0.000	0.000	0.112	0.0	136	0.410
5.000	0.761	186.3	7.7	0.000	0.000	0.057	0.0	106	0.342
4.006	5.338	4003.8	40.7	0.000	0.000	0.301	0.0	47	1.469
4.005	0.845	207.0	40.7	0.000	0.000	0.301	0.0	190	0.563
4.004	0.706	172.9	40.7	0.000	0.000	0.301	0.0	203	0.492
4.003	0.804	196.9	34.6	0.000	0.000	0.255	0.0	182	0.520
4.002	0.679	166.4	27.7	0.000	0.000	0.204	0.0	179	0.434
4.001	0.722	176.9	19.4	0.000	0.000	0.143	0.0	153	0.416
4.000	0.897	219.9	9.0	0.000	0.000	0.067	0.0	106	0.404
9.014	6.913	5184.8	47.4	0.000	0.000	0.350	0.0	44	1.834
9.013	7.053	5289.5	47.4	0.000	0.000	0.350	0.0	43	1.847
9.012	7.651	5738.5	47.4	0.000	0.000	0.350	0.0	42	1.951
9.011	8.659	6494.2	47.4	0.000	0.000	0.350	0.0	39	2.116
9.010	1.206	295.4	47.4	0.000	0.000	0.350	0.0	176	0.763
10.000	3.478	2608.3	0.0	0.000	0.000	0.000	0.0	0	0.000
9.009	1.312	321.4	45.6	0.000	0.000	0.337	0.0	169	0.806

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
9.008	74	75	29.268	0.040	269.281	267.950	1.331	22.0	1400	13.91	50.0
9.007	73	74	26.347	0.040	269.335	269.281	0.054	487.9	1400	13.59	50.0
9.006	72	73	31.862	0.040	269.724	269.335	0.389	81.9	1400	12.26	50.0
9.005	71	72	28.107	0.040	270.240	269.724	0.516	54.5	1400	11.59	50.0
9.004	70	71	25.117	0.040	272.393	270.240	2.153	11.7	1400	11.12	50.0
9.003	69	70	27.974	0.040	274.940	272.393	2.547	11.0	1400	10.92	50.0
9.002	68	69	31.840	0.040	278.265	274.940	3.325	9.6	1400	10.71	50.0
9.001	67	68	29.275	0.040	280.060	278.265	1.795	16.3	1400	10.48	50.0
9.000	66	67	26.229	0.040	282.216	280.060	2.156	12.2	1400	10.21	50.0

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
9.008	1.548	379.4	42.9	0.000	0.000	0.316	0.0	155	0.899
9.007	0.329	80.5	39.2	0.000	0.000	0.289	0.0	267	0.274
9.006	0.802	196.6	35.5	0.000	0.000	0.262	0.0	184	0.523
9.005	0.984	241.0	30.6	0.000	0.000	0.226	0.0	162	0.588
9.004	2.126	520.8	26.4	0.000	0.000	0.195	0.0	115	1.009
9.003	2.191	536.8	22.1	0.000	0.000	0.163	0.0	106	0.986
9.002	2.346	574.9	17.0	0.000	0.000	0.125	0.0	93	0.972
9.001	1.798	440.5	11.4	0.000	0.000	0.084	0.0	89	0.719
9.000	2.082	510.0	6.0	0.000	0.000	0.044	0.0	66	0.684

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.027	31.616	9.2	750	1:2 swale 500mm	256.471	255.971	0.000	253.051	252.551	0.000
1.026	21.300	9.9	750	1:2 swale 500mm	258.612	258.112	0.000	256.471	255.971	0.000
1.025	24.973	9.0	750	1:2 swale 500mm	261.375	260.875	0.000	258.612	258.112	0.000
1.024	24.353	9.7	750	1:2 swale 500mm	263.892	263.392	0.000	261.375	260.875	0.000
8.000	9.516	1.7	1000	1:2 Swale 250mm	267.131	266.881	0.000	261.375	261.125	0.000
1.023	18.366	10.9	750	1:2 swale 500mm	265.581	265.081	0.000	263.892	263.392	0.000
7.000	14.907	2.3	1000	1:2 Swale 250mm	270.390	270.140	0.000	263.892	263.642	0.000
1.022	14.165	16.8	750	1:2 swale 500mm	266.422	265.922	0.000	265.581	265.081	0.000
1.021	18.637	19.9	750	1:2 swale 500mm	267.358	266.858	0.000	266.422	265.922	0.000
1.020	15.449	24.0	750	1:2 swale 500mm	268.003	267.503	0.000	267.358	266.858	0.000
4.012	5.574	2.5	500	1:2 swale 500mm	270.194	269.694	0.000	268.003	267.503	0.000

Link	US Node	Node Type	DS Node	Node Type
1.027	65	Junction	65_OUT	Junction
1.026	64	Junction	65	Junction
1.025	63	Junction	64	Junction
1.024	61	Junction	63	Junction
8.000	62	Junction	63	Junction
1.023	59	Junction	61	Junction
7.000	60	Junction	61	Junction
1.022	58	Junction	59	Junction
1.021	57	Junction	58	Junction
1.020	56	Junction	57	Junction
4.012	55	Junction	56	Junction

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.019	6.357	24.0	500	1:2 swale 500mm	268.687	267.768	0.419	268.003	267.503	0.000
1.018	19.787	8.6	500	1:2 swale 500mm	270.995	270.495	0.000	268.687	268.187	0.000
1.017	24.333	9.0	500	1:2 swale 500mm	273.692	273.192	0.000	270.995	270.495	0.000
1.016	24.526	8.7	500	1:2 swale 500mm	276.511	276.011	0.000	273.692	273.192	0.000
1.015	22.998	11.1	500	1:2 swale 500mm	278.587	278.087	0.000	276.511	276.011	0.000
1.014	21.548	12.2	500	1:2 swale 500mm	280.358	279.858	0.000	278.587	278.087	0.000
1.013	24.772	11.3	500	1:2 swale 500mm	282.550	282.050	0.000	280.358	279.858	0.000
1.012	21.706	11.0	500	1:2 swale 500mm	284.526	284.026	0.000	282.550	282.050	0.000
1.011	23.307	11.8	500	1:2 swale 500mm	286.500	286.000	0.000	284.526	284.026	0.000
3.002	28.635	8.6	500	1:2 swale 500mm	289.845	289.345	0.000	286.500	286.000	0.000
1.010	9.010	2.6	500	1:2 swale 500mm	290.024	289.524	0.000	286.500	286.000	0.000
1.009	2.189	3.3	500	1:2 swale 500mm	290.683	290.183	0.000	290.024	289.524	0.000
2.006	2.867	68.3	1400	Trian swale 350mm	290.725	290.375	0.000	290.683	290.333	0.000
1.008	45.308	2.8	500	1:2 swale 500mm	306.640	306.140	0.000	290.683	290.183	0.000
1.007	2.188	8.5	500	1:2 swale 500mm	306.897	306.397	0.000	306.640	306.140	0.000
1.006	3.172	99.1	1400	Trian swale 350mm	306.929	306.579	0.000	306.897	306.547	0.000
1.005	26.550	45.9	1400	Trian swale 350mm	307.508	307.158	0.000	306.929	306.579	0.000
1.004	31.862	137.3	1400	Trian swale 350mm	307.740	307.390	0.000	307.508	307.158	0.000
1.003	35.514	277.5	1400	Trian swale 350mm	307.868	307.518	0.000	307.740	307.390	0.000
1.002	35.242	100.1	1400	Trian swale 350mm	308.220	307.870	0.000	307.868	307.518	0.000
1.001	24.971	99.9	1400	Trian swale 350mm	308.470	308.120	0.000	308.220	307.870	0.000
1.000	21.664	100.3	1400	Trian swale 350mm	308.686	308.336	0.000	308.470	308.120	0.000
2.005	29.103	92.7	1400	Trian swale 350mm	291.039	290.689	0.000	290.725	290.375	0.000
2.004	34.417	107.2	1400	Trian swale 350mm	291.360	291.010	0.000	291.039	290.689	0.000
2.003	29.098	100.0	1400	Trian swale 350mm	291.651	291.301	0.000	291.360	291.010	0.000

Link	US Node	Node Type	DS Node	Node Type
1.019	30	Junction	56	Junction
1.018	29	Junction	30	Junction
1.017	28	Junction	29	Junction
1.016	27	Junction	28	Junction
1.015	26	Junction	27	Junction
1.014	25	Junction	26	Junction
1.013	24	Junction	25	Junction
1.012	23	Junction	24	Junction
1.011	22	Junction	23	Junction
3.002	21	Junction	22	Junction
1.010	18	Junction	22	Junction
1.009	17	Junction	18	Junction
2.006	16	Junction	17	Junction
1.008	9	Junction	17	Junction
1.007	8	Junction	9	Junction
1.006	7	Junction	8	Junction
1.005	6	Junction	7	Junction
1.004	5	Junction	6	Junction
1.003	4	Junction	5	Junction
1.002	3	Junction	4	Junction
1.001	2	Junction	3	Junction
1.000	1	Junction	2	Junction
2.005	15	Junction	16	Junction
2.004	14	Junction	15	Junction
2.003	13	Junction	14	Junction

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
2.002	28.207	100.0	1400	Trian swale 350mm	291.933	291.583	0.000	291.651	291.301	0.000
2.001	28.633	100.1	1400	Trian swale 350mm	292.219	291.869	0.000	291.933	291.583	0.000
2.000	24.989	100.0	1400	Trian swale 350mm	292.469	292.119	0.000	292.219	291.869	0.000
3.001	27.960	5.8	500	1:2 swale 500mm	294.671	294.171	0.000	289.845	289.345	0.000
3.000	34.455	5.2	500	1:2 swale 500mm	301.269	300.769	0.000	294.671	294.171	0.000
4.011	52.704	2.5	500	1:2 swale 500mm	291.338	290.838	0.000	270.194	269.694	0.000
4.010	4.369	3.7	500	1:2 swale 500mm	292.530	292.030	0.000	291.338	290.838	0.000
4.009	41.742	2.8	500	1:2 swale 500mm	307.521	307.021	0.000	292.530	292.030	0.000
6.004	4.529	107.8	1400	Trian swale 350mm	292.572	292.222	0.000	292.530	292.180	0.000
6.003	16.740	46.6	1400	Trian swale 350mm	292.931	292.581	0.000	292.572	292.222	0.000
6.002	21.240	1062.0	1400	Trian swale 350mm	292.951	292.601	0.000	292.931	292.581	0.000
6.001	25.738	56.9	1400	Trian swale 350mm	293.403	293.053	0.000	292.951	292.601	0.000
6.000	24.641	473.9	1400	Trian swale 350mm	293.455	293.105	0.000	293.403	293.053	0.000
4.008	3.621	3.0	500	1:2 swale 500mm	308.730	308.230	0.000	307.521	307.021	0.000
4.007	36.026	2.6	500	1:2 swale 500mm	322.679	322.179	0.000	308.730	308.230	0.000
5.006	4.337	100.9	1400	Trian swale 350mm	308.773	308.423	0.000	308.730	308.380	0.000
5.005	29.538	100.1	1400	Trian swale 350mm	309.068	308.718	0.000	308.773	308.423	0.000
5.004	31.748	99.8	1400	Trian swale 350mm	309.386	309.036	0.000	309.068	308.718	0.000
5.003	36.135	171.3	1400	Trian swale 350mm	309.597	309.247	0.000	309.386	309.036	0.000
5.002	38.459	78.6	1400	Trian swale 350mm	310.086	309.736	0.000	309.597	309.247	0.000
5.001	30.557	89.1	1400	Trian swale 350mm	310.429	310.079	0.000	310.086	309.736	0.000
5.000	19.777	91.1	1400	Trian swale 350mm	310.646	310.296	0.000	310.429	310.079	0.000
4.006	4.163	3.9	500	1:2 swale 500mm	323.745	323.245	0.000	322.679	322.179	0.000
4.005	5.098	73.9	1400	Trian swale 350mm	323.814	323.464	0.000	323.745	323.395	0.000
4.004	32.800	105.8	1400	Trian swale 350mm	324.124	323.774	0.000	323.814	323.464	0.000

Link	US Node	Node Type	DS Node	Node Type
2.002	12	Junction	13	Junction
2.001	11	Junction	12	Junction
2.000	10	Junction	11	Junction
3.001	20	Junction	21	Junction
3.000	19	Junction	20	Junction
4.011	54	Junction	55	Junction
4.010	53	Junction	54	Junction
4.009	47	Junction	53	Junction
6.004	52	Junction	53	Junction
6.003	51	Junction	52	Junction
6.002	50	Junction	51	Junction
6.001	49	Junction	50	Junction
6.000	48	Junction	49	Junction
4.008	46	Junction	47	Junction
4.007	38	Junction	46	Junction
5.006	45	Junction	46	Junction
5.005	44	Junction	45	Junction
5.004	43	Junction	44	Junction
5.003	42	Junction	43	Junction
5.002	41	Junction	42	Junction
5.001	40	Junction	41	Junction
5.000	39	Junction	40	Junction
4.006	37	Junction	38	Junction
4.005	36	Junction	37	Junction
4.004	35	Junction	36	Junction

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
4.003	33.133	81.6	1400	Trian swale 350mm	324.530	324.180	0.000	324.124	323.774	0.000
4.002	43.902	114.3	1400	Trian swale 350mm	324.914	324.564	0.000	324.530	324.180	0.000
4.001	49.126	101.1	1400	Trian swale 350mm	325.400	325.050	0.000	324.914	324.564	0.000
4.000	46.087	65.5	1400	Trian swale 350mm	326.104	325.754	0.000	325.400	325.050	0.000
9.014	16.567	2.3	500	1:2 swale 500mm	244.007	243.507	0.000	236.893	236.393	0.000
9.013	15.915	2.2	500	1:2 swale 500mm	251.120	250.620	0.000	244.007	243.507	0.000
9.012	16.111	1.9	500	1:2 swale 500mm	259.595	259.095	0.000	251.120	250.620	0.000
9.011	10.418	1.5	500	1:2 swale 500mm	266.614	266.114	0.000	259.595	259.095	0.000
9.010	26.393	36.3	1400	Trian swale 350mm	267.342	266.992	0.000	266.614	266.264	0.000
10.000	7.232	9.2	500	1:2 swale 500mm	267.400	266.900	0.000	266.614	266.114	0.000
9.009	29.348	30.6	1400	Trian swale 350mm	268.300	267.950	0.000	267.342	266.992	0.000
9.008	29.268	22.0	1400	Trian swale 350mm	269.631	269.281	0.000	268.300	267.950	0.000
9.007	26.347	487.9	1400	Trian swale 350mm	269.685	269.335	0.000	269.631	269.281	0.000
9.006	31.862	81.9	1400	Trian swale 350mm	270.074	269.724	0.000	269.685	269.335	0.000
9.005	28.107	54.5	1400	Trian swale 350mm	270.590	270.240	0.000	270.074	269.724	0.000
9.004	25.117	11.7	1400	Trian swale 350mm	272.743	272.393	0.000	270.590	270.240	0.000
9.003	27.974	11.0	1400	Trian swale 350mm	275.290	274.940	0.000	272.743	272.393	0.000
9.002	31.840	9.6	1400	Trian swale 350mm	278.615	278.265	0.000	275.290	274.940	0.000
9.001	29.275	16.3	1400	Trian swale 350mm	280.410	280.060	0.000	278.615	278.265	0.000
9.000	26.229	12.2	1400	Trian swale 350mm	282.566	282.216	0.000	280.410	280.060	0.000

Link	US Node	Node Type	DS Node	Node Type
4.003	34	Junction	35	Junction
4.002	33	Junction	34	Junction
4.001	32	Junction	33	Junction
4.000	31	Junction	32	Junction
9.014	81	Junction	81_OUT	Junction
9.013	80	Junction	81	Junction
9.012	79	Junction	80	Junction
9.011	78	Junction	79	Junction
9.010	76	Junction	78	Junction
10.000	77	Junction	78	Junction
9.009	75	Junction	76	Junction
9.008	74	Junction	75	Junction
9.007	73	Junction	74	Junction
9.006	72	Junction	73	Junction
9.005	71	Junction	72	Junction
9.004	70	Junction	71	Junction
9.003	69	Junction	70	Junction
9.002	68	Junction	69	Junction
9.001	67	Junction	68	Junction
9.000	66	Junction	67	Junction

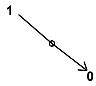
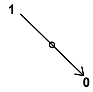
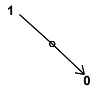
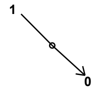
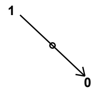
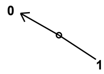
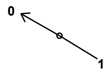
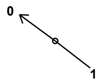
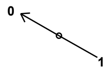
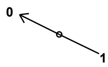
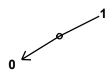
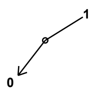
Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Connections	Link	IL (m)	Dia (mm)
31	301055.947	196474.370	326.104	0.350	0	4.000	325.754	1400
32	301079.974	196435.042	325.400	0.350	1	4.000	325.050	1400
					0	4.001	325.050	1400
37	301197.914	196321.002	323.745	0.500	1	4.005	323.395	1400
					0	4.006	323.245	500
48	301067.270	196317.940	293.455	0.350	0	6.000	293.105	1400
53	301138.995	196258.979	292.530	0.500	1	6.004	292.180	1400
					2	4.009	292.030	500
					0	4.010	292.030	500
46	301170.237	196291.867	308.730	0.500	1	5.006	308.380	1400
					2	4.007	308.230	500
					0	4.008	308.230	500
39	301035.850	196426.929	310.646	0.350	0	5.000	310.296	1400
56	301096.312	196213.138	268.003	0.500	1	4.012	267.503	500
					2	1.019	267.503	500
					0	1.020	267.503	750
1	301174.036	196289.567	308.686	0.350	0	1.000	308.336	1400
8	301302.967	196165.496	306.897	0.500	1	1.006	306.547	1400
					0	1.007	306.397	500
17	301270.067	196131.275	290.683	0.500	1	2.006	290.333	1400
					2	1.008	290.183	500
					0	1.009	290.183	500
22	301262.636	196122.897	286.500	0.500	1	1.010	286.000	500
					2	3.002	286.000	500
					0	1.011	286.000	500
10	301142.813	196254.689	292.469	0.350	0	2.000	292.119	1400

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Connections	Link	IL (m)	Dia (mm)
19	301345.263	196085.730	301.269	0.500				
					0	3.000	300.769	500
20	301312.300	196095.760	294.671	0.500	1	3.000	294.171	500
					0	3.001	294.171	500
26	301183.626	196168.705	278.587	0.500	1	1.014	278.087	500
					0	1.015	278.087	500
33	301115.327	196400.931	324.914	0.350	1	4.001	324.564	1400
					0	4.002	324.564	1400
21	301287.682	196109.016	289.845	0.500	1	3.001	289.345	500
					0	3.002	289.345	500
79	301080.978	196193.883	259.595	0.500	1	9.011	259.095	500
					0	9.012	259.095	500
35	301170.656	196347.331	324.124	0.350	1	4.003	323.774	1400
					0	4.004	323.774	1400
78	301087.610	196201.918	266.614	0.500	1	10.000	266.114	500
					2	9.010	266.264	1400
					0	9.011	266.114	500
66	301346.293	196028.882	282.566	0.350				
					0	9.000	282.216	1400
72	301201.655	196115.312	270.074	0.350	1	9.005	269.724	1400
					0	9.006	269.724	1400
76	301108.271	196185.495	267.342	0.350	1	9.009	266.992	1400
					0	9.010	266.992	1400
41	301071.236	196391.133	310.086	0.350	1	5.001	309.736	1400
					0	5.002	309.736	1400
43	301124.260	196338.685	309.386	0.350	1	5.003	309.036	1400
					0	5.004	309.036	1400

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Connections		Link	IL (m)	Dia (mm)
50	301106.166	196285.949	292.951	0.350		1	6.001	292.601	1400
						0	6.002	292.601	1400
3	301207.543	196257.132	308.220	0.350		1	1.001	307.870	1400
						0	1.002	307.870	1400
5	301259.126	196208.718	307.740	0.350		1	1.003	307.390	1400
						0	1.004	307.390	1400
12	301180.742	196216.787	291.933	0.350		1	2.001	291.583	1400
						0	2.002	291.583	1400
14	301222.816	196177.884	291.360	0.350		1	2.003	291.010	1400
						0	2.004	291.010	1400
68	301298.894	196057.715	278.615	0.350		1	9.001	278.265	1400
						0	9.002	278.265	1400
70	301247.311	196087.973	272.743	0.350		1	9.003	272.393	1400
						0	9.004	272.393	1400
74	301155.512	196150.795	269.631	0.350		1	9.007	269.281	1400
						0	9.008	269.281	1400
24	301223.663	196145.414	282.550	0.500		1	1.012	282.050	500
						0	1.013	282.050	500
28	301141.532	196190.712	273.692	0.500		1	1.016	273.192	500
						0	1.017	273.192	500
80	301066.595	196186.624	251.120	0.500		1	9.012	250.620	500
						0	9.013	250.620	500
81	301053.072	196178.233	244.007	0.500		1	9.013	243.507	500
						0	9.014	243.507	500
81_OUT	301042.922	196165.140	236.893	0.500		1	9.014	236.393	500

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Connections	Link	IL (m)	Dia (mm)
58	301065.580	196227.882	266.422	0.500	1	1.021	265.922	750
					0	1.022	265.922	750
61	301036.396	196242.239	263.892	0.500	1	1.023	263.392	750
					2	7.000	263.642	1000
					0	1.024	263.392	750
23	301242.578	196134.767	284.526	0.500	1	1.011	284.026	500
					0	1.012	284.026	500
63	301015.256	196254.329	261.375	0.500	1	8.000	261.125	1000
					2	1.024	260.875	750
					0	1.025	260.875	750
64	300993.688	196266.918	258.612	0.500	1	1.025	258.112	750
					0	1.026	258.112	750
38	301195.173	196317.869	322.679	0.500	1	4.006	322.179	500
					0	4.007	322.179	500
47	301167.700	196289.284	307.521	0.500	1	4.008	307.021	500
					0	4.009	307.021	500
62	301020.833	196262.040	267.131	0.250	0	8.000	266.881	1000
54	301135.833	196255.964	291.338	0.500	1	4.010	290.838	500
					0	4.011	290.838	500
9	301301.236	196164.158	306.640	0.500	1	1.007	306.140	500
					0	1.008	306.140	500
18	301268.576	196129.672	290.024	0.500	1	1.009	289.524	500
					0	1.010	289.524	500
65	300975.116	196277.348	256.471	0.500	1	1.026	255.971	750
					0	1.027	255.971	750
65_OUT	300948.150	196293.853	253.051	0.500	1	1.027	252.551	750

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Connections	Link	IL (m)	Dia (mm)
30	301101.956	196210.213	268.687	0.919	1	1.018	268.187	500
					0	1.019	267.768	500
55	301099.954	196217.358	270.194	0.500	1	4.011	269.694	500
					0	4.012	269.694	500
77	301092.140	196207.556	267.400	0.500	0	10.000	266.900	500
34	301146.992	196370.522	324.530	0.350	1	4.002	324.180	1400
					0	4.003	324.180	1400
60	301045.240	196254.239	270.390	0.250	0	7.000	270.140	1000
40	301049.747	196412.857	310.429	0.350	1	5.000	310.079	1400
					0	5.001	310.079	1400
42	301098.098	196363.610	309.597	0.350	1	5.002	309.247	1400
					0	5.003	309.247	1400
44	301146.628	196316.155	309.068	0.350	1	5.004	308.718	1400
					0	5.005	308.718	1400
2	301189.690	196274.591	308.470	0.350	1	1.000	308.120	1400
					0	1.001	308.120	1400
4	301232.789	196232.543	307.868	0.350	1	1.002	307.518	1400
					0	1.003	307.518	1400
6	301282.195	196186.741	307.508	0.350	1	1.004	307.158	1400
					0	1.005	307.158	1400
11	301160.600	196237.137	292.219	0.350	1	2.000	291.869	1400
					0	2.001	291.869	1400
13	301201.603	196197.801	291.651	0.350	1	2.002	291.301	1400
					0	2.003	291.301	1400

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Connections	Link	IL (m)	Dia (mm)
15	301247.828	196154.242	291.039	0.350	1	2.004	290.689	1400
					0	2.005	290.689	1400
25	301202.157	196157.709	280.358	0.500	1	1.013	279.858	500
					0	1.014	279.858	500
27	301163.608	196180.027	276.511	0.500	1	1.015	276.011	500
					0	1.016	276.011	500
29	301119.745	196201.548	270.995	0.500	1	1.017	270.495	500
					0	1.018	270.495	500
57	301082.401	196219.858	267.358	0.500	1	1.020	266.858	750
					0	1.021	266.858	750
59	301052.733	196233.848	265.581	0.500	1	1.022	265.081	750
					0	1.023	265.081	750
45	301167.105	196294.867	308.773	0.350	1	5.005	308.423	1400
					0	5.006	308.423	1400
36	301194.282	196324.579	323.814	0.350	1	4.004	323.464	1400
					0	4.005	323.464	1400
52	301135.517	196261.880	292.572	0.350	1	6.003	292.222	1400
					0	6.004	292.222	1400
7	301300.593	196167.599	306.929	0.350	1	1.005	306.579	1400
					0	1.006	306.579	1400
16	301268.038	196133.300	290.725	0.350	1	2.005	290.375	1400
					0	2.006	290.375	1400
49	301086.711	196302.800	293.403	0.350	1	6.000	293.053	1400
					0	6.001	293.053	1400
51	301122.992	196272.987	292.931	0.350	1	6.002	292.581	1400
					0	6.003	292.581	1400

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Connections	Link	IL (m)	Dia (mm)
67	301323.475	196041.816	280.410	0.350	1	9.000	280.060	1400
					0	9.001	280.060	1400
69	301271.143	196073.324	275.290	0.350	1	9.002	274.940	1400
					0	9.003	274.940	1400
71	301225.519	196100.462	270.590	0.350	1	9.004	270.240	1400
					0	9.005	270.240	1400
73	301176.356	196134.680	269.685	0.350	1	9.006	269.335	1400
					0	9.007	269.335	1400
75	301131.934	196168.135	268.300	0.350	1	9.008	267.950	1400
					0	9.009	267.950	1400

Simulation Settings

Rainfall Methodology	FSR	Skip Steady State	✓
FSR Region	England and Wales	Drain Down Time (mins)	360
M5-60 (mm)	20.000	Additional Storage (m^3/ha)	20.0
Ratio-R	0.200	Check Discharge Rate(s)	x
Summer CV	0.750	Check Discharge Volume	✓
Winter CV	0.840	100 year 360 minute (m^3)	
Analysis Speed	Detailed		

Storm Durations

15	30	60	120	180	240	360	480	600	720	960	1440

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
2	0	0	0
5	0	0	0
30	0	0	0
100	0	0	0
100	40	0	0

Pre-development Discharge Volume

Site Makeup	Greenfield	Return Period (years)	100
Greenfield Method	FSR/FEH	Climate Change (%)	0
Positively Drained Area (ha)	2.712	Storm Duration (mins)	360
Soil Index	5	Betterment (%)	0
SPR	0.53	PR	
CWI		Runoff Volume (m^3)	

Node 56 Offline Weir Control

Flap Valve	x	Invert Level (m)	267.750	Discharge Coefficient	0.590
Loop to Node	77	Width (m)	1.000		

Node 20 Online Orifice Control

Flap Valve	x	Invert Level (m)	294.171	Discharge Coefficient	0.600
Replaces Downstream Link	x	Diameter (m)	0.150		

Node 20 Online Weir Control

Flap Valve	x	Invert Level (m)	294.571	Discharge Coefficient	0.590
Replaces Downstream Link	x	Width (m)	2.100		

Node 21 Online Orifice Control

Flap Valve	x	Invert Level (m)	289.345	Discharge Coefficient	0.600
Replaces Downstream Link	x	Diameter (m)	0.150		

Node 21 Online Weir Control

Flap Valve	x	Invert Level (m)	289.745	Discharge Coefficient	0.590
Replaces Downstream Link	x	Width (m)	2.100		

Node 23 Online Orifice Control

Flap Valve	x	Invert Level (m)	284.026	Discharge Coefficient	0.600
Replaces Downstream Link	x	Diameter (m)	0.100		

Node 23 Online Weir Control

Flap Valve	x	Invert Level (m)	284.426	Discharge Coefficient	0.590
Replaces Downstream Link	x	Width (m)	2.100		

Node 24 Online Orifice Control

Flap Valve	x	Invert Level (m)	282.050	Discharge Coefficient	0.600
Replaces Downstream Link	x	Diameter (m)	0.100		

Node 24 Online Weir Control

Flap Valve	x	Invert Level (m)	282.345	Discharge Coefficient	0.590
Replaces Downstream Link	x	Width (m)	2.100		

Node 25 Online Orifice Control

Flap Valve	x	Invert Level (m)	279.858	Discharge Coefficient	0.600
Replaces Downstream Link	x	Diameter (m)	0.100		

Node 25 Online Weir Control

Flap Valve	x	Invert Level (m)	280.258	Discharge Coefficient	0.590
Replaces Downstream Link	x	Width (m)	2.100		

Node 26 Online Orifice Control

Flap Valve	x	Invert Level (m)	278.087	Discharge Coefficient	0.600
Replaces Downstream Link	x	Diameter (m)	0.100		

Node 26 Online Weir Control

Flap Valve	x	Invert Level (m)	278.487	Discharge Coefficient	0.590
Replaces Downstream Link	x	Width (m)	2.100		

Node 27 Online Orifice Control

Flap Valve	x	Invert Level (m)	276.011	Discharge Coefficient	0.600
Replaces Downstream Link	x	Diameter (m)	0.100		

Node 27 Online Weir Control

Flap Valve	x	Invert Level (m)	276.411	Discharge Coefficient	0.590
Replaces Downstream Link	x	Width (m)	2.100		

Node 28 Online Orifice Control

Flap Valve	x	Invert Level (m)	273.192	Discharge Coefficient	0.600
Replaces Downstream Link	x	Diameter (m)	0.100		

Node 28 Online Weir Control

Flap Valve	x	Invert Level (m)	273.592	Discharge Coefficient	0.590
Replaces Downstream Link	x	Width (m)	2.100		

Node 29 Online Orifice Control

Flap Valve	x	Invert Level (m)	270.495	Discharge Coefficient	0.600
Replaces Downstream Link	x	Diameter (m)	0.100		

Node 29 Online Weir Control

Flap Valve	x	Invert Level (m)	270.895	Discharge Coefficient	0.590
Replaces Downstream Link	x	Width (m)	2.100		

Node 30 Online Orifice Control

Flap Valve	x	Invert Level (m)	267.768	Discharge Coefficient	0.600
Replaces Downstream Link	x	Diameter (m)	0.100		

Node 30 Online Weir Control

Flap Valve	x	Invert Level (m)	268.587	Discharge Coefficient	0.590
Replaces Downstream Link	x	Width (m)	2.100		

Node 57 Online Orifice Control

Flap Valve	x	Invert Level (m)	266.858	Discharge Coefficient	0.600
Replaces Downstream Link	x	Diameter (m)	0.150		

Node 57 Online Weir Control

Flap Valve	x	Invert Level (m)	267.158	Discharge Coefficient	0.590
Replaces Downstream Link	x	Width (m)	1.950		

Node 58 Online Orifice Control

Flap Valve	x	Invert Level (m)	265.922	Discharge Coefficient	0.600
Replaces Downstream Link	x	Diameter (m)	0.150		

Node 58 Online Weir Control

Flap Valve	x	Invert Level (m)	266.222	Discharge Coefficient	0.590
Replaces Downstream Link	x	Width (m)	1.950		

Node 59 Online Orifice Control

Flap Valve	x	Invert Level (m)	265.081	Discharge Coefficient	0.600
Replaces Downstream Link	x	Diameter (m)	0.150		

Node 59 Online Weir Control

Flap Valve	x	Invert Level (m)	265.381	Discharge Coefficient	0.590
Replaces Downstream Link	x	Width (m)	1.950		

Node 36 Online V-Notch Weir Control

Flap Valve	x	Invert Level (m)	323.464	Discharge Coefficient	0.590
Replaces Downstream Link	x	Angle of V (degrees)	120.000		

Node 45 Online V-Notch Weir Control

Flap Valve	x	Invert Level (m)	308.423	Discharge Coefficient	0.590
Replaces Downstream Link	x	Angle of V (degrees)	120.000		

Node 52 Online V-Notch Weir Control

Flap Valve	x	Invert Level (m)	292.222	Discharge Coefficient	0.590
Replaces Downstream Link	x	Angle of V (degrees)	120.000		

Node 7 Online V-Notch Weir Control

Flap Valve	x	Invert Level (m)	306.579	Discharge Coefficient	0.590
Replaces Downstream Link	x	Angle of V (degrees)	120.000		

Node 16 Online V-Notch Weir Control

Flap Valve	x	Invert Level (m)	290.375	Discharge Coefficient	0.590
Replaces Downstream Link	x	Angle of V (degrees)	120.000		

Node 67 Online Orifice Control

Flap Valve	x	Invert Level (m)	280.060	Discharge Coefficient	0.600
Replaces Downstream Link	x	Diameter (m)	0.150		

Node 67 Online Weir Control

Flap Valve	x	Invert Level (m)	280.310	Discharge Coefficient	0.590
Replaces Downstream Link	x	Width (m)	1.000		

Node 68 Online Orifice Control

Flap Valve	x	Invert Level (m)	278.265	Discharge Coefficient	0.600
Replaces Downstream Link	x	Diameter (m)	0.150		

Node 68 Online Weir Control

Flap Valve	x	Invert Level (m)	278.515	Discharge Coefficient	0.590
Replaces Downstream Link	x	Width (m)	1.000		

Node 69 Online Orifice Control

Flap Valve	x	Invert Level (m)	274.940	Discharge Coefficient	0.600
Replaces Downstream Link	x	Diameter (m)	0.150		

Node 69 Online Weir Control

Flap Valve	x	Invert Level (m)	275.190	Discharge Coefficient	0.590
Replaces Downstream Link	x	Width (m)	1.000		

Node 70 Online Orifice Control

Flap Valve	x	Invert Level (m)	272.393	Discharge Coefficient	0.600
Replaces Downstream Link	x	Diameter (m)	0.150		

Node 70 Online Weir Control

Flap Valve	x	Invert Level (m)	272.643	Discharge Coefficient	0.590
Replaces Downstream Link	x	Width (m)	1.000		

Node 71 Online Orifice Control

Flap Valve	x	Invert Level (m)	270.240	Discharge Coefficient	0.600
Replaces Downstream Link	x	Diameter (m)	0.150		

Node 71 Online Weir Control

Flap Valve	x	Invert Level (m)	270.490	Discharge Coefficient	0.590
Replaces Downstream Link	x	Width (m)	1.000		

Node 72 Online Orifice Control

Flap Valve	x	Invert Level (m)	269.724	Discharge Coefficient	0.600
Replaces Downstream Link	x	Diameter (m)	0.150		

Node 72 Online Weir Control

Flap Valve	x	Invert Level (m)	269.974	Discharge Coefficient	0.590
Replaces Downstream Link	x	Width (m)	1.000		

Node 73 Online Orifice Control

Flap Valve	x	Invert Level (m)	269.335	Discharge Coefficient	0.600
Replaces Downstream Link	x	Diameter (m)	0.150		

Node 73 Online Weir Control

Flap Valve	x	Invert Level (m)	269.585	Discharge Coefficient	0.590
Replaces Downstream Link	x	Width (m)	1.000		

Node 74 Online Orifice Control

Flap Valve	x	Invert Level (m)	269.281	Discharge Coefficient	0.600
Replaces Downstream Link	x	Diameter (m)	0.150		

Node 74 Online Weir Control

Flap Valve	x	Invert Level (m)	269.531	Discharge Coefficient	0.590
Replaces Downstream Link	x	Width (m)	1.000		

Node 75 Online Orifice Control

Flap Valve	x	Invert Level (m)	267.950	Discharge Coefficient	0.600
Replaces Downstream Link	x	Diameter (m)	0.150		

Node 75 Online Weir Control

Flap Valve	x	Invert Level (m)	268.200	Discharge Coefficient	0.590
Replaces Downstream Link	x	Width (m)	1.000		

Node 76 Online Orifice Control

Flap Valve	x	Design Depth (m)	0.500	Discharge Coefficient	0.600
Replaces Downstream Link	x	Design Flow (l/s)	20.0		
Invert Level (m)	266.992	Diameter (m)	0.150		

Node 76 Online Weir Control

Flap Valve	x	Invert Level (m)	267.242	Discharge Coefficient	0.590
Replaces Downstream Link	x	Width (m)	1.000		

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)	Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
2 year 15 minute summer	112.777	31.912	2 year 240 minute winter	19.398	7.716
2 year 15 minute winter	79.142	31.912	2 year 360 minute summer	23.988	6.173
2 year 30 minute summer	81.416	23.038	2 year 360 minute winter	15.593	6.173
2 year 30 minute winter	57.134	23.038	2 year 480 minute summer	19.942	5.270
2 year 60 minute summer	61.301	16.200	2 year 480 minute winter	13.249	5.270
2 year 60 minute winter	40.727	16.200	2 year 600 minute summer	17.030	4.658
2 year 120 minute summer	42.559	11.247	2 year 600 minute winter	11.636	4.658
2 year 120 minute winter	28.275	11.247	2 year 720 minute summer	15.715	4.212
2 year 180 minute summer	35.121	9.038	2 year 720 minute winter	10.561	4.212
2 year 180 minute winter	22.829	9.038	2 year 960 minute summer	13.650	3.594
2 year 240 minute summer	29.197	7.716	2 year 960 minute winter	9.042	3.594

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
2 year 1440 minute summer	10.717	2.872
2 year 1440 minute winter	7.203	2.872
5 year 15 minute summer	147.002	41.597
5 year 15 minute winter	103.160	41.597
5 year 30 minute summer	104.975	29.704
5 year 30 minute winter	73.667	29.704
5 year 60 minute summer	77.950	20.600
5 year 60 minute winter	51.788	20.600
5 year 120 minute summer	53.163	14.049
5 year 120 minute winter	35.320	14.049
5 year 180 minute summer	43.395	11.167
5 year 180 minute winter	28.208	11.167
5 year 240 minute summer	35.814	9.465
5 year 240 minute winter	23.794	9.465
5 year 360 minute summer	28.994	7.461
5 year 360 minute winter	18.847	7.461
5 year 480 minute summer	23.941	6.327
5 year 480 minute winter	15.906	6.327
5 year 600 minute summer	20.349	5.566
5 year 600 minute winter	13.904	5.566
5 year 720 minute summer	18.700	5.012
5 year 720 minute winter	12.568	5.012
5 year 960 minute summer	16.127	4.247
5 year 960 minute winter	10.683	4.247
5 year 1440 minute summer	12.542	3.361
5 year 1440 minute winter	8.429	3.361
30 year 15 minute summer	212.586	60.154
30 year 15 minute winter	149.183	60.154
30 year 30 minute summer	155.010	43.862
30 year 30 minute winter	108.779	43.862
30 year 60 minute summer	116.589	30.811
30 year 60 minute winter	77.459	30.811
30 year 120 minute summer	78.946	20.863
30 year 120 minute winter	52.450	20.863
30 year 180 minute summer	63.479	16.335
30 year 180 minute winter	41.263	16.335
30 year 240 minute summer	51.899	13.715
30 year 240 minute winter	34.480	13.715
30 year 360 minute summer	41.522	10.685
30 year 360 minute winter	26.991	10.685
30 year 480 minute summer	33.795	8.931
30 year 480 minute winter	22.452	8.931
30 year 600 minute summer	28.377	7.762
30 year 600 minute winter	19.389	7.762
30 year 720 minute summer	25.804	6.916
30 year 720 minute winter	17.342	6.916
30 year 960 minute summer	21.860	5.756
30 year 960 minute winter	14.481	5.756
30 year 1440 minute summer	16.557	4.437

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
30 year 1440 minute winter	11.127	4.437
100 year 15 minute summer	273.602	77.420
100 year 15 minute winter	192.002	77.420
100 year 30 minute summer	202.154	57.203
100 year 30 minute winter	141.863	57.203
100 year 60 minute summer	153.288	40.510
100 year 60 minute winter	101.841	40.510
100 year 120 minute summer	103.325	27.306
100 year 120 minute winter	68.647	27.306
100 year 180 minute summer	82.228	21.160
100 year 180 minute winter	53.450	21.160
100 year 240 minute summer	66.740	17.637
100 year 240 minute winter	44.341	17.637
100 year 360 minute summer	52.784	13.583
100 year 360 minute winter	34.311	13.583
100 year 480 minute summer	42.569	11.250
100 year 480 minute winter	28.282	11.250
100 year 600 minute summer	35.470	9.702
100 year 600 minute winter	24.235	9.702
100 year 720 minute summer	32.039	8.587
100 year 720 minute winter	21.532	8.587
100 year 960 minute summer	26.838	7.067
100 year 960 minute winter	17.778	7.067
100 year 1440 minute summer	19.990	5.358
100 year 1440 minute winter	13.435	5.358
100 year +40% CC 15 minute summer	383.043	108.388
100 year +40% CC 15 minute winter	268.802	108.388
100 year +40% CC 30 minute summer	283.016	80.084
100 year +40% CC 30 minute winter	198.608	80.084
100 year +40% CC 60 minute summer	214.603	56.713
100 year +40% CC 60 minute winter	142.577	56.713
100 year +40% CC 120 minute summer	144.655	38.228
100 year +40% CC 120 minute winter	96.105	38.228
100 year +40% CC 180 minute summer	115.119	29.624
100 year +40% CC 180 minute winter	74.831	29.624
100 year +40% CC 240 minute summer	93.436	24.692
100 year +40% CC 240 minute winter	62.077	24.692
100 year +40% CC 360 minute summer	73.898	19.016
100 year +40% CC 360 minute winter	48.036	19.016
100 year +40% CC 480 minute summer	59.596	15.750
100 year +40% CC 480 minute winter	39.594	15.750
100 year +40% CC 600 minute summer	49.658	13.583
100 year +40% CC 600 minute winter	33.930	13.583
100 year +40% CC 720 minute summer	44.855	12.022
100 year +40% CC 720 minute winter	30.145	12.022
100 year +40% CC 960 minute summer	37.573	9.894
100 year +40% CC 960 minute winter	24.889	9.894
100 year +40% CC 1440 minute summer	27.987	7.501
100 year +40% CC 1440 minute winter	18.809	7.501

Results for 2 year Critical Storm Duration. Lowest mass balance: 97.13%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	31	11	325.860	0.106	9.7	0.4015	0.0000	OK
15 minute winter	32	12	325.196	0.146	19.5	0.6379	0.0000	OK
30 minute winter	37	22	323.285	0.040	30.1	0.0000	0.0000	OK
15 minute winter	48	11	293.212	0.107	3.6	0.1524	0.0000	OK
30 minute winter	6.000:50%	21	293.200	0.121	5.5	0.8453	0.0000	OK
30 minute winter	53	22	292.104	0.074	90.1	0.0000	0.0000	OK
30 minute winter	46	22	308.286	0.056	63.1	0.0000	0.0000	OK
15 minute winter	39	11	310.403	0.107	8.2	0.3467	0.0000	OK
30 minute winter	56	24	267.650	0.147	178.7	0.2143	0.0000	OK
30 minute winter	1.020:50%	25	267.327	0.147	179.7	2.4060	0.0000	OK
15 minute winter	1	10	308.414	0.078	3.3	0.1002	0.0000	OK
15 minute winter	1.000:50%	11	308.322	0.094	5.5	0.0000	0.0000	OK
30 minute winter	8	24	306.442	0.045	23.7	0.0000	0.0000	OK
30 minute winter	17	25	290.234	0.051	49.6	0.0000	0.0000	OK
30 minute winter	22	24	286.081	0.081	61.6	0.0452	0.0000	OK
15 minute winter	10	10	292.197	0.078	3.4	0.1060	0.0000	OK
15 minute winter	2.000:50%	11	292.087	0.093	5.3	0.0000	0.0000	OK
15 minute winter	19	10	300.783	0.014	4.8	0.0190	0.0000	OK
15 minute winter	3.000:50%	11	297.486	0.016	5.6	0.0010	0.0000	OK
15 minute winter	20	12	294.290	0.119	9.6	0.1345	0.0000	OK
15 minute winter	3.001:50%	11	291.782	0.024	11.2	0.0067	0.0000	OK
30 minute winter	26	25	278.552	0.465	77.7	0.5179	0.0000	OK
15 minute winter	33	13	324.732	0.168	24.5	0.5848	0.0000	OK
15 minute winter	21	12	289.510	0.165	15.1	0.1994	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	31	4.000	32	9.0	0.301	0.041	1.4739	
15 minute winter	32	4.001	33	17.2	0.362	0.097	2.3976	
30 minute winter	37	4.006	38	30.1	1.407	0.008	0.0891	
15 minute winter	48	6.000	6.000:50%	3.3	0.165	0.041	0.3073	
30 minute winter	48	6.000	49	4.9	0.187	0.060	0.3516	
30 minute winter	53	4.010	54	90.1	2.028	0.022	0.1943	
30 minute winter	46	4.008	47	63.0	1.880	0.014	0.1213	
15 minute winter	39	5.000	40	7.9	0.274	0.042	0.5908	
30 minute winter	56	1.020	1.020:50%	178.3	1.173	0.090	1.1822	
15 minute summer	56	Weir	77	0.0				0.0
30 minute winter	56	1.020	57	178.7	0.476	0.091	3.1951	
15 minute winter	1	1.000	1.000:50%	3.2	0.223	0.018	0.1612	
15 minute winter	1	1.000	2	5.4	0.251	0.030	0.2348	
30 minute winter	8	1.007	9	23.7	1.092	0.009	0.0476	
30 minute winter	17	1.009	18	49.6	1.725	0.011	0.0630	
30 minute winter	22	1.011	23	61.7	0.222	0.027	8.0975	
15 minute winter	10	2.000	2.000:50%	3.3	0.233	0.018	0.1838	
15 minute winter	10	2.000	11	5.2	0.246	0.029	0.2644	
15 minute winter	19	3.000	3.000:50%	4.7	0.596	0.001	0.1372	
15 minute winter	19	3.000	20	5.5	0.144	0.002	0.8249	
15 minute winter	20	3.001	3.001:50%	8.8	0.705	0.003	0.1751	
15 minute winter	20	3.001	21	11.0	0.179	0.003	1.0538	
30 minute winter	26	1.015	27	77.5	0.392	0.033	8.4056	
30 minute summer	33	4.002	34	22.6	0.413	0.136	2.4005	
15 minute winter	21	3.002	3.002:50%	14.1	0.738	0.005	0.2751	

Results for 2 year Critical Storm Duration. Lowest mass balance: 97.13%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	3.002:50%	12	287.708	0.036	17.4	0.1324	0.0000	OK
60 minute winter	79	49	259.120	0.025	20.6	0.0000	0.0000	OK
30 minute winter	35	21	323.956	0.182	31.0	0.4750	0.0000	OK
60 minute winter	78	49	266.137	0.023	20.6	0.0000	0.0000	OK
30 minute winter	66	21	282.276	0.060	4.6	0.1509	0.0000	OK
30 minute winter	72	27	269.989	0.265	19.7	0.5428	0.0000	OK
60 minute winter	76	48	267.257	0.265	20.8	0.2009	0.0000	OK
15 minute winter	41	12	309.886	0.150	22.4	0.4569	0.0000	OK
30 minute summer	43	21	309.212	0.176	29.6	0.4405	0.0000	OK
30 minute summer	50	20	292.811	0.209	19.0	0.2480	0.0000	OK
30 minute winter	6.002:50%	21	292.790	0.199	20.0	0.3861	0.0000	OK
15 minute winter	3	12	308.006	0.136	14.6	0.2249	0.0000	OK
15 minute winter	1.002:50%	13	307.839	0.145	17.3	0.0000	0.0000	OK
30 minute winter	5	23	307.580	0.190	22.7	0.3678	0.0000	OK
15 minute winter	12	12	291.716	0.133	13.6	0.1802	0.0000	OK
15 minute winter	2.002:50%	13	291.581	0.139	15.5	0.0000	0.0000	OK
30 minute winter	14	23	291.168	0.158	20.7	0.2865	0.0000	OK
30 minute winter	2.004:50%	24	291.013	0.163	23.2	1.4916	0.0000	OK
30 minute winter	68	22	278.419	0.154	12.7	0.3647	0.0000	OK
30 minute winter	70	26	272.612	0.219	17.5	0.3920	0.0000	OK
60 minute winter	74	46	269.542	0.261	20.1	0.4077	0.0000	OK
30 minute winter	24	24	282.406	0.356	69.6	0.3415	0.0000	OK
30 minute winter	28	25	273.664	0.472	88.0	0.5164	0.0000	OK
30 minute winter	1.017:50%	25	271.936	0.092	89.2	0.0000	0.0000	OK
60 minute winter	80	49	250.647	0.027	20.6	0.0000	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	21	3.002	22	17.4	0.703	0.006	0.4361	
60 minute winter	79	9.012	80	20.6	1.433	0.004	0.2312	
30 minute winter	35	4.004	36	30.3	0.411	0.175	2.4521	
60 minute winter	78	9.011	79	20.6	1.538	0.003	0.1393	
30 minute winter	66	9.000	67	4.6	0.309	0.009	0.5604	
30 minute winter	72	9.006	73	19.4	0.226	0.099	3.1277	
60 minute winter	76	9.010	78	20.6	0.659	0.070	0.8267	
15 minute winter	41	5.002	42	20.9	0.371	0.104	2.2900	
30 minute summer	43	5.004	44	28.4	0.436	0.160	2.0700	
30 minute summer	50	6.002	6.002:50%	18.3	0.224	0.336	0.8875	
30 minute winter	50	6.002	51	19.7	0.329	0.362	0.6531	
15 minute winter	3	1.002	1.002:50%	14.4	0.371	0.081	0.6959	
15 minute winter	3	1.002	4	16.9	0.306	0.095	0.9962	
30 minute winter	5	1.004	6	22.4	0.407	0.148	1.7945	
15 minute winter	12	2.002	2.002:50%	13.5	0.367	0.076	0.5221	
15 minute winter	12	2.002	13	15.2	0.352	0.086	0.6568	
30 minute winter	14	2.004	2.004:50%	20.6	0.409	0.120	0.8864	
30 minute winter	14	2.004	15	22.5	0.423	0.131	0.9158	
30 minute winter	68	9.002	69	12.5	0.391	0.022	1.4369	
30 minute winter	70	9.004	71	16.5	0.358	0.032	1.9038	
60 minute winter	74	9.008	75	20.0	0.357	0.053	2.4274	
30 minute winter	24	1.013	25	69.4	0.390	0.029	8.8190	
30 minute winter	28	1.017	1.017:50%	87.9	1.395	0.033	0.7667	
30 minute winter	28	1.017	29	89.2	0.342	0.034	4.5542	
60 minute winter	80	9.013	81	20.6	1.377	0.004	0.2378	

Results for 2 year Critical Storm Duration. Lowest mass balance: 97.13%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
60 minute winter	81	49	243.534	0.027	20.6	0.0000	0.0000	OK
60 minute winter	81_OUT	49	236.419	0.026	20.6	0.0000	0.0000	OK
60 minute summer	58	39	266.346	0.424	182.4	0.3399	0.0000	OK
60 minute summer	1.022:50%	39	265.637	0.135	183.8	0.4359	0.0000	OK
60 minute summer	61	39	263.513	0.121	197.3	0.1106	0.0000	OK
30 minute winter	23	24	284.481	0.455	62.5	0.3279	0.0000	OK
60 minute summer	63	39	260.995	0.120	202.9	0.4432	0.0000	OK
60 minute summer	1.025:50%	39	259.617	0.124	214.0	1.5254	0.0000	OK
60 minute summer	64	39	258.240	0.128	216.3	0.2689	0.0000	OK
60 minute summer	1.026:50%	39	257.174	0.133	229.3	0.0000	0.0000	OK
30 minute winter	38	22	322.213	0.034	30.1	0.0000	0.0000	OK
30 minute winter	47	22	307.075	0.054	63.0	0.0000	0.0000	OK
15 minute winter	62	10	266.917	0.036	3.1	0.0602	0.0000	OK
30 minute winter	54	22	290.903	0.065	90.1	0.0000	0.0000	OK
30 minute winter	9	24	306.171	0.031	23.7	0.0000	0.0000	OK
30 minute winter	18	25	289.569	0.045	49.6	0.0000	0.0000	OK
60 minute summer	65	39	256.102	0.131	233.6	0.4482	0.0000	OK
60 minute winter	1.027:50%	38	254.393	0.132	238.4	0.0000	0.0000	OK
60 minute winter	65_OUT	38	252.683	0.132	238.1	0.0000	0.0000	OK
60 minute winter	30	40	268.658	0.890	92.3	0.0000	0.0000	FLOOD RISK
30 minute winter	55	22	269.758	0.064	90.0	0.0000	0.0000	OK
15 minute summer	77	1	266.900	0.000	0.0	0.0000	0.0000	OK
30 minute winter	34	21	324.346	0.165	27.5	0.4807	0.0000	OK
15 minute winter	60	10	270.199	0.059	10.9	0.1602	0.0000	OK
15 minute winter	7.000:50%	11	266.959	0.068	14.7	0.0000	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
60 minute winter	81	9.014	81_OUT	20.6	1.388	0.004	0.2455	47.6
60 minute summer	58	1.022	1.022:50%	182.3	1.323	0.078	0.9756	
60 minute summer	58	1.022	59	183.7	0.502	0.078	2.8899	
60 minute summer	61	1.024	63	197.0	1.651	0.064	2.9069	
30 minute winter	23	1.012	24	62.4	0.306	0.026	5.2608	
60 minute summer	63	1.025	1.025:50%	202.7	1.674	0.063	1.5125	
60 minute summer	63	1.025	64	213.6	1.696	0.067	1.5729	
60 minute summer	64	1.026	1.026:50%	216.1	1.644	0.071	1.4012	
60 minute summer	64	1.026	65	229.2	1.719	0.075	1.4206	
30 minute winter	38	4.007	46	30.0	1.125	0.006	0.9696	
30 minute winter	47	4.009	53	62.8	1.580	0.013	1.6769	
15 minute winter	62	8.000	63	3.1	1.265	0.005	0.0230	
30 minute winter	54	4.011	55	90.0	2.220	0.018	2.1366	
30 minute winter	9	1.008	17	23.6	0.999	0.005	1.0837	
30 minute winter	18	1.010	22	49.6	1.261	0.010	0.3626	
60 minute summer	65	1.027	1.027:50%	233.5	1.754	0.074	2.1048	
60 minute winter	65	1.027	65_OUT	238.1	1.774	0.075	2.1221	967.9
60 minute winter	30	1.019	56	92.3	0.916	0.057	0.6501	
30 minute winter	55	4.012	56	89.7	1.427	0.018	0.4342	
15 minute summer	77	10.000	78	0.0	0.000	0.000	0.0341	
30 minute winter	34	4.003	35	26.7	0.444	0.136	2.0058	
15 minute winter	60	7.000	7.000:50%	10.9	1.351	0.023	0.0604	
15 minute winter	60	7.000	61	14.6	1.626	0.031	0.0671	

Results for 2 year Critical Storm Duration. Lowest mass balance: 97.13%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	40	11	310.215	0.136	15.8	0.4313	0.0000	OK
15 minute winter	42	13	309.441	0.194	27.3	0.6029	0.0000	OK
30 minute winter	44	21	308.905	0.187	33.9	0.6281	0.0000	OK
15 minute winter	2	11	308.233	0.113	8.9	0.1659	0.0000	OK
15 minute winter	1.001:50%	12	308.118	0.123	11.1	0.0000	0.0000	OK
15 minute winter	4	12	307.707	0.189	20.1	0.3170	0.0000	OK
30 minute winter	1.003:50%	22	307.642	0.188	21.6	1.8330	0.0000	OK
30 minute winter	6	23	307.300	0.142	23.9	0.1918	0.0000	OK
15 minute winter	11	11	291.981	0.112	8.8	0.1686	0.0000	OK
15 minute winter	2.001:50%	12	291.849	0.123	10.9	0.0000	0.0000	OK
15 minute winter	13	12	291.466	0.165	18.3	0.2685	0.0000	OK
30 minute winter	2.003:50%	23	291.305	0.150	21.0	3.1946	0.0000	OK
30 minute winter	15	24	290.852	0.163	24.2	0.2865	0.0000	OK
30 minute winter	2.005:50%	25	290.700	0.168	26.7	1.6799	0.0000	OK
30 minute winter	25	25	280.319	0.461	70.8	0.5075	0.0000	OK
30 minute winter	27	25	276.478	0.467	80.2	1.1586	0.0000	OK
30 minute winter	1.016:50%	25	274.688	0.087	80.9	0.0000	0.0000	OK
60 minute winter	29	40	270.969	0.474	90.6	0.5788	0.0000	OK
60 minute winter	1.018:50%	40	269.434	0.093	92.3	0.0000	0.0000	OK
60 minute summer	57	39	267.281	0.423	179.7	0.4133	0.0000	OK
60 minute summer	1.021:50%	39	266.531	0.141	181.4	0.1265	0.0000	OK
60 minute summer	59	39	265.505	0.424	183.7	0.0000	0.0000	OK
60 minute summer	1.023:50%	39	264.357	0.120	185.3	0.7907	0.0000	OK
30 minute winter	45	22	308.638	0.215	33.3	0.0000	0.0000	OK
30 minute winter	36	22	323.668	0.204	30.3	0.0000	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	40	5.001	41	15.1	0.382	0.080	1.2363	
15 minute winter	42	5.003	43	25.4	0.376	0.187	2.4447	
30 minute winter	44	5.005	45	33.3	0.417	0.187	2.3830	
15 minute winter	2	1.001	1.001:50%	8.7	0.316	0.049	0.3461	
15 minute winter	2	1.001	3	11.0	0.327	0.062	0.4219	
15 minute winter	4	1.003	1.003:50%	20.1	0.329	0.189	1.1826	
30 minute winter	4	1.003	5	20.2	0.285	0.190	1.2664	
30 minute winter	6	1.005	7	23.7	0.441	0.090	1.4617	
15 minute winter	11	2.001	2.001:50%	8.5	0.315	0.048	0.3928	
15 minute winter	11	2.001	12	10.8	0.331	0.061	0.4686	
15 minute winter	13	2.003	2.003:50%	18.9	0.454	0.106	0.6380	
30 minute winter	13	2.003	14	18.5	0.391	0.104	0.6897	
30 minute winter	15	2.005	2.005:50%	24.1	0.444	0.130	0.7963	
30 minute winter	15	2.005	16	26.0	0.409	0.141	0.9315	
30 minute winter	25	1.014	26	70.5	0.242	0.031	7.8165	
30 minute winter	27	1.016	1.016:50%	79.9	1.373	0.030	0.7132	
30 minute winter	27	1.016	28	80.9	0.273	0.030	4.5378	
60 minute winter	29	1.018	1.018:50%	90.5	1.430	0.033	0.6259	
60 minute winter	29	1.018	30	92.3	0.766	0.034	3.6800	
60 minute summer	57	1.021	1.021:50%	179.8	1.242	0.083	1.3483	
60 minute summer	57	1.021	58	181.3	0.489	0.084	3.8316	
60 minute summer	59	1.023	1.023:50%	183.6	1.545	0.063	1.0914	
60 minute summer	59	1.023	61	184.9	1.548	0.063	1.0971	
30 minute winter	45	5.006	46	33.1	0.625	0.187	0.2335	
30 minute winter	36	4.005	37	30.1	0.632	0.145	0.2460	

Results for 2 year Critical Storm Duration. Lowest mass balance: 97.13%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
30 minute summer	52	20	292.426	0.204	28.3	0.0000	0.0000	OK
30 minute winter	7	24	306.766	0.187	23.7	0.0000	0.0000	OK
30 minute winter	16	25	290.564	0.189	26.0	0.0000	0.0000	OK
30 minute summer	49	19	293.174	0.121	14.1	0.5470	0.0000	OK
15 minute winter	6.001:50%	12	292.956	0.129	16.5	0.0000	0.0000	OK
30 minute summer	51	20	292.729	0.148	26.4	0.5445	0.0000	OK
30 minute summer	6.003:50%	20	292.554	0.152	28.3	0.0000	0.0000	OK
30 minute winter	67	22	280.194	0.134	8.8	0.3031	0.0000	OK
30 minute winter	69	24	275.136	0.196	16.2	0.4231	0.0000	OK
30 minute winter	71	26	270.498	0.258	18.5	0.4635	0.0000	OK
60 minute winter	73	44	269.613	0.278	19.8	0.4333	0.0000	OK
60 minute winter	75	47	268.214	0.264	20.6	0.3056	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
30 minute winter	52	6.004	53	28.2	0.590	0.165	0.2214	
30 minute winter	7	1.006	8	23.7	0.591	0.132	0.1291	
30 minute winter	16	2.006	17	26.0	0.645	0.121	0.1168	
30 minute summer	49	6.001	6.001:50%	13.9	0.447	0.059	0.4026	
15 minute winter	49	6.001	50	16.5	0.297	0.070	0.7681	
30 minute summer	51	6.003	6.003:50%	26.3	0.584	0.101	0.3775	
30 minute summer	51	6.003	52	28.3	0.447	0.109	0.5411	
30 minute winter	67	9.001	68	8.5	0.326	0.019	0.8769	
30 minute winter	69	9.003	70	15.1	0.391	0.028	1.5711	
30 minute winter	71	9.005	72	18.0	0.279	0.075	2.4605	
60 minute winter	73	9.007	74	19.2	0.204	0.239	3.1539	
60 minute winter	75	9.009	76	20.5	0.341	0.064	2.5212	

Results for 5 year Critical Storm Duration. Lowest mass balance: 97.13%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	31	11	325.871	0.117	12.6	0.4452	0.0000	OK
15 minute winter	32	12	325.213	0.163	25.7	0.7107	0.0000	OK
30 minute winter	37	22	323.293	0.048	39.9	0.0000	0.0000	OK
15 minute winter	48	11	293.225	0.119	4.7	0.1706	0.0000	OK
30 minute winter	6.000:50%	21	293.213	0.134	7.1	1.0376	0.0000	OK
30 minute winter	53	22	292.116	0.086	119.0	0.0000	0.0000	OK
30 minute winter	46	22	308.296	0.066	83.6	0.0000	0.0000	OK
15 minute winter	39	11	310.414	0.118	10.7	0.3828	0.0000	OK
30 minute winter	56	23	267.675	0.172	237.6	0.2502	0.0000	OK
30 minute winter	1.020:50%	24	267.352	0.172	239.5	3.2908	0.0000	OK
15 minute winter	1	10	308.422	0.086	4.3	0.1107	0.0000	OK
15 minute winter	1.000:50%	11	308.332	0.104	7.1	0.0000	0.0000	OK
30 minute winter	8	24	306.450	0.052	31.3	0.0000	0.0000	OK
30 minute winter	17	24	290.243	0.060	65.7	0.0000	0.0000	OK
30 minute winter	22	23	286.096	0.096	83.6	0.0533	0.0000	OK
15 minute winter	10	10	292.206	0.087	4.5	0.1178	0.0000	OK
15 minute winter	2.000:50%	11	292.097	0.103	6.9	0.0000	0.0000	OK
15 minute winter	19	10	300.786	0.017	6.3	0.0223	0.0000	OK
15 minute winter	3.000:50%	11	297.489	0.018	7.4	0.0014	0.0000	OK
15 minute winter	20	11	294.314	0.143	12.6	0.1619	0.0000	OK
15 minute winter	3.001:50%	11	291.787	0.029	14.7	0.0094	0.0000	OK
30 minute winter	26	25	278.567	0.480	100.8	0.5342	0.0000	OK
15 minute winter	33	12	324.751	0.187	32.9	0.6513	0.0000	OK
15 minute winter	21	13	289.561	0.216	20.0	0.2606	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	31	4.000	32	11.9	0.319	0.054	1.8197	
15 minute winter	32	4.001	33	22.9	0.384	0.129	3.0107	
30 minute winter	37	4.006	38	39.9	1.547	0.010	0.1074	
15 minute winter	48	6.000	6.000:50%	4.3	0.173	0.053	0.3898	
30 minute winter	48	6.000	49	6.5	0.202	0.080	0.4317	
30 minute winter	53	4.010	54	119.2	2.211	0.029	0.2357	
30 minute winter	46	4.008	47	83.7	2.058	0.018	0.1472	
15 minute winter	39	5.000	40	10.3	0.292	0.055	0.7239	
30 minute winter	56	1.020	1.020:50%	237.6	1.273	0.120	1.4487	
15 minute summer	56	Weir	77	0.0				0.0
30 minute winter	56	1.020	57	238.4	0.556	0.121	3.6187	
15 minute winter	1	1.000	1.000:50%	4.2	0.237	0.023	0.1966	
15 minute winter	1	1.000	2	7.0	0.267	0.040	0.2884	
30 minute winter	8	1.007	9	31.3	1.202	0.012	0.0573	
30 minute winter	17	1.009	18	65.5	1.890	0.015	0.0760	
30 minute winter	22	1.011	23	83.3	0.276	0.036	8.6576	
15 minute winter	10	2.000	2.000:50%	4.3	0.248	0.024	0.2264	
15 minute winter	10	2.000	11	6.8	0.263	0.038	0.3266	
15 minute winter	19	3.000	3.000:50%	6.2	0.659	0.002	0.1631	
15 minute winter	19	3.000	20	7.3	0.152	0.002	1.0520	
15 minute winter	20	3.001	3.001:50%	11.6	0.779	0.004	0.2088	
15 minute winter	20	3.001	21	14.6	0.187	0.004	1.5178	
30 minute winter	26	1.015	27	100.7	0.389	0.042	8.9658	
15 minute winter	33	4.002	34	30.4	0.445	0.183	3.0013	
15 minute winter	21	3.002	3.002:50%	17.7	0.801	0.007	0.3186	

Results for 5 year Critical Storm Duration. Lowest mass balance: 97.13%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	3.002:50%	12	287.714	0.041	21.9	0.1722	0.0000	OK
60 minute winter	79	44	259.126	0.031	28.7	0.0000	0.0000	OK
30 minute winter	35	21	323.977	0.203	41.0	0.5284	0.0000	OK
60 minute winter	78	44	266.143	0.028	28.7	0.0000	0.0000	OK
30 minute winter	66	20	282.282	0.066	6.0	0.1661	0.0000	OK
30 minute winter	72	25	270.002	0.278	25.2	0.5702	0.0000	OK
60 minute winter	76	44	267.276	0.284	28.9	0.2149	0.0000	OK
15 minute winter	41	12	309.903	0.166	29.3	0.5076	0.0000	OK
15 minute winter	43	13	309.232	0.196	39.8	0.4906	0.0000	OK
30 minute summer	50	20	292.831	0.230	24.8	0.2720	0.0000	OK
15 minute winter	6.002:50%	13	292.810	0.219	26.6	0.4644	0.0000	OK
15 minute winter	3	12	308.021	0.151	19.3	0.2494	0.0000	OK
15 minute winter	1.002:50%	12	307.855	0.161	22.7	0.0000	0.0000	OK
30 minute winter	5	22	307.600	0.210	29.8	0.4056	0.0000	OK
15 minute winter	12	12	291.731	0.148	18.0	0.2003	0.0000	OK
15 minute winter	2.002:50%	12	291.597	0.155	20.5	0.0000	0.0000	OK
30 minute winter	14	22	291.186	0.176	27.3	0.3183	0.0000	OK
30 minute winter	2.004:50%	23	291.031	0.181	30.6	1.8380	0.0000	OK
30 minute winter	68	23	278.463	0.198	16.8	0.4691	0.0000	OK
30 minute winter	70	25	272.652	0.259	20.9	0.4645	0.0000	OK
60 minute winter	74	42	269.560	0.279	27.2	0.4354	0.0000	OK
30 minute winter	24	24	282.421	0.371	91.9	0.3556	0.0000	OK
30 minute winter	28	25	273.679	0.487	112.6	0.5329	0.0000	OK
30 minute winter	1.017:50%	25	271.950	0.106	114.4	0.0000	0.0000	OK
60 minute winter	80	44	250.652	0.032	28.7	0.0000	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	21	3.002	22	21.8	0.745	0.008	0.5595	
60 minute winter	79	9.012	80	28.7	1.611	0.005	0.2866	
30 minute winter	35	4.004	36	40.2	0.440	0.233	3.0218	
60 minute winter	78	9.011	79	28.7	1.730	0.004	0.1726	
30 minute winter	66	9.000	67	5.9	0.332	0.012	0.7041	
30 minute winter	72	9.006	73	24.8	0.243	0.126	3.5343	
60 minute winter	76	9.010	78	28.7	0.714	0.097	1.0630	
15 minute winter	41	5.002	42	27.7	0.393	0.138	2.8609	
15 minute winter	43	5.004	44	37.8	0.473	0.213	2.5410	
15 minute winter	50	6.002	6.002:50%	24.4	0.248	0.447	1.0650	
15 minute winter	50	6.002	51	26.1	0.358	0.478	0.7892	
15 minute winter	3	1.002	1.002:50%	19.0	0.396	0.107	0.8586	
15 minute winter	3	1.002	4	22.3	0.329	0.126	1.2181	
30 minute winter	5	1.004	6	29.5	0.437	0.194	2.1916	
15 minute winter	12	2.002	2.002:50%	17.9	0.393	0.101	0.6469	
15 minute winter	12	2.002	13	20.2	0.380	0.114	0.7968	
30 minute winter	14	2.004	2.004:50%	27.3	0.436	0.159	1.0924	
30 minute winter	14	2.004	15	29.8	0.453	0.173	1.1318	
30 minute winter	68	9.002	69	15.4	0.386	0.027	2.1837	
30 minute winter	70	9.004	71	20.2	0.344	0.039	2.1114	
60 minute winter	74	9.008	75	27.1	0.350	0.071	2.8188	
30 minute winter	24	1.013	25	91.8	0.380	0.039	9.4130	
30 minute winter	28	1.017	1.017:50%	112.7	1.502	0.043	0.9134	
30 minute winter	28	1.017	29	114.5	0.351	0.043	4.8566	
60 minute winter	80	9.013	81	28.6	1.546	0.005	0.2946	

Results for 5 year Critical Storm Duration. Lowest mass balance: 97.13%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
60 minute winter	81	45	243.540	0.033	28.6	0.0000	0.0000	OK
60 minute winter	81_OUT	45	236.425	0.032	28.6	0.0000	0.0000	OK
30 minute winter	58	24	266.376	0.454	243.4	0.3641	0.0000	OK
30 minute winter	1.022:50%	24	265.660	0.158	245.3	0.5978	0.0000	OK
30 minute winter	61	24	263.533	0.141	259.8	0.1288	0.0000	OK
30 minute winter	23	24	284.496	0.470	84.7	0.3388	0.0000	OK
30 minute winter	63	25	261.014	0.139	265.8	0.5144	0.0000	OK
30 minute winter	1.025:50%	25	259.637	0.143	279.3	2.0525	0.0000	OK
30 minute winter	64	25	258.260	0.148	281.9	0.3116	0.0000	OK
30 minute winter	1.026:50%	25	257.195	0.153	297.4	0.0000	0.0000	OK
30 minute winter	38	22	322.219	0.040	39.9	0.0000	0.0000	OK
30 minute winter	47	22	307.084	0.063	83.7	0.0000	0.0000	OK
15 minute winter	62	10	266.920	0.039	4.0	0.0664	0.0000	OK
30 minute winter	54	22	290.914	0.076	119.2	0.0000	0.0000	OK
30 minute winter	9	24	306.176	0.036	31.3	0.0000	0.0000	OK
30 minute winter	18	25	289.577	0.053	65.5	0.0000	0.0000	OK
30 minute winter	65	25	256.122	0.151	302.0	0.5169	0.0000	OK
60 minute summer	1.027:50%	37	254.414	0.153	309.3	0.0000	0.0000	OK
60 minute summer	65_OUT	37	252.703	0.152	308.7	0.0000	0.0000	OK
30 minute winter	30	25	268.674	0.906	118.4	0.0000	0.0000	FLOOD RISK
30 minute winter	55	22	269.769	0.075	119.3	0.0000	0.0000	OK
15 minute summer	77	1	266.900	0.000	0.0	0.0000	0.0000	OK
30 minute summer	34	21	324.364	0.183	36.6	0.5329	0.0000	OK
15 minute winter	60	10	270.202	0.062	12.4	0.1681	0.0000	OK
15 minute winter	7.000:50%	11	266.963	0.072	17.4	0.0000	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
60 minute winter	81	9.014	81_OUT	28.6	1.558	0.006	0.3042	60.1
30 minute winter	58	1.022	1.022:50%	243.3	1.443	0.103	1.1947	
30 minute winter	58	1.022	59	245.0	0.587	0.104	3.2671	
30 minute winter	61	1.024	63	259.0	1.797	0.083	3.5118	
30 minute winter	23	1.012	24	84.5	0.376	0.035	5.7061	
30 minute winter	63	1.025	1.025:50%	265.3	1.820	0.083	1.8240	
30 minute winter	63	1.025	64	279.4	1.840	0.087	1.8964	
30 minute winter	64	1.026	1.026:50%	282.3	1.784	0.092	1.6863	
30 minute winter	64	1.026	65	297.9	1.861	0.097	1.7052	
30 minute winter	38	4.007	46	39.9	1.237	0.008	1.1734	
30 minute winter	47	4.009	53	83.7	1.725	0.018	2.0353	
15 minute winter	62	8.000	63	4.0	1.349	0.007	0.0280	
30 minute winter	54	4.011	55	119.3	2.423	0.024	2.5948	
30 minute winter	9	1.008	17	31.3	1.098	0.007	1.3065	
30 minute winter	18	1.010	22	65.5	1.370	0.013	0.4446	
30 minute winter	65	1.027	1.027:50%	302.7	1.897	0.095	2.5219	
60 minute summer	65	1.027	65_OUT	308.7	1.917	0.097	2.5456	1019.4
30 minute winter	30	1.019	56	118.5	0.976	0.073	0.8060	
30 minute winter	55	4.012	56	119.3	1.517	0.024	0.5373	
15 minute summer	77	10.000	78	0.0	0.000	0.000	0.0386	
30 minute summer	34	4.003	35	35.2	0.479	0.179	2.4625	
15 minute winter	60	7.000	7.000:50%	12.4	1.371	0.026	0.0677	
15 minute winter	60	7.000	61	17.3	1.695	0.036	0.0760	

Results for 5 year Critical Storm Duration. Lowest mass balance: 97.13%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m^3)	Flood (m^3)	Status
15 minute winter	40	11	310.230	0.150	20.7	0.4782	0.0000	OK
15 minute winter	42	12	309.463	0.216	36.5	0.6699	0.0000	OK
30 minute winter	44	21	308.926	0.208	44.9	0.6985	0.0000	OK
15 minute winter	2	11	308.245	0.125	11.6	0.1841	0.0000	OK
15 minute winter	1.001:50%	12	308.132	0.137	14.6	0.0000	0.0000	OK
15 minute winter	4	12	307.726	0.208	26.6	0.3493	0.0000	OK
30 minute winter	1.003:50%	22	307.662	0.208	28.2	2.2491	0.0000	OK
30 minute winter	6	23	307.316	0.158	31.6	0.2131	0.0000	OK
15 minute winter	11	11	291.994	0.125	11.5	0.1876	0.0000	OK
15 minute winter	2.001:50%	12	291.862	0.136	14.4	0.0000	0.0000	OK
15 minute winter	13	12	291.481	0.180	24.4	0.2931	0.0000	OK
30 minute winter	2.003:50%	22	291.321	0.166	27.2	3.9163	0.0000	OK
30 minute winter	15	23	290.870	0.181	32.1	0.3189	0.0000	OK
30 minute winter	2.005:50%	24	290.719	0.187	35.6	2.0815	0.0000	OK
30 minute winter	25	24	280.334	0.475	93.5	0.5240	0.0000	OK
30 minute winter	27	25	276.493	0.482	103.9	1.1961	0.0000	OK
30 minute winter	1.016:50%	25	274.702	0.100	105.3	0.0000	0.0000	OK
30 minute winter	29	25	270.984	0.489	116.0	0.5976	0.0000	OK
30 minute winter	1.018:50%	24	269.447	0.106	118.5	0.0000	0.0000	OK
30 minute winter	57	24	267.311	0.453	239.9	0.4426	0.0000	OK
30 minute winter	1.021:50%	24	266.555	0.165	242.2	0.1735	0.0000	OK
30 minute winter	59	24	265.535	0.454	245.0	0.0000	0.0000	OK
30 minute winter	1.023:50%	24	264.377	0.141	246.8	1.0883	0.0000	OK
30 minute winter	45	22	308.661	0.238	44.1	0.0000	0.0000	OK
30 minute winter	36	22	323.691	0.227	40.2	0.0000	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m^3)	Discharge Vol (m^3)
15 minute winter	40	5.001	41	19.8	0.404	0.105	1.5203	
15 minute winter	42	5.003	43	34.2	0.405	0.252	3.0648	
30 minute winter	44	5.005	45	44.1	0.447	0.248	2.9423	
15 minute winter	2	1.001	1.001:50%	11.5	0.338	0.065	0.4259	
15 minute winter	2	1.001	3	14.5	0.349	0.081	0.5185	
15 minute winter	4	1.003	1.003:50%	26.4	0.353	0.247	1.4614	
30 minute winter	4	1.003	5	26.6	0.305	0.249	1.5473	
30 minute winter	6	1.005	7	31.4	0.473	0.120	1.8028	
15 minute winter	11	2.001	2.001:50%	11.3	0.337	0.064	0.4825	
15 minute winter	11	2.001	12	14.3	0.355	0.080	0.5782	
15 minute winter	13	2.003	2.003:50%	25.1	0.490	0.141	0.7868	
30 minute winter	13	2.003	14	24.3	0.418	0.137	0.8487	
30 minute winter	15	2.005	2.005:50%	32.0	0.476	0.173	0.9848	
30 minute winter	15	2.005	16	34.7	0.439	0.188	1.1536	
30 minute winter	25	1.014	26	93.1	0.295	0.041	8.3323	
30 minute winter	27	1.016	1.016:50%	104.0	1.486	0.039	0.8578	
30 minute winter	27	1.016	28	105.3	0.330	0.039	4.8344	
30 minute winter	29	1.018	1.018:50%	116.1	1.540	0.043	0.7457	
30 minute winter	29	1.018	30	118.4	0.785	0.044	3.9313	
30 minute winter	57	1.021	1.021:50%	240.0	1.353	0.111	1.6527	
30 minute winter	57	1.021	58	242.2	0.572	0.112	4.3365	
30 minute winter	59	1.023	1.023:50%	244.6	1.685	0.084	1.3329	
30 minute winter	59	1.023	61	245.7	1.693	0.084	1.3339	
30 minute winter	45	5.006	46	43.7	0.675	0.247	0.2854	
30 minute winter	36	4.005	37	39.9	0.681	0.193	0.3019	

Results for 5 year Critical Storm Duration. Lowest mass balance: 97.13%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
30 minute summer	52	20	292.448	0.226	37.3	0.0000	0.0000	OK
30 minute winter	7	23	306.786	0.207	31.4	0.0000	0.0000	OK
30 minute winter	16	25	290.586	0.211	34.7	0.0000	0.0000	OK
15 minute winter	49	11	293.188	0.135	19.0	0.6094	0.0000	OK
15 minute winter	6.001:50%	12	292.971	0.143	21.9	0.0000	0.0000	OK
15 minute winter	51	12	292.746	0.165	35.0	0.6053	0.0000	OK
30 minute summer	6.003:50%	20	292.570	0.169	37.2	0.0000	0.0000	OK
30 minute winter	67	20	280.210	0.150	11.3	0.3405	0.0000	OK
30 minute winter	69	25	275.186	0.246	20.0	0.5324	0.0000	OK
30 minute winter	71	25	270.511	0.271	22.5	0.4865	0.0000	OK
60 minute winter	73	41	269.627	0.292	25.9	0.4542	0.0000	OK
60 minute winter	75	43	268.232	0.282	28.3	0.3266	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
30 minute summer	52	6.004	53	37.4	0.638	0.218	0.2702	
30 minute winter	7	1.006	8	31.3	0.638	0.175	0.1578	
30 minute winter	16	2.006	17	34.6	0.694	0.161	0.1440	
15 minute winter	49	6.001	6.001:50%	18.5	0.483	0.079	0.4959	
15 minute winter	49	6.001	50	21.9	0.321	0.093	0.9437	
15 minute winter	51	6.003	6.003:50%	34.8	0.627	0.134	0.4650	
30 minute summer	51	6.003	52	37.3	0.481	0.143	0.6651	
30 minute winter	67	9.001	68	11.3	0.329	0.026	1.3599	
30 minute winter	69	9.003	70	18.1	0.395	0.034	2.1507	
30 minute winter	71	9.005	72	22.3	0.277	0.093	2.7509	
30 minute winter	73	9.007	74	25.4	0.198	0.316	3.6269	
60 minute winter	75	9.009	76	28.2	0.340	0.088	2.9422	

Results for 30 year Critical Storm Duration. Lowest mass balance: 97.13%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	31	11	325.889	0.135	18.2	0.5124	0.0000	OK
15 minute winter	32	12	325.238	0.188	37.5	0.8235	0.0000	OK
30 minute summer	37	21	323.306	0.061	61.1	0.0000	0.0000	OK
30 minute summer	48	19	293.246	0.141	6.5	0.2008	0.0000	OK
30 minute summer	6.000:50%	20	293.235	0.156	10.7	1.4107	0.0000	OK
30 minute winter	53	21	292.139	0.109	182.1	0.0000	0.0000	OK
30 minute summer	46	21	308.314	0.084	128.3	0.0000	0.0000	OK
15 minute winter	39	11	310.432	0.136	15.5	0.4398	0.0000	OK
30 minute winter	56	22	267.707	0.204	328.2	0.2974	0.0000	OK
30 minute winter	1.020:50%	22	267.385	0.205	331.4	4.6711	0.0000	OK
15 minute winter	1	10	308.435	0.099	6.2	0.1274	0.0000	OK
15 minute winter	1.000:50%	11	308.348	0.120	10.3	0.0000	0.0000	OK
30 minute winter	8	23	306.463	0.066	47.5	0.0000	0.0000	OK
30 minute winter	17	24	290.259	0.076	99.9	0.0000	0.0000	OK
30 minute winter	22	23	286.121	0.121	127.2	0.0670	0.0000	OK
15 minute winter	10	10	292.219	0.100	6.5	0.1357	0.0000	OK
15 minute winter	2.000:50%	11	292.113	0.119	10.0	0.0000	0.0000	OK
15 minute winter	19	10	300.790	0.021	9.0	0.0276	0.0000	OK
15 minute winter	3.000:50%	11	297.493	0.023	10.6	0.0021	0.0000	OK
15 minute winter	20	12	294.364	0.193	18.2	0.2185	0.0000	OK
15 minute winter	3.001:50%	11	291.793	0.035	20.4	0.0138	0.0000	OK
30 minute winter	26	21	278.587	0.500	144.6	0.5565	2.5755	FLOOD
15 minute winter	33	12	324.782	0.218	48.9	0.7605	0.0000	OK
15 minute winter	21	13	289.668	0.323	28.1	0.3900	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	31	4.000	32	17.3	0.345	0.079	2.4489	
15 minute winter	32	4.001	33	33.9	0.419	0.192	4.0782	
30 minute summer	37	4.006	38	61.1	1.782	0.015	0.1429	
15 minute winter	48	6.000	6.000:50%	6.2	0.183	0.076	0.5344	
30 minute winter	48	6.000	49	9.9	0.226	0.122	0.5883	
30 minute winter	53	4.010	54	181.9	2.512	0.044	0.3168	
30 minute summer	46	4.008	47	128.0	2.352	0.028	0.1974	
15 minute winter	39	5.000	40	14.9	0.319	0.080	0.9607	
30 minute winter	56	1.020	1.020:50%	328.3	1.394	0.166	1.8283	
15 minute summer	56	Weir	77	0.0				0.0
30 minute winter	56	1.020	57	330.7	0.653	0.168	4.2361	
15 minute winter	1	1.000	1.000:50%	6.0	0.260	0.034	0.2597	
15 minute winter	1	1.000	2	10.2	0.293	0.058	0.3813	
30 minute winter	8	1.007	9	47.5	1.383	0.018	0.0756	
30 minute winter	17	1.009	18	100.0	2.162	0.023	0.1014	
30 minute winter	22	1.011	23	126.8	0.368	0.055	9.6687	
15 minute winter	10	2.000	2.000:50%	6.3	0.272	0.036	0.2998	
15 minute winter	10	2.000	11	9.9	0.289	0.056	0.4341	
15 minute winter	19	3.000	3.000:50%	8.9	0.749	0.003	0.2053	
15 minute winter	19	3.000	20	10.5	0.164	0.003	1.5710	
15 minute winter	20	3.001	3.001:50%	16.1	0.872	0.005	0.2586	
15 minute winter	20	3.001	21	20.3	0.194	0.006	2.7251	
30 minute summer	26	1.015	27	135.5	0.388	0.057	9.6779	
30 minute summer	33	4.002	34	45.9	0.492	0.276	4.1039	
15 minute winter	21	3.002	3.002:50%	23.4	0.887	0.009	0.3823	

Results for 30 year Critical Storm Duration. Lowest mass balance: 97.13%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	3.002:50%	12	287.721	0.048	29.0	0.2394	0.0000	OK
30 minute winter	79	27	259.136	0.041	46.0	0.0000	0.0000	OK
30 minute summer	35	21	324.011	0.237	63.3	0.6191	0.0000	OK
30 minute winter	78	27	266.152	0.038	46.1	0.0000	0.0000	OK
30 minute winter	66	20	282.292	0.076	8.8	0.1920	0.0000	OK
30 minute winter	72	24	270.032	0.308	41.7	0.6312	0.0000	OK
30 minute winter	76	27	267.305	0.313	46.2	0.2367	0.0000	OK
15 minute winter	41	12	309.928	0.192	42.8	0.5862	0.0000	OK
15 minute winter	43	13	309.266	0.230	60.7	0.5764	0.0000	OK
30 minute summer	50	20	292.865	0.264	37.5	0.3126	0.0000	OK
30 minute summer	6.002:50%	20	292.842	0.251	39.7	0.6116	0.0000	OK
30 minute summer	3	19	308.044	0.174	27.7	0.2870	0.0000	OK
15 minute winter	1.002:50%	12	307.880	0.186	33.0	0.0000	0.0000	OK
30 minute winter	5	22	307.633	0.243	45.2	0.4706	0.0000	OK
15 minute winter	12	12	291.754	0.171	26.5	0.2311	0.0000	OK
15 minute winter	2.002:50%	12	291.621	0.179	30.0	0.0000	0.0000	OK
30 minute winter	14	22	291.215	0.205	41.6	0.3724	0.0000	OK
30 minute winter	2.004:50%	23	291.061	0.212	46.5	2.5102	0.0000	OK
30 minute winter	68	23	278.531	0.266	23.3	0.6313	0.0000	OK
30 minute winter	70	24	272.682	0.288	33.1	0.5166	0.0000	OK
30 minute winter	74	26	269.590	0.309	44.6	0.4819	0.0000	OK
30 minute winter	24	24	282.447	0.397	136.8	0.3806	0.0000	OK
60 minute winter	28	34	273.692	0.500	148.3	0.5470	6.6819	FLOOD
30 minute winter	1.017:50%	21	271.961	0.118	139.3	0.0000	0.0000	OK
60 minute winter	80	43	250.663	0.043	46.0	0.0000	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	21	3.002	22	29.0	0.777	0.011	0.7643	
60 minute winter	79	9.012	80	46.0	1.895	0.008	0.3913	
30 minute summer	35	4.004	36	61.4	0.491	0.355	4.1808	
30 minute winter	78	9.011	79	46.0	2.039	0.007	0.2353	
30 minute winter	66	9.000	67	8.7	0.349	0.017	1.2841	
30 minute winter	72	9.006	73	41.3	0.303	0.210	4.6335	
30 minute winter	76	9.010	78	46.1	0.800	0.156	1.5229	
15 minute winter	41	5.002	42	40.6	0.426	0.202	3.8456	
15 minute winter	43	5.004	44	58.2	0.522	0.327	3.5449	
30 minute summer	50	6.002	6.002:50%	36.5	0.279	0.668	1.4091	
30 minute summer	50	6.002	51	39.5	0.404	0.723	1.0594	
30 minute summer	3	1.002	1.002:50%	27.6	0.430	0.155	1.1345	
15 minute winter	3	1.002	4	32.8	0.365	0.184	1.6073	
30 minute winter	5	1.004	6	44.6	0.488	0.294	2.9706	
15 minute winter	12	2.002	2.002:50%	26.2	0.432	0.147	0.8640	
15 minute winter	12	2.002	13	29.9	0.421	0.168	1.0361	
30 minute winter	14	2.004	2.004:50%	41.4	0.483	0.241	1.4902	
30 minute winter	14	2.004	15	45.1	0.502	0.262	1.5469	
30 minute winter	68	9.002	69	22.5	0.388	0.039	2.8394	
30 minute winter	70	9.004	71	33.0	0.367	0.063	2.6428	
30 minute winter	74	9.008	75	44.5	0.407	0.117	3.5492	
30 minute winter	24	1.013	25	137.1	0.391	0.058	10.4418	
120 minute summer	28	1.017	1.017:50%	135.7	1.586	0.052	1.0424	
30 minute winter	28	1.017	29	139.3	0.403	0.053	5.0900	
60 minute winter	80	9.013	81	46.0	1.818	0.009	0.4031	

Results for 30 year Critical Storm Duration. Lowest mass balance: 97.13%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
60 minute winter	81	43	243.551	0.044	46.0	0.0000	0.0000	OK
60 minute winter	81_OUT	43	236.435	0.042	46.1	0.0000	0.0000	OK
30 minute winter	58	22	266.419	0.497	341.1	0.3985	0.0000	OK
30 minute winter	1.022:50%	22	265.692	0.190	344.3	0.8615	0.0000	OK
30 minute winter	61	22	263.562	0.170	369.0	0.1557	0.0000	OK
30 minute winter	23	24	284.522	0.496	128.8	0.3577	0.0000	OK
30 minute winter	63	22	261.046	0.171	385.9	0.6304	0.0000	OK
30 minute winter	1.025:50%	22	259.670	0.176	412.0	3.1074	0.0000	OK
30 minute winter	64	22	258.295	0.183	417.1	0.3844	0.0000	OK
30 minute winter	1.026:50%	22	257.232	0.190	447.4	0.0000	0.0000	OK
30 minute winter	38	22	322.230	0.051	61.0	0.0000	0.0000	OK
30 minute summer	47	22	307.101	0.080	128.0	0.0000	0.0000	OK
15 minute winter	62	10	266.926	0.045	5.8	0.0763	0.0000	OK
30 minute winter	54	22	290.935	0.097	181.9	0.0000	0.0000	OK
30 minute winter	9	23	306.186	0.046	47.5	0.0000	0.0000	OK
30 minute winter	18	24	289.592	0.068	100.0	0.0000	0.0000	OK
30 minute winter	65	22	256.160	0.189	459.5	0.6467	0.0000	OK
30 minute winter	1.027:50%	22	254.452	0.191	469.4	0.0000	0.0000	OK
30 minute winter	65_OUT	22	252.742	0.191	467.2	0.0000	0.0000	OK
30 minute winter	30	21	268.687	0.919	140.6	0.0000	0.0000	FLOOD RISK
30 minute winter	55	22	269.789	0.095	182.1	0.0000	0.0000	OK
15 minute summer	77	1	266.900	0.000	0.0	0.0000	0.0000	OK
30 minute summer	34	20	324.396	0.216	56.3	0.6285	0.0000	OK
15 minute winter	60	10	270.207	0.067	15.3	0.1819	0.0000	OK
15 minute winter	7.000:50%	11	266.971	0.080	22.4	0.0000	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
60 minute winter	81	9.014	81_OUT	46.1	1.833	0.009	0.4162	89.9
30 minute winter	58	1.022	1.022:50%	340.6	1.589	0.145	1.5182	
30 minute winter	58	1.022	59	343.8	0.695	0.146	3.8367	
30 minute winter	61	1.024	63	368.2	1.985	0.119	4.5281	
30 minute winter	23	1.012	24	128.7	0.491	0.054	6.5268	
30 minute winter	63	1.025	1.025:50%	385.0	2.020	0.120	2.3797	
30 minute winter	63	1.025	64	408.9	2.052	0.127	2.4885	
30 minute winter	64	1.026	1.026:50%	415.8	1.985	0.136	2.2320	
30 minute winter	64	1.026	65	446.3	2.086	0.146	2.2785	
30 minute winter	38	4.007	46	61.0	1.421	0.012	1.5664	
30 minute summer	47	4.009	53	128.2	1.977	0.027	2.7297	
15 minute winter	62	8.000	63	5.7	1.480	0.010	0.0369	
30 minute winter	54	4.011	55	182.1	2.755	0.036	3.4830	
30 minute winter	9	1.008	17	47.4	1.257	0.010	1.7317	
30 minute winter	18	1.010	22	100.1	1.545	0.020	0.5961	
30 minute winter	65	1.027	1.027:50%	457.8	2.134	0.144	3.3920	
30 minute winter	65	1.027	65_OUT	467.2	2.162	0.147	3.4159	1045.5
30 minute winter	30	1.019	56	140.6	1.055	0.087	0.9829	
30 minute winter	55	4.012	56	182.1	1.599	0.037	0.6979	
15 minute summer	77	10.000	78	0.0	0.000	0.000	0.0542	
30 minute summer	34	4.003	35	54.6	0.532	0.277	3.4102	
15 minute winter	60	7.000	7.000:50%	15.2	1.416	0.032	0.0809	
15 minute winter	60	7.000	61	22.4	1.808	0.047	0.0923	

Results for 30 year Critical Storm Duration. Lowest mass balance: 97.13%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	40	11	310.253	0.174	30.1	0.5518	0.0000	OK
15 minute winter	42	12	309.498	0.251	54.3	0.7785	0.0000	OK
30 minute summer	44	20	308.961	0.243	69.3	0.8186	0.0000	OK
15 minute winter	2	11	308.264	0.144	16.8	0.2117	0.0000	OK
30 minute summer	1.001:50%	19	308.152	0.157	21.0	0.0000	0.0000	OK
15 minute winter	4	12	307.756	0.238	39.1	0.3999	0.0000	OK
30 minute winter	1.003:50%	22	307.696	0.242	41.8	3.0484	0.0000	OK
30 minute winter	6	22	307.343	0.185	48.3	0.2492	0.0000	OK
15 minute winter	11	11	292.013	0.144	16.7	0.2163	0.0000	OK
15 minute winter	2.001:50%	12	291.883	0.157	21.1	0.0000	0.0000	OK
15 minute winter	13	11	291.505	0.204	36.0	0.3317	0.0000	OK
30 minute winter	2.003:50%	22	291.349	0.193	40.4	5.3283	0.0000	OK
30 minute winter	15	23	290.901	0.212	49.2	0.3730	0.0000	OK
30 minute winter	2.005:50%	24	290.751	0.219	54.2	2.8600	0.0000	OK
30 minute winter	25	23	280.358	0.500	139.5	0.5510	0.5177	FLOOD
60 minute winter	27	36	276.511	0.500	143.0	1.2410	2.5681	FLOOD
30 minute winter	1.016:50%	21	274.718	0.116	138.5	0.0000	0.0000	OK
60 minute winter	29	33	270.995	0.500	143.9	0.6110	4.6147	FLOOD
30 minute winter	1.018:50%	21	269.458	0.117	140.6	0.0000	0.0000	OK
30 minute winter	57	22	267.352	0.494	334.5	0.4835	0.0000	OK
30 minute winter	1.021:50%	22	266.587	0.197	338.3	0.2482	0.0000	OK
30 minute winter	59	22	265.579	0.498	343.8	0.0000	0.0000	OK
30 minute winter	1.023:50%	23	264.407	0.170	347.2	1.5887	0.0000	OK
30 minute summer	45	21	308.703	0.280	67.4	0.0000	0.0000	OK
30 minute summer	36	21	323.731	0.267	61.4	0.0000	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	40	5.001	41	29.1	0.440	0.154	2.0444	
15 minute winter	42	5.003	43	51.3	0.450	0.377	4.1280	
30 minute summer	44	5.005	45	67.4	0.500	0.379	4.0589	
15 minute winter	2	1.001	1.001:50%	16.7	0.370	0.094	0.5649	
30 minute summer	2	1.001	3	20.9	0.382	0.118	0.6854	
15 minute winter	4	1.003	1.003:50%	38.8	0.383	0.363	1.9690	
30 minute winter	4	1.003	5	39.8	0.338	0.373	2.0901	
30 minute winter	6	1.005	7	47.7	0.526	0.182	2.4606	
15 minute winter	11	2.001	2.001:50%	16.6	0.370	0.093	0.6423	
15 minute winter	11	2.001	12	20.8	0.389	0.117	0.7677	
15 minute winter	13	2.003	2.003:50%	36.9	0.535	0.208	1.0485	
30 minute winter	13	2.003	14	36.6	0.463	0.206	1.1583	
30 minute winter	15	2.005	2.005:50%	48.6	0.529	0.263	1.3505	
30 minute winter	15	2.005	16	52.9	0.486	0.286	1.5938	
30 minute winter	25	1.014	26	135.5	0.385	0.060	9.1012	
30 minute summer	27	1.016	1.016:50%	135.7	1.609	0.051	1.0368	
30 minute winter	27	1.016	28	138.5	0.403	0.052	5.1216	
30 minute summer	29	1.018	1.018:50%	135.7	1.617	0.050	0.8366	
30 minute winter	29	1.018	30	140.6	0.773	0.052	4.1319	
30 minute winter	57	1.021	1.021:50%	334.3	1.488	0.155	2.0933	
30 minute winter	57	1.021	58	338.0	0.675	0.156	5.0876	
30 minute winter	59	1.023	1.023:50%	343.3	1.861	0.117	1.6948	
30 minute winter	59	1.023	61	347.2	1.874	0.119	1.7017	
30 minute summer	45	5.006	46	67.4	0.759	0.381	0.3902	
30 minute summer	36	4.005	37	61.1	0.762	0.295	0.4128	

Results for 30 year Critical Storm Duration. Lowest mass balance: 97.13%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
30 minute summer	52	20	292.486	0.264	56.5	0.0000	0.0000	OK
30 minute winter	7	23	306.821	0.242	47.7	0.0000	0.0000	OK
30 minute winter	16	24	290.623	0.248	52.9	0.0000	0.0000	OK
30 minute summer	49	19	293.210	0.157	27.9	0.7076	0.0000	OK
30 minute summer	6.001:50%	19	292.994	0.167	32.7	0.0000	0.0000	OK
30 minute summer	51	19	292.774	0.193	53.4	0.7080	0.0000	OK
30 minute summer	6.003:50%	20	292.599	0.197	56.7	0.0000	0.0000	OK
30 minute winter	67	22	280.268	0.208	16.6	0.4719	0.0000	OK
30 minute winter	69	24	275.220	0.280	29.1	0.6058	0.0000	OK
30 minute winter	71	24	270.540	0.300	37.1	0.5381	0.0000	OK
30 minute winter	73	25	269.663	0.328	43.5	0.5102	0.0000	OK
30 minute winter	75	26	268.261	0.311	45.7	0.3604	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
30 minute summer	52	6.004	53	56.8	0.715	0.332	0.3649	
30 minute winter	7	1.006	8	47.5	0.714	0.266	0.2135	
30 minute winter	16	2.006	17	53.0	0.774	0.246	0.1974	
30 minute summer	49	6.001	6.001:50%	27.6	0.531	0.117	0.6729	
30 minute summer	49	6.001	50	32.6	0.353	0.138	1.2479	
30 minute summer	51	6.003	6.003:50%	52.9	0.697	0.203	0.6351	
30 minute summer	51	6.003	52	56.5	0.535	0.217	0.9068	
30 minute winter	67	9.001	68	15.5	0.332	0.035	2.3612	
30 minute winter	69	9.003	70	28.7	0.390	0.054	2.7087	
30 minute winter	71	9.005	72	37.0	0.319	0.153	3.5083	
30 minute winter	73	9.007	74	42.7	0.240	0.530	4.7089	
30 minute winter	75	9.009	76	45.4	0.394	0.141	3.6973	

Results for 100 year Critical Storm Duration. Lowest mass balance: 97.13%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	31	11	325.903	0.149	23.4	0.5647	0.0000	OK
30 minute summer	32	19	325.259	0.209	48.0	0.9127	0.0000	OK
30 minute summer	37	21	323.317	0.072	81.8	0.0000	0.0000	OK
30 minute summer	48	19	293.263	0.158	8.5	0.2255	0.0000	OK
30 minute summer	6.000:50%	20	293.253	0.174	14.0	1.7480	0.0000	OK
30 minute summer	53	21	292.157	0.127	243.8	0.0000	0.0000	OK
30 minute summer	46	21	308.329	0.099	171.7	0.0000	0.0000	OK
15 minute winter	39	10	310.446	0.150	20.0	0.4848	0.0000	OK
30 minute winter	56	21	267.726	0.223	389.7	0.3254	0.0000	OK
30 minute summer	1.020:50%	22	267.405	0.224	393.0	5.6004	0.0000	OK
15 minute winter	1	10	308.445	0.109	8.0	0.1404	0.0000	OK
15 minute winter	1.000:50%	11	308.360	0.132	13.2	0.0000	0.0000	OK
30 minute winter	8	22	306.473	0.076	60.2	0.0000	0.0000	OK
30 minute winter	17	23	290.270	0.087	128.9	0.0000	0.0000	OK
30 minute winter	22	22	286.138	0.138	164.5	0.0768	0.0000	OK
15 minute winter	10	10	292.229	0.110	8.4	0.1496	0.0000	OK
15 minute winter	2.000:50%	11	292.125	0.131	13.0	0.0000	0.0000	OK
15 minute winter	19	10	300.793	0.024	11.6	0.0321	0.0000	OK
15 minute winter	3.000:50%	11	297.497	0.027	13.7	0.0028	0.0000	OK
15 minute winter	20	12	294.421	0.250	23.5	0.2838	0.0000	OK
30 minute summer	3.001:50%	19	291.798	0.039	25.0	0.0176	0.0000	OK
60 minute winter	26	32	278.587	0.500	148.0	0.5565	8.7026	FLOOD
15 minute winter	33	12	324.806	0.241	64.1	0.8424	0.0000	OK
30 minute summer	21	20	289.755	0.410	34.4	0.4949	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	31	4.000	32	22.4	0.365	0.102	3.0023	
30 minute summer	32	4.001	33	44.6	0.447	0.252	4.9544	
30 minute summer	37	4.006	38	81.8	1.957	0.020	0.1742	
15 minute winter	48	6.000	6.000:50%	8.1	0.189	0.099	0.6661	
30 minute summer	48	6.000	49	13.2	0.249	0.162	0.7383	
30 minute summer	53	4.010	54	243.1	2.736	0.059	0.3887	
30 minute summer	46	4.008	47	171.1	2.568	0.037	0.2413	
15 minute winter	39	5.000	40	19.3	0.340	0.104	1.1653	
30 minute winter	56	1.020	1.020:50%	389.4	1.457	0.197	2.0674	
15 minute summer	56	Weir	77	0.0				0.0
30 minute summer	56	1.020	57	392.9	0.736	0.199	4.4166	
15 minute winter	1	1.000	1.000:50%	7.8	0.276	0.044	0.3143	
15 minute winter	1	1.000	2	13.2	0.312	0.074	0.4622	
30 minute winter	8	1.007	9	60.2	1.496	0.022	0.0887	
30 minute winter	17	1.009	18	128.8	2.338	0.030	0.1207	
30 minute winter	22	1.011	23	163.8	0.451	0.071	9.9908	
15 minute winter	10	2.000	2.000:50%	8.2	0.289	0.046	0.3636	
15 minute winter	10	2.000	11	12.9	0.308	0.072	0.5268	
15 minute winter	19	3.000	3.000:50%	11.5	0.821	0.003	0.2419	
15 minute winter	19	3.000	20	13.5	0.171	0.004	2.2757	
30 minute summer	20	3.001	3.001:50%	19.7	0.939	0.006	0.2952	
30 minute summer	20	3.001	21	25.0	0.190	0.008	3.9457	
15 minute summer	26	1.015	27	135.5	0.388	0.057	9.6779	
15 minute winter	33	4.002	34	60.8	0.529	0.366	5.0449	
30 minute summer	21	3.002	3.002:50%	31.1	0.968	0.012	0.4622	

Results for 100 year Critical Storm Duration. Lowest mass balance: 97.13%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
30 minute winter	3.002:50%	21	287.729	0.056	37.9	0.3253	0.0000	OK
60 minute winter	79	41	259.144	0.049	62.9	0.0000	0.0000	OK
30 minute summer	35	21	324.040	0.266	84.5	0.6935	0.0000	OK
60 minute winter	78	41	266.159	0.045	62.9	0.0000	0.0000	OK
30 minute winter	66	21	282.300	0.084	11.5	0.2122	0.0000	OK
30 minute winter	72	23	270.055	0.331	58.1	0.6776	0.0000	OK
60 minute winter	76	41	267.327	0.335	63.0	0.2535	0.0000	OK
30 minute summer	41	19	309.949	0.213	54.9	0.6484	0.0000	OK
30 minute summer	43	20	309.293	0.257	79.7	0.6429	0.0000	OK
30 minute summer	50	20	292.891	0.290	49.5	0.3433	0.0000	OK
30 minute summer	6.002:50%	20	292.867	0.276	52.6	0.7373	0.0000	OK
30 minute summer	3	19	308.063	0.193	36.2	0.3177	0.0000	OK
30 minute summer	1.002:50%	20	307.899	0.205	43.3	0.0000	0.0000	OK
30 minute winter	5	21	307.652	0.262	55.9	0.5067	0.0000	OK
30 minute summer	12	19	291.772	0.189	34.4	0.2554	0.0000	OK
15 minute winter	2.002:50%	12	291.640	0.198	38.8	0.0000	0.0000	OK
30 minute winter	14	21	291.238	0.228	55.1	0.4127	0.0000	OK
30 minute winter	2.004:50%	23	291.084	0.235	61.2	3.0850	0.0000	OK
30 minute winter	68	23	278.548	0.282	30.4	0.6706	0.0000	OK
30 minute winter	70	23	272.701	0.308	44.9	0.5509	0.0000	OK
60 minute winter	74	40	269.609	0.328	58.5	0.5116	0.0000	OK
30 minute winter	24	20	282.453	0.403	147.7	0.3861	0.0000	OK
60 minute winter	28	30	273.692	0.500	151.0	0.5470	13.5090	FLOOD
30 minute winter	1.017:50%	20	271.962	0.118	140.4	0.0000	0.0000	OK
60 minute winter	80	41	250.671	0.051	62.9	0.0000	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
30 minute winter	21	3.002	22	37.9	0.641	0.014	1.0073	
60 minute winter	79	9.012	80	62.9	2.103	0.011	0.4816	
30 minute summer	35	4.004	36	83.1	0.526	0.480	5.2345	
60 minute winter	78	9.011	79	62.9	2.264	0.010	0.2895	
30 minute winter	66	9.000	67	11.4	0.358	0.022	1.9765	
30 minute winter	72	9.006	73	57.6	0.354	0.293	5.4583	
60 minute winter	76	9.010	78	62.9	0.862	0.213	1.9299	
30 minute summer	41	5.002	42	53.1	0.452	0.265	4.6390	
30 minute summer	43	5.004	44	77.9	0.556	0.437	4.4471	
30 minute summer	50	6.002	6.002:50%	48.5	0.305	0.888	1.6993	
30 minute summer	50	6.002	51	52.3	0.439	0.958	1.2874	
30 minute summer	3	1.002	1.002:50%	36.2	0.460	0.203	1.3923	
30 minute summer	3	1.002	4	42.6	0.391	0.240	1.9602	
30 minute winter	5	1.004	6	55.5	0.515	0.365	3.4852	
30 minute summer	12	2.002	2.002:50%	34.2	0.460	0.192	1.0512	
15 minute winter	12	2.002	13	38.8	0.451	0.218	1.2408	
30 minute winter	14	2.004	2.004:50%	54.5	0.517	0.317	1.8284	
30 minute winter	14	2.004	15	59.4	0.537	0.345	1.9017	
30 minute winter	68	9.002	69	30.0	0.395	0.052	3.2510	
30 minute winter	70	9.004	71	44.7	0.423	0.086	3.0651	
60 minute winter	74	9.008	75	58.3	0.457	0.154	4.1062	
30 minute winter	24	1.013	25	147.9	0.416	0.063	10.5058	
15 minute summer	28	1.017	1.017:50%	135.8	1.590	0.052	1.0451	
30 minute winter	28	1.017	29	140.4	0.406	0.053	5.0930	
60 minute winter	80	9.013	81	62.8	2.016	0.012	0.4961	

Results for 100 year Critical Storm Duration. Lowest mass balance: 97.13%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
60 minute winter	81	42	243.559	0.052	62.8	0.0000	0.0000	OK
60 minute winter	81_OUT	42	236.443	0.050	62.8	0.0000	0.0000	OK
30 minute winter	58	19	266.422	0.500	359.0	0.4010	3.4530	FLOOD
30 minute winter	1.022:50%	20	265.694	0.193	353.4	0.8869	0.0000	OK
30 minute winter	61	20	263.566	0.174	386.4	0.1597	0.0000	OK
30 minute winter	23	20	284.526	0.500	167.1	0.3605	10.8929	FLOOD
30 minute winter	63	20	261.053	0.178	416.1	0.6577	0.0000	OK
30 minute winter	1.025:50%	20	259.680	0.186	453.3	3.4710	0.0000	OK
30 minute winter	64	20	258.307	0.195	467.2	0.4090	0.0000	OK
30 minute winter	1.026:50%	20	257.246	0.204	510.0	0.0000	0.0000	OK
30 minute summer	38	21	322.240	0.061	81.8	0.0000	0.0000	OK
30 minute summer	47	22	307.115	0.094	171.1	0.0000	0.0000	OK
15 minute winter	62	10	266.931	0.050	7.4	0.0837	0.0000	OK
30 minute summer	54	21	290.951	0.113	243.1	0.0000	0.0000	OK
30 minute winter	9	22	306.193	0.053	60.2	0.0000	0.0000	OK
30 minute winter	18	23	289.602	0.078	128.8	0.0000	0.0000	OK
30 minute winter	65	20	256.175	0.204	532.3	0.7004	0.0000	OK
30 minute winter	1.027:50%	20	254.470	0.209	551.6	0.0000	0.0000	OK
30 minute winter	65_OUT	20	252.759	0.208	551.2	0.0000	0.0000	OK
30 minute winter	30	19	268.687	0.919	142.1	0.0000	0.2567	FLOOD
30 minute winter	55	22	269.804	0.110	241.7	0.0000	0.0000	OK
15 minute summer	77	1	266.900	0.000	0.0	0.0000	0.0000	OK
30 minute summer	34	20	324.422	0.242	75.4	0.7016	0.0000	OK
15 minute winter	60	10	270.211	0.071	17.9	0.1930	0.0000	OK
30 minute summer	7.000:50%	18	266.977	0.086	27.2	0.0000	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
60 minute winter	81	9.014	81_OUT	62.8	2.032	0.012	0.5123	117.2
15 minute winter	58	1.022	1.022:50%	349.0	1.606	0.148	1.5441	
30 minute winter	58	1.022	59	353.4	0.707	0.150	3.8748	
30 minute winter	61	1.024	63	386.5	1.996	0.125	4.7350	
15 minute winter	23	1.012	24	135.5	0.508	0.057	6.6478	
30 minute winter	63	1.025	1.025:50%	416.7	2.055	0.130	2.5393	
30 minute winter	63	1.025	64	453.5	2.105	0.141	2.6911	
30 minute winter	64	1.026	1.026:50%	467.2	2.042	0.153	2.4375	
30 minute winter	64	1.026	65	510.0	2.157	0.167	2.5183	
30 minute summer	38	4.007	46	81.3	1.554	0.017	1.9158	
30 minute summer	47	4.009	53	170.6	2.160	0.036	3.3498	
15 minute winter	62	8.000	63	7.3	1.574	0.013	0.0444	
30 minute summer	54	4.011	55	242.2	3.001	0.048	4.2543	
30 minute winter	9	1.008	17	60.1	1.358	0.013	2.0501	
30 minute winter	18	1.010	22	128.8	1.669	0.026	0.7141	
30 minute winter	65	1.027	1.027:50%	532.0	2.216	0.168	3.7955	
30 minute winter	65	1.027	65_OUT	551.2	2.267	0.174	3.8435	1150.5
15 minute winter	30	1.019	56	141.0	1.086	0.087	1.0576	
30 minute winter	55	4.012	56	241.7	1.738	0.049	0.8105	
15 minute summer	77	10.000	78	0.0	0.000	0.000	0.0715	
30 minute summer	34	4.003	35	73.2	0.570	0.372	4.2681	
15 minute winter	60	7.000	7.000:50%	17.8	1.456	0.037	0.0922	
30 minute summer	60	7.000	61	27.1	1.898	0.057	0.1066	

Results for 100 year Critical Storm Duration. Lowest mass balance: 97.13%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	40	11	310.270	0.191	38.9	0.6082	0.0000	OK
15 minute winter	42	12	309.524	0.277	70.9	0.8593	0.0000	OK
30 minute summer	44	21	308.990	0.272	92.5	0.9166	0.0000	OK
15 minute winter	2	11	308.279	0.159	21.7	0.2332	0.0000	OK
30 minute summer	1.001:50%	19	308.168	0.173	27.3	0.0000	0.0000	OK
30 minute summer	4	20	307.781	0.263	51.6	0.4420	0.0000	OK
30 minute winter	1.003:50%	23	307.713	0.259	55.1	4.4885	0.0000	PONDING
30 minute winter	6	21	307.360	0.202	61.1	0.2727	0.0000	OK
15 minute winter	11	11	292.027	0.158	21.6	0.2383	0.0000	OK
30 minute summer	2.001:50%	19	291.899	0.173	27.3	0.0000	0.0000	OK
15 minute winter	13	11	291.523	0.222	46.6	0.3617	0.0000	OK
30 minute winter	2.003:50%	22	291.370	0.214	52.8	6.5454	0.0000	OK
30 minute winter	15	23	290.924	0.235	64.5	0.4136	0.0000	OK
30 minute winter	2.005:50%	23	290.775	0.243	71.1	3.5254	0.0000	OK
60 minute winter	25	33	280.358	0.500	152.8	0.5510	9.8876	FLOOD
60 minute winter	27	31	276.511	0.500	149.9	1.2410	9.2873	FLOOD
30 minute winter	1.016:50%	20	274.718	0.117	139.3	0.0000	0.0000	OK
60 minute winter	29	30	270.995	0.500	146.6	0.6110	9.0213	FLOOD
30 minute winter	1.018:50%	20	269.459	0.117	142.1	0.0000	0.0000	OK
30 minute winter	57	19	267.358	0.500	397.1	0.4890	13.7183	FLOOD
30 minute winter	1.021:50%	20	266.592	0.202	353.4	0.2602	0.0000	OK
30 minute winter	59	19	265.581	0.500	353.4	0.0000	1.4862	FLOOD
30 minute winter	1.023:50%	21	264.408	0.172	355.0	1.6221	0.0000	OK
30 minute summer	45	21	308.736	0.313	91.1	0.0000	0.0000	OK
30 minute summer	36	21	323.762	0.298	83.1	0.0000	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	40	5.001	41	37.7	0.467	0.200	2.4977	
15 minute winter	42	5.003	43	67.9	0.482	0.499	5.0997	
30 minute summer	44	5.005	45	91.1	0.536	0.513	5.0783	
15 minute winter	2	1.001	1.001:50%	21.7	0.395	0.122	0.6868	
30 minute summer	2	1.001	3	27.3	0.408	0.153	0.8383	
30 minute summer	4	1.003	1.003:50%	50.5	0.382	0.473	2.4082	
30 minute winter	4	1.003	5	48.1	0.359	0.450	2.4062	
30 minute winter	6	1.005	7	60.7	0.559	0.231	2.9419	
15 minute winter	11	2.001	2.001:50%	21.5	0.395	0.121	0.7820	
30 minute summer	11	2.001	12	27.1	0.415	0.153	0.9379	
15 minute winter	13	2.003	2.003:50%	47.9	0.570	0.269	1.2727	
30 minute winter	13	2.003	14	48.2	0.495	0.271	1.4200	
30 minute winter	15	2.005	2.005:50%	64.1	0.568	0.347	1.6662	
30 minute winter	15	2.005	16	70.0	0.520	0.379	1.9672	
15 minute winter	25	1.014	26	135.5	0.385	0.060	9.1012	
30 minute winter	27	1.016	1.016:50%	135.8	1.610	0.051	1.0397	
30 minute winter	27	1.016	28	139.3	0.405	0.052	5.1238	
30 minute winter	29	1.018	1.018:50%	135.7	1.617	0.050	0.8404	
30 minute winter	29	1.018	30	142.1	0.774	0.053	4.1378	
15 minute winter	57	1.021	1.021:50%	348.1	1.505	0.161	2.1561	
30 minute winter	57	1.021	58	353.4	0.694	0.163	5.1619	
30 minute winter	59	1.023	1.023:50%	349.6	1.874	0.119	1.7171	
30 minute winter	59	1.023	61	354.7	1.886	0.121	1.7427	
30 minute summer	45	5.006	46	90.4	0.820	0.510	0.4830	
30 minute summer	36	4.005	37	81.8	0.822	0.395	0.5119	

Results for 100 year Critical Storm Duration. Lowest mass balance: 97.13%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
30 minute summer	52	20	292.515	0.293	75.1	0.0000	0.0000	OK
30 minute winter	7	22	306.844	0.265	60.7	0.0000	0.0000	OK
30 minute winter	16	24	290.651	0.276	70.0	0.0000	0.0000	OK
30 minute summer	49	19	293.227	0.174	36.9	0.7860	0.0000	OK
30 minute summer	6.001:50%	19	293.012	0.185	43.2	0.0000	0.0000	OK
30 minute summer	51	19	292.796	0.215	71.0	0.7886	0.0000	OK
30 minute summer	6.003:50%	19	292.621	0.219	75.5	0.0000	0.0000	OK
30 minute winter	67	22	280.322	0.262	21.7	0.5938	0.0000	OK
30 minute winter	69	23	275.238	0.298	38.6	0.6443	0.0000	OK
30 minute winter	71	23	270.560	0.320	51.1	0.5753	0.0000	OK
30 minute winter	73	23	269.685	0.350	61.0	0.5450	1.0783	FLOOD
60 minute winter	75	40	268.282	0.332	61.3	0.3848	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
30 minute summer	52	6.004	53	75.2	0.772	0.439	0.4468	
30 minute winter	7	1.006	8	60.2	0.760	0.337	0.2538	
30 minute winter	16	2.006	17	70.0	0.831	0.325	0.2428	
30 minute summer	49	6.001	6.001:50%	36.6	0.570	0.155	0.8300	
30 minute summer	49	6.001	50	43.1	0.383	0.183	1.5218	
30 minute summer	51	6.003	6.003:50%	70.5	0.749	0.271	0.7882	
30 minute summer	51	6.003	52	75.1	0.575	0.288	1.1176	
30 minute winter	67	9.001	68	20.3	0.344	0.046	2.6921	
30 minute winter	69	9.003	70	38.5	0.402	0.072	3.1215	
30 minute winter	71	9.005	72	50.8	0.368	0.211	4.1424	
30 minute winter	73	9.007	74	54.5	0.268	0.677	5.3806	
60 minute winter	75	9.009	76	61.1	0.448	0.190	4.3268	

Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 97.13%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	31	11	325.923	0.169	32.8	0.6415	0.0000	OK
30 minute summer	32	19	325.288	0.238	67.4	1.0412	0.0000	OK
30 minute summer	37	21	323.333	0.088	118.7	0.0000	0.0000	OK
30 minute summer	48	19	293.288	0.183	11.9	0.2608	0.0000	OK
30 minute summer	6.000:50%	20	293.278	0.199	19.7	2.2830	0.0000	OK
30 minute summer	53	21	292.183	0.153	343.6	0.0000	0.0000	OK
30 minute summer	46	21	308.349	0.119	240.7	0.0000	0.0000	OK
15 minute winter	39	10	310.466	0.170	28.0	0.5511	0.0000	OK
30 minute summer	56	21	267.755	0.252	494.2	0.3680	0.0000	OK
30 minute summer	1.020:50%	21	267.434	0.253	498.9	7.1477	0.0000	OK
15 minute winter	1	10	308.459	0.123	11.2	0.1594	0.0000	OK
15 minute winter	1.000:50%	11	308.378	0.150	18.6	0.0000	0.0000	OK
30 minute winter	8	20	306.480	0.083	71.4	0.0000	0.0000	OK
30 minute winter	17	23	290.284	0.101	166.7	0.0000	0.0000	OK
30 minute winter	22	22	286.161	0.161	219.2	0.0892	0.0000	OK
15 minute winter	10	10	292.244	0.125	11.7	0.1696	0.0000	OK
15 minute winter	2.000:50%	11	292.142	0.148	18.0	0.0000	0.0000	OK
15 minute winter	19	10	300.799	0.030	16.3	0.0392	0.0000	OK
15 minute winter	3.000:50%	10	297.502	0.032	19.2	0.0042	0.0000	OK
30 minute summer	20	20	294.535	0.363	32.3	0.4122	0.0000	OK
30 minute summer	3.001:50%	19	291.804	0.046	32.5	0.0237	0.0000	OK
120 minute winter	26	56	278.587	0.500	147.7	0.5565	17.5298	FLOOD
15 minute winter	33	12	324.840	0.276	91.4	0.9619	0.0000	OK
15 minute winter	21	11	289.773	0.428	46.0	0.5156	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	31	4.000	32	31.4	0.393	0.143	3.9195	
30 minute summer	32	4.001	33	63.4	0.487	0.358	6.4762	
30 minute summer	37	4.006	38	118.7	2.197	0.030	0.2254	
15 minute winter	48	6.000	6.000:50%	11.3	0.198	0.138	0.8835	
30 minute summer	48	6.000	49	19.2	0.274	0.235	0.9680	
30 minute summer	53	4.010	54	343.7	3.018	0.083	0.4981	
30 minute summer	46	4.008	47	240.4	2.837	0.053	0.3070	
15 minute winter	39	5.000	40	27.2	0.368	0.146	1.5034	
30 minute summer	56	1.020	1.020:50%	493.4	1.560	0.250	2.4515	
30 minute summer	56	Weir	77	0.7				0.1
30 minute summer	56	1.020	57	496.7	0.878	0.252	4.6079	
15 minute winter	1	1.000	1.000:50%	11.0	0.300	0.062	0.4052	
15 minute winter	1	1.000	2	18.6	0.340	0.105	0.5977	
30 minute winter	8	1.007	9	71.4	1.580	0.026	0.0996	
30 minute winter	17	1.009	18	166.9	2.529	0.038	0.1446	
30 minute winter	22	1.011	23	218.2	0.569	0.095	10.2771	
15 minute winter	10	2.000	2.000:50%	11.5	0.313	0.064	0.4667	
15 minute winter	10	2.000	11	18.0	0.334	0.101	0.6790	
15 minute winter	19	3.000	3.000:50%	16.2	0.927	0.005	0.3010	
30 minute summer	19	3.000	20	18.8	0.171	0.005	3.9841	
30 minute summer	20	3.001	3.001:50%	25.2	1.029	0.008	0.3482	
30 minute summer	20	3.001	21	32.4	0.187	0.010	4.2384	
15 minute summer	26	1.015	27	135.5	0.388	0.057	9.6779	
15 minute winter	33	4.002	34	88.0	0.579	0.529	6.6676	
30 minute summer	21	3.002	3.002:50%	45.6	1.075	0.017	0.6113	

Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 97.13%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
30 minute summer	3.002:50%	19	287.744	0.072	58.2	0.5303	0.0000	OK
60 minute summer	79	36	259.148	0.053	74.0	0.0000	0.0000	OK
30 minute summer	35	20	324.079	0.305	122.0	0.7968	0.0000	OK
60 minute summer	78	36	266.164	0.049	74.1	0.0000	0.0000	OK
30 minute winter	66	21	282.312	0.095	16.1	0.2407	0.0000	OK
30 minute winter	72	20	270.074	0.350	86.6	0.7175	3.3536	FLOOD
60 minute summer	76	35	267.341	0.349	75.1	0.2642	0.0000	OK
15 minute winter	41	11	309.979	0.243	77.9	0.7401	0.0000	OK
30 minute summer	43	20	309.330	0.294	114.6	0.7364	0.0000	OK
30 minute summer	50	19	292.928	0.327	70.2	0.3876	0.0000	OK
30 minute summer	6.002:50%	20	292.901	0.310	75.1	0.9341	0.0000	OK
30 minute summer	3	19	308.089	0.219	51.0	0.3614	0.0000	OK
30 minute summer	1.002:50%	19	307.927	0.233	61.0	0.0000	0.0000	OK
30 minute summer	5	19	307.661	0.271	63.0	0.5251	0.0000	OK
30 minute summer	12	19	291.798	0.215	48.3	0.2906	0.0000	OK
30 minute summer	2.002:50%	19	291.667	0.225	55.3	0.0000	0.0000	OK
30 minute winter	14	21	291.269	0.259	77.9	0.4691	0.0000	OK
30 minute winter	2.004:50%	23	291.117	0.267	86.2	3.9969	0.0000	OK
30 minute winter	68	22	278.571	0.306	44.9	0.7274	0.0000	OK
30 minute winter	70	22	272.730	0.337	67.4	0.6035	0.0000	OK
60 minute summer	74	34	269.615	0.334	63.9	0.5216	0.0000	OK
30 minute summer	24	18	282.455	0.405	152.9	0.3883	0.0000	OK
120 minute winter	28	54	273.692	0.500	150.8	0.5470	26.3196	FLOOD
30 minute winter	1.017:50%	20	271.963	0.119	142.3	0.0000	0.0000	OK
60 minute summer	80	37	250.676	0.056	73.8	0.0000	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
30 minute summer	21	3.002	22	58.3	0.744	0.022	1.2382	
60 minute summer	79	9.012	80	73.8	2.218	0.013	0.5370	
30 minute summer	35	4.004	36	120.3	0.575	0.695	6.8992	
60 minute summer	78	9.011	79	74.0	2.390	0.011	0.3226	
30 minute winter	66	9.000	67	16.0	0.356	0.031	2.3534	
30 minute winter	72	9.006	73	73.8	0.421	0.376	5.7765	
60 minute summer	76	9.010	78	74.1	0.896	0.251	2.1868	
15 minute winter	41	5.002	42	75.6	0.492	0.377	6.0467	
30 minute summer	43	5.004	44	111.8	0.607	0.628	5.8562	
30 minute summer	50	6.002	6.002:50%	69.3	0.342	1.270	2.1541	
30 minute summer	50	6.002	51	74.5	0.491	1.364	1.6562	
30 minute summer	3	1.002	1.002:50%	51.0	0.501	0.287	1.8059	
30 minute summer	3	1.002	4	60.3	0.427	0.339	2.5224	
30 minute summer	5	1.004	6	62.5	0.529	0.411	3.8120	
30 minute summer	12	2.002	2.002:50%	48.3	0.500	0.272	1.3642	
30 minute summer	12	2.002	13	54.8	0.501	0.308	1.5781	
30 minute winter	14	2.004	2.004:50%	76.6	0.563	0.446	2.3758	
30 minute winter	14	2.004	15	83.8	0.585	0.488	2.4670	
30 minute winter	68	9.002	69	44.4	0.422	0.077	3.9253	
30 minute winter	70	9.004	71	66.8	0.510	0.128	3.7356	
30 minute winter	74	9.008	75	63.4	0.465	0.167	4.3872	
30 minute summer	24	1.013	25	152.3	0.426	0.065	10.5314	
30 minute winter	28	1.017	1.017:50%	135.9	1.600	0.052	1.0529	
30 minute winter	28	1.017	29	142.2	0.411	0.054	5.0980	
60 minute summer	80	9.013	81	74.0	2.125	0.014	0.5544	

Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 97.13%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
60 minute summer	81	37	243.564	0.057	74.0	0.0000	0.0000	OK
60 minute summer	81_OUT	37	236.448	0.055	74.1	0.0000	0.0000	OK
60 minute winter	58	30	266.422	0.500	360.7	0.4010	9.2480	FLOOD
30 minute winter	1.022:50%	20	265.695	0.194	355.4	0.8922	0.0000	OK
30 minute summer	61	19	263.570	0.178	401.3	0.1630	0.0000	OK
60 minute winter	23	30	284.526	0.500	202.5	0.3605	49.6369	FLOOD
30 minute summer	63	19	261.061	0.186	450.5	0.6865	0.0000	OK
30 minute summer	1.025:50%	19	259.690	0.196	499.6	3.8507	0.0000	OK
30 minute summer	64	19	258.318	0.206	522.5	0.4341	0.0000	OK
30 minute summer	1.026:50%	19	257.259	0.218	579.0	0.0000	0.0000	OK
30 minute summer	38	21	322.254	0.075	118.7	0.0000	0.0000	OK
30 minute summer	47	21	307.134	0.113	240.4	0.0000	0.0000	OK
15 minute winter	62	10	266.937	0.056	10.4	0.0951	0.0000	OK
30 minute summer	54	21	290.974	0.136	343.7	0.0000	0.0000	OK
30 minute winter	9	21	306.198	0.058	71.4	0.0000	0.0000	OK
30 minute winter	18	23	289.614	0.090	166.9	0.0000	0.0000	OK
30 minute summer	65	19	256.192	0.221	616.0	0.7565	0.0000	OK
30 minute summer	1.027:50%	19	254.488	0.227	648.4	0.0000	0.0000	OK
30 minute summer	65_OUT	19	252.778	0.227	648.1	0.0000	0.0000	OK
30 minute winter	30	17	268.687	0.919	144.7	0.0000	1.5093	FLOOD
30 minute summer	55	21	269.827	0.133	344.1	0.0000	0.0000	OK
30 minute summer	77	21	266.905	0.005	0.7	0.0000	0.0000	OK
30 minute summer	34	20	324.457	0.277	108.5	0.8036	0.0000	OK
15 minute winter	60	10	270.218	0.078	22.7	0.2109	0.0000	OK
30 minute summer	7.000:50%	18	266.986	0.095	35.7	0.0000	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
60 minute summer	81	9.014	81_OUT	74.1	2.145	0.014	0.5728	132.7
15 minute summer	58	1.022	1.022:50%	349.1	1.606	0.148	1.5461	
30 minute winter	58	1.022	59	355.4	0.710	0.151	3.8779	
30 minute summer	61	1.024	63	401.4	2.005	0.129	4.9387	
15 minute summer	23	1.012	24	135.5	0.508	0.057	6.7106	
30 minute summer	63	1.025	1.025:50%	451.3	2.099	0.141	2.7052	
30 minute summer	63	1.025	64	499.8	2.152	0.156	2.9006	
30 minute summer	64	1.026	1.026:50%	522.6	2.098	0.171	2.6536	
30 minute summer	64	1.026	65	578.9	2.222	0.189	2.7754	
30 minute summer	38	4.007	46	118.6	1.768	0.024	2.4505	
30 minute summer	47	4.009	53	240.0	2.383	0.051	4.2795	
15 minute winter	62	8.000	63	10.3	1.715	0.018	0.0573	
30 minute summer	54	4.011	55	344.1	3.317	0.069	5.4680	
30 minute winter	9	1.008	17	71.4	1.415	0.015	2.3960	
30 minute winter	18	1.010	22	166.9	1.796	0.034	0.8701	
30 minute summer	65	1.027	1.027:50%	615.8	2.296	0.194	4.2401	
30 minute summer	65	1.027	65_OUT	648.1	2.373	0.204	4.3180	1229.4
15 minute summer	30	1.019	56	141.0	1.113	0.087	1.1624	
30 minute summer	55	4.012	56	343.9	2.012	0.069	0.9921	
30 minute summer	77	10.000	78	0.7	0.047	0.000	0.1104	
30 minute summer	34	4.003	35	105.2	0.622	0.534	5.6269	
15 minute winter	60	7.000	7.000:50%	22.6	1.522	0.047	0.1119	
30 minute summer	60	7.000	61	35.6	2.031	0.074	0.1308	

Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 97.13%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	40	11	310.297	0.218	54.6	0.6916	0.0000	OK
15 minute winter	42	12	309.562	0.315	100.8	0.9769	0.0000	OK
30 minute summer	44	20	309.031	0.313	133.6	1.0535	0.0000	OK
15 minute winter	2	11	308.301	0.181	30.5	0.2652	0.0000	OK
30 minute summer	1.001:50%	19	308.192	0.197	38.4	0.0000	0.0000	OK
15 minute winter	4	12	307.816	0.298	72.0	0.5002	0.0000	OK
30 minute winter	1.003:50%	25	307.722	0.268	77.7	11.5985	0.0000	PONDING
30 minute winter	6	19	307.373	0.215	71.9	0.2899	0.0000	OK
15 minute winter	11	11	292.049	0.180	30.2	0.2708	0.0000	OK
30 minute summer	2.001:50%	19	291.923	0.196	38.2	0.0000	0.0000	OK
15 minute winter	13	11	291.551	0.250	66.2	0.4069	0.0000	OK
30 minute winter	2.003:50%	22	291.399	0.244	73.4	8.4672	0.0000	OK
30 minute winter	15	22	290.957	0.268	91.5	0.4719	0.0000	OK
30 minute winter	2.005:50%	23	290.810	0.278	101.3	4.6081	0.0000	OK
60 minute winter	25	29	280.358	0.500	158.2	0.5510	21.0249	FLOOD
120 minute winter	27	56	276.511	0.500	149.3	1.2410	19.7604	FLOOD
30 minute winter	1.016:50%	20	274.719	0.117	140.8	0.0000	0.0000	OK
120 minute winter	29	52	270.995	0.500	146.4	0.6110	18.0423	FLOOD
30 minute winter	1.018:50%	20	269.460	0.119	144.7	0.0000	0.0000	OK
30 minute winter	57	17	267.358	0.500	501.5	0.4890	65.5220	FLOOD
30 minute winter	1.021:50%	20	266.592	0.202	355.5	0.2619	0.0000	OK
60 minute winter	59	30	265.581	0.500	354.2	0.0000	3.7954	FLOOD
30 minute winter	1.023:50%	20	264.409	0.172	356.9	1.6330	0.0000	OK
30 minute summer	45	20	308.773	0.350	132.1	0.0000	1.0186	FLOOD
30 minute summer	36	21	323.807	0.343	120.3	0.0000	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	40	5.001	41	53.1	0.507	0.282	3.2476	
15 minute winter	42	5.003	43	97.4	0.527	0.716	6.6908	
30 minute summer	44	5.005	45	132.1	0.601	0.743	6.5143	
15 minute winter	2	1.001	1.001:50%	30.5	0.431	0.172	0.8900	
30 minute summer	2	1.001	3	38.4	0.444	0.216	1.0842	
30 minute summer	4	1.003	1.003:50%	71.7	0.456	0.671	2.8130	
30 minute winter	4	1.003	5	52.3	0.369	0.490	2.5474	
30 minute winter	6	1.005	7	71.4	0.582	0.272	3.3450	
15 minute winter	11	2.001	2.001:50%	30.2	0.429	0.170	1.0121	
30 minute summer	11	2.001	12	38.1	0.451	0.214	1.2123	
15 minute winter	13	2.003	2.003:50%	67.5	0.619	0.379	1.6616	
30 minute winter	13	2.003	14	68.0	0.539	0.382	1.8363	
30 minute winter	15	2.005	2.005:50%	91.1	0.620	0.493	2.1708	
30 minute winter	15	2.005	16	100.0	0.566	0.541	2.5816	
15 minute summer	25	1.014	26	135.5	0.385	0.060	9.1012	
30 minute summer	27	1.016	1.016:50%	135.8	1.610	0.051	1.0431	
30 minute winter	27	1.016	28	140.8	0.408	0.052	5.1277	
30 minute summer	29	1.018	1.018:50%	136.3	1.618	0.050	0.8451	
30 minute winter	29	1.018	30	144.7	0.784	0.054	4.1433	
15 minute summer	57	1.021	1.021:50%	348.2	1.505	0.161	2.1594	
30 minute winter	57	1.021	58	355.5	0.697	0.164	5.1665	
30 minute winter	59	1.023	1.023:50%	349.4	1.886	0.119	1.7206	
30 minute winter	59	1.023	61	356.9	1.886	0.122	1.7691	
15 minute winter	45	5.006	46	122.1	0.888	0.689	0.6016	
30 minute summer	36	4.005	37	118.7	0.904	0.574	0.6739	

Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 97.13%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
30 minute summer	52	19	292.556	0.334	107.6	0.0000	0.0000	OK
30 minute winter	7	20	306.862	0.283	71.4	0.0000	0.0000	OK
30 minute winter	16	23	290.691	0.316	100.0	0.0000	0.0000	OK
30 minute summer	49	19	293.252	0.199	52.5	0.8971	0.0000	OK
30 minute summer	6.001:50%	19	293.038	0.211	61.3	0.0000	0.0000	OK
30 minute summer	51	19	292.827	0.245	101.4	0.9024	0.0000	OK
30 minute summer	6.003:50%	19	292.653	0.251	108.0	0.0000	0.0000	OK
30 minute winter	67	21	280.344	0.284	30.5	0.6445	0.0000	OK
30 minute winter	69	22	275.265	0.325	57.4	0.7021	0.0000	OK
30 minute winter	71	22	270.590	0.350	77.1	0.6286	0.1591	FLOOD
60 minute winter	73	31	269.685	0.350	80.4	0.5450	17.4216	FLOOD
30 minute winter	75	20	268.293	0.343	70.8	0.3979	0.0000	OK

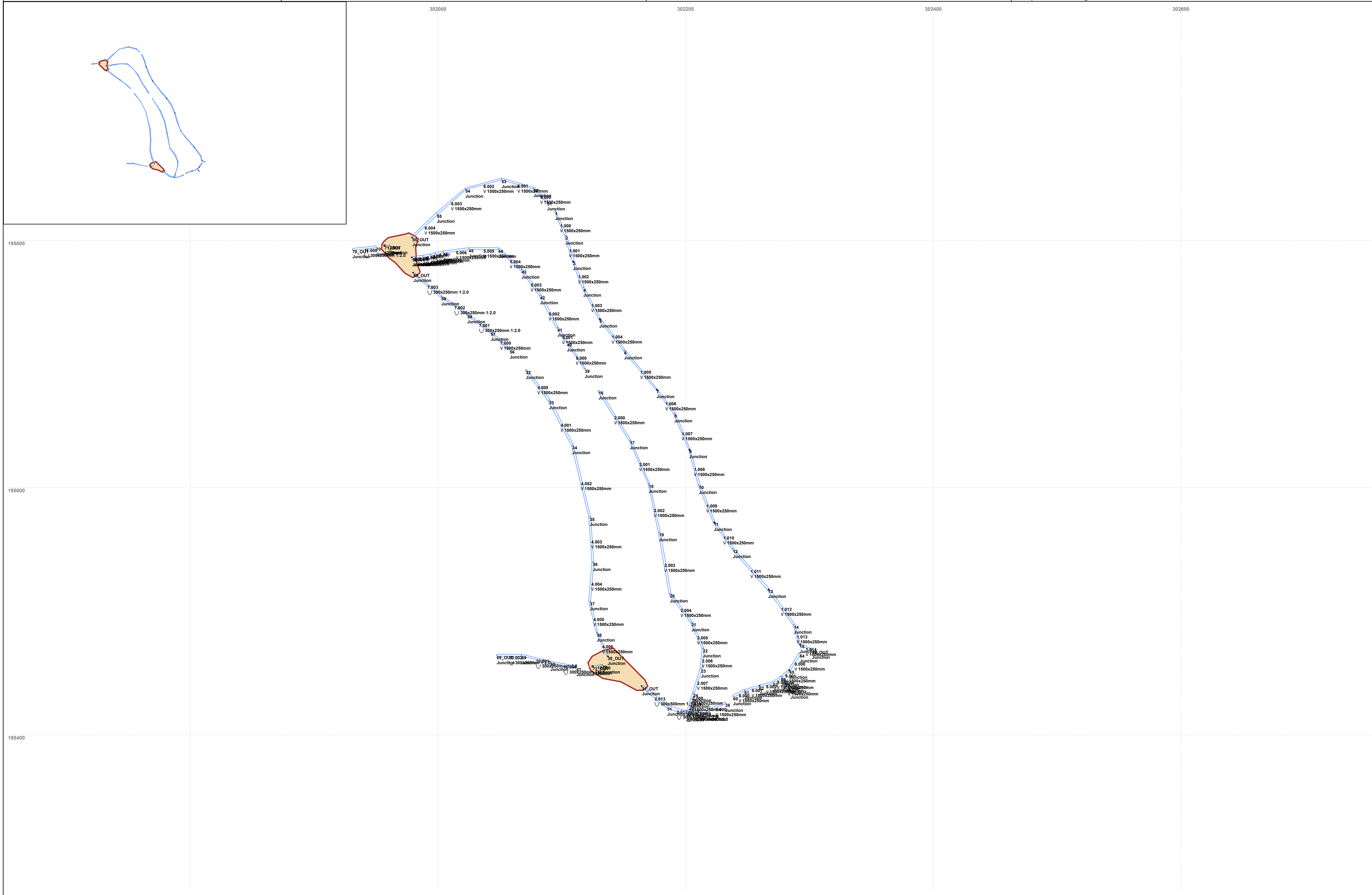
Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
30 minute summer	52	6.004	53	107.0	0.848	0.625	0.5772	
30 minute winter	7	1.006	8	71.4	0.795	0.400	0.2874	
30 minute winter	16	2.006	17	99.7	0.908	0.463	0.3163	
30 minute summer	49	6.001	6.001:50%	52.0	0.623	0.221	1.0810	
30 minute summer	49	6.001	50	61.2	0.423	0.260	1.9526	
30 minute summer	51	6.003	6.003:50%	101.0	0.819	0.388	1.0324	
30 minute summer	51	6.003	52	107.6	0.628	0.413	1.4636	
30 minute winter	67	9.001	68	29.8	0.350	0.068	3.2236	
30 minute winter	69	9.003	70	57.1	0.480	0.106	3.8136	
30 minute winter	71	9.005	72	75.0	0.452	0.311	4.8777	
15 minute winter	73	9.007	74	54.8	0.272	0.680	5.3908	
60 minute summer	75	9.009	76	70.6	0.471	0.220	4.7278	

CAUSEWAY

Capita

File: Receptor site C - proposed model - FSR.pfd
Network: Storm Network
Jacques Calitz
24/05/2021

Tylorstown Phase 4
Receptor site C
Proposed drainage



Design Settings

Rainfall Methodology	FSR
Return Period (years)	2
Additional Flow (%)	0
FSR Region	England and Wales
M5-60 (mm)	20.000
Ratio-R	0.200
CV	0.750
Time of Entry (mins)	5.00

Maximum Time of Concentration (mins)	60.00
Maximum Rainfall (mm/hr)	50.0
Minimum Velocity (m/s)	1.00
Connection Type	Level Soffits
Minimum Backdrop Height (m)	0.200
Preferred Cover Depth (m)	1.200
Include Intermediate Ground	✓
Enforce best practice design rules	x

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
1	0.002	5.00	411.845		302094.660	195823.794	0.250
51	0.003	5.00	411.821		302088.207	195831.625	0.250
52	0.003	5.00	411.392		302077.162	195842.379	0.250
53	0.002	5.00	410.447		302051.378	195849.713	0.250
54	0.004	5.00	409.633		302022.212	195841.931	0.250
55	0.009	5.00	408.504		301999.162	195821.652	0.250
55_OUT			406.100		301979.347	195802.701	0.660
39	0.041	10.00	414.491		302118.616	195696.153	0.250
40	0.045	10.00	414.345		302104.266	195717.524	0.250
41	0.042	10.00	413.975		302096.508	195729.482	0.250
42	0.130	10.00	413.268		302082.547	195755.647	0.250
43	0.057	10.00	412.575		302067.542	195776.471	0.250
44	0.069	10.00	411.790		302048.725	195793.245	0.250
45	0.003	10.00	410.987		302024.874	195793.652	0.250
46	0.007	10.00	410.323		302004.289	195790.724	0.250
47			410.121		301997.913	195789.383	0.250
50_OUT			406.100		301979.286	195786.429	0.660
2	0.002	5.00	411.440		302102.911	195804.016	0.250
3	0.007	5.00	411.248		302109.093	195783.415	0.250
4	0.011	5.00	410.777		302117.445	195761.839	0.250
5	0.019	5.00	410.145		302130.403	195736.855	0.250
6	0.017	5.00	409.946		302150.435	195711.056	0.250
7	0.025	5.00	408.806		302176.580	195679.682	0.250
8			408.789		302190.988	195660.067	0.250
9	0.023	5.00	408.516		302202.983	195631.211	0.250
10	0.027	5.00	406.288		302210.754	195602.223	0.250
11	0.011	5.00	405.733		302222.869	195572.263	0.250
12	0.015	5.00	405.550		302238.253	195550.318	0.250
13	0.010	5.00	403.454		302266.708	195517.972	0.250
14	0.004	5.00	403.071		302287.452	195489.100	0.250
15			402.410		302292.035	195473.393	0.250
15_OUT			402.039		302302.104	195468.741	0.250
64	0.004	5.00	401.755		302292.157	195465.779	0.250
66_OUT			399.385		302284.672	195436.383	0.250
33			407.266		302089.744	195670.772	0.250
63	0.005	5.00	400.084		302270.668	195442.328	0.250
66	0.008	5.00	399.764		302277.089	195446.662	0.250
56	0.027	5.00	408.032		302058.023	195711.789	0.250
57	0.017	5.00	407.541		302042.658	195726.126	0.250
58			407.223		302023.759	195740.332	0.250
59_OUT			406.100		301980.197	195773.747	0.660

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
71		5.00	406.100		301960.937	195796.217	0.800
70		5.00	404.750		301950.111	195795.015	0.250
70_OUT			403.487		301930.927	195792.914	0.250
25			402.123		302204.925	195429.176	0.250
32	0.034	5.00	407.343		302071.045	195695.142	0.250
34	0.033	5.00	405.102		302108.528	195634.292	0.250
35	0.041	5.00	404.053		302122.597	195576.275	0.250
36	0.027	5.00	403.476		302125.018	195539.855	0.250
37	0.022	5.00	400.835		302122.753	195507.986	0.250
38	0.014	5.00	398.696		302128.385	195482.668	0.250
38_OUT			397.185		302137.050	195463.816	0.917
31_OUT	0.034		397.185		302164.809	195439.245	0.917
16	0.076	10.00	414.013		302129.765	195678.649	0.250
17	0.069	10.00	412.909		302155.061	195638.385	0.250
18	0.071	10.00	411.873		302170.262	195603.128	0.250
19	0.134	10.00	410.150		302178.566	195563.888	0.250
20	0.140	10.00	407.200		302187.331	195514.317	0.250
21	0.103	10.00	405.764		302204.716	195491.041	0.250
22			404.483		302214.004	195469.874	0.250
23	0.089	10.00	403.533		302212.472	195453.627	0.250
26			400.591		302203.293	195423.679	0.250
24			402.393		302206.211	195433.852	0.250
30	0.019	5.00	399.090		302200.475	195418.070	0.500
31			398.303		302185.186	195422.760	0.500
62			400.665		302259.353	195439.525	0.250
61			400.899		302247.476	195436.043	0.250
72		5.00	397.185		302132.599	195456.747	1.000
68			392.651		302090.808	195458.982	0.250
69			389.889		302067.509	195464.347	0.250
69_OUT			387.691		302047.440	195464.412	0.250
60	0.003	5.00	400.901		302238.392	195431.144	0.250
65			400.083		302283.882	195452.613	0.250
27			399.170		302201.449	195419.283	0.500
28	0.008	5.00	400.710		302232.059	195425.852	0.250
29			399.983		302216.683	195418.935	0.250
48			409.999		301994.028	195788.522	0.250
49			408.111		301987.669	195787.365	0.250
50			406.113		301981.689	195786.658	0.250
71_OUT			406.100	1200	301956.819	195796.033	0.800
72_OUT			397.185	1200	302124.908	195455.456	1.000
67		5.00	395.067		302111.857	195454.691	0.250
59	0.013	5.00	406.667		302002.753	195754.823	0.250
73			399.585		302280.742	195441.772	0.250

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.014	15	15_OUT	11.092	0.040	402.160	401.789	0.371	29.9	250	16.08	30.9
1.013	14	15	16.362	0.040	402.821	402.160	0.661	24.8	250	15.92	31.1
1.012	13	14	35.551	0.040	403.204	402.821	0.383	92.8	250	15.69	31.3
1.011	12	13	43.081	0.040	405.300	403.204	2.096	20.6	250	14.74	32.2
1.010	11	12	26.800	0.040	405.483	405.300	0.183	146.4	250	14.20	32.7
1.009	10	11	32.317	0.040	406.038	405.483	0.555	58.2	250	13.31	33.7
1.008	9	10	30.012	0.040	408.266	406.038	2.228	13.5	250	12.63	34.5
1.007	8	9	31.250	0.040	408.539	408.266	0.273	114.5	250	12.32	34.8
1.006	7	8	24.338	0.040	408.556	408.539	0.017	1431.6	250	11.40	36.0
1.005	6	7	40.840	0.040	409.696	408.556	1.140	35.8	250	8.86	40.0
1.004	5	6	32.663	0.040	409.895	409.696	0.199	164.1	250	8.18	41.3
1.003	4	5	28.144	0.040	410.527	409.895	0.632	44.5	250	7.03	43.7
1.002	3	4	23.136	0.040	410.998	410.527	0.471	49.1	250	6.51	44.9
1.001	2	3	21.509	0.040	411.190	410.998	0.192	112.0	250	6.06	46.1
1.000	1	2	21.430	0.040	411.595	411.190	0.405	52.9	250	5.43	47.8
6.004	55	55_OUT	27.419	0.040	408.254	405.850	2.404	11.4	250	6.86	44.1
6.003	54	55	30.701	0.040	409.383	408.254	1.129	27.2	250	6.60	44.7
6.002	53	54	30.186	0.040	410.197	409.383	0.814	37.1	250	6.16	45.8
6.001	52	53	26.807	0.040	411.142	410.197	0.945	28.4	250	5.65	47.2
6.000	51	52	15.416	0.040	411.571	411.142	0.429	35.9	250	5.26	48.4
5.011	50	50_OUT	2.414	0.040	405.863	405.842	0.021	114.9	250	13.52	33.4
5.010	49	50	6.022	0.040	407.861	405.863	1.998	3.0	250	13.45	33.5
5.009	48	49	6.463	0.040	409.749	407.861	1.888	3.4	250	13.42	33.5
5.008	47	48	3.979	0.040	409.871	409.749	0.122	32.6	250	13.39	33.6

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
1.014	1.104	206.9	14.5	0.000	0.000	0.173	0.0	92	0.568
1.013	1.213	227.4	14.6	0.000	0.000	0.173	0.0	89	0.611
1.012	0.626	117.4	14.3	0.000	0.000	0.169	0.0	114	0.371
1.011	1.331	249.6	13.9	0.000	0.000	0.159	0.0	84	0.646
1.010	0.499	93.5	12.8	0.000	0.000	0.144	0.0	119	0.303
1.009	0.791	148.3	12.1	0.000	0.000	0.133	0.0	98	0.424
1.008	1.644	308.3	9.9	0.000	0.000	0.106	0.0	69	0.696
1.007	0.564	105.8	7.9	0.000	0.000	0.083	0.0	94	0.294
1.006	0.159	29.9	8.2	0.000	0.000	0.083	0.0	154	0.115
1.005	1.008	189.0	6.4	0.000	0.000	0.059	0.0	70	0.431
1.004	0.471	88.3	4.7	0.000	0.000	0.042	0.0	83	0.225
1.003	0.904	169.5	2.7	0.000	0.000	0.023	0.0	53	0.322
1.002	0.861	161.4	1.4	0.000	0.000	0.012	0.0	42	0.264
1.001	0.570	106.9	0.5	0.000	0.000	0.004	0.0	34	0.150
1.000	0.830	155.5	0.2	0.000	0.000	0.002	0.0	22	0.164
6.004	1.787	335.0	2.6	0.000	0.000	0.021	0.0	41	0.531
6.003	1.157	217.0	1.5	0.000	0.000	0.012	0.0	39	0.333
6.002	0.991	185.8	1.0	0.000	0.000	0.008	0.0	36	0.270
6.001	1.133	212.4	0.8	0.000	0.000	0.006	0.0	31	0.280
6.000	1.007	188.7	0.4	0.000	0.000	0.003	0.0	26	0.222
5.011	0.563	105.5	35.7	0.000	0.008	0.394	0.0	167	0.429
5.010	3.476	651.7	35.8	0.000	0.000	0.394	0.0	84	1.686
5.009	3.261	611.5	35.8	0.000	0.000	0.394	0.0	86	1.606
5.008	1.057	198.1	35.8	0.000	0.000	0.394	0.0	131	0.688

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
5.007	46	47	6.515	0.040	410.073	409.871	0.202	32.3	250	13.33	33.7
5.006	45	46	20.792	0.040	410.737	410.073	0.664	31.3	250	13.23	33.8
5.005	44	45	23.854	0.040	411.540	410.737	0.803	29.7	250	12.90	34.1
5.004	43	44	25.208	0.040	412.325	411.540	0.785	32.1	250	12.54	34.6
5.003	42	43	25.667	0.040	413.018	412.325	0.693	37.0	250	12.15	35.0
5.002	41	42	29.657	0.040	413.725	413.018	0.707	41.9	250	11.72	35.6
5.001	40	41	14.254	0.040	414.095	413.725	0.370	38.5	250	11.19	36.3
5.000	39	40	25.742	0.040	414.241	414.095	0.146	176.3	250	10.94	36.7
9.001	65	66	9.031	0.040	399.833	399.514	0.319	28.3	250	5.26	48.3
8.003	63	66	7.747	0.040	399.834	399.514	0.320	24.2	250	7.55	42.6
8.002	62	63	11.657	0.040	400.415	399.834	0.581	20.1	250	7.44	42.8
8.001	61	62	12.377	0.040	400.649	400.415	0.234	52.9	250	7.30	43.1
8.000	60	61	10.321	0.040	400.651	400.649	0.002	5160.4	250	7.05	43.7
9.000	64	65	15.551	0.040	401.505	399.833	1.672	9.3	250	5.13	48.8
4.006	38	38_OUT	20.748	0.040	398.446	396.935	1.511	13.7	250	10.00	38.1
4.005	37	38	25.937	0.040	400.585	398.446	2.139	12.1	250	9.79	38.4
4.004	36	37	31.949	0.040	403.226	400.585	2.641	12.1	250	9.54	38.8
4.003	35	36	36.500	0.040	403.803	403.226	0.577	63.3	250	9.23	39.3
4.002	34	35	59.698	0.040	404.852	403.803	1.049	56.9	250	8.43	40.8
4.001	33	34	41.032	0.040	407.016	404.852	2.164	19.0	250	7.19	43.3
4.000	32	33	30.717	0.040	407.093	407.016	0.077	398.9	250	6.69	44.5
7.003	59	59_OUT	29.443	0.050	406.417	405.850	0.567	51.9	250	7.19	43.3
7.002	58	59	25.519	0.050	406.973	406.417	0.556	45.9	250	6.54	44.9

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
5.007	1.063	199.2	35.9	0.000	0.000	0.394	0.0	131	0.692
5.006	1.078	202.2	35.4	0.000	0.000	0.387	0.0	130	0.699
5.005	1.107	207.6	35.5	0.000	0.000	0.383	0.0	128	0.710
5.004	1.065	199.7	29.5	0.000	0.000	0.315	0.0	122	0.659
5.003	0.992	185.9	24.5	0.000	0.000	0.258	0.0	117	0.597
5.002	0.932	174.7	12.3	0.000	0.000	0.128	0.0	92	0.479
5.001	0.972	182.3	8.4	0.000	0.000	0.086	0.0	79	0.450
5.000	0.454	85.2	4.0	0.000	0.000	0.041	0.0	80	0.212
9.001	1.134	212.6	0.5	0.000	0.000	0.004	0.0	26	0.250
8.003	1.226	230.0	0.8	0.000	0.000	0.007	0.0	31	0.303
8.002	1.347	252.6	0.3	0.000	0.000	0.003	0.0	20	0.250
8.001	0.830	155.6	0.3	0.000	0.000	0.003	0.0	24	0.174
8.000	0.084	15.8	0.3	0.000	0.000	0.003	0.0	57	0.031
9.000	1.979	371.0	0.5	0.000	0.000	0.004	0.0	21	0.379
4.006	1.628	305.3	17.6	0.000	0.000	0.171	0.0	85	0.796
4.005	1.733	324.9	16.3	0.000	0.000	0.157	0.0	82	0.821
4.004	1.735	325.3	14.1	0.000	0.000	0.134	0.0	77	0.789
4.003	0.759	142.3	11.4	0.000	0.000	0.107	0.0	97	0.404
4.002	0.800	150.0	7.3	0.000	0.000	0.066	0.0	81	0.376
4.001	1.386	259.8	4.0	0.000	0.000	0.034	0.0	52	0.488
4.000	0.302	56.6	4.1	0.000	0.000	0.034	0.0	93	0.157
7.003	0.752	150.4	6.7	0.000	0.000	0.057	0.0	51	0.319
7.002	0.800	160.0	5.3	0.000	0.000	0.044	0.0	43	0.310

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
7.001	57	58	23.643	0.050	407.291	406.973	0.318	74.3	250	6.01	46.2
7.000	56	57	21.015	0.040	407.782	407.291	0.491	42.8	250	5.38	48.0
13.000	71	71_OUT	4.122	0.600	405.300	405.300	0.000	0.0	225	5.07	48.9
11.000	70	70_OUT	19.299	0.050	404.500	403.237	1.263	15.3	250	5.23	48.4
2.013	31	31_OUT	26.210	0.050	397.803	396.685	1.118	23.4	500	14.22	32.7
2.012	30	31	15.992	0.050	398.590	397.803	0.787	20.3	500	13.95	33.0
2.011	27	30	1.556	0.050	398.670	398.590	0.080	19.4	500	13.81	33.1
3.001	29	30	16.231	0.040	399.733	398.840	0.893	18.2	250	5.42	47.9
3.000	28	29	16.860	0.040	400.460	399.733	0.727	23.2	250	5.22	48.5
2.010	26	27	4.767	0.040	400.341	398.920	1.421	3.4	250	13.79	33.1
2.009	25	26	5.734	0.040	401.873	400.341	1.532	3.7	250	13.77	33.2
2.008	24	25	4.850	0.040	402.143	401.873	0.270	18.0	250	13.74	33.2
2.007	23	24	20.742	0.040	403.283	402.143	1.140	18.2	250	13.68	33.3
2.006	22	23	16.319	0.040	404.233	403.283	0.950	17.2	250	13.44	33.5
2.005	21	22	23.115	0.040	405.514	404.233	1.281	18.0	250	13.25	33.7
2.004	20	21	29.052	0.040	406.950	405.514	1.436	20.2	250	12.98	34.1
2.003	19	20	50.340	0.040	409.900	406.950	2.950	17.1	250	12.62	34.5
2.002	18	19	40.109	0.040	411.623	409.900	1.723	23.3	250	12.04	35.2
2.001	17	18	38.394	0.040	412.659	411.623	1.036	37.1	250	11.51	35.9
2.000	16	17	47.551	0.040	413.763	412.659	1.104	43.1	250	10.86	36.8
12.000	72	72_OUT	7.799	0.600	396.185	396.185	0.000	0.0	150	5.13	48.8
10.002	69	69_OUT	20.069	0.050	389.639	387.441	2.198	9.1	250	5.60	47.4
10.001	68	69	23.909	0.050	392.401	389.639	2.762	8.7	250	5.41	47.9
10.000	67	68	21.482	0.050	394.817	392.401	2.416	8.9	250	5.20	48.5

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
7.001	0.628	125.7	5.5	0.000	0.000	0.044	0.0	51	0.267
7.000	0.922	172.9	3.5	0.000	0.000	0.027	0.0	58	0.349
13.000	1.000	39.8	0.0	0.575	0.575	0.000	0.0	0	0.000
11.000	1.386	277.3	0.0	0.000	0.000	0.000	0.0	0	0.000
2.013	1.667	1083.3	62.8	0.000	0.000	0.709	0.0	136	0.803
2.012	1.790	1163.6	63.3	0.000	0.000	0.709	0.0	132	0.850
2.011	1.830	1189.5	61.2	0.000	0.000	0.682	0.0	128	0.855
3.001	1.415	265.4	1.0	0.000	0.000	0.008	0.0	31	0.350
3.000	1.253	234.9	1.0	0.000	0.000	0.008	0.0	32	0.317
2.010	3.295	617.7	61.3	0.000	0.000	0.682	0.0	105	1.847
2.009	3.119	584.8	61.3	0.000	0.000	0.682	0.0	107	1.771
2.008	1.424	267.0	61.4	0.000	0.000	0.682	0.0	144	0.986
2.007	1.415	265.2	61.5	0.000	0.000	0.682	0.0	144	0.980
2.006	1.456	273.0	53.9	0.000	0.000	0.593	0.0	136	0.971
2.005	1.421	266.4	54.2	0.000	0.000	0.593	0.0	137	0.952
2.004	1.342	251.5	45.2	0.000	0.000	0.490	0.0	131	0.874
2.003	1.461	273.9	32.7	0.000	0.000	0.350	0.0	113	0.859
2.002	1.251	234.5	20.6	0.000	0.000	0.216	0.0	100	0.679
2.001	0.991	185.9	14.0	0.000	0.000	0.144	0.0	95	0.521
2.000	0.919	172.4	7.6	0.000	0.000	0.076	0.0	78	0.422
12.000	1.000	17.7	0.0	0.850	0.850	0.000	0.0	0	0.000
10.002	1.793	358.7	0.0	0.000	0.000	0.000	0.0	0	0.000
10.001	1.842	368.4	0.0	0.000	0.000	0.000	0.0	0	0.000
10.000	1.817	363.5	0.0	0.000	0.000	0.000	0.0	0	0.000

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
9.004	66	73	6.104	0.040	399.514	399.335	0.179	34.1	250	7.64	42.4
9.005	73	66_OUT	6.670	0.040	399.335	399.135	0.200	33.3	250	7.75	42.1

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
9.004	1.033	193.8	2.1	0.000	0.000	0.019	0.0	46	0.336
9.005	1.045	195.9	2.1	0.000	0.000	0.019	0.0	46	0.340

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.014	11.092	29.9	250	Swale 1:3 250mm	402.410	402.160	0.000	402.039	401.789	0.000
1.013	16.362	24.8	250	Swale 1:3 250mm	403.071	402.821	0.000	402.410	402.160	0.000
1.012	35.551	92.8	250	Swale 1:3 250mm	403.454	403.204	0.000	403.071	402.821	0.000
1.011	43.081	20.6	250	Swale 1:3 250mm	405.550	405.300	0.000	403.454	403.204	0.000
1.010	26.800	146.4	250	Swale 1:3 250mm	405.733	405.483	0.000	405.550	405.300	0.000
1.009	32.317	58.2	250	Swale 1:3 250mm	406.288	406.038	0.000	405.733	405.483	0.000
1.008	30.012	13.5	250	Swale 1:3 250mm	408.516	408.266	0.000	406.288	406.038	0.000
1.007	31.250	114.5	250	Swale 1:3 250mm	408.789	408.539	0.000	408.516	408.266	0.000
1.006	24.338	1431.6	250	Swale 1:3 250mm	408.806	408.556	0.000	408.789	408.539	0.000
1.005	40.840	35.8	250	Swale 1:3 250mm	409.946	409.696	0.000	408.806	408.556	0.000
1.004	32.663	164.1	250	Swale 1:3 250mm	410.145	409.895	0.000	409.946	409.696	0.000
1.003	28.144	44.5	250	Swale 1:3 250mm	410.777	410.527	0.000	410.145	409.895	0.000
1.002	23.136	49.1	250	Swale 1:3 250mm	411.248	410.998	0.000	410.777	410.527	0.000
1.001	21.509	112.0	250	Swale 1:3 250mm	411.440	411.190	0.000	411.248	410.998	0.000
1.000	21.430	52.9	250	Swale 1:3 250mm	411.845	411.595	0.000	411.440	411.190	0.000
6.004	27.419	11.4	250	Swale 1:3 250mm	408.504	408.254	0.000	406.100	405.850	0.000
6.003	30.701	27.2	250	Swale 1:3 250mm	409.633	409.383	0.000	408.504	408.254	0.000
6.002	30.186	37.1	250	Swale 1:3 250mm	410.447	410.197	0.000	409.633	409.383	0.000

Link	US Node	Node Type	DS Node	Dia (mm)	Node Type	MH Type
1.014	15	Junction	15_OUT		Junction	
1.013	14	Junction	15		Junction	
1.012	13	Junction	14		Junction	
1.011	12	Junction	13		Junction	
1.010	11	Junction	12		Junction	
1.009	10	Junction	11		Junction	
1.008	9	Junction	10		Junction	
1.007	8	Junction	9		Junction	
1.006	7	Junction	8		Junction	
1.005	6	Junction	7		Junction	
1.004	5	Junction	6		Junction	
1.003	4	Junction	5		Junction	
1.002	3	Junction	4		Junction	
1.001	2	Junction	3		Junction	
1.000	1	Junction	2		Junction	
6.004	55	Junction	55_OUT		Junction	
6.003	54	Junction	55		Junction	
6.002	53	Junction	54		Junction	

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
6.001	26.807	28.4	250	Swale 1:3 250mm	411.392	411.142	0.000	410.447	410.197	0.000
6.000	15.416	35.9	250	Swale 1:3 250mm	411.821	411.571	0.000	411.392	411.142	0.000
5.011	2.414	114.9	250	Swale 1:3 250mm	406.113	405.863	0.000	406.100	405.842	0.008
5.010	6.022	3.0	250	Swale 1:3 250mm	408.111	407.861	0.000	406.113	405.863	0.000
5.009	6.463	3.4	250	Swale 1:3 250mm	409.999	409.749	0.000	408.111	407.861	0.000
5.008	3.979	32.6	250	Swale 1:3 250mm	410.121	409.871	0.000	409.999	409.749	0.000
5.007	6.515	32.3	250	Swale 1:3 250mm	410.323	410.073	0.000	410.121	409.871	0.000
5.006	20.792	31.3	250	Swale 1:3 250mm	410.987	410.737	0.000	410.323	410.073	0.000
5.005	23.854	29.7	250	Swale 1:3 250mm	411.790	411.540	0.000	410.987	410.737	0.000
5.004	25.208	32.1	250	Swale 1:3 250mm	412.575	412.325	0.000	411.790	411.540	0.000
5.003	25.667	37.0	250	Swale 1:3 250mm	413.268	413.018	0.000	412.575	412.325	0.000
5.002	29.657	41.9	250	Swale 1:3 250mm	413.975	413.725	0.000	413.268	413.018	0.000
5.001	14.254	38.5	250	Swale 1:3 250mm	414.345	414.095	0.000	413.975	413.725	0.000
5.000	25.742	176.3	250	Swale 1:3 250mm	414.491	414.241	0.000	414.345	414.095	0.000
9.001	9.031	28.3	250	Swale 1:3 250mm	400.083	399.833	0.000	399.764	399.514	0.000
8.003	7.747	24.2	250	Swale 1:3 250mm	400.084	399.834	0.000	399.764	399.514	0.000
8.002	11.657	20.1	250	Swale 1:3 250mm	400.665	400.415	0.000	400.084	399.834	0.000
8.001	12.377	52.9	250	Swale 1:3 250mm	400.899	400.649	0.000	400.665	400.415	0.000
8.000	10.321	5160.4	250	Swale 1:3 250mm	400.901	400.651	0.000	400.899	400.649	0.000
9.000	15.551	9.3	250	Swale 1:3 250mm	401.755	401.505	0.000	400.083	399.833	0.000
4.006	20.748	13.7	250	Swale 1:3 250mm	398.696	398.446	0.000	397.185	396.935	0.000
4.005	25.937	12.1	250	Swale 1:3 250mm	400.835	400.585	0.000	398.696	398.446	0.000
4.004	31.949	12.1	250	Swale 1:3 250mm	403.476	403.226	0.000	400.835	400.585	0.000
4.003	36.500	63.3	250	Swale 1:3 250mm	404.053	403.803	0.000	403.476	403.226	0.000

Link	US Node	Node Type	DS Node	Dia (mm)	Node Type	MH Type
6.001	52	Junction	53		Junction	
6.000	51	Junction	52		Junction	
5.011	50	Junction	50_OUT		Junction	
5.010	49	Junction	50		Junction	
5.009	48	Junction	49		Junction	
5.008	47	Junction	48		Junction	
5.007	46	Junction	47		Junction	
5.006	45	Junction	46		Junction	
5.005	44	Junction	45		Junction	
5.004	43	Junction	44		Junction	
5.003	42	Junction	43		Junction	
5.002	41	Junction	42		Junction	
5.001	40	Junction	41		Junction	
5.000	39	Junction	40		Junction	
9.001	65	Junction	66		Junction	
8.003	63	Junction	66		Junction	
8.002	62	Junction	63		Junction	
8.001	61	Junction	62		Junction	
8.000	60	Junction	61		Junction	
9.000	64	Junction	65		Junction	
4.006	38	Junction	38_OUT		Junction	
4.005	37	Junction	38		Junction	
4.004	36	Junction	37		Junction	
4.003	35	Junction	36		Junction	

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
4.002	59.698	56.9	250	Swale 1:3 250mm	405.102	404.852	0.000	404.053	403.803	0.000
4.001	41.032	19.0	250	Swale 1:3 250mm	407.266	407.016	0.000	405.102	404.852	0.000
4.000	30.717	398.9	250	Swale 1:3 250mm	407.343	407.093	0.000	407.266	407.016	0.000
7.003	29.443	51.9	250	Swale trapezoidal	406.667	406.417	0.000	406.100	405.850	0.000
7.002	25.519	45.9	250	Swale trapezoidal	407.223	406.973	0.000	406.667	406.417	0.000
7.001	23.643	74.3	250	Swale trapezoidal	407.541	407.291	0.000	407.223	406.973	0.000
7.000	21.015	42.8	250	Swale 1:3 250mm	408.032	407.782	0.000	407.541	407.291	0.000
13.000	4.122	0.0	225	Circular	406.100	405.300	0.575	406.100	405.300	0.575
11.000	19.299	15.3	250	Swale trapezoidal	404.750	404.500	0.000	403.487	403.237	0.000
2.013	26.210	23.4	500	Swale trapezoidal	398.303	397.803	0.000	397.185	396.685	0.000
2.012	15.992	20.3	500	Swale trapezoidal	399.090	398.590	0.000	398.303	397.803	0.000
2.011	1.556	19.4	500	Swale trapezoidal	399.170	398.670	0.000	399.090	398.590	0.000
3.001	16.231	18.2	250	Swale 1:3 250mm	399.983	399.733	0.000	399.090	398.840	0.000
3.000	16.860	23.2	250	Swale 1:3 250mm	400.710	400.460	0.000	399.983	399.733	0.000
2.010	4.767	3.4	250	Swale 1:3 250mm	400.591	400.341	0.000	399.170	398.920	0.000
2.009	5.734	3.7	250	Swale 1:3 250mm	402.123	401.873	0.000	400.591	400.341	0.000
2.008	4.850	18.0	250	Swale 1:3 250mm	402.393	402.143	0.000	402.123	401.873	0.000
2.007	20.742	18.2	250	Swale 1:3 250mm	403.533	403.283	0.000	402.393	402.143	0.000
2.006	16.319	17.2	250	Swale 1:3 250mm	404.483	404.233	0.000	403.533	403.283	0.000
2.005	23.115	18.0	250	Swale 1:3 250mm	405.764	405.514	0.000	404.483	404.233	0.000
2.004	29.052	20.2	250	Swale 1:3 250mm	407.200	406.950	0.000	405.764	405.514	0.000
2.003	50.340	17.1	250	Swale 1:3 250mm	410.150	409.900	0.000	407.200	406.950	0.000
2.002	40.109	23.3	250	Swale 1:3 250mm	411.873	411.623	0.000	410.150	409.900	0.000
2.001	38.394	37.1	250	Swale 1:3 250mm	412.909	412.659	0.000	411.873	411.623	0.000
2.000	47.551	43.1	250	Swale 1:3 250mm	414.013	413.763	0.000	412.909	412.659	0.000

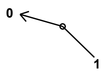
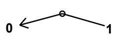
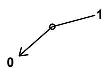
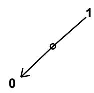
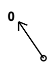
Link	US Node	Node Type	DS Node	Dia (mm)	Node Type	MH Type
4.002	34	Junction	35		Junction	
4.001	33	Junction	34		Junction	
4.000	32	Junction	33		Junction	
7.003	59	Junction	59_OUT		Junction	
7.002	58	Junction	59		Junction	
7.001	57	Junction	58		Junction	
7.000	56	Junction	57		Junction	
13.000	71	Junction	71_OUT	1200	Manhole	Adoptable
11.000	70	Junction	70_OUT		Junction	
2.013	31	Junction	31_OUT		Junction	
2.012	30	Junction	31		Junction	
2.011	27	Junction	30		Junction	
3.001	29	Junction	30		Junction	
3.000	28	Junction	29		Junction	
2.010	26	Junction	27		Junction	
2.009	25	Junction	26		Junction	
2.008	24	Junction	25		Junction	
2.007	23	Junction	24		Junction	
2.006	22	Junction	23		Junction	
2.005	21	Junction	22		Junction	
2.004	20	Junction	21		Junction	
2.003	19	Junction	20		Junction	
2.002	18	Junction	19		Junction	
2.001	17	Junction	18		Junction	
2.000	16	Junction	17		Junction	

Pipeline Schedule

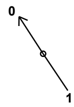
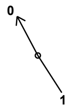
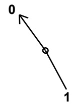
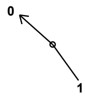
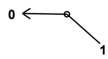
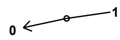
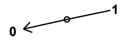
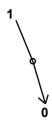
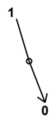
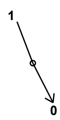
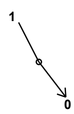
Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
12.000	7.799	0.0	150	Circular	397.185	396.185	0.850	397.185	396.185	0.850
10.002	20.069	9.1	250	Swale trapezoidal	389.889	389.639	0.000	387.691	387.441	0.000
10.001	23.909	8.7	250	Swale trapezoidal	392.651	392.401	0.000	389.889	389.639	0.000
10.000	21.482	8.9	250	Swale trapezoidal	395.067	394.817	0.000	392.651	392.401	0.000
9.004	6.104	34.1	250	Swale 1:3 250mm	399.764	399.514	0.000	399.585	399.335	0.000
9.005	6.670	33.3	250	Swale 1:3 250mm	399.585	399.335	0.000	399.385	399.135	0.000

Link	US Node	Node Type	DS Node	Dia (mm)	Node Type	MH Type
12.000	72	Junction	72_OUT	1200	Manhole	Adoptable
10.002	69	Junction	69_OUT		Junction	
10.001	68	Junction	69		Junction	
10.000	67	Junction	68		Junction	
9.004	66	Junction	73		Junction	
9.005	73	Junction	66_OUT		Junction	

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections		Link	IL (m)	Dia (mm)
1	302094.660	195823.794	411.845	0.250			0	1.000	411.595	250
51	302088.207	195831.625	411.821	0.250			0	6.000	411.571	250
52	302077.162	195842.379	411.392	0.250			1	6.000	411.142	250
							0	6.001	411.142	250
53	302051.378	195849.713	410.447	0.250			1	6.001	410.197	250
							0	6.002	410.197	250
54	302022.212	195841.931	409.633	0.250			1	6.002	409.383	250
							0	6.003	409.383	250
55	301999.162	195821.652	408.504	0.250			1	6.003	408.254	250
							0	6.004	408.254	250
55_OUT	301979.347	195802.701	406.100	0.660			1	6.004	405.850	250
39	302118.616	195696.153	414.491	0.250			0	5.000	414.241	250

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections		Link	IL (m)	Dia (mm)
40	302104.266	195717.524	414.345	0.250			1	5.000	414.095	250
							0	5.001	414.095	250
41	302096.508	195729.482	413.975	0.250			1	5.001	413.725	250
							0	5.002	413.725	250
42	302082.547	195755.647	413.268	0.250			1	5.002	413.018	250
							0	5.003	413.018	250
43	302067.542	195776.471	412.575	0.250			1	5.003	412.325	250
							0	5.004	412.325	250
44	302048.725	195793.245	411.790	0.250			1	5.004	411.540	250
							0	5.005	411.540	250
45	302024.874	195793.652	410.987	0.250			1	5.005	410.737	250
							0	5.006	410.737	250
46	302004.289	195790.724	410.323	0.250			1	5.006	410.073	250
							0	5.007	410.073	250
47	301997.913	195789.383	410.121	0.250			1	5.007	409.871	250
							0	5.008	409.871	250
50_OUT	301979.286	195786.429	406.100	0.660			1	5.011	405.842	250
2	302102.911	195804.016	411.440	0.250			1	1.000	411.190	250
							0	1.001	411.190	250
3	302109.093	195783.415	411.248	0.250			1	1.001	410.998	250
							0	1.002	410.998	250
4	302117.445	195761.839	410.777	0.250			1	1.002	410.527	250
							0	1.003	410.527	250
5	302130.403	195736.855	410.145	0.250			1	1.003	409.895	250
							0	1.004	409.895	250

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
6	302150.435	195711.056	409.946	0.250		1	1.004	409.696	250
						0	1.005	409.696	250
7	302176.580	195679.682	408.806	0.250		1	1.005	408.556	250
						0	1.006	408.556	250
8	302190.988	195660.067	408.789	0.250		1	1.006	408.539	250
						0	1.007	408.539	250
9	302202.983	195631.211	408.516	0.250		1	1.007	408.266	250
						0	1.008	408.266	250
10	302210.754	195602.223	406.288	0.250		1	1.008	406.038	250
						0	1.009	406.038	250
11	302222.869	195572.263	405.733	0.250		1	1.009	405.483	250
						0	1.010	405.483	250
12	302238.253	195550.318	405.550	0.250		1	1.010	405.300	250
						0	1.011	405.300	250
13	302266.708	195517.972	403.454	0.250		1	1.011	403.204	250
						0	1.012	403.204	250
14	302287.452	195489.100	403.071	0.250		1	1.012	402.821	250
						0	1.013	402.821	250
15	302292.035	195473.393	402.410	0.250		1	1.013	402.160	250
						0	1.014	402.160	250
15_OUT	302302.104	195468.741	402.039	0.250		1	1.014	401.789	250
64	302292.157	195465.779	401.755	0.250		0	9.000	401.505	250
66_OUT	302284.672	195436.383	399.385	0.250		1	9.005	399.135	250

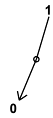
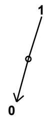
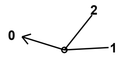
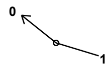
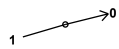
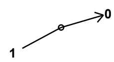
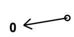
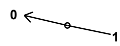
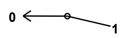
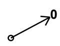
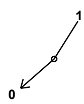
Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
33	302089.744	195670.772	407.266	0.250		1	4.000	407.016	250
						0	4.001	407.016	250
63	302270.668	195442.328	400.084	0.250		1	8.002	399.834	250
						0	8.003	399.834	250
66	302277.089	195446.662	399.764	0.250		1	9.001	399.514	250
						2	8.003	399.514	250
						0	9.004	399.514	250
56	302058.023	195711.789	408.032	0.250		0	7.000	407.782	250
57	302042.658	195726.126	407.541	0.250		1	7.000	407.291	250
						0	7.001	407.291	250
58	302023.759	195740.332	407.223	0.250		1	7.001	406.973	250
						0	7.002	406.973	250
59_OUT	301980.197	195773.747	406.100	0.660		1	7.003	405.850	250
71	301960.937	195796.217	406.100	0.800		0	13.000	405.300	225
70	301950.111	195795.015	404.750	0.250		0	11.000	404.500	250
70_OUT	301930.927	195792.914	403.487	0.250		1	11.000	403.237	250
25	302204.925	195429.176	402.123	0.250		1	2.008	401.873	250
						0	2.009	401.873	250
32	302071.045	195695.142	407.343	0.250		0	4.000	407.093	250
34	302108.528	195634.292	405.102	0.250		1	4.001	404.852	250
						0	4.002	404.852	250

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
35	302122.597	195576.275	404.053	0.250		1	4.002	403.803	250
						0	4.003	403.803	250
36	302125.018	195539.855	403.476	0.250		1	4.003	403.226	250
						0	4.004	403.226	250
37	302122.753	195507.986	400.835	0.250		1	4.004	400.585	250
						0	4.005	400.585	250
38	302128.385	195482.668	398.696	0.250		1	4.005	398.446	250
						0	4.006	398.446	250
38_OUT	302137.050	195463.816	397.185	0.917		1	4.006	396.935	250
31_OUT	302164.809	195439.245	397.185	0.917		1	2.013	396.685	500
16	302129.765	195678.649	414.013	0.250					
						0	2.000	413.763	250
17	302155.061	195638.385	412.909	0.250		1	2.000	412.659	250
						0	2.001	412.659	250
18	302170.262	195603.128	411.873	0.250		1	2.001	411.623	250
						0	2.002	411.623	250
19	302178.566	195563.888	410.150	0.250		1	2.002	409.900	250
						0	2.003	409.900	250
20	302187.331	195514.317	407.200	0.250		1	2.003	406.950	250
						0	2.004	406.950	250
21	302204.716	195491.041	405.764	0.250		1	2.004	405.514	250
						0	2.005	405.514	250
22	302214.004	195469.874	404.483	0.250		1	2.005	404.233	250
						0	2.006	404.233	250

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections		Link	IL (m)	Dia (mm)
23	302212.472	195453.627	403.533	0.250			1	2.006	403.283	250
							0	2.007	403.283	250
26	302203.293	195423.679	400.591	0.250			1	2.009	400.341	250
							0	2.010	400.341	250
24	302206.211	195433.852	402.393	0.250			1	2.007	402.143	250
							0	2.008	402.143	250
30	302200.475	195418.070	399.090	0.500			1	3.001	398.840	250
							2	2.011	398.590	500
							0	2.012	398.590	500
31	302185.186	195422.760	398.303	0.500			1	2.012	397.803	500
							0	2.013	397.803	500
62	302259.353	195439.525	400.665	0.250			1	8.001	400.415	250
							0	8.002	400.415	250
61	302247.476	195436.043	400.899	0.250			1	8.000	400.649	250
							0	8.001	400.649	250
72	302132.599	195456.747	397.185	1.000						
							0	12.000	396.185	150
68	302090.808	195458.982	392.651	0.250			1	10.000	392.401	250
							0	10.001	392.401	250
69	302067.509	195464.347	389.889	0.250			1	10.001	389.639	250
							0	10.002	389.639	250
69_OUT	302047.440	195464.412	387.691	0.250			1	10.002	387.441	250
60	302238.392	195431.144	400.901	0.250						
							0	8.000	400.651	250
65	302283.882	195452.613	400.083	0.250			1	9.000	399.833	250
							0	9.001	399.833	250

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
27	302201.449	195419.283	399.170	0.500		1	2.010	398.920	250
						0	2.011	398.670	500
28	302232.059	195425.852	400.710	0.250		0	3.000	400.460	250
29	302216.683	195418.935	399.983	0.250		1	3.000	399.733	250
						0	3.001	399.733	250
48	301994.028	195788.522	409.999	0.250		1	5.008	409.749	250
						0	5.009	409.749	250
49	301987.669	195787.365	408.111	0.250		1	5.009	407.861	250
						0	5.010	407.861	250
50	301981.689	195786.658	406.113	0.250		1	5.010	405.863	250
						0	5.011	405.863	250
71_OUT	301956.819	195796.033	406.100	0.800	1200	1	13.000	405.300	225
72_OUT	302124.908	195455.456	397.185	1.000	1200	1	12.000	396.185	150
67	302111.857	195454.691	395.067	0.250		0	10.000	394.817	250
59	302002.753	195754.823	406.667	0.250		1	7.002	406.417	250
						0	7.003	406.417	250
73	302280.742	195441.772	399.585	0.250		1	9.004	399.335	250
						0	9.005	399.335	250

Simulation Settings

Rainfall Methodology	FSR	Analysis Speed	Normal
FSR Region	England and Wales	Skip Steady State	x
M5-60 (mm)	20.000	Drain Down Time (mins)	240
Ratio-R	0.200	Additional Storage (m³/ha)	20.0
Summer CV	0.750	Check Discharge Rate(s)	x
Winter CV	0.840	Check Discharge Volume	x

Storm Durations

15	30	60	120	180	240	360	480	600	720	960	1440

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
2	0	0	0
30	0	0	0
100	0	0	0
100	40	0	0

Node 71_OUT Offline Weir Control

Flap Valve	x	Invert Level (m)	405.800	Discharge Coefficient	0.590
Loop to Node	70	Width (m)	1.000		

Node 71_OUT Offline Orifice Control

Flap Valve	x	Invert Level (m)	405.300	Discharge Coefficient	0.600
Loop to Node	70	Diameter (m)	0.150		

Node 72_OUT Offline Weir Control

Flap Valve	x	Invert Level (m)	396.885	Discharge Coefficient	0.590
Loop to Node	67	Width (m)	1.000		

Node 72_OUT Offline Orifice Control

Flap Valve	x	Invert Level (m)	396.185	Discharge Coefficient	0.600
Loop to Node	67	Diameter (m)	0.300		

Node 38_OUT Online Weir Control

Flap Valve	x	Invert Level (m)	396.935	Discharge Coefficient	0.590
Replaces Downstream Link	x	Width (m)	3.000		

Node 31_OUT Online Weir Control

Flap Valve	x	Invert Level (m)	396.685	Discharge Coefficient	0.590
Replaces Downstream Link	x	Width (m)	3.000		

Node 55_OUT Online Weir Control

Flap Valve	x	Invert Level (m)	405.850	Discharge Coefficient	0.590
Replaces Downstream Link	x	Width (m)	3.000		

Node 50_OUT Online Weir Control

Flap Valve	x	Invert Level (m)	405.850	Discharge Coefficient	0.590
Replaces Downstream Link	x	Width (m)	3.000		

Node 59_OUT Online Weir Control

Flap Valve	x	Invert Level (m)	405.850	Discharge Coefficient	0.590
Replaces Downstream Link	x	Width (m)	3.000		

Node 73 Online Weir Control

Flap Valve	x	Invert Level (m)	399.535	Discharge Coefficient	0.590
Replaces Downstream Link	x	Width (m)	1.000		

Node 73 Online Orifice Control

Flap Valve	x	Invert Level (m)	399.335	Discharge Coefficient	0.600
Replaces Downstream Link	x	Diameter (m)	0.100		

Node 62 Online Weir Control

Flap Valve	x	Invert Level (m)	400.615	Discharge Coefficient	0.590
Replaces Downstream Link	x	Width (m)	1.000		

Node 62 Online Orifice Control

Flap Valve	x	Invert Level (m)	400.415	Discharge Coefficient	0.600
Replaces Downstream Link	x	Diameter (m)	0.100		

Node 65 Online Weir Control

Flap Valve	x	Invert Level (m)	400.033	Discharge Coefficient	0.590
Replaces Downstream Link	x	Width (m)	1.000		

Node 65 Online Orifice Control

Flap Valve	x	Invert Level (m)	399.833	Discharge Coefficient	0.600
Replaces Downstream Link	x	Diameter (m)	0.100		

Node 3 Online Weir Control

Flap Valve	x	Invert Level (m)	411.198	Discharge Coefficient	0.590
Replaces Downstream Link	x	Width (m)	1.000		

Node 3 Online Orifice Control

Flap Valve	x	Invert Level (m)	410.998	Discharge Coefficient	0.600
Replaces Downstream Link	x	Diameter (m)	0.100		

Node 5 Online Weir Control

Flap Valve	x	Invert Level (m)	410.095	Discharge Coefficient	0.590
Replaces Downstream Link	x	Width (m)	1.000		

Node 5 Online Orifice Control

Flap Valve	x	Invert Level (m)	409.895	Discharge Coefficient	0.600
Replaces Downstream Link	x	Diameter (m)	0.100		

Node 7 Online Weir Control

Flap Valve	x	Invert Level (m)	408.756	Discharge Coefficient	0.590
Replaces Downstream Link	x	Width (m)	1.000		

Node 7 Online Orifice Control

Flap Valve	x	Invert Level (m)	408.556	Discharge Coefficient	0.600
Replaces Downstream Link	x	Diameter (m)	0.100		

Node 9 Online Weir Control

Flap Valve	x	Invert Level (m)	408.466	Discharge Coefficient	0.590
Replaces Downstream Link	x	Width (m)	1.000		

Node 9 Online Orifice Control

Flap Valve	x	Invert Level (m)	408.266	Discharge Coefficient	0.600
Replaces Downstream Link	x	Diameter (m)	0.100		

Node 11 Online Weir Control

Flap Valve	x	Invert Level (m)	405.683	Discharge Coefficient	0.590
Replaces Downstream Link	x	Width (m)	1.000		

Node 11 Online Orifice Control

Flap Valve	x	Invert Level (m)	405.483	Discharge Coefficient	0.600
Replaces Downstream Link	x	Diameter (m)	0.100		

Node 13 Online Weir Control

Flap Valve	x	Invert Level (m)	403.404	Discharge Coefficient	0.590
Replaces Downstream Link	x	Width (m)	1.000		

Node 13 Online Orifice Control

Flap Valve	x	Invert Level (m)	403.204	Discharge Coefficient	0.600
Replaces Downstream Link	x	Diameter (m)	0.100		

Node 15 Online Weir Control

Flap Valve	x	Invert Level (m)	402.310	Discharge Coefficient	0.590
Replaces Downstream Link	x	Width (m)	1.000		

Node 15 Online Orifice Control

Flap Valve	x	Invert Level (m)	402.160	Discharge Coefficient	0.600
Replaces Downstream Link	x	Diameter (m)	0.100		

Node 71 Flow through Pond Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Main Channel Length (m)	42.000
Side Inf Coefficient (m/hr)	0.00000	Invert Level (m)	405.300	Main Channel Slope (1:X)	300.0
Safety Factor	2.0	Time to half empty (mins)	88	Main Channel n	0.060

Inlets

59_OUT	50_OUT	55_OUT

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	457.0	0.0	0.800	695.3	0.0

Node 72 Flow through Pond Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Main Channel Length (m)	25.000
Side Inf Coefficient (m/hr)	0.00000	Invert Level (m)	396.185	Main Channel Slope (1:X)	300.0
Safety Factor	2.0	Time to half empty (mins)	156	Main Channel n	0.060

Inlets

31_OUT	38_OUT

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	496.0	0.0	1.000	839.0	0.0

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)	Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
2 year 15 minute summer	112.777	31.912	30 year 240 minute winter	34.480	13.715
2 year 15 minute winter	79.142	31.912	30 year 360 minute summer	41.522	10.685
2 year 30 minute summer	81.416	23.038	30 year 360 minute winter	26.991	10.685
2 year 30 minute winter	57.134	23.038	30 year 480 minute summer	33.795	8.931
2 year 60 minute summer	61.301	16.200	30 year 480 minute winter	22.452	8.931
2 year 60 minute winter	40.727	16.200	30 year 600 minute summer	28.377	7.762
2 year 120 minute summer	42.559	11.247	30 year 600 minute winter	19.389	7.762
2 year 120 minute winter	28.275	11.247	30 year 720 minute summer	25.804	6.916
2 year 180 minute summer	35.121	9.038	30 year 720 minute winter	17.342	6.916
2 year 180 minute winter	22.829	9.038	30 year 960 minute summer	21.860	5.756
2 year 240 minute summer	29.197	7.716	30 year 960 minute winter	14.481	5.756
2 year 240 minute winter	19.398	7.716	30 year 1440 minute summer	16.557	4.437
2 year 360 minute summer	23.988	6.173	30 year 1440 minute winter	11.127	4.437
2 year 360 minute winter	15.593	6.173	100 year 15 minute summer	273.602	77.420
2 year 480 minute summer	19.942	5.270	100 year 15 minute winter	192.002	77.420
2 year 480 minute winter	13.249	5.270	100 year 30 minute summer	202.154	57.203
2 year 600 minute summer	17.030	4.658	100 year 30 minute winter	141.863	57.203
2 year 600 minute winter	11.636	4.658	100 year 60 minute summer	153.288	40.510
2 year 720 minute summer	15.715	4.212	100 year 60 minute winter	101.841	40.510
2 year 720 minute winter	10.561	4.212	100 year 120 minute summer	103.325	27.306
2 year 960 minute summer	13.650	3.594	100 year 120 minute winter	68.647	27.306
2 year 960 minute winter	9.042	3.594	100 year 180 minute summer	82.228	21.160
2 year 1440 minute summer	10.717	2.872	100 year 180 minute winter	53.450	21.160
2 year 1440 minute winter	7.203	2.872	100 year 240 minute summer	66.740	17.637
30 year 15 minute summer	212.586	60.154	100 year 240 minute winter	44.341	17.637
30 year 15 minute winter	149.183	60.154	100 year 360 minute summer	52.784	13.583
30 year 30 minute summer	155.010	43.862	100 year 360 minute winter	34.311	13.583
30 year 30 minute winter	108.779	43.862	100 year 480 minute summer	42.569	11.250
30 year 60 minute summer	116.589	30.811	100 year 480 minute winter	28.282	11.250
30 year 60 minute winter	77.459	30.811	100 year 600 minute summer	35.470	9.702
30 year 120 minute summer	78.946	20.863	100 year 600 minute winter	24.235	9.702
30 year 120 minute winter	52.450	20.863	100 year 720 minute summer	32.039	8.587
30 year 180 minute summer	63.479	16.335	100 year 720 minute winter	21.532	8.587
30 year 180 minute winter	41.263	16.335	100 year 960 minute summer	26.838	7.067
30 year 240 minute summer	51.899	13.715	100 year 960 minute winter	17.778	7.067

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)	Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
100 year 1440 minute summer	19.990	5.358	100 year +40% CC 240 minute winter	62.077	24.692
100 year 1440 minute winter	13.435	5.358	100 year +40% CC 360 minute summer	73.898	19.016
100 year +40% CC 15 minute summer	383.043	108.388	100 year +40% CC 360 minute winter	48.036	19.016
100 year +40% CC 15 minute winter	268.802	108.388	100 year +40% CC 480 minute summer	59.596	15.750
100 year +40% CC 30 minute summer	283.016	80.084	100 year +40% CC 480 minute winter	39.594	15.750
100 year +40% CC 30 minute winter	198.608	80.084	100 year +40% CC 600 minute summer	49.658	13.583
100 year +40% CC 60 minute summer	214.603	56.713	100 year +40% CC 600 minute winter	33.930	13.583
100 year +40% CC 60 minute winter	142.577	56.713	100 year +40% CC 720 minute summer	44.855	12.022
100 year +40% CC 120 minute summer	144.655	38.228	100 year +40% CC 720 minute winter	30.145	12.022
100 year +40% CC 120 minute winter	96.105	38.228	100 year +40% CC 960 minute summer	37.573	9.894
100 year +40% CC 180 minute summer	115.119	29.624	100 year +40% CC 960 minute winter	24.889	9.894
100 year +40% CC 180 minute winter	74.831	29.624	100 year +40% CC 1440 minute summer	27.987	7.501
100 year +40% CC 240 minute summer	93.436	24.692	100 year +40% CC 1440 minute winter	18.809	7.501

Results for 2 year Critical Storm Duration. Lowest mass balance: 98.13%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	1	11	411.616	0.021	0.3	0.0030	0.0000	OK
15 minute winter	51	11	411.598	0.027	0.5	0.0071	0.0000	OK
15 minute winter	52	11	411.174	0.032	0.9	0.0076	0.0000	OK
30 minute summer	53	20	410.232	0.035	1.1	0.0060	0.0000	OK
30 minute summer	54	21	409.420	0.037	1.4	0.0107	0.0000	OK
30 minute summer	55	20	408.292	0.038	2.4	0.0287	0.0000	OK
30 minute summer	55_OUT	20	405.856	0.416	2.3	0.0000	0.0000	OK
30 minute winter	39	21	414.322	0.081	4.2	0.2624	0.0000	OK
30 minute winter	40	21	414.175	0.080	8.9	0.2886	0.0000	OK
30 minute winter	41	22	413.819	0.094	13.1	0.3166	0.0000	OK
30 minute winter	42	22	413.137	0.119	26.3	1.2411	0.0000	OK
30 minute winter	43	22	412.450	0.125	31.7	0.5723	0.0000	OK
30 minute winter	44	22	411.673	0.133	38.3	0.7272	0.0000	OK
30 minute winter	45	23	410.871	0.134	38.5	0.0368	0.0000	OK
30 minute winter	46	23	410.209	0.136	39.0	0.0762	0.0000	OK
30 minute winter	47	23	410.008	0.137	39.0	0.0000	0.0000	OK
30 minute winter	50_OUT	23	405.887	0.447	39.0	0.0000	0.0000	OK
30 minute winter	2	20	411.222	0.032	0.5	0.0061	0.0000	OK
30 minute winter	3	20	411.052	0.053	1.3	0.0313	0.0000	OK
30 minute winter	4	20	410.577	0.050	2.4	0.0454	0.0000	OK
30 minute winter	5	22	410.012	0.117	4.5	0.1770	0.0000	OK
30 minute winter	6	22	409.760	0.064	5.2	0.0888	0.0000	OK
60 minute winter	7	42	408.746	0.190	6.6	0.3727	0.0000	OK
60 minute winter	8	45	408.620	0.081	5.3	0.0000	0.0000	OK
60 minute winter	9	46	408.403	0.137	6.3	0.2478	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	1	1.000	2	0.2	0.117	0.001	0.0428	
15 minute winter	51	6.000	52	0.5	0.194	0.003	0.0397	
15 minute winter	52	6.001	53	0.8	0.280	0.004	0.0881	
30 minute summer	53	6.002	54	1.0	0.256	0.005	0.1180	
30 minute summer	54	6.003	55	1.3	0.316	0.006	0.1310	
30 minute summer	55	6.004	55_OUT	2.3	0.513	0.007	0.1215	
30 minute winter	55_OUT	Flow through pond	71	53.8	0.116	0.011	34.7236	
30 minute winter	39	5.000	40	4.2	0.214	0.049	0.5005	
30 minute winter	40	5.001	41	8.8	0.385	0.048	0.3260	
30 minute winter	41	5.002	42	12.9	0.378	0.074	1.0281	
30 minute winter	42	5.003	43	25.9	0.579	0.139	1.1516	
30 minute winter	43	5.004	44	31.5	0.633	0.158	1.2563	
30 minute winter	44	5.005	45	38.2	0.718	0.184	1.2705	
30 minute winter	45	5.006	46	38.3	0.704	0.190	1.1339	
30 minute winter	46	5.007	47	39.0	0.699	0.196	0.3640	
30 minute winter	47	5.008	48	39.0	1.010	0.197	0.1606	
30 minute winter	50_OUT	Flow through pond	71	53.8	0.116	0.011	34.7236	
30 minute winter	2	1.001	3	0.4	0.086	0.004	0.1253	
30 minute winter	3	1.002	4	1.2	0.200	0.008	0.1427	
30 minute winter	4	1.003	5	2.4	0.124	0.014	0.6851	
30 minute winter	5	1.004	6	3.7	0.220	0.042	0.5565	
30 minute winter	6	1.005	7	5.0	0.141	0.027	2.3464	
60 minute winter	7	1.006	8	5.3	0.166	0.177	0.8150	
60 minute winter	8	1.007	9	5.2	0.156	0.050	1.1922	
60 minute winter	9	1.008	10	5.9	0.434	0.019	0.4341	

Results for 2 year Critical Storm Duration. Lowest mass balance: 98.13%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
60 minute winter	10	39	406.119	0.081	7.4	0.1732	0.0000	OK
60 minute winter	11	42	405.691	0.208	8.2	0.1903	0.0000	OK
60 minute winter	12	44	405.370	0.070	8.4	0.0850	0.0000	OK
120 minute winter	13	80	403.414	0.210	8.5	0.1634	0.0000	OK
120 minute winter	14	80	402.894	0.073	8.5	0.0237	0.0000	OK
120 minute winter	15	82	402.322	0.162	8.5	0.0000	0.0000	OK
120 minute winter	15_OUT	82	401.859	0.070	8.5	0.0000	0.0000	OK
15 minute summer	64	11	401.526	0.021	0.5	0.0061	0.0000	OK
30 minute summer	66_OUT	20	399.175	0.039	2.1	0.0000	0.0000	OK
30 minute summer	33	21	407.068	0.052	4.2	0.0000	0.0000	OK
30 minute summer	63	18	399.862	0.028	0.7	0.0107	0.0000	OK
30 minute summer	66	19	399.560	0.046	2.2	0.0285	0.0000	OK
15 minute winter	56	11	407.842	0.060	3.9	0.1288	0.0000	OK
15 minute winter	57	11	407.356	0.065	6.2	0.0869	0.0000	OK
15 minute winter	58	12	407.020	0.047	6.3	0.0000	0.0000	OK
30 minute summer	59_OUT	21	405.861	0.421	6.1	0.0000	0.0000	OK
180 minute winter	71	128	405.473	0.173	24.4	0.0000	0.0000	OK
180 minute winter	70	128	404.556	0.056	14.2	0.0000	0.0000	OK
180 minute winter	70_OUT	128	403.291	0.054	14.2	0.0000	0.0000	OK
30 minute winter	25	23	401.984	0.111	66.3	0.0000	0.0000	OK
15 minute winter	32	11	407.214	0.121	4.9	0.3276	0.0000	OK
30 minute winter	34	21	404.930	0.078	7.3	0.2034	0.0000	OK
30 minute winter	35	21	403.908	0.105	11.0	0.3408	0.0000	OK
30 minute winter	36	21	403.300	0.073	12.5	0.1595	0.0000	OK
30 minute winter	37	21	400.663	0.078	14.5	0.1393	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
60 minute winter	10	1.009	11	7.3	0.196	0.049	2.4191	
60 minute winter	11	1.010	12	7.7	0.288	0.082	0.7634	
60 minute winter	12	1.011	13	8.3	0.220	0.033	3.1132	
120 minute winter	13	1.012	14	8.3	0.332	0.071	0.9298	
120 minute winter	14	1.013	15	8.5	0.309	0.037	0.7731	
120 minute winter	15	1.014	15_OUT	8.5	0.524	0.041	0.1796	32.0
15 minute summer	64	9.000	65	0.5	0.440	0.001	0.0293	
30 minute summer	33	4.001	34	3.9	0.312	0.015	0.5332	
30 minute summer	63	8.003	66	0.7	0.169	0.003	0.0336	
30 minute summer	66	9.004	73	2.1	0.272	0.011	0.0657	
15 minute winter	56	7.000	57	3.8	0.336	0.022	0.2463	
15 minute winter	57	7.001	58	6.3	0.284	0.050	0.5344	
15 minute winter	58	7.002	59	6.0	0.297	0.037	0.5705	
30 minute winter	59_OUT	Flow through pond	71	53.8	0.116	0.011	34.7236	
180 minute winter	71	13.000	71_OUT	14.2	0.447	0.357	0.1326	
180 minute winter	70	11.000	70_OUT	14.2	0.628	0.051	0.4368	100.1
30 minute winter	25	2.009	26	66.3	1.837	0.113	0.2071	
15 minute winter	32	4.000	33	4.3	0.200	0.077	0.7840	
30 minute winter	34	4.002	35	6.8	0.270	0.045	1.5306	
30 minute winter	35	4.003	36	10.1	0.422	0.071	0.8968	
30 minute winter	36	4.004	37	12.4	0.725	0.038	0.5488	
30 minute winter	37	4.005	38	14.5	0.753	0.045	0.4987	

Results for 2 year Critical Storm Duration. Lowest mass balance: 98.13%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
30 minute winter	38	21	398.528	0.082	15.8	0.0949	0.0000	OK
30 minute winter	38_OUT	21	396.955	0.687	15.8	0.0000	0.0000	OK
30 minute winter	31_OUT	23	396.739	0.471	69.7	0.3519	0.0000	OK
30 minute winter	16	21	413.841	0.078	7.9	0.4734	0.0000	OK
30 minute winter	17	22	412.755	0.096	14.8	0.5280	0.0000	OK
30 minute winter	18	22	411.725	0.102	21.8	0.5818	0.0000	OK
30 minute winter	19	22	410.015	0.115	34.9	1.2321	0.0000	OK
30 minute winter	20	22	407.084	0.134	48.3	1.5034	0.0000	OK
30 minute winter	21	22	405.655	0.141	58.2	1.1657	0.0000	OK
30 minute winter	22	23	404.373	0.140	57.9	0.0000	0.0000	OK
30 minute winter	23	23	403.432	0.149	66.4	1.0623	0.0000	OK
30 minute winter	26	23	400.450	0.108	66.3	0.0000	0.0000	OK
30 minute winter	24	23	402.296	0.153	66.2	0.0000	0.0000	OK
30 minute winter	30	23	398.727	0.137	68.1	0.1054	0.0000	OK
30 minute winter	31	23	397.948	0.145	68.1	0.0000	0.0000	OK
30 minute winter	62	24	400.439	0.024	0.3	0.0000	0.0000	OK
30 minute winter	61	20	400.680	0.031	0.3	0.0000	0.0000	OK
240 minute winter	72	172	396.433	0.248	28.5	0.0000	0.0000	SURCHARGED
240 minute winter	68	172	392.459	0.058	20.2	0.0000	0.0000	OK
240 minute winter	69	172	389.698	0.059	20.2	0.0000	0.0000	OK
240 minute winter	69_OUT	172	387.500	0.059	20.2	0.0000	0.0000	OK
15 minute summer	60	12	400.700	0.049	0.4	0.0099	0.0000	OK
30 minute summer	65	20	399.864	0.031	0.5	0.0000	0.0000	OK
30 minute winter	27	23	398.804	0.134	66.3	0.0000	0.0000	OK
15 minute winter	28	10	400.494	0.034	1.1	0.0206	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
30 minute winter	38	4.006	38_OUT	15.8	0.776	0.052	0.4210	
30 minute winter	38_OUT	Flow through pond	72	83.3	0.097	0.006	66.8037	
30 minute winter	31_OUT	Flow through pond	72	83.3	0.097	0.006	66.8037	
30 minute winter	16	2.000	17	7.7	0.343	0.045	1.0914	
30 minute winter	17	2.001	18	14.5	0.494	0.078	1.1319	
30 minute winter	18	2.002	19	21.5	0.609	0.092	1.4210	
30 minute winter	19	2.003	20	34.5	0.741	0.126	2.3589	
30 minute winter	20	2.004	21	48.0	0.842	0.191	1.6569	
30 minute winter	21	2.005	22	57.9	0.979	0.217	1.3672	
30 minute winter	22	2.006	23	57.8	0.928	0.212	1.0176	
30 minute winter	23	2.007	24	66.2	0.975	0.250	1.4103	
30 minute winter	26	2.010	27	66.3	1.899	0.107	0.1665	
30 minute winter	24	2.008	25	66.3	1.274	0.248	0.2588	
30 minute winter	30	2.012	31	68.1	0.832	0.059	1.3128	
30 minute winter	31	2.013	31_OUT	67.7	0.858	0.062	2.0719	
30 minute winter	62	8.002	63	0.3	0.194	0.001	0.0182	
30 minute winter	61	8.001	62	0.3	0.294	0.002	0.0240	
240 minute winter	72	12.000	72_OUT	20.2	1.153	1.141	0.1309	
240 minute winter	68	10.001	69	20.2	0.829	0.055	0.5818	
240 minute winter	69	10.002	69_OUT	20.2	0.821	0.056	0.4930	227.9
30 minute summer	60	8.000	61	0.3	0.080	0.020	0.0476	
30 minute summer	65	9.001	66	0.5	0.134	0.002	0.0369	
30 minute winter	27	2.011	30	66.3	0.857	0.056	0.1205	
15 minute winter	28	3.000	29	1.1	0.363	0.005	0.0530	

Results for 2 year Critical Storm Duration. Lowest mass balance: 98.13%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	29	12	399.764	0.031	1.1	0.0000	0.0000	OK
30 minute winter	48	23	409.839	0.090	39.0	0.0000	0.0000	OK
30 minute winter	49	23	407.947	0.086	39.1	0.0000	0.0000	OK
30 minute winter	50	23	406.023	0.160	39.1	0.0000	0.0000	OK
180 minute winter	71_OUT	128	405.467	0.167	14.2	0.1883	0.0000	OK
240 minute winter	72_OUT	172	396.313	0.128	20.2	0.1442	0.0000	OK
240 minute winter	67	172	394.876	0.059	20.2	0.0000	0.0000	OK
30 minute summer	59	21	406.481	0.064	7.1	0.0668	0.0000	OK
30 minute summer	73	19	399.406	0.071	2.1	0.0000	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	29	3.001	30	1.0	0.361	0.004	0.0450	
30 minute winter	48	5.009	49	39.1	1.684	0.064	0.1499	
30 minute winter	49	5.010	50	39.1	1.171	0.060	0.2994	
30 minute winter	50	5.011	50_OUT	39.0	0.625	0.370	0.1526	
15 minute summer	71_OUT	Weir	70	0.0				0.0
180 minute winter	71_OUT	Orifice	70	14.2				100.1
15 minute summer	72_OUT	Weir	67	0.0				0.0
240 minute winter	72_OUT	Orifice	67	20.2				228.0
240 minute winter	67	10.000	68	20.2	0.832	0.055	0.5208	
30 minute summer	59	7.003	59_OUT	6.1	0.320	0.041	0.5798	
30 minute summer	73	9.005	66_OUT	2.1	0.361	0.011	0.0384	1.6

Results for 30 year Critical Storm Duration. Lowest mass balance: 98.13%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	1	11	411.624	0.028	0.5	0.0041	0.0000	OK
30 minute summer	51	18	411.605	0.033	0.9	0.0088	0.0000	OK
30 minute summer	52	19	411.182	0.040	1.7	0.0097	0.0000	OK
30 minute summer	53	20	410.243	0.045	2.2	0.0077	0.0000	OK
30 minute summer	54	20	409.431	0.048	2.9	0.0139	0.0000	OK
30 minute summer	55	20	408.304	0.050	4.7	0.0373	0.0000	OK
30 minute summer	55_OUT	20	405.859	0.419	4.6	0.0000	0.0000	OK
30 minute winter	39	21	414.344	0.103	8.1	0.3352	0.0000	OK
30 minute winter	40	21	414.197	0.102	16.9	0.3689	0.0000	OK
30 minute winter	41	21	413.846	0.121	25.2	0.4055	0.0000	OK
30 minute winter	42	21	413.171	0.153	50.5	1.5892	0.0000	OK
30 minute winter	43	22	412.485	0.160	61.3	0.7325	0.0000	OK
30 minute winter	44	22	411.710	0.170	74.3	0.9317	0.0000	OK
30 minute winter	45	22	410.909	0.172	74.6	0.0473	0.0000	OK
30 minute winter	46	22	410.247	0.174	75.9	0.0978	0.0000	OK
30 minute winter	47	22	410.045	0.174	75.8	0.0000	0.0000	OK
30 minute winter	50_OUT	23	405.907	0.467	75.6	0.0000	0.0000	OK
30 minute summer	2	20	411.232	0.042	1.0	0.0080	0.0000	OK
15 minute winter	3	12	411.076	0.078	2.8	0.0459	0.0000	OK
30 minute summer	4	20	410.592	0.065	5.0	0.0587	0.0000	OK
30 minute winter	5	22	410.092	0.197	8.8	0.2970	0.0000	OK
30 minute winter	6	21	409.776	0.080	9.4	0.1108	0.0000	OK
30 minute winter	7	21	408.783	0.227	14.2	0.4455	0.0000	OK
30 minute winter	8	24	408.651	0.112	13.1	0.0000	0.0000	OK
60 minute winter	9	39	408.490	0.224	15.0	0.4042	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	1	1.000	2	0.5	0.139	0.003	0.0820	
30 minute summer	51	6.000	52	0.9	0.223	0.005	0.0620	
30 minute summer	52	6.001	53	1.6	0.300	0.007	0.1468	
30 minute summer	53	6.002	54	2.0	0.305	0.011	0.1984	
30 minute summer	54	6.003	55	2.7	0.372	0.012	0.2214	
30 minute summer	55	6.004	55_OUT	4.6	0.611	0.014	0.2050	
15 minute winter	55_OUT	Flow through pond	71	96.2	0.148	0.019	47.3967	
30 minute winter	39	5.000	40	8.0	0.252	0.094	0.8175	
30 minute winter	40	5.001	41	16.9	0.452	0.092	0.5348	
30 minute winter	41	5.002	42	25.0	0.446	0.143	1.6861	
30 minute winter	42	5.003	43	50.1	0.682	0.269	1.8856	
30 minute winter	43	5.004	44	60.9	0.747	0.305	2.0601	
30 minute winter	44	5.005	45	74.0	0.846	0.357	2.0905	
30 minute winter	45	5.006	46	74.6	0.831	0.369	1.8679	
30 minute winter	46	5.007	47	75.8	0.836	0.381	0.5907	
30 minute winter	47	5.008	48	75.8	1.212	0.382	0.2590	
15 minute winter	50_OUT	Flow through pond	71	96.2	0.148	0.019	47.3967	
30 minute summer	2	1.001	3	0.9	0.085	0.009	0.2541	
30 minute summer	3	1.002	4	2.4	0.237	0.015	0.2390	
30 minute summer	4	1.003	5	4.7	0.130	0.028	1.6911	
30 minute winter	5	1.004	6	6.2	0.252	0.070	0.8217	
30 minute winter	6	1.005	7	9.1	0.146	0.048	3.5511	
30 minute winter	7	1.006	8	13.1	0.229	0.439	1.4855	
30 minute winter	8	1.007	9	12.3	0.153	0.117	2.9002	
60 minute winter	9	1.008	10	14.8	0.532	0.048	0.8668	

Results for 30 year Critical Storm Duration. Lowest mass balance: 98.13%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
60 minute winter	10	39	406.151	0.113	18.3	0.2425	0.0000	OK
60 minute winter	11	40	405.721	0.238	19.4	0.2171	0.0000	OK
60 minute winter	12	41	405.398	0.098	20.8	0.1197	0.0000	OK
60 minute winter	13	42	403.445	0.241	21.6	0.1878	0.0000	OK
60 minute winter	14	43	402.924	0.103	21.6	0.0336	0.0000	OK
60 minute winter	15	44	402.351	0.191	21.6	0.0000	0.0000	OK
60 minute winter	15_OUT	44	401.890	0.101	21.5	0.0000	0.0000	OK
30 minute summer	64	18	401.532	0.027	1.0	0.0079	0.0000	OK
30 minute summer	66_OUT	19	399.187	0.052	4.0	0.0000	0.0000	OK
15 minute winter	33	13	407.084	0.068	8.6	0.0000	0.0000	OK
30 minute winter	63	21	399.871	0.037	1.4	0.0141	0.0000	OK
15 minute winter	66	11	399.573	0.059	4.1	0.0363	0.0000	OK
15 minute winter	56	10	407.858	0.076	7.4	0.1639	0.0000	OK
15 minute winter	57	11	407.380	0.089	11.7	0.1178	0.0000	OK
15 minute winter	58	12	407.040	0.067	11.9	0.0000	0.0000	OK
15 minute winter	59_OUT	13	405.867	0.427	12.5	0.0000	0.0000	OK
180 minute winter	71	132	405.566	0.266	36.2	0.0000	0.0000	SURCHARGED
180 minute winter	70	132	404.568	0.068	20.0	0.0000	0.0000	OK
180 minute winter	70_OUT	132	403.303	0.066	20.0	0.0000	0.0000	OK
30 minute winter	25	22	402.016	0.143	129.4	0.0000	0.0000	OK
15 minute winter	32	11	407.245	0.152	9.3	0.4122	0.0000	OK
30 minute summer	34	20	404.955	0.103	15.3	0.2670	0.0000	OK
30 minute winter	35	21	403.939	0.136	22.3	0.4419	0.0000	OK
30 minute winter	36	20	403.323	0.097	26.3	0.2104	0.0000	OK
30 minute winter	37	20	400.688	0.103	30.6	0.1839	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
60 minute winter	10	1.009	11	18.0	0.220	0.121	3.3639	
60 minute winter	11	1.010	12	19.2	0.369	0.205	1.4830	
60 minute winter	12	1.011	13	20.6	0.245	0.082	4.3657	
60 minute winter	13	1.012	14	21.3	0.433	0.182	1.8164	
60 minute winter	14	1.013	15	21.6	0.331	0.095	1.1603	
60 minute winter	15	1.014	15_OUT	21.5	0.655	0.104	0.3657	44.7
30 minute summer	64	9.000	65	1.0	0.412	0.003	0.0610	
15 minute winter	33	4.001	34	8.0	0.378	0.031	0.9174	
30 minute winter	63	8.003	66	1.4	0.219	0.006	0.0539	
15 minute winter	66	9.004	73	4.0	0.350	0.021	0.1230	
15 minute winter	56	7.000	57	7.2	0.356	0.041	0.4276	
15 minute winter	57	7.001	58	11.9	0.341	0.094	0.8290	
15 minute winter	58	7.002	59	11.5	0.340	0.072	0.9120	
15 minute winter	59_OUT	Flow through pond	71	96.2	0.148	0.019	47.3967	
180 minute winter	71	13.000	71_OUT	20.0	0.503	0.503	0.1639	
180 minute winter	70	11.000	70_OUT	20.0	0.691	0.072	0.5592	187.2
30 minute winter	25	2.009	26	129.4	2.171	0.221	0.3417	
15 minute winter	32	4.000	33	8.6	0.245	0.152	1.2559	
30 minute summer	34	4.002	35	14.0	0.329	0.093	2.5854	
30 minute winter	35	4.003	36	21.0	0.518	0.148	1.5236	
30 minute winter	36	4.004	37	26.1	0.872	0.080	0.9559	
30 minute winter	37	4.005	38	30.4	0.908	0.093	0.8677	

Results for 30 year Critical Storm Duration. Lowest mass balance: 98.13%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
30 minute winter	38	21	398.555	0.108	33.2	0.1252	0.0000	OK
30 minute winter	38_OUT	21	396.968	0.700	32.9	0.0000	0.0000	OK
30 minute winter	31_OUT	22	396.770	0.502	136.8	0.3748	0.0000	OK
30 minute winter	16	21	413.863	0.100	15.1	0.6049	0.0000	OK
30 minute winter	17	21	412.782	0.123	28.4	0.6748	0.0000	OK
30 minute winter	18	22	411.754	0.131	42.0	0.7450	0.0000	OK
30 minute winter	19	22	410.047	0.147	67.6	1.5801	0.0000	OK
30 minute winter	20	22	407.122	0.172	93.9	1.9305	0.0000	OK
30 minute winter	21	22	405.696	0.182	112.8	1.4972	0.0000	OK
30 minute winter	22	22	404.413	0.179	113.0	0.0000	0.0000	OK
30 minute winter	23	22	403.474	0.191	129.7	1.3661	0.0000	OK
30 minute winter	26	22	400.480	0.139	129.4	0.0000	0.0000	OK
30 minute winter	24	22	402.338	0.195	129.6	0.0000	0.0000	OK
30 minute winter	30	22	398.780	0.190	133.4	0.1459	0.0000	OK
30 minute winter	31	23	398.002	0.199	133.2	0.0000	0.0000	OK
30 minute summer	62	21	400.450	0.035	0.8	0.0000	0.0000	OK
30 minute summer	61	19	400.687	0.038	0.6	0.0000	0.0000	OK
240 minute winter	72	176	396.610	0.425	48.5	0.0000	0.0000	SURCHARGED
240 minute winter	68	176	392.472	0.071	29.3	0.0000	0.0000	OK
240 minute winter	69	176	389.711	0.072	29.3	0.0000	0.0000	OK
240 minute winter	69_OUT	176	387.513	0.072	29.3	0.0000	0.0000	OK
15 minute winter	60	11	400.712	0.061	0.7	0.0125	0.0000	OK
30 minute summer	65	19	399.877	0.044	1.0	0.0000	0.0000	OK
30 minute winter	27	22	398.856	0.186	129.3	0.0000	0.0000	OK
15 minute winter	28	10	400.503	0.043	2.1	0.0261	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
30 minute winter	38	4.006	38_OUT	32.9	0.934	0.108	0.7320	
15 minute winter	38_OUT	Flow through pond	72	149.1	0.135	0.011	92.4350	
15 minute winter	31_OUT	Flow through pond	72	149.1	0.135	0.011	92.4350	
30 minute winter	16	2.000	17	14.9	0.402	0.086	1.7873	
30 minute winter	17	2.001	18	28.0	0.582	0.150	1.8518	
30 minute winter	18	2.002	19	41.6	0.717	0.177	2.3338	
30 minute winter	19	2.003	20	67.0	0.873	0.245	3.8853	
30 minute winter	20	2.004	21	93.4	0.994	0.371	2.7326	
30 minute winter	21	2.005	22	113.0	1.156	0.424	2.2603	
30 minute winter	22	2.006	23	112.9	1.097	0.414	1.6820	
30 minute winter	23	2.007	24	129.6	1.162	0.488	2.3135	
30 minute winter	26	2.010	27	129.3	2.244	0.209	0.2747	
30 minute winter	24	2.008	25	129.4	1.519	0.485	0.4233	
30 minute winter	30	2.012	31	133.2	0.997	0.115	2.1381	
30 minute winter	31	2.013	31_OUT	132.9	1.015	0.123	3.4358	
30 minute summer	62	8.002	63	0.6	0.222	0.002	0.0351	
30 minute summer	61	8.001	62	0.8	0.276	0.005	0.0432	
240 minute winter	72	12.000	72_OUT	29.3	1.662	1.655	0.1373	
240 minute winter	68	10.001	69	29.3	0.925	0.079	0.7565	
240 minute winter	69	10.002	69_OUT	29.3	0.916	0.082	0.6411	408.2
15 minute winter	60	8.000	61	0.7	0.108	0.045	0.0757	
30 minute summer	65	9.001	66	0.9	0.149	0.004	0.0603	
30 minute winter	27	2.011	30	129.3	1.017	0.109	0.1978	
15 minute winter	28	3.000	29	2.0	0.406	0.009	0.0857	

Results for 30 year Critical Storm Duration. Lowest mass balance: 98.13%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	29	11	399.773	0.040	2.0	0.0000	0.0000	OK
30 minute winter	48	22	409.864	0.115	75.8	0.0000	0.0000	OK
30 minute winter	49	22	407.971	0.110	75.7	0.0000	0.0000	OK
30 minute winter	50	22	406.064	0.201	75.7	0.0000	0.0000	OK
180 minute winter	71_OUT	132	405.557	0.257	20.0	0.2901	0.0000	OK
240 minute winter	72_OUT	176	396.348	0.163	29.3	0.1848	0.0000	OK
240 minute winter	67	176	394.889	0.072	29.3	0.0000	0.0000	OK
15 minute winter	59	13	406.507	0.090	14.3	0.0939	0.0000	OK
15 minute winter	73	11	399.435	0.100	4.0	0.0000	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	29	3.001	30	1.9	0.422	0.007	0.0749	
30 minute winter	48	5.009	49	75.7	1.988	0.124	0.2463	
30 minute winter	49	5.010	50	75.7	1.043	0.116	0.4739	
30 minute winter	50	5.011	50_OUT	75.6	0.746	0.716	0.2467	
15 minute summer	71_OUT	Weir	70	0.0				0.0
180 minute winter	71_OUT	Orifice	70	20.0				187.2
15 minute summer	72_OUT	Weir	67	0.0				0.0
240 minute winter	72_OUT	Orifice	67	29.3				408.5
240 minute winter	67	10.000	68	29.3	0.928	0.080	0.6772	
15 minute winter	59	7.003	59_OUT	12.5	0.404	0.083	0.9325	
30 minute summer	73	9.005	66_OUT	4.0	0.426	0.020	0.0632	3.1

Results for 100 year Critical Storm Duration. Lowest mass balance: 98.13%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
30 minute summer	1	19	411.626	0.031	0.6	0.0044	0.0000	OK
15 minute winter	51	11	411.608	0.037	1.2	0.0097	0.0000	OK
15 minute winter	52	11	411.186	0.044	2.2	0.0107	0.0000	OK
15 minute winter	53	12	410.247	0.050	2.8	0.0086	0.0000	OK
30 minute summer	54	20	409.436	0.053	3.6	0.0153	0.0000	OK
30 minute summer	55	19	408.309	0.055	6.2	0.0413	0.0000	OK
30 minute summer	55_OUT	19	405.861	0.421	6.0	0.0000	0.0000	OK
30 minute winter	39	21	414.355	0.114	10.5	0.3697	0.0000	OK
30 minute winter	40	21	414.208	0.113	22.0	0.4075	0.0000	OK
30 minute winter	41	21	413.858	0.133	32.8	0.4482	0.0000	OK
30 minute winter	42	21	413.187	0.169	65.9	1.7582	0.0000	OK
30 minute winter	43	21	412.502	0.177	80.3	0.8106	0.0000	OK
30 minute winter	44	22	411.728	0.188	97.4	1.0306	0.0000	OK
30 minute winter	45	22	410.927	0.190	97.7	0.0524	0.0000	OK
30 minute winter	46	22	410.266	0.193	99.5	0.1084	0.0000	OK
30 minute winter	47	22	410.062	0.191	99.5	0.0000	0.0000	OK
30 minute winter	50_OUT	22	405.919	0.478	99.4	0.0000	0.0000	OK
15 minute winter	2	12	411.237	0.046	1.4	0.0089	0.0000	OK
30 minute summer	3	20	411.090	0.092	3.6	0.0539	0.0000	OK
30 minute summer	4	20	410.599	0.072	6.5	0.0653	0.0000	OK
30 minute winter	5	20	410.112	0.217	11.6	0.3269	0.0000	OK
30 minute winter	6	22	409.788	0.092	13.7	0.1277	0.0000	OK
30 minute winter	7	21	408.794	0.238	18.5	0.4667	0.0000	OK
30 minute winter	8	23	408.667	0.128	18.3	0.0000	0.0000	OK
30 minute winter	9	23	408.503	0.237	21.2	0.4272	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
30 minute summer	1	1.000	2	0.6	0.138	0.004	0.0990	
15 minute winter	51	6.000	52	1.1	0.237	0.006	0.0768	
15 minute winter	52	6.001	53	2.1	0.332	0.010	0.1783	
15 minute winter	53	6.002	54	2.6	0.326	0.014	0.2414	
30 minute summer	54	6.003	55	3.4	0.393	0.016	0.2693	
30 minute summer	55	6.004	55_OUT	6.0	0.654	0.018	0.2514	
15 minute winter	55_OUT	Flow through pond	71	122.0	0.163	0.024	61.4876	
30 minute winter	39	5.000	40	10.4	0.269	0.122	0.9960	
30 minute winter	40	5.001	41	22.0	0.483	0.121	0.6529	
30 minute winter	41	5.002	42	32.6	0.476	0.187	2.0621	
30 minute winter	42	5.003	43	65.6	0.729	0.353	2.3105	
30 minute winter	43	5.004	44	79.8	0.799	0.400	2.5196	
30 minute winter	44	5.005	45	96.9	0.906	0.467	2.5594	
30 minute winter	45	5.006	46	97.8	0.888	0.484	2.2903	
30 minute winter	46	5.007	47	99.5	0.900	0.499	0.7203	
30 minute winter	47	5.008	48	99.5	1.307	0.502	0.3149	
15 minute winter	50_OUT	Flow through pond	71	122.0	0.163	0.024	61.4876	
15 minute winter	2	1.001	3	1.2	0.085	0.011	0.3363	
30 minute summer	3	1.002	4	3.2	0.254	0.020	0.2957	
30 minute summer	4	1.003	5	6.2	0.129	0.037	2.1874	
30 minute winter	5	1.004	6	10.0	0.286	0.113	1.1641	
30 minute winter	6	1.005	7	13.2	0.162	0.070	3.9801	
30 minute winter	7	1.006	8	18.3	0.251	0.611	1.8820	
30 minute winter	8	1.007	9	17.7	0.177	0.167	3.3957	
30 minute winter	9	1.008	10	21.0	0.587	0.068	1.0999	

Results for 100 year Critical Storm Duration. Lowest mass balance: 98.13%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
60 minute summer	10	38	406.166	0.128	25.4	0.2744	0.0000	OK
60 minute winter	11	37	405.733	0.250	27.0	0.2283	0.1481	FLOOD
60 minute winter	12	39	405.411	0.111	28.9	0.1355	0.0000	OK
60 minute winter	13	37	403.454	0.250	30.4	0.1950	1.1572	FLOOD
60 minute winter	14	39	402.934	0.113	27.5	0.0368	0.0000	OK
60 minute winter	15	40	402.361	0.201	27.5	0.0000	0.0000	OK
60 minute winter	15_OUT	40	401.900	0.111	27.4	0.0000	0.0000	OK
15 minute winter	64	10	401.535	0.030	1.3	0.0087	0.0000	OK
30 minute summer	66_OUT	20	399.192	0.057	5.2	0.0000	0.0000	OK
15 minute winter	33	12	407.092	0.075	11.3	0.0000	0.0000	OK
30 minute winter	63	19	399.877	0.043	2.1	0.0162	0.0000	OK
30 minute summer	66	19	399.579	0.065	5.4	0.0405	0.0000	OK
15 minute winter	56	10	407.865	0.083	9.5	0.1802	0.0000	OK
15 minute winter	57	11	407.391	0.100	15.1	0.1330	0.0000	OK
15 minute winter	58	12	407.050	0.077	15.2	0.0000	0.0000	OK
30 minute summer	59_OUT	20	405.871	0.431	16.6	0.0000	0.0000	OK
180 minute winter	71	136	405.631	0.331	38.8	0.0000	0.0000	SURCHARGED
180 minute winter	70	136	404.573	0.073	23.1	0.0000	0.0000	OK
180 minute winter	70_OUT	136	403.309	0.072	23.1	0.0000	0.0000	OK
30 minute winter	25	22	402.031	0.158	170.3	0.0000	0.0000	OK
15 minute winter	32	11	407.259	0.166	11.9	0.4487	0.0000	OK
30 minute summer	34	20	404.967	0.115	20.3	0.2984	0.0000	OK
30 minute summer	35	20	403.954	0.151	30.7	0.4915	0.0000	OK
30 minute summer	36	20	403.335	0.109	35.5	0.2356	0.0000	OK
30 minute summer	37	20	400.700	0.115	41.0	0.2059	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
60 minute summer	10	1.009	11	25.0	0.233	0.169	3.8269	
60 minute winter	11	1.010	12	26.1	0.401	0.279	1.8512	
60 minute winter	12	1.011	13	28.7	0.293	0.115	4.8355	
60 minute winter	13	1.012	14	26.8	0.462	0.228	2.1361	
60 minute winter	14	1.013	15	27.5	0.371	0.121	1.3078	
60 minute winter	15	1.014	15_OUT	27.4	0.693	0.133	0.4398	57.4
15 minute winter	64	9.000	65	1.3	0.483	0.003	0.0760	
15 minute winter	33	4.001	34	10.7	0.402	0.041	1.1328	
30 minute winter	63	8.003	66	2.0	0.235	0.009	0.0704	
30 minute summer	66	9.004	73	5.4	0.320	0.028	0.1874	
15 minute winter	56	7.000	57	9.2	0.368	0.053	0.5329	
15 minute winter	57	7.001	58	15.2	0.367	0.121	0.9902	
15 minute winter	58	7.002	59	14.7	0.360	0.092	1.0911	
15 minute winter	59_OUT	Flow through pond	71	122.0	0.163	0.024	61.4876	
180 minute winter	71	13.000	71_OUT	23.1	0.582	0.582	0.1639	
180 minute winter	70	11.000	70_OUT	23.1	0.719	0.083	0.6217	243.1
30 minute winter	25	2.009	26	170.3	2.326	0.291	0.4199	
15 minute winter	32	4.000	33	11.3	0.265	0.199	1.5065	
30 minute summer	34	4.002	35	18.8	0.355	0.125	3.2233	
30 minute summer	35	4.003	36	28.4	0.562	0.200	1.8956	
30 minute summer	36	4.004	37	35.3	0.941	0.108	1.1983	
30 minute summer	37	4.005	38	41.0	0.977	0.126	1.0892	

Results for 100 year Critical Storm Duration. Lowest mass balance: 98.13%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
30 minute summer	38	20	398.568	0.122	44.6	0.1403	0.0000	OK
30 minute summer	38_OUT	20	396.976	0.707	44.6	0.0000	0.0000	OK
30 minute winter	31_OUT	22	396.787	0.519	180.8	0.3877	0.0000	OK
30 minute winter	16	21	413.873	0.110	19.7	0.6685	0.0000	OK
30 minute winter	17	21	412.795	0.136	37.2	0.7470	0.0000	OK
30 minute winter	18	22	411.768	0.145	55.0	0.8243	0.0000	OK
30 minute winter	19	22	410.063	0.163	88.7	1.7491	0.0000	OK
30 minute winter	20	22	407.141	0.191	123.5	2.1380	0.0000	OK
30 minute winter	21	22	405.715	0.201	148.4	1.6578	0.0000	OK
30 minute winter	22	22	404.432	0.199	148.3	0.0000	0.0000	OK
30 minute winter	23	22	403.495	0.212	170.3	1.5137	0.0000	OK
30 minute winter	26	22	400.496	0.154	170.3	0.0000	0.0000	OK
30 minute winter	24	22	402.358	0.215	170.3	0.0000	0.0000	OK
30 minute winter	30	22	398.806	0.216	175.5	0.1661	0.0000	OK
30 minute winter	31	22	398.029	0.226	175.5	0.0000	0.0000	OK
30 minute summer	62	20	400.455	0.040	1.0	0.0000	0.0000	OK
15 minute winter	61	12	400.690	0.041	0.9	0.0000	0.0000	OK
240 minute winter	72	180	396.726	0.541	60.8	0.0000	0.0000	SURCHARGED
240 minute winter	68	180	392.478	0.077	34.2	0.0000	0.0000	OK
240 minute winter	69	180	389.717	0.078	34.2	0.0000	0.0000	OK
240 minute winter	69_OUT	180	387.519	0.078	34.2	0.0000	0.0000	OK
15 minute summer	60	11	400.716	0.065	0.9	0.0132	0.0000	OK
15 minute winter	65	12	399.882	0.049	1.3	0.0000	0.0000	OK
30 minute winter	27	22	398.882	0.212	170.2	0.0000	0.0000	OK
15 minute winter	28	10	400.508	0.048	2.7	0.0287	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
30 minute summer	38	4.006	38_OUT	44.6	1.007	0.146	0.9196	
15 minute winter	38_OUT	Flow through pond	72	185.5	0.145	0.013	121.4157	
15 minute winter	31_OUT	Flow through pond	72	185.5	0.145	0.013	121.4157	
30 minute winter	16	2.000	17	19.5	0.429	0.113	2.1876	
30 minute winter	17	2.001	18	36.7	0.622	0.197	2.2672	
30 minute winter	18	2.002	19	54.4	0.767	0.232	2.8586	
30 minute winter	19	2.003	20	87.8	0.934	0.321	4.7636	
30 minute winter	20	2.004	21	122.7	1.065	0.488	3.3509	
30 minute winter	21	2.005	22	148.3	1.237	0.557	2.7729	
30 minute winter	22	2.006	23	148.4	1.174	0.544	2.0649	
30 minute winter	23	2.007	24	170.3	1.248	0.642	2.8315	
30 minute winter	26	2.010	27	170.2	2.404	0.276	0.3377	
30 minute winter	24	2.008	25	170.3	1.633	0.638	0.5177	
30 minute winter	30	2.012	31	175.5	1.072	0.151	2.6196	
30 minute winter	31	2.013	31_OUT	174.5	1.085	0.161	4.2204	
30 minute summer	62	8.002	63	0.8	0.231	0.003	0.0449	
30 minute summer	61	8.001	62	1.0	0.325	0.006	0.0542	
240 minute winter	72	12.000	72_OUT	34.2	1.945	1.938	0.1373	
240 minute winter	68	10.001	69	34.2	0.967	0.093	0.8464	
240 minute winter	69	10.002	69_OUT	34.2	0.958	0.095	0.7173	522.5
15 minute winter	60	8.000	61	0.9	0.111	0.054	0.0879	
15 minute winter	65	9.001	66	1.1	0.157	0.005	0.0730	
30 minute winter	27	2.011	30	170.2	1.091	0.143	0.2427	
15 minute winter	28	3.000	29	2.6	0.432	0.011	0.1043	

Results for 100 year Critical Storm Duration. Lowest mass balance: 98.13%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	29	11	399.777	0.044	2.6	0.0000	0.0000	OK
30 minute winter	48	22	409.877	0.127	99.5	0.0000	0.0000	OK
30 minute winter	49	22	407.983	0.122	99.5	0.0000	0.0000	OK
30 minute winter	50	22	406.084	0.220	99.4	0.0000	0.0000	OK
180 minute winter	71_OUT	136	405.618	0.318	23.1	0.3594	0.0000	OK
240 minute winter	72_OUT	180	396.367	0.181	34.2	0.2053	0.0000	OK
240 minute winter	67	180	394.895	0.078	34.2	0.0000	0.0000	OK
30 minute summer	59	20	406.520	0.103	18.2	0.1074	0.0000	OK
30 minute summer	73	20	399.463	0.128	5.4	0.0000	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	29	3.001	30	2.6	0.449	0.010	0.0922	
30 minute winter	48	5.009	49	99.5	2.128	0.163	0.3022	
30 minute winter	49	5.010	50	99.4	1.129	0.153	0.5741	
30 minute winter	50	5.011	50_OUT	99.4	0.801	0.942	0.3016	
15 minute summer	71_OUT	Weir	70	0.0				0.0
180 minute winter	71_OUT	Orifice	70	23.1				243.2
15 minute summer	72_OUT	Weir	67	0.0				0.0
240 minute winter	72_OUT	Orifice	67	34.2				522.9
240 minute winter	67	10.000	68	34.2	0.971	0.094	0.7576	
30 minute summer	59	7.003	59_OUT	16.6	0.442	0.110	1.1342	
30 minute summer	73	9.005	66_OUT	5.2	0.453	0.026	0.0766	4.0

Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 98.13%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m^3)	Flood (m^3)	Status
30 minute summer	1	18	411.631	0.036	0.9	0.0051	0.0000	OK
30 minute summer	51	18	411.613	0.042	1.6	0.0110	0.0000	OK
15 minute winter	52	11	411.192	0.050	3.0	0.0121	0.0000	OK
15 minute winter	53	12	410.254	0.057	3.9	0.0098	0.0000	OK
30 minute summer	54	20	409.444	0.061	5.2	0.0176	0.0000	OK
30 minute summer	55	19	408.318	0.063	8.9	0.0474	0.0000	OK
30 minute summer	55_OUT	19	405.864	0.423	8.7	0.0000	0.0000	OK
30 minute winter	39	21	414.370	0.129	14.8	0.4196	0.0000	OK
30 minute winter	40	21	414.223	0.128	30.9	0.4627	0.0000	OK
30 minute winter	41	21	413.876	0.151	45.9	0.5092	0.0000	OK
30 minute winter	42	21	413.210	0.192	92.5	1.9982	0.0000	OK
30 minute winter	43	21	412.527	0.201	112.8	0.9216	0.0000	OK
30 minute winter	44	21	411.754	0.213	136.9	1.1714	0.0000	OK
30 minute winter	45	22	410.953	0.216	137.5	0.0595	0.0000	OK
30 minute winter	46	22	410.292	0.219	139.9	0.1231	0.0000	OK
30 minute winter	47	22	410.087	0.215	140.0	0.0000	0.0000	OK
30 minute winter	50_OUT	22	405.936	0.496	140.0	0.0000	0.0000	OK
30 minute summer	2	19	411.243	0.053	2.0	0.0102	0.0000	OK
30 minute summer	3	20	411.110	0.111	5.1	0.0653	0.0000	OK
30 minute summer	4	19	410.610	0.083	9.5	0.0751	0.0000	OK
30 minute summer	5	19	410.127	0.231	17.4	0.3491	0.0000	OK
30 minute winter	6	21	409.806	0.110	22.0	0.1525	0.0000	OK
30 minute winter	7	19	408.806	0.250	29.7	0.4905	0.9857	FLOOD
60 minute summer	8	38	408.683	0.144	24.5	0.0000	0.0000	OK
60 minute winter	9	35	408.516	0.250	30.3	0.4510	0.3795	FLOOD

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m^3)	Discharge Vol (m^3)
30 minute summer	1	1.000	2	0.9	0.151	0.006	0.1317	
30 minute summer	51	6.000	52	1.6	0.255	0.008	0.0969	
15 minute winter	52	6.001	53	2.9	0.352	0.014	0.2303	
15 minute winter	53	6.002	54	3.7	0.353	0.020	0.3167	
30 minute summer	54	6.003	55	5.0	0.434	0.023	0.3544	
30 minute summer	55	6.004	55_OUT	8.7	0.717	0.026	0.3312	
15 minute winter	55_OUT	Flow through pond	71	172.5	0.185	0.034	88.1130	
30 minute winter	39	5.000	40	14.6	0.293	0.172	1.2834	
30 minute winter	40	5.001	41	30.8	0.525	0.169	0.8423	
30 minute winter	41	5.002	42	45.8	0.518	0.262	2.6630	
30 minute winter	42	5.003	43	92.3	0.794	0.496	2.9857	
30 minute winter	43	5.004	44	112.3	0.870	0.563	3.2588	
30 minute winter	44	5.005	45	136.3	0.986	0.657	3.3015	
30 minute winter	45	5.006	46	137.5	0.967	0.680	2.9567	
30 minute winter	46	5.007	47	140.0	0.988	0.703	0.9229	
30 minute winter	47	5.008	48	140.0	1.438	0.707	0.4024	
15 minute winter	50_OUT	Flow through pond	71	172.5	0.185	0.034	88.1130	
30 minute summer	2	1.001	3	1.7	0.086	0.016	0.4917	
30 minute summer	3	1.002	4	4.5	0.279	0.028	0.3855	
30 minute summer	4	1.003	5	9.0	0.129	0.053	2.5551	
30 minute winter	5	1.004	6	15.7	0.323	0.178	1.6262	
30 minute winter	6	1.005	7	21.3	0.219	0.113	4.5735	
15 minute winter	7	1.006	8	24.6	0.290	0.823	2.2856	
60 minute summer	8	1.007	9	24.4	0.210	0.231	3.9065	
60 minute summer	9	1.008	10	28.7	0.627	0.093	1.4661	

Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 98.13%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
60 minute summer	10	36	406.187	0.148	37.7	0.3177	0.0000	OK
60 minute winter	11	31	405.733	0.250	39.6	0.2283	8.1962	FLOOD
60 minute summer	12	35	405.415	0.115	32.0	0.1405	0.0000	OK
120 minute winter	13	60	403.454	0.250	31.7	0.1950	4.8564	FLOOD
60 minute summer	14	35	402.935	0.114	28.4	0.0372	0.0000	OK
60 minute summer	15	35	402.362	0.202	28.3	0.0000	0.0000	OK
60 minute summer	15_OUT	36	401.902	0.112	28.2	0.0000	0.0000	OK
15 minute winter	64	10	401.539	0.034	1.8	0.0098	0.0000	OK
30 minute summer	66_OUT	20	399.200	0.065	7.3	0.0000	0.0000	OK
15 minute winter	33	12	407.103	0.087	16.0	0.0000	0.0000	OK
30 minute summer	63	19	399.884	0.049	3.1	0.0188	0.0000	OK
30 minute summer	66	19	399.590	0.076	8.1	0.0471	0.0000	OK
15 minute winter	56	10	407.877	0.095	13.3	0.2046	0.0000	OK
15 minute winter	57	11	407.408	0.117	21.1	0.1562	0.0000	OK
15 minute winter	58	12	407.065	0.092	21.3	0.0000	0.0000	OK
30 minute summer	59_OUT	20	405.877	0.437	24.1	0.0000	0.0000	OK
180 minute winter	71	136	405.748	0.448	52.3	0.0000	0.0000	SURCHARGED
180 minute winter	70	136	404.581	0.081	27.9	0.0000	0.0000	OK
180 minute winter	70_OUT	136	403.317	0.080	27.9	0.0000	0.0000	OK
30 minute winter	25	22	402.053	0.180	240.1	0.0000	0.0000	OK
15 minute winter	32	11	407.278	0.185	16.7	0.5023	0.0000	OK
30 minute summer	34	20	404.984	0.132	29.0	0.3424	0.0000	OK
30 minute summer	35	20	403.976	0.173	44.2	0.5619	0.0000	OK
30 minute summer	36	20	403.351	0.125	51.9	0.2715	0.0000	OK
30 minute summer	37	20	400.717	0.132	60.1	0.2371	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
60 minute summer	10	1.009	11	37.0	0.310	0.249	4.0989	
60 minute winter	11	1.010	12	26.3	0.401	0.281	1.8570	
60 minute summer	12	1.011	13	31.5	0.316	0.126	4.8952	
15 minute winter	13	1.012	14	27.0	0.465	0.230	2.1452	
60 minute summer	14	1.013	15	28.3	0.375	0.124	1.3268	
60 minute summer	15	1.014	15_OUT	28.2	0.697	0.136	0.4489	62.7
15 minute winter	64	9.000	65	1.8	0.513	0.005	0.1096	
15 minute winter	33	4.001	34	15.4	0.433	0.059	1.5144	
30 minute summer	63	8.003	66	3.1	0.260	0.013	0.0954	
30 minute summer	66	9.004	73	8.1	0.342	0.042	0.4030	
15 minute winter	56	7.000	57	12.9	0.386	0.075	0.7137	
15 minute winter	57	7.001	58	21.3	0.403	0.169	1.2561	
15 minute winter	58	7.002	59	20.6	0.390	0.129	1.4014	
15 minute winter	59_OUT	Flow through pond	71	172.5	0.185	0.034	88.1130	
180 minute winter	71	13.000	71_OUT	28.0	0.703	0.703	0.1639	
180 minute winter	70	11.000	70_OUT	27.9	0.756	0.101	0.7137	341.7
30 minute winter	25	2.009	26	240.1	2.535	0.411	0.5434	
15 minute winter	32	4.000	33	16.0	0.293	0.283	1.9138	
30 minute summer	34	4.002	35	27.1	0.391	0.181	4.2237	
30 minute summer	35	4.003	36	41.6	0.625	0.292	2.4906	
30 minute summer	36	4.004	37	51.4	1.034	0.158	1.5902	
30 minute summer	37	4.005	38	59.8	1.074	0.184	1.4451	

Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 98.13%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
30 minute summer	38	20	398.586	0.140	65.1	0.1616	0.0000	OK
30 minute summer	38_OUT	20	396.987	0.719	65.1	0.0000	0.0000	OK
240 minute winter	31_OUT	184	396.931	0.662	106.3	0.4946	0.0000	OK
30 minute winter	16	21	413.888	0.125	27.6	0.7591	0.0000	OK
30 minute winter	17	21	412.814	0.155	52.1	0.8489	0.0000	OK
30 minute winter	18	21	411.787	0.164	77.2	0.9368	0.0000	OK
30 minute winter	19	21	410.085	0.185	124.7	1.9879	0.0000	OK
30 minute winter	20	22	407.167	0.217	173.8	2.4292	0.0000	OK
30 minute winter	21	21	405.743	0.228	209.3	1.8837	0.0000	OK
30 minute winter	22	22	404.459	0.226	208.6	0.0000	0.0000	OK
30 minute winter	23	22	403.524	0.241	239.6	1.7213	0.0000	OK
30 minute winter	26	22	400.517	0.176	240.1	0.0000	0.0000	OK
30 minute winter	24	22	402.386	0.243	240.0	0.0000	0.0000	OK
30 minute winter	30	22	398.843	0.253	247.4	0.1948	0.0000	OK
30 minute winter	31	22	398.067	0.264	247.6	0.0000	0.0000	OK
15 minute winter	62	13	400.464	0.048	1.5	0.0000	0.0000	OK
15 minute winter	61	11	400.695	0.046	1.3	0.0000	0.0000	OK
240 minute winter	72	184	396.929	0.744	82.5	0.0000	0.0000	FLOOD RISK
240 minute winter	68	184	392.487	0.086	41.8	0.0000	0.0000	OK
240 minute winter	69	184	389.726	0.087	41.8	0.0000	0.0000	OK
240 minute winter	69_OUT	184	387.528	0.087	41.8	0.0000	0.0000	OK
15 minute winter	60	11	400.724	0.073	1.3	0.0148	0.0000	OK
15 minute winter	65	12	399.893	0.060	1.8	0.0000	0.0000	OK
30 minute winter	27	22	398.919	0.249	240.2	0.0000	0.0000	OK
15 minute winter	28	10	400.514	0.054	3.7	0.0323	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
30 minute summer	38	4.006	38_OUT	65.1	1.107	0.213	1.2203	
15 minute winter	38_OUT	Flow through pond	72	244.9	0.158	0.018	174.5248	
15 minute winter	31_OUT	Flow through pond	72	244.9	0.158	0.018	174.5248	
30 minute winter	16	2.000	17	27.3	0.467	0.158	2.8234	
30 minute winter	17	2.001	18	51.6	0.676	0.278	2.9303	
30 minute winter	18	2.002	19	76.6	0.835	0.326	3.6922	
30 minute winter	19	2.003	20	123.6	1.018	0.451	6.1486	
30 minute winter	20	2.004	21	172.5	1.159	0.686	4.3260	
30 minute winter	21	2.005	22	208.6	1.348	0.783	3.5819	
30 minute winter	22	2.006	23	208.9	1.278	0.765	2.6696	
30 minute winter	23	2.007	24	240.0	1.366	0.905	3.6458	
30 minute winter	26	2.010	27	240.2	2.620	0.389	0.4371	
30 minute winter	24	2.008	25	240.1	1.789	0.899	0.6659	
30 minute winter	30	2.012	31	247.6	1.173	0.213	3.3797	
30 minute winter	31	2.013	31_OUT	247.1	1.179	0.228	5.4938	
15 minute winter	62	8.002	63	1.1	0.255	0.004	0.0555	
15 minute winter	61	8.001	62	1.5	0.259	0.009	0.0730	
240 minute winter	72	12.000	72_OUT	41.8	2.375	2.366	0.1373	
240 minute winter	68	10.001	69	41.8	1.024	0.113	0.9765	
240 minute winter	69	10.002	69_OUT	41.8	1.014	0.117	0.8276	715.5
15 minute winter	60	8.000	61	1.3	0.124	0.080	0.1141	
15 minute winter	65	9.001	66	1.6	0.168	0.008	0.0949	
30 minute winter	27	2.011	30	240.2	1.191	0.202	0.3139	
15 minute winter	28	3.000	29	3.6	0.468	0.016	0.1330	

Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 98.13%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	29	11	399.783	0.050	3.6	0.0000	0.0000	OK
30 minute winter	48	22	409.894	0.145	140.0	0.0000	0.0000	OK
30 minute winter	49	22	408.000	0.139	140.0	0.0000	0.0000	OK
30 minute winter	50	22	406.111	0.248	140.0	0.0000	0.0000	OK
180 minute winter	71_OUT	136	405.729	0.429	28.0	0.4852	0.0000	OK
240 minute winter	72_OUT	184	396.392	0.207	41.8	0.2345	0.0000	OK
240 minute winter	67	184	394.904	0.087	41.8	0.0000	0.0000	OK
30 minute summer	59	20	406.540	0.123	25.9	0.1275	0.0000	OK
30 minute summer	73	20	399.531	0.196	8.1	0.0000	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	29	3.001	30	3.6	0.485	0.013	0.1191	
30 minute winter	48	5.009	49	140.0	2.318	0.229	0.3906	
30 minute winter	49	5.010	50	140.0	1.245	0.215	0.7312	
30 minute winter	50	5.011	50_OUT	140.0	0.875	1.327	0.3884	
15 minute summer	71_OUT	Weir	70	0.0				0.0
180 minute winter	71_OUT	Orifice	70	27.9				341.8
15 minute summer	72_OUT	Weir	67	0.0				0.0
240 minute winter	72_OUT	Orifice	67	41.8				716.4
240 minute winter	67	10.000	68	41.8	1.028	0.115	0.8740	
30 minute summer	59	7.003	59_OUT	24.1	0.496	0.160	1.4654	
30 minute summer	73	9.005	66_OUT	7.3	0.492	0.037	0.0989	5.6

REDSTART

Tylorstown Phase 4

Schedule of maintenance

24 May 2021

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1. Schedules of Maintenance

1.1 Introduction

The maintenance of drainage and SuDS features is vital ensuring that they work as efficiently as they set out to do. Maintenance activities can be broadly defined as:

- Regular maintenance – basic tasks carried out regularly
- Occasional maintenance – tasks that are required periodically but on a much less frequent basis
- Remedial maintenance – tasks required when a fault needs rectifying and often includes unforeseen events

This section highlights the maintenance requirements for the proposed drainage system and components. During construction the contractor will be responsible for the maintenance of the drainage system. Upon completion of the construction work that responsibility would pass to RCT.

This section will be subject to review following detailed design.

1.2 Gullies, catchpits, manholes, sewers

Stormwater gullies, manholes and sewers, and catchpits are located across the site, and are the principle means of collecting and conveying stormwater runoff to the discharge point.

The responsibility for the operation and maintenance of the stormwater drainage infrastructure will be with the owner/occupier of the site. Table 1.1 provides guidance on the type of operational and maintenance requirements that may be appropriate. The list of actions is not exhaustive and some actions may not always be required.

Maintenance Schedule

Table 1.1: Operation and Maintenance Requirements for Below Ground Drainage

Maintenance Schedule	Required Action	Typical Frequency
Regular maintenance	Remove litter and debris	Monthly (or as required)
	Monitoring	Inspect monthly
Occasional maintenance	Sediment management	As required
Remedial maintenance	Structure rehabilitation/repair	As required

Regular maintenance should be undertaken to ensure the performance of the system remains at a satisfactory level, and operates as intended/designed. Regular maintenance of stormwater infrastructure generally involves inspection/monitoring, and the removal of the sediments, litter and debris.

Monthly inspections/monitoring of stormwater infrastructure should be undertaken to determine silt accumulation rates and establish appropriate removal frequencies. Removal of silt build up from inlets/sumps should be undertaken as necessary.

All litter and debris should be removed from the stormwater infrastructure, and should be undertaken as part of general maintenance. Removal of litter and debris should be undertaken from the surface without the requirement for entry into confined spaces. If entry into confined spaces is required, a suitably qualified specialist should be engaged to undertake the works.

Occasional maintenance of stormwater devices generally involves the removal of sediment that has accumulated over time within the device. Gullies, catch pits, and other collection points should be cleaned out when necessary to prevent the re-entry of sediments into the downstream system, and maintain the overall long term performance of the drainage system. Cleaning can be undertaken by vacuum pumping, whereby sediment is vacuumed from the device and transferred to a tanker to be carried off site to an approved dumping location. Most suppliers recommend that cleaning operations be undertaken every 6 months.

If defects are found in the drainage infrastructure which are affecting or may affect the performance of the system, the defects should be remedied immediately. Remedial maintenance to manholes, catch pits headwalls, sewer or other drainage infrastructure may be able to undertaken using hand tools, but depending upon the nature and severity of the maintenance required, light machinery and hydraulic excavating machinery may be required.

Remedial maintenance for stormwater devices includes repairing access covers and frames and cover and frame seating, and replacing sections of sewer, or other infrastructure that has failed.

Construction

During construction the principal contractor must ensure that preventative measures have been put in place as to not allow the construction runoff drain into the system. Measures must be taken to ensure debris from the construction site does not block the components. Routine inspections should be undertaken ensuring that the drainage is functioning properly. Outfalls must be constructed to the correct level and all joints must be correctly sealed. During construction backfill should be correctly installed as specified as per the manufactures' recommendations.

1.3 Swales

Construction

Construction vehicles and equipment not directly involved in the construction of the rills and swales should be kept away from these areas. Excavations for the swales should aim to be undertaken in times of dry weather, when possible, to prevent mobilisation of sediments from exposed surfaces. Exposed surfaces after rill or swale excavations should be stabilised as soon as possible with grass seed and straw mulch. Perimeter controls should be installed prior to construction to protect watercourses.

Maintenance Schedule

Table 1.2 below shows the operation and maintenance requirements for the swale, taken from the CIRIA C753 SuDS Manual.

Table 1.2: Operation and maintenance requirements for swales (CIRIA C753, 2015)

Maintenance Schedule	Required Action	Typical Frequency
Regular maintenance	Remove litter and debris	Monthly, or as required
	Cut grass - to retain grass height within specified design range	Monthly (during growing season), or as required
	Manage other vegetation and remove nuisance plants	Monthly at start, then as required
	Inspect inlets, outlets and overflows for blockages, and clear if required	Monthly
	Inspect vegetation coverage	Monthly for 6 months, quarterly for 2 years, then half yearly
	Inspect inlets for silt accumulation, establish appropriate silt removal frequencies	Half yearly
	Inspect check dams for blockages and failure.	Half yearly
Occasional maintenance	Reseed areas of poor vegetation growth, alter plant types to better suit conditions, if required	As required or if bare soil is exposed over 10% or more of the swale treatment area
Remedial actions	Repair erosion or other damage by re-turfing or reseeding	As required
	Relevel uneven surfaces and reinstate design levels	As required
	Remove and dispose of oils or petrol residues using safe standard practices	As required

1.4 Detention/attenuation ponds

Construction

Construction vehicles and equipment not directly involved in the construction of the detention/attenuation ponds will be kept away from these areas. Silt fences, staged excavation works and temporary drainage swales/bunds to divert runoff away from exposed areas will be utilised, as appropriate, to manage the risks associated with, and to intercept the discharge of, sediment laden runoff prior to its discharge to nearby watercourses. Excavations for the detention/attenuation pond should aim to be undertaken in times of dry weather when possible, to prevent mobilisation of sediments, during rainfall events. Surfaces exposed as part of the detention/attenuation pond construction should be stabilised as soon as possible, by the use of hydroseeding or an alternative approved approach. Perimeter controls should be installed prior to construction to protect watercourses. Perimeter controls should be installed prior to construction to protect watercourses.

Maintenance Schedule

Table 1.3 shows the operation and maintenance requirements for the detention/attenuation ponds, taken from the CIRIA C753 SuDS Manual.

Table 1.3: Operation and maintenance requirements for detention/attenuation ponds (CIRIA C753, 2015)

Maintenance Schedule	Required Action	Typical frequency
Regular maintenance	Remove litter and debris	Monthly (or as required)
	Cut the grass - public areas	Monthly (during growing season)
	Cut the meadow grass	Half yearly (spring, before nesting season, and autumn)
	Inspect marginal and bankside vegetation and remove nuisance plants (for first 3 years)	Monthly (at start, then as required)
	Inspect inlets, outlets, banksides, structures, pipework etc. for evidence of blockage and/or physical damage	Monthly
	Inspect silt accumulation rates in the detention basin and establish appropriate removal frequencies; undertake contamination testing once some build-up has occurred, to inform management and disposal options	Half yearly
	Check any mechanical devices, e.g. penstocks	Half yearly
	Tidy all dead growth (scrub clearance) before start of growing season (Note: tree maintenance is usually part of overall landscape management contract)	Annually
	Remove sediment from any forebay.	Every 1-5 years, or as required
	Remove sediment and planting from one quadrant of the main body of detention/attenuation ponds without sediment forebays.	Every 5 years, or as required
Occasional maintenance	Remove sediment from the main body of big detention basins when pool volume is reduced by 20%	With effective pre-treatment, this will only be required rarely, e.g. every 25-50 years
Remedial actions	Repair erosion or other damage	As required
	Replant, where necessary	As required
	Aerate detention basin when signs of eutrophication are detected	As required
	Realign rip-rap or repair other damage	As required
	Repair/rehabilitate inlets, outlets and overflows.	As required

REDSTART

St David's House
Pascal Close
St Mellons
Cardiff
CF3 0LW

www.redstartwales.com

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St David’s House
Pascal Close
St Mellons
Cardiff
CF3 0LW

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Tylorstown Phase 4

Drainage Strategy Report

20 September 2021

REDSTART

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Quality Management

Job No	GC/3694		
Project	Tylorstown - Phase 4		
Location	Tylorstown		
Title	Drainage Strategy Report		
Document Ref	GC3613-RED-73-RSC-RP-C-0001	**Issue / Revision**	P02
File reference	P:\Schemes_CGC\GC003600-99\GC003613 - RCT Tylorstown Landslide\1 - Documents\Drainage\Phase 4 - Drainage strategy\GC3613-RED-73-RSC-RP-C-0001 - P02 - Phase 4 Drainage strategy report.docx		
Date	20 September 2021		
Prepared by	Jacques Calitz	Signature (for file)	
Checked by	Jack Southon	Signature (for file)	
Authorised by	Phill Hardwick	Signature (for file)	

Revision Status / History

Rev	Date	Issue / Purpose/ Comment	Prepared	Checked	Authorised
P01		First issue	JC	JS	PH
P02		Second Issue	JC	JS	PH

Contents

Appendices

1. Introduction

1.1 Brief and overview

As a result of heavy rainfall associated with Storm Dennis, a landslip of approximately 28,000m^3 of material occurred in Tylorstown, Rhondda Cynon Taff on 16 February 2020. This resulted in blocking of the river channel and foot path and removal/altering of the existing drainage channels.

Following on from previous phases of work, the Phase 4 works propose to move the remaining material to the receptor site (Site C) and reprofile the slip. This will include works reinstating the footpath/dismantled tramway and drainage channels as well as reprofiling of the tip after approximately 151,000m^3 of tip material has been removed.

Approximately 151,000m^3 of material is proposed to be moved to Receptor Site C which is located to the side of the Lllawanno Tip.

Capita Redstart has been commissioned by the client Rhondda Cynon Taf County Borough Council (RCTCBC) to provide a drainage strategy in support of a full planning application and subsequent full SAB application for the proposed works.

The drainage strategy covers both sites (the donor site and the receptor site) due to alterations in existing exceedance flow paths.

This assessment is a qualitative report and based on readily available information.

1.2 Aims and Objectives

This document outlines and discusses the strategy for the surface water drainage from the proposed Receptor Site C and the reprofiled donor site (Tylorstown slip). It is recommended that this drainage strategy is read in conjunction with the drawings and documents contained in Appendix A to D.

2. Site Context

2.1 Site location

Donor Site (Tylorstown slip)

The donor site (location of the slip) is located at the existing Tylorstown Upper Tip north of Tylorstown and just south of the "Wales with view" lookout point along Blaenllechau road. The nearest postcode for the site is CF43 4UF and the National Grid Reference for the approximate centre of the site is ST 01225 96194 (Figure 2.1). The site is a greenfield site with no previous development apart from the tip (no impermeable area).

Receptor Site C

The proposed receptor site C is located alongside of Llanwonno Tip located east of Tylorstown just off of Blaenllechau road. The nearest postcode for the site is CF37 3PH and the National Grid Reference for the approximate centre of the site is ST 02116 95641 (Figure 2.1). The site is a greenfield site with no previous development (no impermeable area).

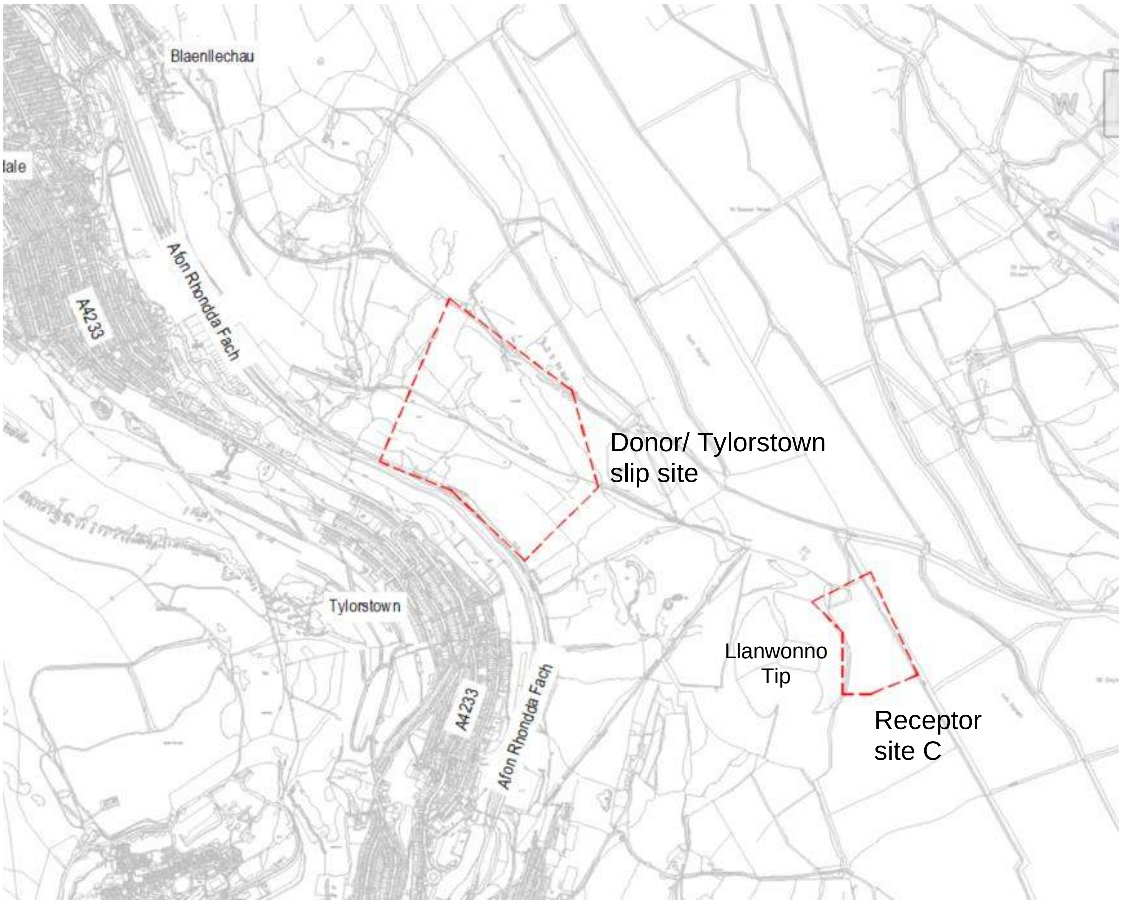


Figure 2.1 – Site Location (Donor (Tylorstown slip) and receptor Site C location

The image below (Figure 2.2) shows the location and extent of the slip taken with a drone after the slip happened.

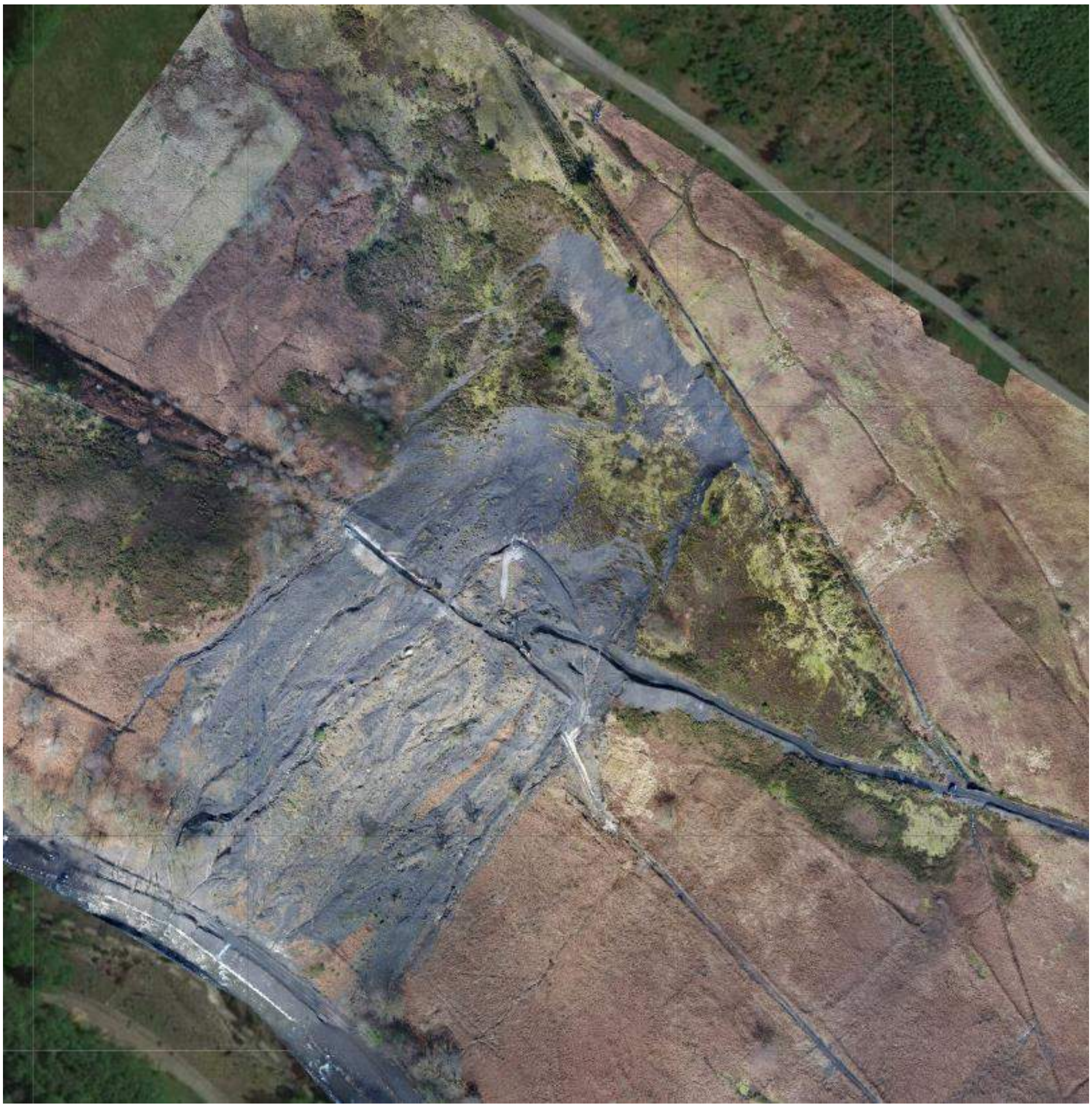


Figure 2.2 – Tylorstown slip

2.2 Topography

A topographical survey was undertaken by Vinci Surveys in May 2020 and is contained in Appendix A.

LIDAR data was also obtained as part of this assessment and is shown in Figure 2.3 and 2.4 below.

Donor Site (Tylorstown slip)

Tylorstown Upper Tip is located within the valley of the Afon Rhondda Fach. The existing site topography is steep and falls North-East to South-West towards the river.

Available data suggests that the existing site ground elevations range from approximately 344m to 180m above ordnance datum (AOD).

Due to the slip, the existing dismantled tramline and drainage channels have been removed and the existing topography has been steepened.

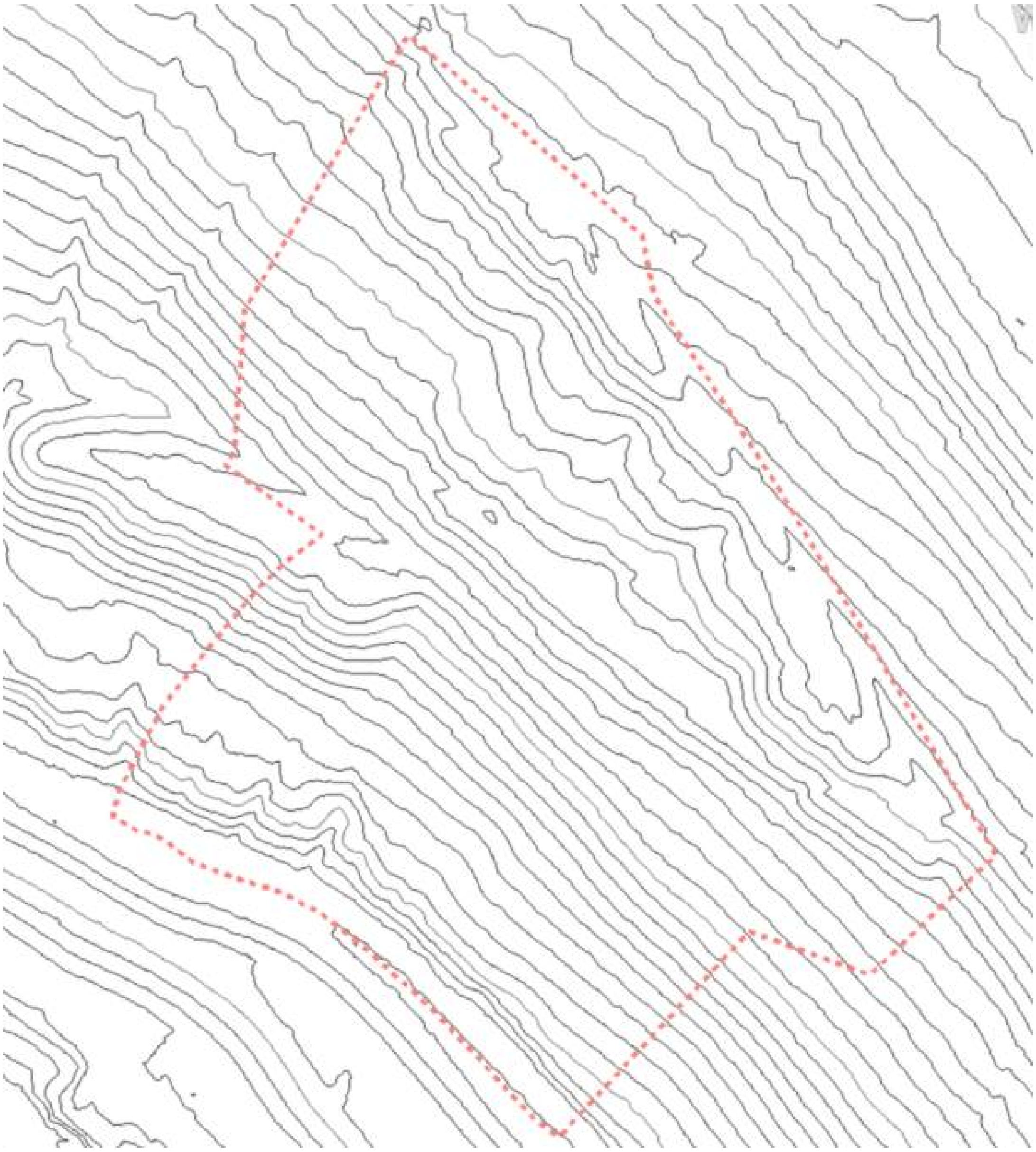


Figure 2.3 – Donor site (pre slip) – 2015 LIDAR data

<u>Receptor Site C</u>

The northern section of the Receptor site C falls towards the west while the southern section falls towards the south-west and south east respectively.

The existing site ground elevations range from approximately 412m to 383m above ordnance datum (AOD).

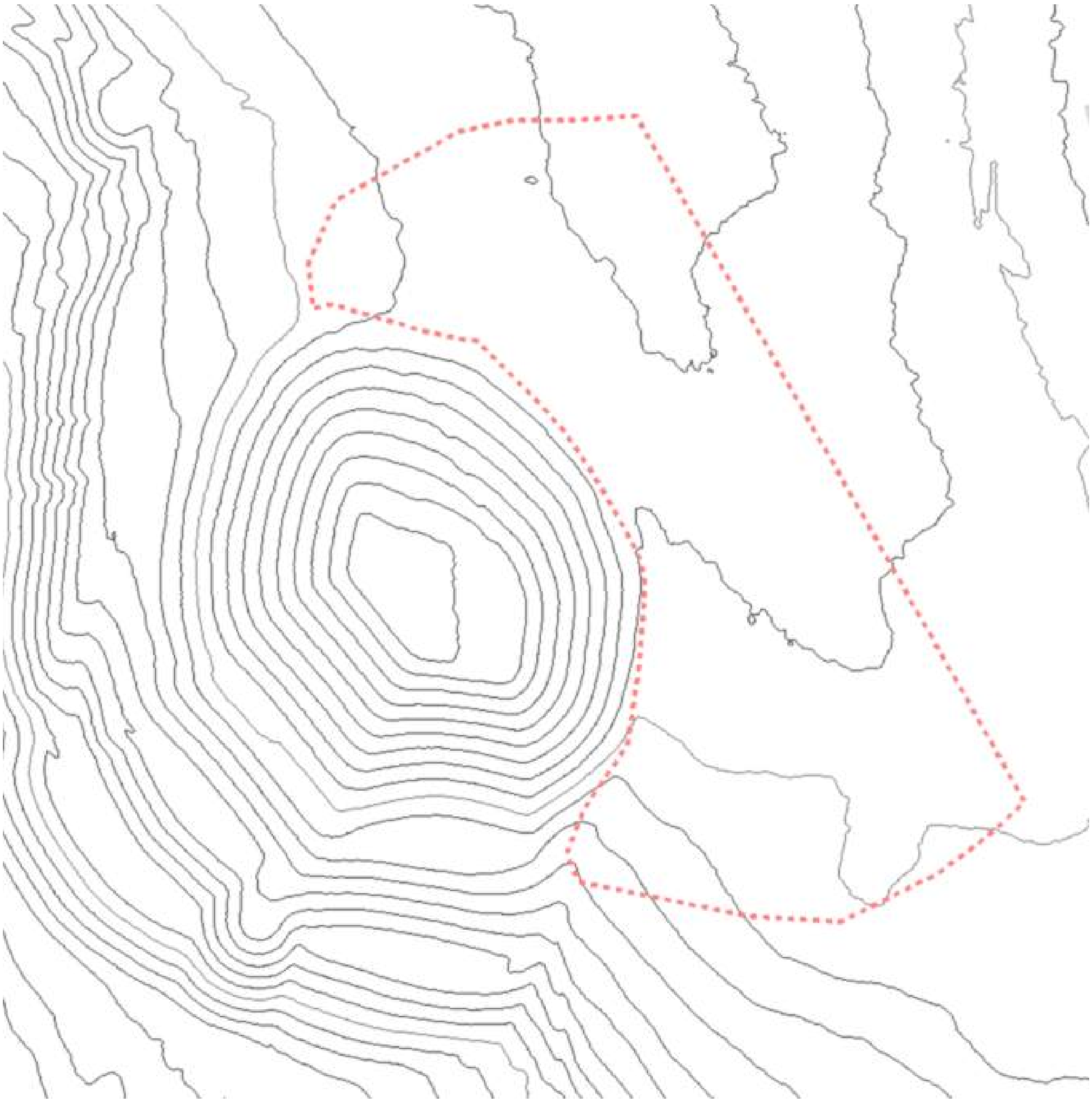


Figure 2.4 – Receptor Site C - 2015 LIDAR data

2.3 Geology

The British Geological Survey (BGS) Online Geology Viewer[1] notes the underlain bedrock of both sites as Secondary A: Secondary A strata are permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers.

Donor site (Tylorstown Upper Tip)

Ground Investigations were undertaken by Exploration Associates in November 2001 and are contained in Appendix B. The expected geology for the site is shown is Table 2.1.

[1] British Geological Survey (BGS) Online Geology http://mapapps.bgs.ac.uk/geologyofbritain/home.html

Table 2.1: Tylorstown Upper Tip - Site geology

Strata	Expected Thickness (m)	Generalised Description
MADE GROUND	0 – 10.75m	Loose dark grey and black slightly clayey very sandy GRAVEL. Gravel is fine to coarse angular to sub-angular mudstone, clinker and coal
Boulder Clay (outside tip)	0 - 2.8m	Boulder Clay Medium dense dark orange brown very clayey sandy slightly gravely angular cobbles of siltstone and sandstone
HIGHLY WEATHERED BRITHDIR MEMBER	2.2 – 5.65m	Moderately weak to moderately strong grey/orange brown fine medium SANDSTONE. Highly weathered to non-intact fracture discontinuity.
SILTSTONE	0.7 – 1.5m	Very weak and weak dark grey SILTSTONE. In other areas layer is slightly sandy gravelly CLAY or SILT rather than SILSTONE.
SANDSTONE (BRITHDIR MEMBER	6.5 - m	Strong grey fine grained SANDSTONE (SANDSTONE (BRITHDIR MEMBER). Slightly weathered.
SILTSTONE	7 - m	Very weak and weak dark grey SILTSTONE.
SANDSTONE (BRITHDIR MEMBER	4.3 – m+	Strong grey fine grained SANDSTONE (SANDSTONE (BRITHDIR MEMBER). Slightly weathered.

Receptor Site C

Ground Investigations were undertaken by Quantum Geotech in March 2021 and are contained in Appendix B. The expected geology for the site is shown is Table 2.2.

Table 2.2: Receptor site C - Site geology

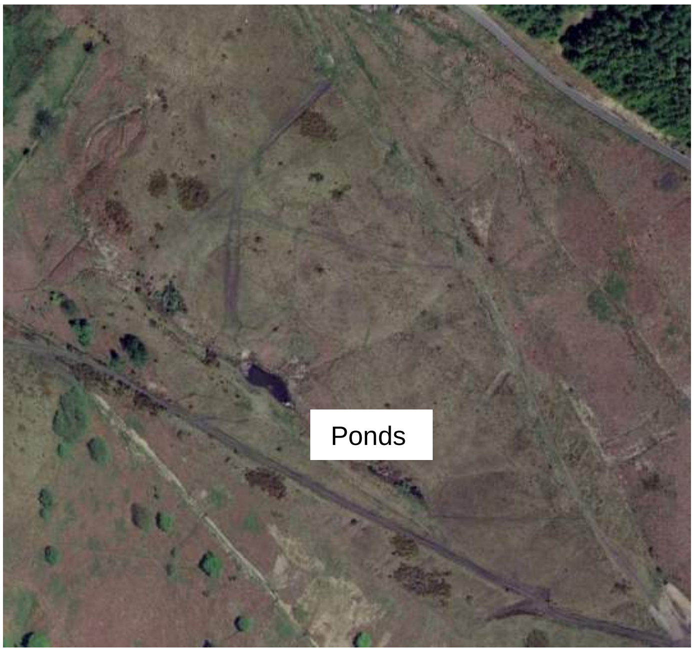
Strata	Expected Thickness (m)	Generalised Description
MADE GROUND	0.15-0.7m	Black dark grey slightly sandy silty GRAVEL with metal. Gravel is fine to coarse angular to sub-angular Mudstone, clinker and coal Grass over soft dark grey slightly sandy slightly gravelly SILT with rootlets and rare coal/charcoal. Gravel is fine to coarse sub
HIGHLY WEATHERED	0.6-2.6m	Slightly clayey slightly silty GRAVEL. GRAVEL with medium to high cobble and boulder content

BRITHDIR MEMBER		(HIGHLY WEATHERED BRITHDIR MEMBER). GRAVEL is fine to coarse sub-angular to sub-rounded Sandstone with some Mudstone
SANDSTONE (BRITHDIR MEMBER	7- 21m+	Strong grey fine grained. Weathered and fractured SANDSTONE (SANDSTONE (BRITHDIR MEMBER)

2.4 Hydrology

The closest river to the sites is the Afon Rhondda Fach which is located between 850m away of the Receptor site C and is located at the discharge point of the ditches at the donor site.

Several surface water features are located within each of the sites (as shown by the topographic survey):

<table>
<tr>
<td>Donor site</td>
<td>
Before the slip occurred, there were three ponds located on the tip created from the existing springs as can be seen from Google earth aerial images (shown below)


There are several springs discharging to the surface due to the perched groundwater (coal/mudstone seam underlying weather/fractured sandstone).
Several ditches/channels are located within the site cascading both the spring flows and the surface water run-off to the Afon Rhondda Fach river.

</td>
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</table>

	
Receptor site C	• To the north west of the site there are two natural ditches that collect run-off and discharges to a lower down concrete channel finally discharging to the Afon Rhondda Fach 

	 Existing natural ditch (North-eastern) • To the south west of the site (along Llanwonno Tip access track) there is an existing concrete channel that collects the run-off from the access track and the surrounding area to the east • There is an additional ditch to the east

2.5 Hydrogeology

The donor site and Receptor site C is not located within a Source protection Zone (SPZ) as designated by Natural Resources Wales (NRW).

The BGS Online Geology Viewer, however, notes that groundwater vulnerability is high as the both sites are underlain by a Secondary A aquifer (superficial deposits and bedrock).

Perched groundwater is expected at both sites due to the presence of mudstone/coal/siltstone seams underlying weathered/fractured sandstone.

The groundwater levels differ at each of the sites:

Donor site	There are several spring discharges visible within the Tylorstown Upper Tip site and the potential for perched groundwater is high due to shallow coal/mudstone seams underlying the fractured/weathered sandstone. Based on the groundwater monitoring results completed in November of 2001, groundwater was found to be relatively deep (shallowest being 6.14m bgl). Based on the borehole information the coal/mudstone/siltstone seams are expected to be relatively shallow.

Receptor site C	Based on the groundwater monitoring results completed, groundwater was found to be very deep (shallowest being 6.43m bgl). Based on the borehole information the coal/mudstone/siltstone seams are expected to be relatively deep at Receptor Site C. There are no springs located within the Receptor Site C area and potential for shallow perched groundwater is low due to the deep fractured sandstone and coal/mudstone/siltstone layers.

2.6 Existing Surface Water Drainage

A summary of each site's existing surface water drainage is given below. Pre and post slip conditions are given for the Tylorstown slip (donor) site.

Donor Site (Tylorstown slip)

Pre-slip

North of the existing tramway	North of the existing tramway, several springs discharge into existing ditches and cascade into ponds which overtop into the existing ditch along the north of the dismantled tramway which discharges towards the west of the site. Other springs discharge into ditches and directly into the ditch along the dismantled tramway. There were three existing ponds based on google earth images that were located on the existing Tylorstown Upper tip before the slip occurred. The ponds were most likely formed by the spring flows and were assumed to have had no storage potential and generally filled with water from the springs especially during wet seasons (winter).
North of the tip	North of the tip, there is a drain along the top which serves the catchment to the north of the road. The ditch also collects runoff from the crest of the tip draining towards the ditch. The ditch discharges via a culvert under the tramway. The ditch downstream ultimately discharges into the river.
South of tramway	South of the dismantled tramway, there are several ditches discharging to the river. There are two main culvert connections to the river. Based on google earth images, due to significant vegetation growth the ditches have become less pronounced due to significant interception.

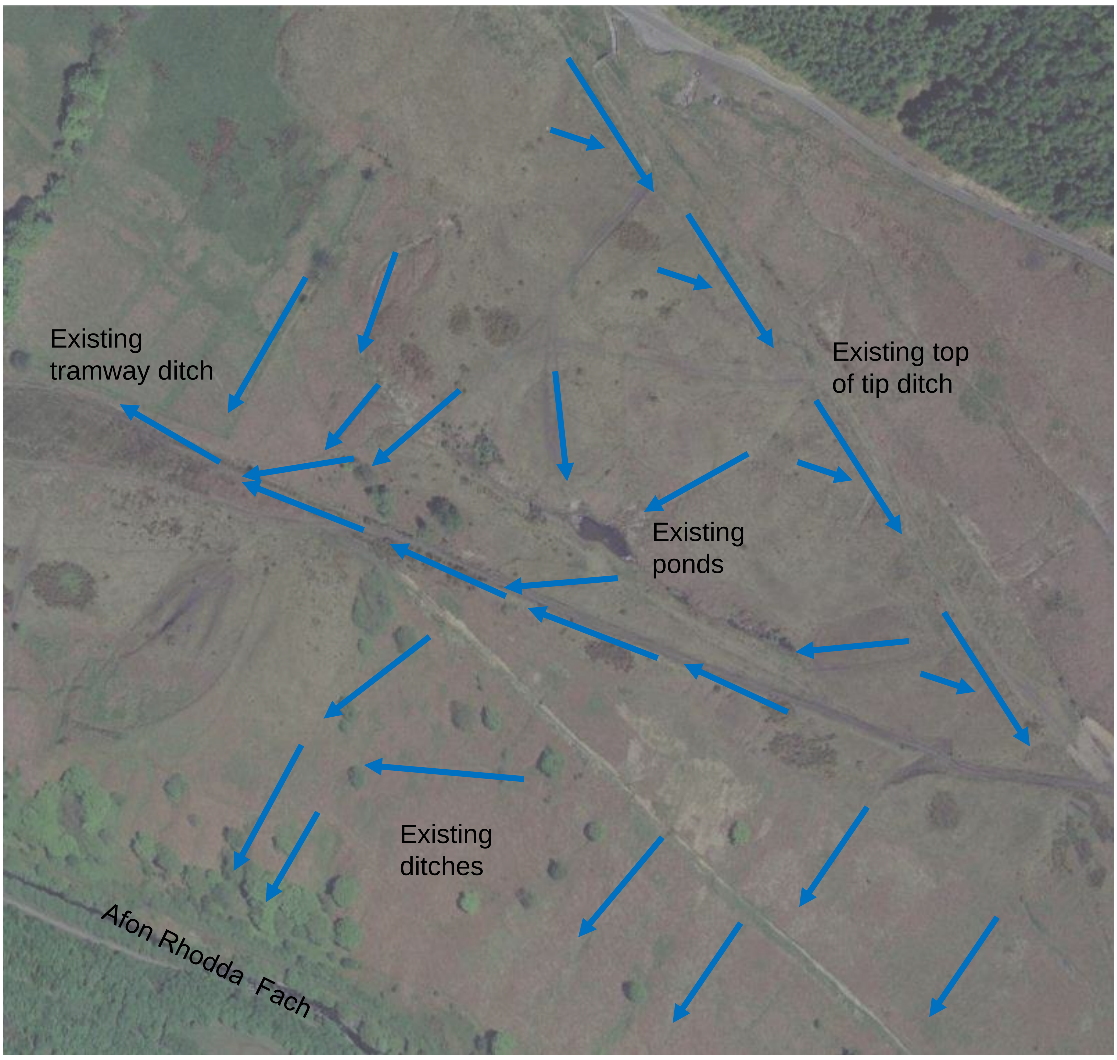

Figure 2.5 – Donor site (pre-slip) - Existing surface water drainage features

<u>Post-slip</u>

North of the existing tramway	Due to the slip, the previous ponds north of the existing dismantled tramway, were destroyed. New cuttings into the soil and slipped material were formed by the springs and surface water run-off. Temporary concrete ditches have been installed to collect the spring and ditch flows as the dismantled tramway and its adjacent ditch was destroyed by the slip. The springs to the west still discharge into ditches and directly into the ditch along the tramway as they have not been impacted by the slip.
North of the tip	North of the tip, there is a drain along the top which serves the catchment to the north of the road. The ditch also collects runoff from the crest of the tip draining towards the ditch. The ditch discharges via a culvert under the tramway. The ditch downstream ultimately discharges into the river. To ensure no further slips occur until works to the tip has been completed, temporary piping is used to collect run-off from the upper catchment and cascade it downstream.

South of tramway	South of the tramway, several new ditches were formed after the slip within the slipped material as the existing ditches were filled/destroyed. A temporary concrete ditch was installed to cascade water into more vegetated areas with ditches to ensure erosion of the slipped material is managed.

The darker blue arrows in the image below shows changes in flow paths due to the slip.

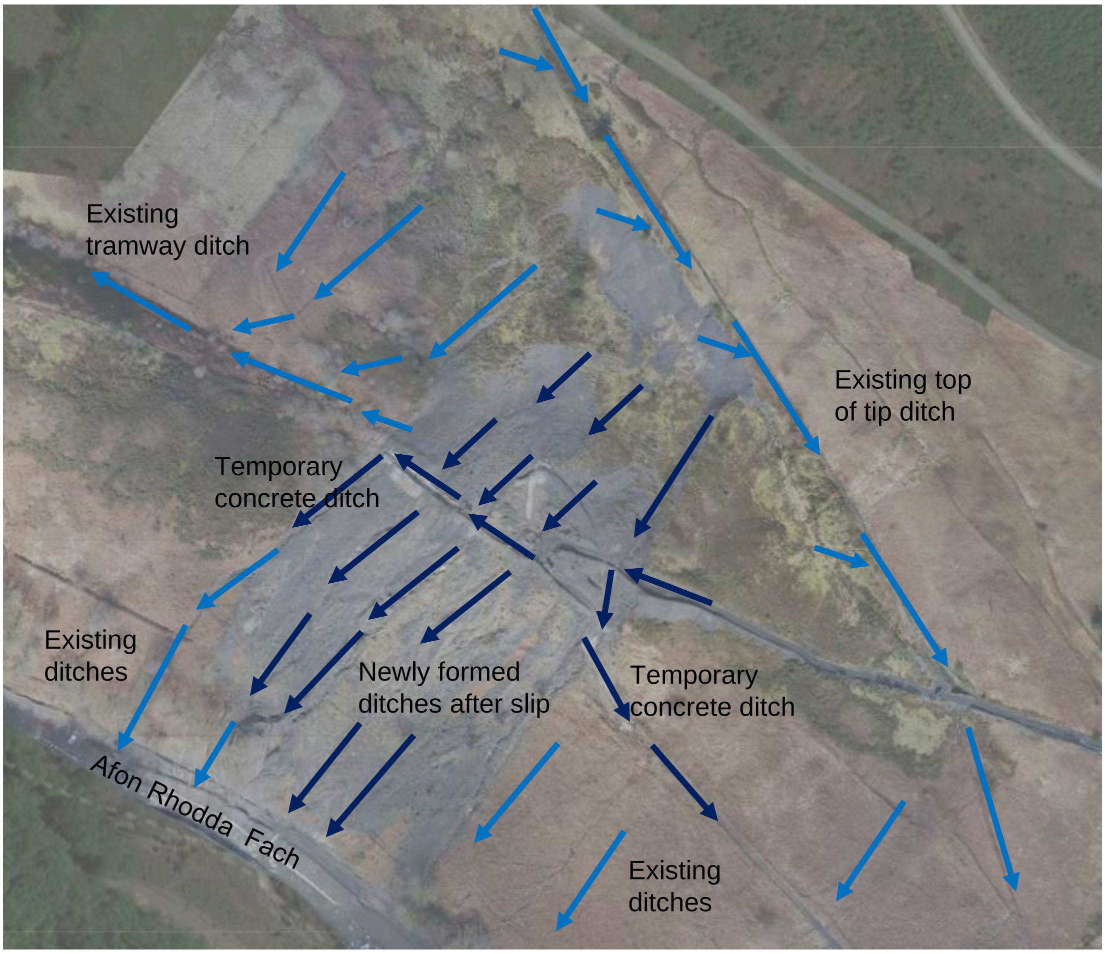

Figure 2.6 – Donor Site (post slip) - Existing surface water drainage features

<u>Receptor Site C</u>

Northern section of the site	The northern section of the site drains to two existing ditches, which discharge to an existing concrete channel. This concrete channel ultimately discharges into the Afon Rhondda Fach downstream.
Eastern and south eastern section of the site	The eastern section of the site (east of the ridgeline along the middle of the site) drains to the existing ditch which is located all along the eastern boundary along the track.
Southern/ south-western section of the site	The southern and western sections of the site drains to the existing concrete ditch which is located along the access track.

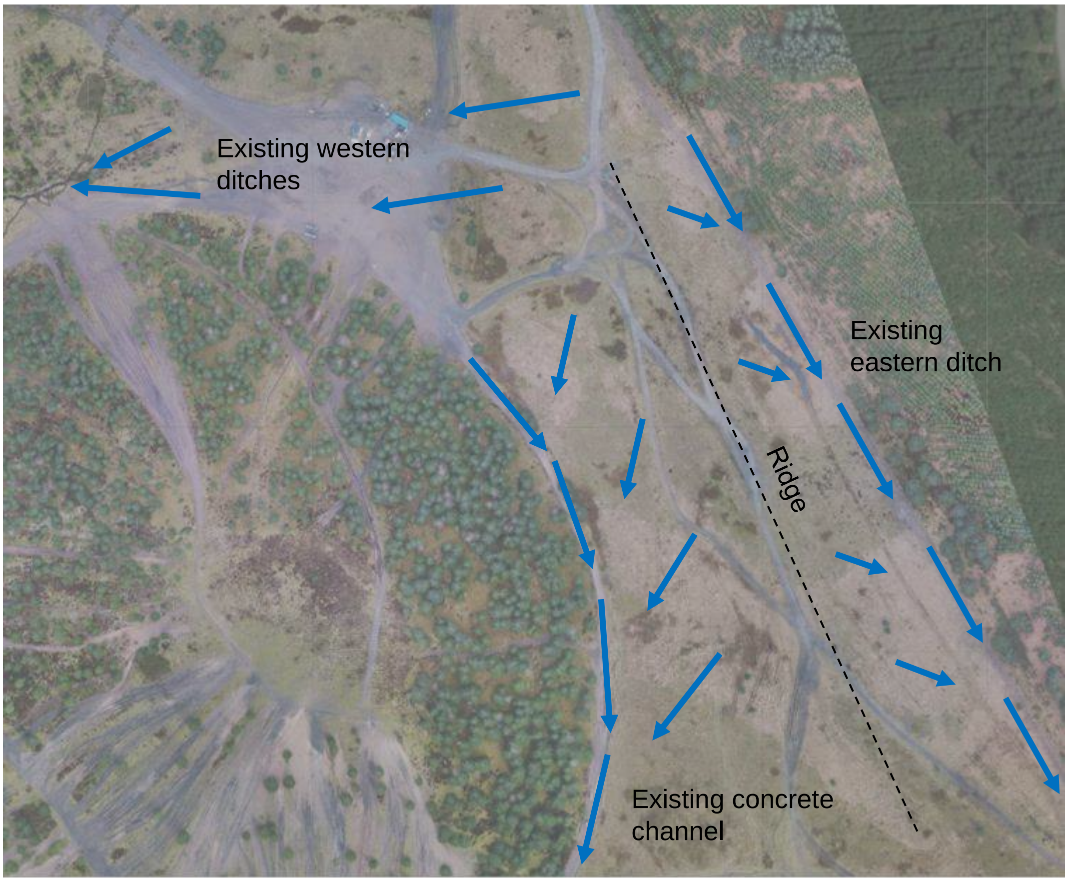

Figure 2.7 – Receptor site C - Existing surface water drainage features

From the information available, there are no flow restrictions or significant storage features, identified across the existing drainage features for both sites (only at the discharge points to the Afon Rhondda Fach).

Before the slip occurred there were three ponds located on the existing Tylorstown Upper tip. In the assessment these ponds were however assumed to have had no storage potential and assumed to be permanently filled with water from the springs especially during the wetter winter season. Invert levels have been taken from the survey where available.

Refer to Appendix C for available information regarding the existing surface water drainage and exceedance flow paths.

3. Existing Flood Risk to the Site

A Flood Consequence Assessment (FCA) or consultation with the NRW was not completed. A summary of flood risk from several sources is however given below.

3.1.1 Tidal flood risk

The site is not located close to any tidal sources. The risk of tidal flooding is therefore considered very low.

3.1.2 Fluvial flood risk

The NRW flood maps indicate that the both sites lies within the Low to Medium Risk of flooding from rivers zone (Figure 3.1).

Only where the existing ditches discharge into the river, are they within the flood zone.

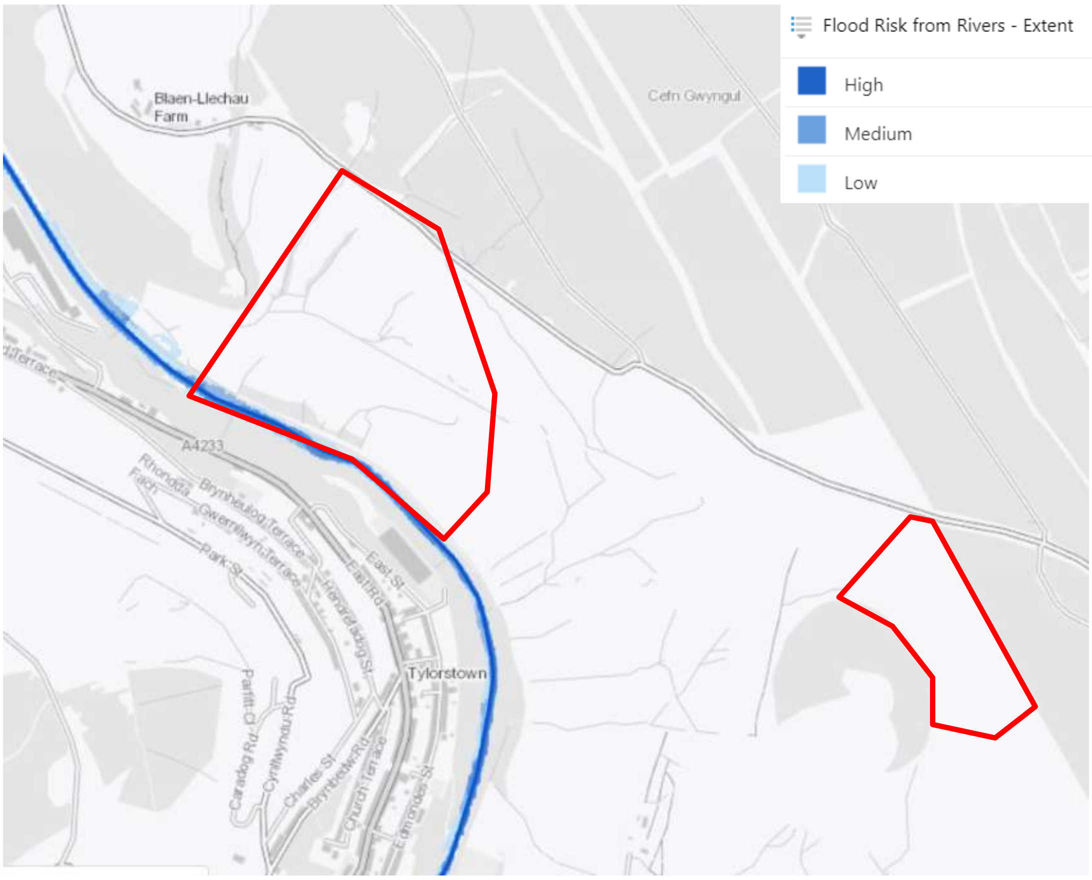

Figure 3.1 – Natural Resources Wales for flood risk from rivers

The existing risk of fluvial flooding is deemed as low risk

3.1.3 *Surface water flood risk*

The proposed sites are within areas at risk of surface water flooding (surface water ditches). There are areas of localised surface water flooding which coincide with the surface water ditches and drainage features, as identified in the topographic survey, which is known to carry water and can flood during larger storm events (Figure 3.2).

The existing risk of surface water flooding is deemed as low risk.

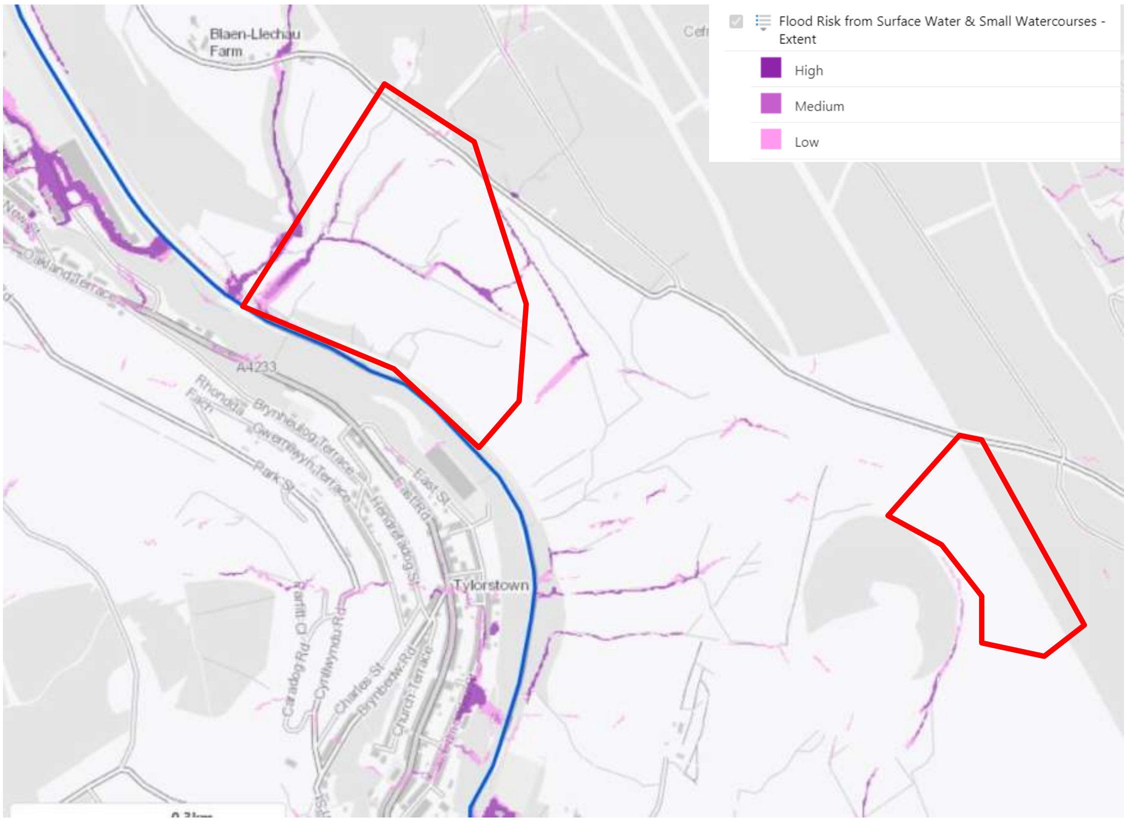

Figure 3.2 – Natural Resources Wales flood map for flood risk from surface water

3.1.4 *Sewer flood risk*

A review of available information from the SFCA indicates no record of sewer flooding on-site. There are also no sewers located within the site.

3.1.5 *Groundwater flood risk*

Perched groundwater is expected at both sites due to the presence of mudstone/coal/siltstone seams underlying weathered/fractured sandstone as per the GI investigations.

According to the RCTCBC Preliminary Flood Risk Assessment (PFRA) groundwater susceptibility maps, the north sites fall in an area which has a medium to high probability of groundwater flooding (Figure 3.3).

For Receptor Site C, potential for shallow perched groundwater is low due to the deep fractured sandstone and coal layers based on the GI. Groundwater flood risk is thus low for the site.

For the Tylerstown slip (donor) site, there are several existing springs visible and shallow perched groundwater is expected. The risk of groundwater flooding for the donor site is thus high.

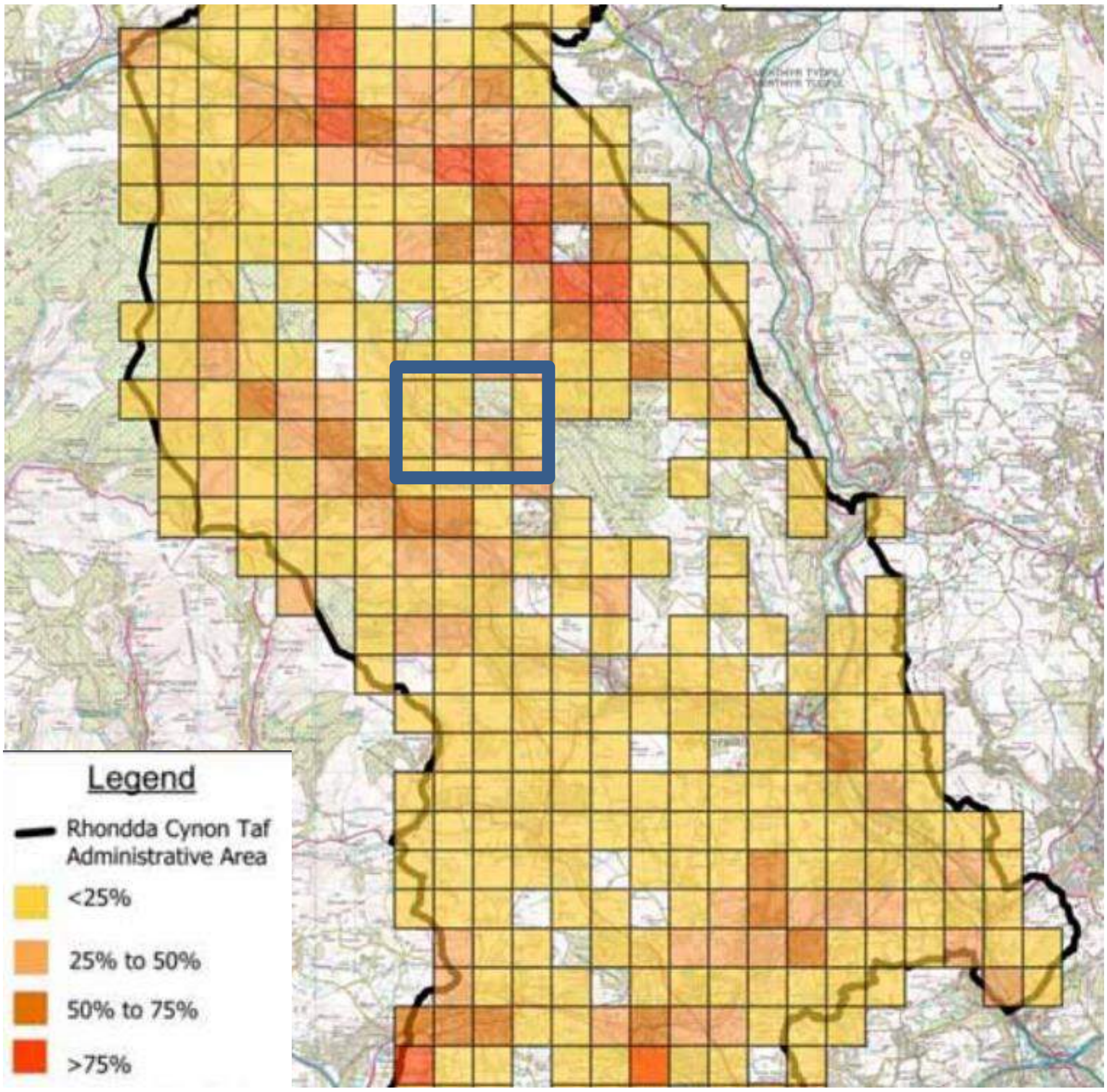

Figure 3.3 – RCTCBC Preliminary Flood Risk Assessment (PFRA) groundwater susceptibility map

3.1.6 Flood risk from artificial sources

There is no risk of flooding of the sites from any artificial sources (reservoirs).

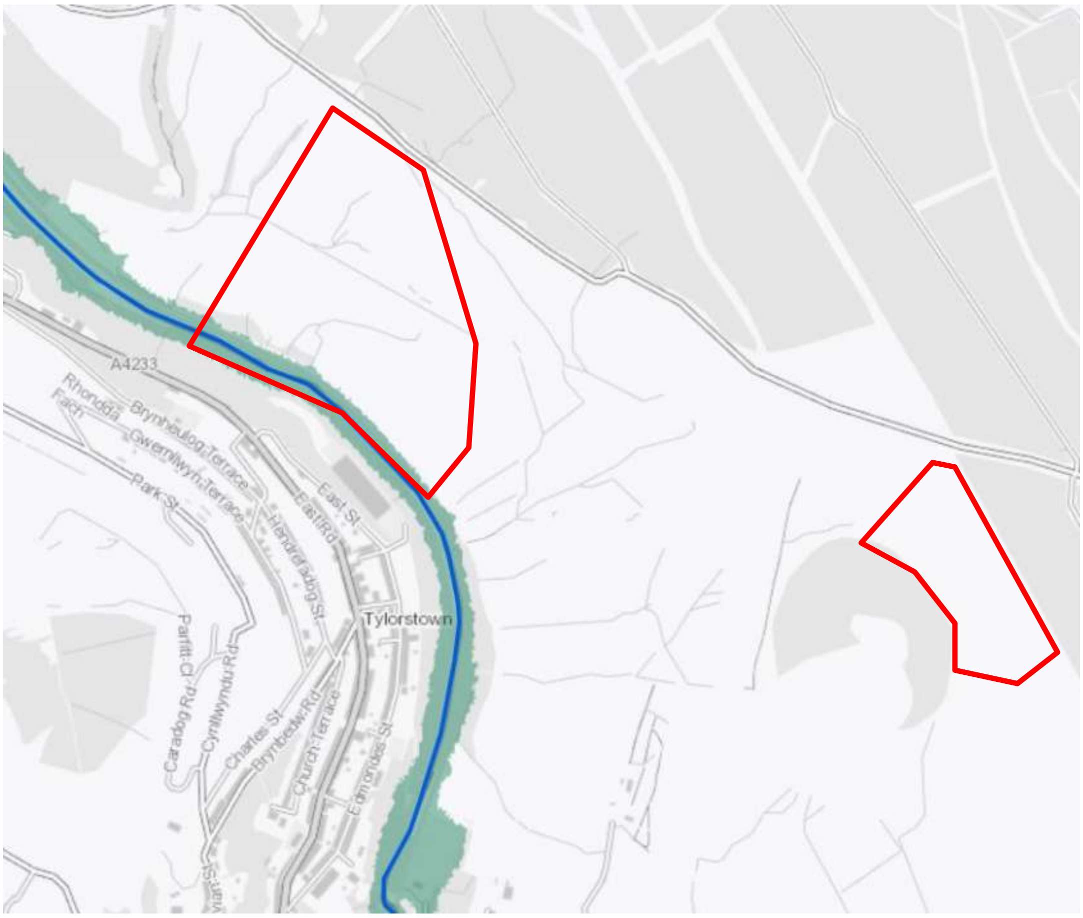

Figure 3.4 – Natural Resources Wales flood map for flood risk from artificial sources

4. Development proposals

4.1 Proposed Development Description

Following on from previous phases of work, the Phase 4 works propose to move the remaining material to the receptor site (Site C) and reprofile the slip. This will include works reinstating the footpath/dismantled tramway and drainage channels as well as reprofiling of the tip after approximately 151,000m^3 of tip material has been removed.

Approximately 151,000m^3 of material is proposed to be moved to Receptor Site C which is located to the side of the Llawanno Tip.

The drainage strategy covers both sites (the donor site and the receptor site) due to alterations in existing exceedance flow paths and to maintain existing greenfield run-off rates.

Development proposals are provided in Appendix D.

5. Surface Water Management

5.1 Overview

The surface water drainage system has been designed in accordance with the NPPF and the accompanying Guidance and Technical Standards for SuDS.

To comply with the National SuDS Standards as referenced in the Rhondda Cynon Taf SAB application documentation, surface water discharge was managed by following the below hierarchy:

1.) Collect for use
2.) Infiltration to the maximum extent that is practical – where it is safe and acceptable to do so
3.) Discharge to watercourses
4.) Discharge to surface water sewer, highway drain or another drainage system
5.) Discharge to combined sewers (last resort)

5.2 Site Constraints

A review of the site characteristics has informed the following site constraints which have influenced the development of the surface water drainage strategy:

- Steep slopes of existing tip/donor site
- Existing tip material containing contaminants from mine workings
- Perched groundwater and springs located within the donor site

5.3 Climate change

The NRW provides guidance on climate change allowances which should be considered when assessing future risk of flooding.

Climate change allowances should be applied to peak rainfall intensities. Table 5.1 shows the anticipated change in extreme rainfall intensity in small (<5km^2) and urban/local drainage catchments[2]. The central and upper allowances should be used to assess the range of impact.

Table 5.1: Change to extreme rainfall intensity compared to a 1961-90 baseline

Applies across all of Wales	Total potential change anticipated for 2020s (2015-2039)	Total potential change anticipated for 2050s (2040-2069)	Total potential change anticipated for 2080s (2070-2115)
Upper estimate	10%	20%	40%
Central estimate	5%	10%	20%

[2] https://gov.wales/sites/default/files/publications/2019-06/adapting-to-climate-change-guidance-for-flood-and-coastal-erosion-risk-management-authorities-in-wales.pdf

5.4 Greenfield Runoff Rates

The Greenfield runoff rates (l/s/ha) for both sites were calculated using the IH124 method and are summarised in Table 5.2.

Table 5.2: IH124 Existing Greenfield run-off rates – per hectare

M5-60	20
'r' ratio M5-60 / M5-2day	0.2
SPR	0.37
Storm event (return period)	Greenfield runoff rate (litres/sec/ha)
Qbar	19.74
1 in 1 Year	17.38
1 in 30 Year	35.15
1 in 100 Year	43.04

Based on visual inspection the existing donor site has approximately 4 springs which are not accounted for in the IH124 method for greenfield run-off rates. Approximately 6l/s per spring (conservative estimate) was calculated as additional spring flow for the existing tip which should be added as a base flow to the greenfield run-off rates. The spring flow estimation, based on available groundwater and ground information, is provided in Appendix C.

Due to the steep nature of the donor site, additional modelling using FSR rainfall was done to check the greenfield rates and to determine potential flows needed to be accommodated in the proposed drainage features. The calculations were done based on the donor site pre-slip conditions determined from Google Earth historic aerial images and LIDAR data. The visible ponds on the existing tip were assumed to be full/saturated and not provide any storage. Where existing drainage elements were unclear, areas were not modelled. These calculations are contained within Appendix C and summarised in Table 5.3. The modelled values include spring flows.

Table 5.3: Modelled Existing Greenfield run-off rates – Existing tip/donor site

IH124 – Greenfield rates (excluding spring flows)			
Storm event (return period)	Area 1 (7.106ha) 4 springs	Area 2 (0.406ha)	Area 3 (0.603ha)
1 in 2 Year	66.44	3.80	5.64
1 in 30 Year	118.31	6.76	10.04
1 in 100 Year	144.89	8.28	12.30
Modelled - Greenfield rates			
Storm event (return period)	Area 1 (7.106ha) 4 springs	Area 2 (0.406ha)	Area 3 (0.603ha)
1 in 2 Year	220.0	-	-
1 in 30 Year	358.3	-	-
1 in 100 Year	445.8	-	-

From Table 5.3 it is evident that the IH124 method is not suitable for steep catchments (slopes between 1:2 and 1:50) as it utilises an averaged slope of a catchment. The modelled greenfield run-off rates for the site are thus more representative of the actual expected greenfield run-off rates and was used in the design of drainage elements.

The discharge areas are shown visually in Figure 5.1.

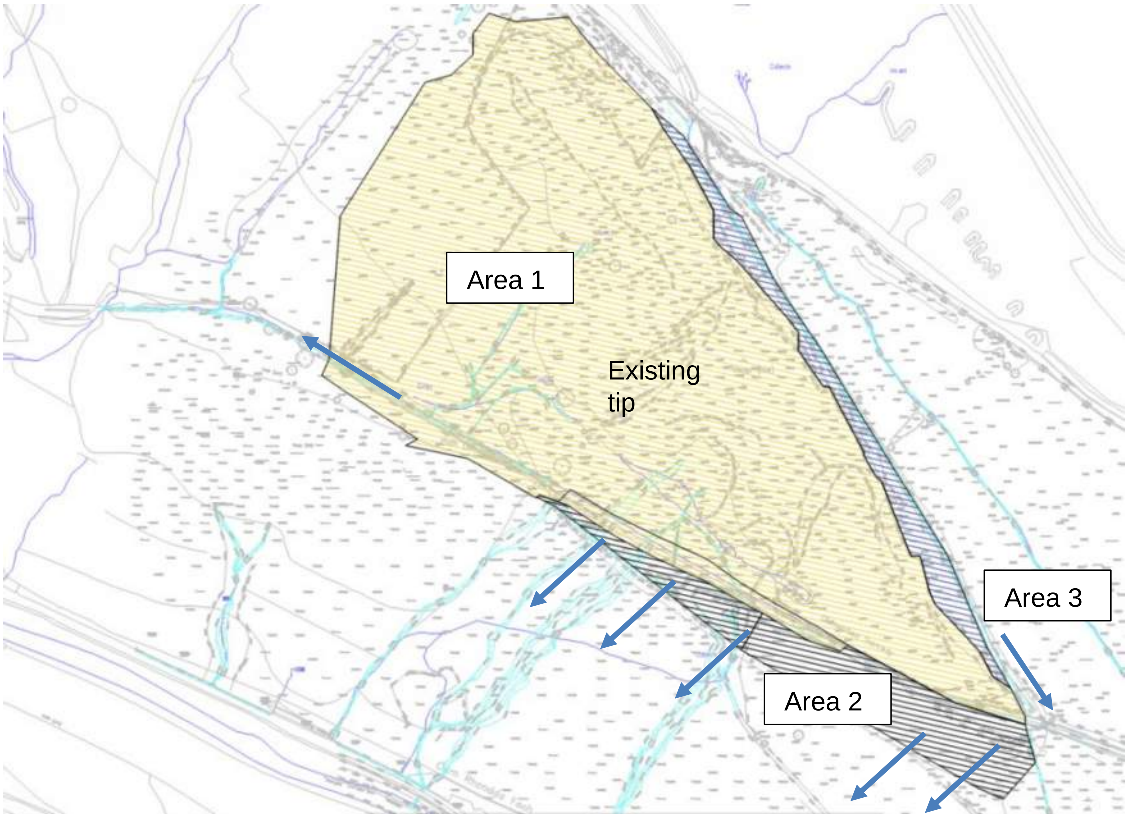

Figure 5.1 – Greenfield discharge areas (existing tip)

Converting the Greenfield run-off rates as per Table 5.4, to averaged l/s/ha rates, the allowable greenfield run-off rates for the donor site are:

Table 5.4: Modelled Greenfield run-off rates – per hectare– Existing tip/donor site

Storm event (return period)	Greenfield runoff rate (litres/sec/ha) – springs incl.
Qbar (1:2 year)	30.96
1 in 30 Year	50.42
1 in 100 Year	62.74

5.5 Allowable Surface Water Discharge Rate

In trying to keep the discharge rates to as close to greenfield discharge rates as reasonably practicable, the proposed discharge rates were developed by ensuring the 1:30 year event can be contained within the drainage system and not flood.

The drainage elements were also designed to be able to cascade run-off from the steep slopes to the tramway ditch during larger events (1:100 year event and larger) without any flooding/ponding on the steep embankment which could cause potential stability issues and scouring.

The land use of the sites will not change (to remain greenfield sites) and the sites will remain 100% permeable. However, how the existing sites drains/ cascades run-off will be altered by the changes in landscape as well as the exceedance flow paths.

Receptor Site C

The deposited material at Receptor Site C will alter the existing exceedance flow paths and run-off. Based on the IH124 method, the greenfield run-off rates of each area were calculated as shown in Table 5.5 below. Table 5.5 also includes the discharge rates achieved with the proposed drainage strategy for Site C as described in Section 5.7.

Table 5.5: Proposed run-off rates – Receptor Site C

Storm event (return period)	Area 1 (2.996ha)	Area 2 (1.351ha)	Area 3 (0.690ha)	Area 4 (0.071ha)	Total
Allowable IH124 Existing run-off rates					
1 in 2 Year	28.01	12.63	6.45	0.67	47.76
1 in 30 Year	49.88	22.49	11.49	1.19	85.05
1 in 100 Year	61.09	27.55	14.07	1.46	104.17
Proposed run-off rates (modelled)					
1 in 2 Year	20.20	14.20	7.50	2.00	43.9
1 in 30 Year	29.30	20.00	20.40	3.09	72.79
1 in 100 Year	34.30	23.30	27.70	5.20	90.5

The discharge areas are shown visually in Figure 5.2.

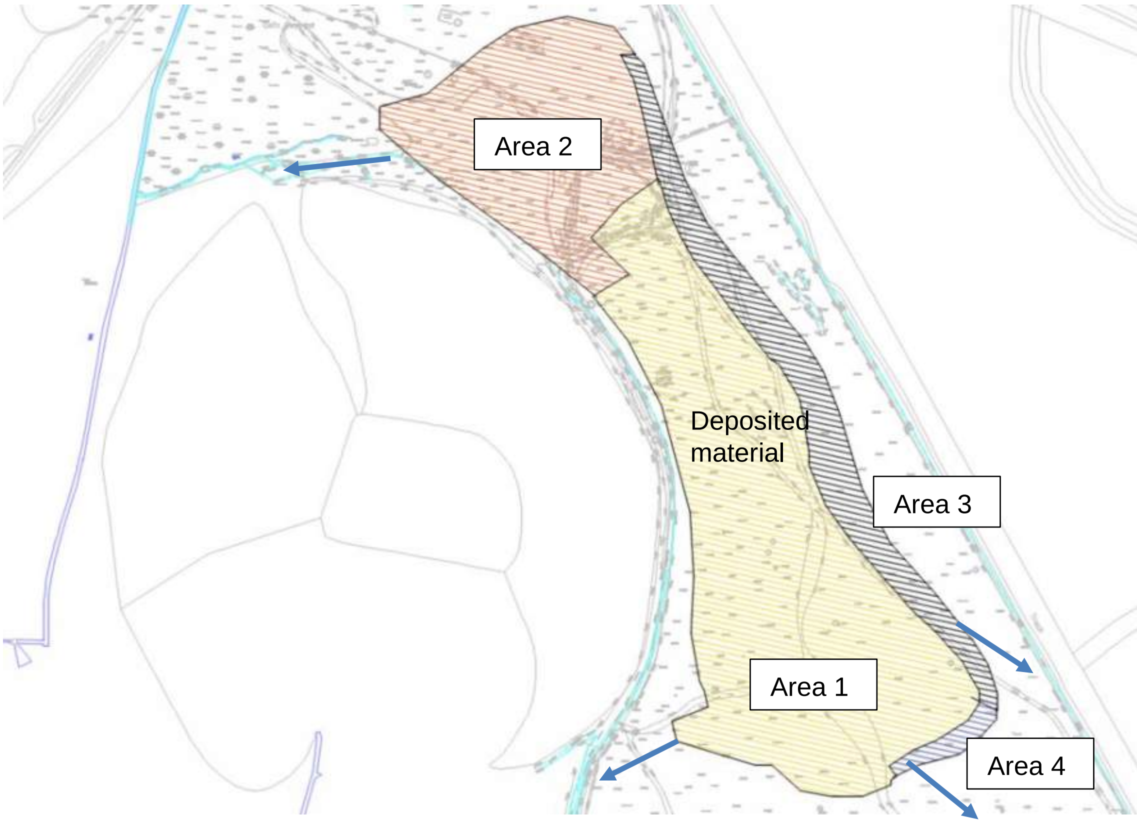

Figure 5.2 – Greenfield/proposed discharge areas (Receptor site C)

<u>Proposed donor site (existing tip)</u>

Due to the slip, several of the existing drainage channels and ponds were destroyed and new channels formed. The proposed drainage strategy tried to mimic and reinstate the existing pre-slip exceedance flow paths and drainage conditions as best as possible. The drainage strategy also tried to provide more slope stability and accommodate the removal of material from the donor site.

Based on the modelled results as per Table 5.4, the greenfield run-off rates of each area were calculated as shown in Table 5.6 below. Table 5.6 also includes the discharge rates achieved with the proposed drainage strategy for the reprofiled tip as described in Section 5.7.

Table 5.6: Proposed run-off rates – Existing tip/donor site

Storm event (return period)	Area 1 (7.330ha) Incl. 4 springs	Area 2 (0.950ha)	Total
Allowable modelled Greenfield run-off rates			
1 in 2 Year	226.93	27.27	254.2
1 in 30 Year	369.59	45.76	415.35
1 in 100 Year	459.85	57.46	517.31
Proposed run-off rates (modelled)			
1 in 2 Year	238.1	20.6	258.7
1 in 30 Year	467.2	46.1	513.3
1 in 100 Year	551.2	62.9	614.1

The discharge areas are shown visually in Figure 5.3.

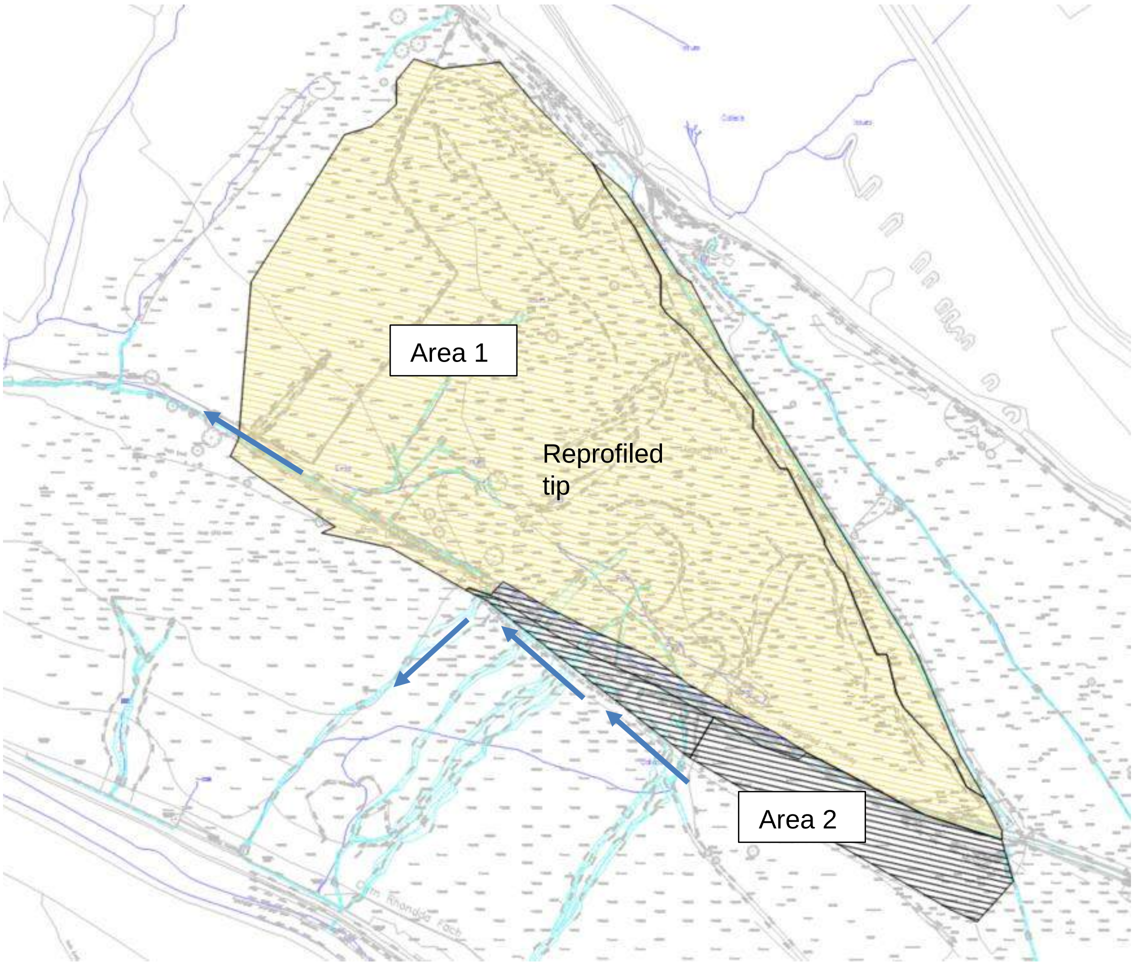

Figure 5.3 – Greenfield/proposed discharge areas (Existing tip)

It should be noted that the modelled Greenfield and proposed run-off rates (presented in Tables 5.3 – 5.6) assume a time of entry of between 5min and 20min dependent on the distance from the drainage features. Once the sites become vegetated and more established, the vegetation will intercept flows and the peak flows indicated will be reduced.

5.6 SuDS discharge hierarchy

The SuDS discharge hierarchy should be followed to attempt to design the SuDS strategy to mimic the natural drainage routes, infiltration rates and discharge rates as far as possible. An assessment of the SuDS discharge hierarchy for the proposed drainage strategy is shown in Table 5.7.

Table 5.7: SuDS discharge hierarchy

Discharge strategy	Description
Re Use	Due to the nature of the development, rainwater harvesting was not deemed appropriate.
Infiltration system/ into ground	Due to the perched groundwater (springs) and potential for destabilising the area further at the existing tip (donor site) and potential contaminants from mine workings (deposited material and existing tip), infiltration was not deemed appropriate. Both sites are also located within high groundwater vulnerability areas.
To surface water body	Both sites discharge into the Afon Rhondda Fach via existing drainage channels (concrete channels and natural ditches). The proposed drainage is to connect into the existing ditches and discharge into the river as existing at similar discharge rates (Greenfield rates). Existing ditches to be reinstated/rehabilitated where they have been damaged.
To surface water sewer	Not applicable
To a combined sewer	Not applicable

5.7 Proposed SuDS Strategy

A surface water drainage strategy has been developed in line with the philosophy that underlies The SuDS Manual; favouring a combination of management techniques managing water quantity and quality and promoting biodiversity and amenity values. The surface water drainage design philosophy approach maintains the relatively natural flow path of water and discharge to existing concrete channels and ditches which ultimately discharge to the Afon Rhondda Fach.

To ensure no increase in discharge to the existing watercourses and drainage channels and not increase flooding downstream, flows are to be attenuated and discharged at Greenfield rates in accordance with TAN15 and not increase water discharged off the site. Greenfield runoff rates are to be maintained as existing whilst also satisfying the other three pillars of SuDS design by offering amenity, biodiversity, water quality improvements.

The proposed receptor site deposited material and slip reprofiling have been designed to mimic existing topography as best as possible to allow for existing exceedance flow paths to be maintained and drainage features incorporated to direct run-off where appropriate to maintain existing flow paths where levels have been altered.

The proposed drainage strategy layouts and other associated calculations and drawings, presented in Appendix E, illustrates the SuDS features proposed to manage the surface water runoff from the site.

Receptor Site C

The proposed drainage strategy for Receptor site C is shown in Figure 5.4 below and in Appendix E.

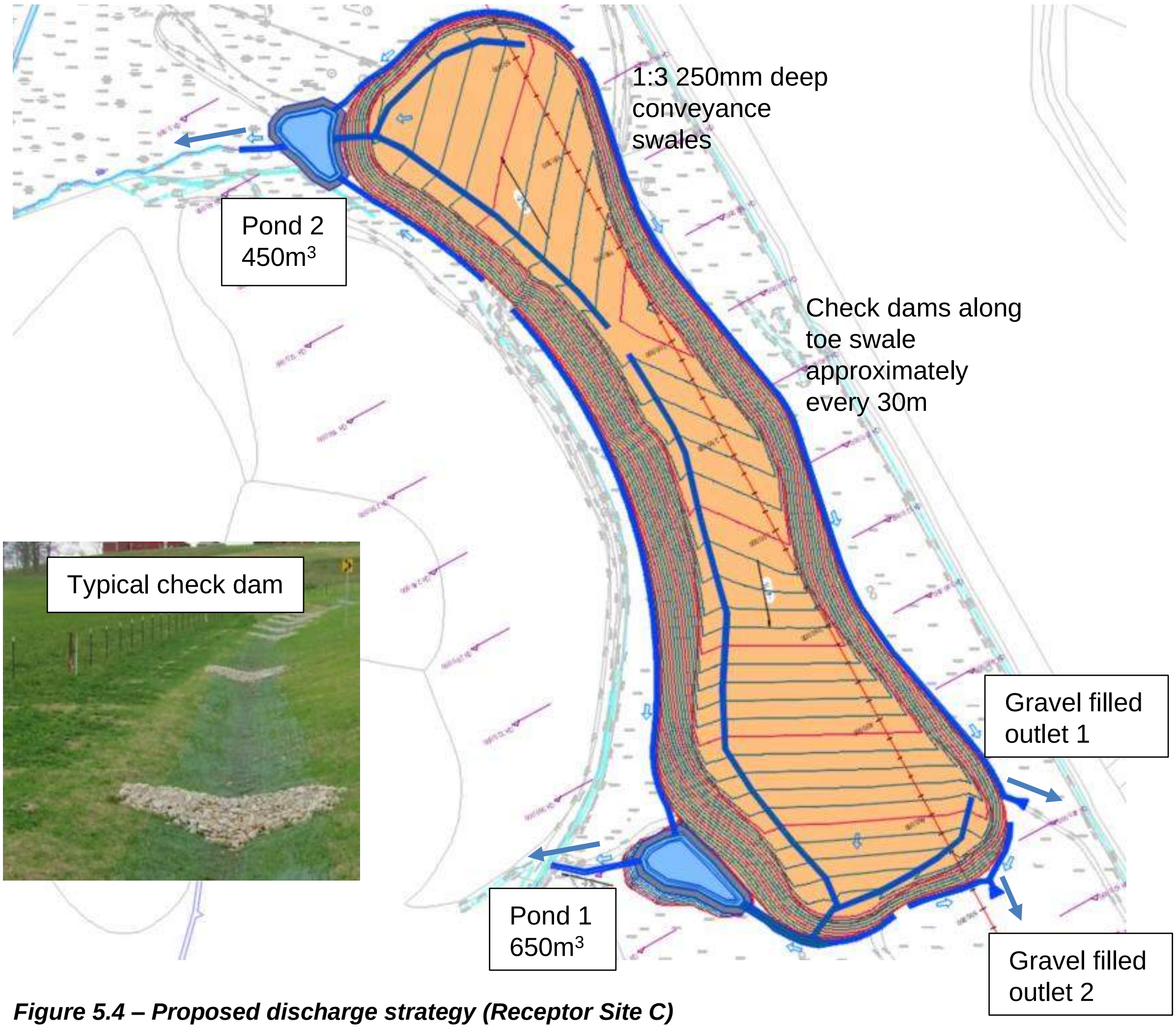

Figure 5.4 – Proposed discharge strategy (Receptor Site C)

For receptor site C, central swales have been incorporated to convey flows from the top of the deposited material and toe swales to convey flows from the banks. The swales convey flows into two attenuation ponds which discharge into the existing ditches at Greenfield rates via a filter drain connections. Overflow weirs have been incorporated if the filter drains become blocked.

Based on the modelled results using FSR rainfall data, the ponds can accommodate up to the 1:100 year event without overtopping and maintain Greenfield run-off rates or lower as shown in Table 5.5. Flooding/ponding from the upstream swales will cascade towards the pond and be confined within the site for events larger than the 1:100 year storm.

For the southern banks/batter of the deposited material, toe swales have been incorporated directing flows towards the eastern ditch as existing. To attenuate and slow down flows and maintain Greenfield run-off rates, check dams have been incorporated into the swales. Additional gravel/cobbled outlets are proposed to spread and slow down flows at discharge.

The modelled discharge from the south eastern swales are higher than the allowable Greenfield rates. The modelled results do not account for the spreading and slowing down of the flows at the gravel outlets and assume a time of entry of 5min which does not account for any interception by vegetation on the embankment batter.

The proposed drainage network will thus be able to contain the 1:30 year event. Localised flooding will occur for more significant storms (larger than the 1:100 year event) within the upstream swales but will be contained within the site.

Proposed donor site (existing tip)

The proposed drainage strategy for the reprofiled tip is shown in Figure 5.5 below and in Appendix E.

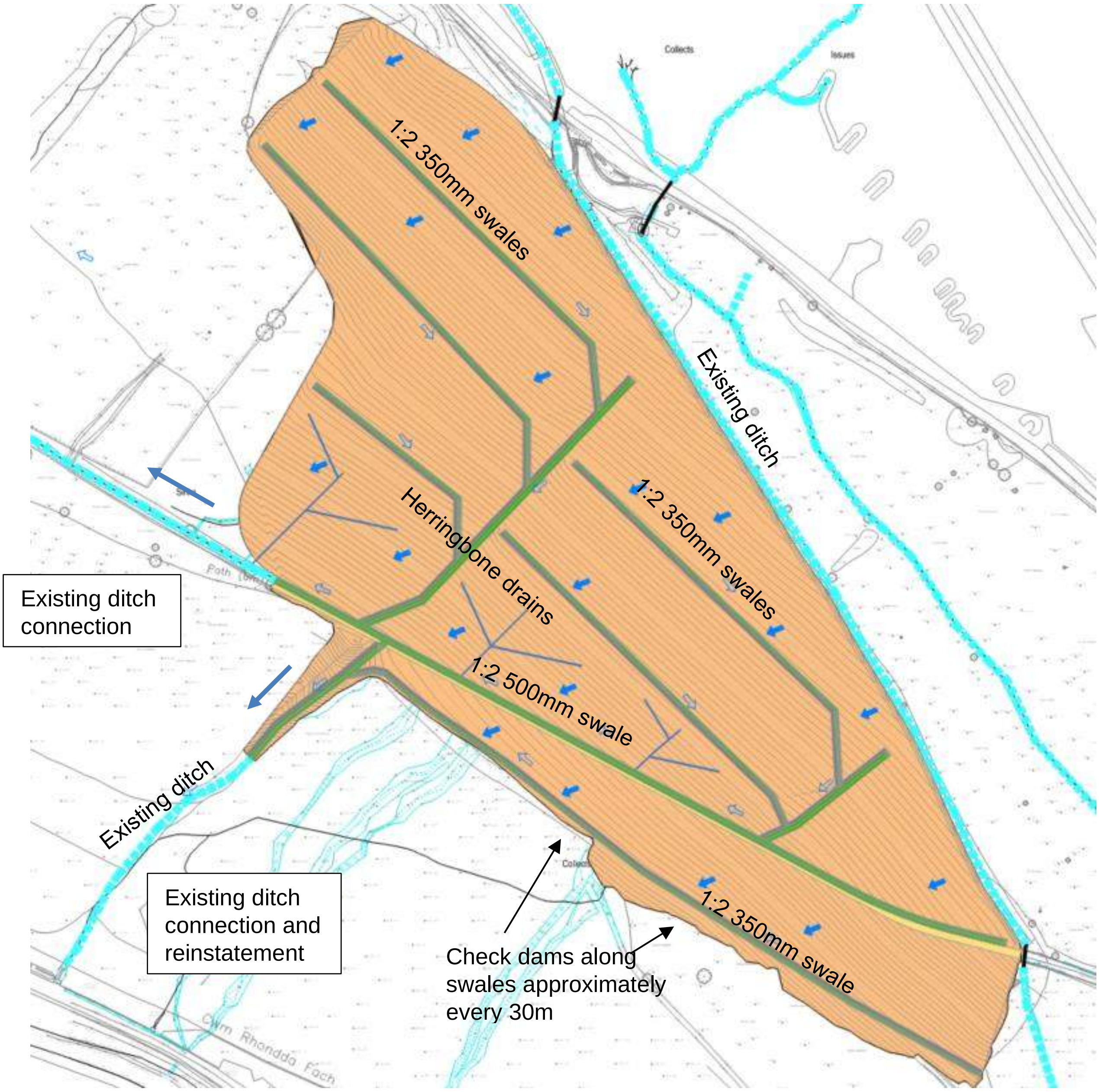

Figure 5.4 – Proposed discharge strategy (Reprofiled tip)

The proposed drainage features for the reprofiled tip have been designed to allow for not only surface water conveyance but also spring flows. Spring flows are to be intercepted and conveyed via gravel filled herringbone drains to the proposed drainage channels to attempt to improve stability and potential future slippages.

Surface water runoff is intercepted by swales located along berms which convey flows to a ditch along the reinstated footpath which discharge to existing ditches/channels. Existing exceedance flow paths will be altered with the reprofiled tip and flows diverted to different discharge points to existing.

Flows to be attenuated with check dams within proposed ditch where appropriate and to maintain as close to possible Greenfield run-off rates.

Based on the modelled results, the proposed drainage features can accommodate up to the 1:30 year event and maintain close to Greenfield run-off rates. Flooding/ponding from the upstream swales will cascade towards the tramway ditch and be confined within the site for events larger than the 1:30 year storm.

The modelled discharges are higher than the allowable Greenfield rates as shown in Table 5.6. The models assume a time of entry of between 5 and 20min which does not account for any interception by vegetation or the effect of the herringbone drains on the spring flows. The spring flows used are also very conservative and based on worst case scenario. Due to the existing tip having slipped due to oversaturation, the proposed discharge rates are thus deemed to be acceptable.

Existing drainage channels damaged by the slip, downstream of the dismantled tramway, are to be reinstated where appropriate and reinforced with erosion matting and seeded with hessian to accommodate steep slopes and promote vegetation growth.

Assessing the proposed and existing levels, when the system floods, majority of the water will flow over the side of proposed swales and cascade down the embankment downhill berms and ultimately towards the proposed ditch along the dismantled tramway. An overflow weir is also proposed along the proposed ditch which can overflow towards the ditch south of the dismantled tramway.

The proposed strategies include; swales and attenuation ponds. Features are to be vegetated and meandered to blend in with natural landscape in addition to providing water quality, amenity and biodiversity benefits.

5.8 Maintenance and operation

The maintenance of SuDS is vital ensuring that they work as efficiently as they set out to do.

A schedule of maintenance for the proposed SuDS features is contained in Chapter 6.

5.9 Proposed Surface Water Quality Management

Water quality has been assessed using the ‘Simple Index Approach’ as outlined under ‘The SuDS Manual’ (CIRIA c753, 2015).

The SuDS components within the surface water drainage strategy have been designed in accordance with the guidance set-out in the SuDS Manual.

Treatment within SuDS components is essential for frequent low intensity and duration rainfall events, where urban contaminants are being mobilised and washed off urban surfaces and the aggregated contribution to the total pollutant load to the receiving surface water body is potentially high. For rainfall events greater than the 1 in 1 return period, the pollutants become diluted and the environmental risks will be reduced which means that the SuDS treatment process becomes less crucial. Treatment effectiveness is strongly linked to the hydraulic control of runoff, in particular velocity control and retention time.

The proposed site development is not of urban or agricultural nature, but the material deposited is of old mine workings. Based on soil assessments the tip material to be deposited and the in-situ material on the site is of the similar composition and nature. The material to be deposited should this not pose any risk dissimilar to the in-situ material.

The proposed drainage systems also utilise vegetated bentonite lined swales with 150mm of topsoil and vegetated lined attenuation ponds. The topsoil layer and vegetation should be able to trap and mitigate any potential contaminant transported from the deposited tip material and existing tip.

6. Schedules of Maintenance

Refer to “GC3613 – Tylorstown Phase 4 - Schedule of maintenance” document contained in Appendix E.

7. SUDS statutory compliance

The preceding sections outlined how the SuDS assets employed within the management train conform with the standards, S1 to S6 detailed under *'Statutory standards for sustainable drainage systems – designing, constructing, operating and maintaining surface water drainage system' (Welsh Government, 2018).* A summary showing how the design for the proposed development satisfies SuDS statutory standards S1 to S6 has been provided in Table 7.1 below.

Table 7.1 – Proposed mid catchment statutory SuDS standards summary

Standard	Designers' response
S1 – Surface water destination	• Level 1 – Rainwater collected for use Rainwater harvesting would not be considered for a scheme of this nature as there would not be a requirement for the water. • Level 2 – Discharge of surface water into the ground Due to the perched groundwater (springs) and potential for destabilising the area further at the existing tip (donor site) and potential contaminants from mine workings (deposited material and existing tip), infiltration was not deemed appropriate. Both sites are also located within high groundwater vulnerability areas. • Level 3 – Discharge to a surface water body The existing site discharges into the Afon Rhondda Fach via existing drainage channels (concrete channels and natural ditches). The proposed drainage system is proposed to connect into the existing ditches and discharge into the river as existing at similar discharge rates.
S2 – Surface water runoff hydraulic control	• Proposed discharge rates to be similar to existing greenfield discharge rates. **Receptor site C** • Up to the 1:30 year event is contained and conveyed within the drainage system and discharged at close to greenfield rates without flooding. • For larger storm events (>1:100 year storm event), there will be some flooding cascaded towards the proposed ponds and contained within the site. **Reprofiled tip** • Up to the 1:30 year event is contained and conveyed within the drainage system and discharged at close to greenfield rates. There is some localised ponding within the system but will cascade back into the system. • For larger storm events (>1:100 year storm event), there will be some more flooding. Assessing the proposed and existing levels, when the system floods, majority of the water will flow over the side of proposed swales and cascade down the embankment downhill berms and ultimately towards the proposed ditch along the dismantled tramway. An overflow weir is also proposed along the proposed ditch which can overflow towards the ditch south of the dismantled tramway.

S3 – Water Quality	• The proposed site development is not of urban or agricultural nature, but the material deposited is of old mine workings. Based on soil assessments the tip material to be deposited and the in-situ material on the site is of the same composition and nature. The material to be deposited should thus not pose any risk dissimilar to the in-situ material. • The proposed drainage systems also utilise vegetated bentonite lined swales with 150mm of topsoil and vegetated lined attenuation ponds. The topsoil layer and vegetation should be able to trap and mitigate any potential contaminant transport from the deposited tip material.
S4 - Amenity	• Minimal impact on existing landscape. • Proposed swale, receptor site C deposited material and reprofiled tip to be seeded and attenuation ponds to be vegetated • All vegetation removed during construction to be reinstated same as existing as far as reasonably practicable.
S5 - Biodiversity	To enhance biodiversity and habitat and not change the existing landscape significantly: • Proposed swale, receptor site C deposited material and reprofiled tip to be seeded and attenuation ponds to be vegetated • All vegetation removed during construction to be reinstated same as existing as far as reasonably practicable.
S6 – Design of drainage for Construction, Operation and Maintenance and Structural Integrity	• Maintenance of swales, attenuation ponds and control structures (check dams and weirs) to be undertaken in accordance with Operation and Maintenance schedule.

8. Conclusion

8.1 Drainage strategy

8.1.1 The proposed works include the raising of the low spot on the section of the existing A4059 carriageway by 250mm, removing the existing road crown and have the whole carriageway draining at 2.5% towards a new swale/shallow-ditch drainage feature along the carriageway in the north eastern verge.

8.1.2 The Natural Resources Wales' Flood Risk Map Viewer does not identify any high risk of flooding to either of the sites. Flooding from fluvial, tidal, sewer flooding, groundwater and artificial sources have been assessed and considered to be low for the site. There are areas of localised surface water flooding which coincide with the drainage features, as identified in the topographic survey, which is known to surcharge and potentially flood during larger storm events. The reprofiled tip is however at risk to groundwater flooding as there are spring and perched groundwater present.

8.1.3 An assessment of the surface water catchment has been made and the Greenfield runoff rate (Qbar) for the sites have been determined. Due to the steep nature of the existing Tylorstown Upper tip, the greenfield rates were modelled to determine the rate rather than using the IH124 method.

8.1.4 Proposed discharge rates to be similar to existing greenfield discharge rates and the surface water drainage strategies are able to contain the 1:30 year event and not cause flooding downstream for events larger than the 1:30 year as detailed for each site below:

<u>Receptor site C</u>

Up to the 1:30 year event is contained and conveyed within the drainage system and discharged at close to greenfield rates without flooding.

For larger storm events (>1:100 year storm event), there will be some flooding but will be cascaded towards the proposed ponds.

<u>Reprofiled tip</u>

Up to the 1:30 year event is contained and conveyed within the drainage system and discharged at close to greenfield rates. There is some localised ponding within the system along the ditch in along the tramway, but will cascade back into the system.

For larger storm events (>1:100 year storm event), there will be some more flooding. Assessing the proposed and existing levels, when the system floods, majority of the water will flow over the side of proposed swales and cascade down the embankment downhill berms and ultimately towards the proposed ditch along the dismantled tramway. An overflow weir is also proposed along the proposed ditch which can overflow towards the ditch south of the dismantled tramway.

8.1.5 The surface water drainage strategies include lined swales and attenuation ponds to control run-off as no infiltration SuDS features are considered due to the perched groundwater and potential contaminants. The proposed drainage strategy provides water quality and quantity benefits in accordance with current guidance and standards. Additional amenity and biodiversity benefits are included with the provision of seeded swales and ponds, which form part of the drainage strategy.

8.1.6 Water quality has been assessed using the ‘Simple Index Approach’ and the SuDS features proposed can provide enough mitigation for the proposed land use.

8.1.7 The proposed surface water and SuDS systems for each proposed catchment have been designed in accordance with standards, S1 to S6 detailed under 'Statutory standards for sustainable drainage systems – designing, constructing, operating and maintaining surface water drainage system' (Welsh Government, 2018).

8.1.8 Providing the guidance presented within the Drainage Strategy Report is followed, Capita Redstart considers the proposed development suitable for the site.