PURSER

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Appendix 9.1

Ground Investigation & Geotechnical Report and Waste Characterisation Assessment

IGSL Ltd

Lisheen Bioenergy Plant

Ground Investigation & Geotechnical Report

Project No. 25517

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FOREWORD

The following conditions and notes on the geotechnical site investigation procedures should be read in conjunction with this report.

Standards

The ground investigation works for this project have been carried out by IGSL in accordance with Eurocode 7 - Part 2: Ground Investigation & Testing (EN 1997-2:2007). This has been used together with complementary documents such as BS 5930 (2015) and BS 1377 (Parts 1 to 9) and the following European Norms:

- EN 1997-2 Eurocode 7: 2007 – Geotechnical Design – Part 2: Ground Investigation & Testing
- EN ISO 22475-1:2006 Geotechnical Investigation and Sampling – Sampling Methods & Groundwater Measurements
- EN ISO 14688-1:2002 Geotechnical Investigation and Testing – Identification and Classification of Soil, Part 1: Identification and Description
- EN ISO 14688-2:2004 Geotechnical Investigation and Testing – Identification and Classification of Soil, Part 2: Classification Principles
- EN ISO 14689-1:2004 Geotechnical Investigation and Testing - Identification & Classification of Rock, Part 1: Identification & Description

Reporting

No responsibility can be held by IGSL Ltd for ground conditions between exploratory hole locations. The engineering logs provide ground profiles and configuration of strata relevant to the investigation depths achieved and caution should be taken when extrapolating between exploratory points. No liability is accepted for ground conditions extraneous to the investigation points. Unless specifically stated, no account has been taken of possible subsidence due to mineral extraction, mining works or karstification below or close to the site.

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Boring Procedures

Where required, 'shell and auger' or cable percussive boring technique is employed as defined by Section 6.3 of IS EN ISO 22475-1:2006. The boring operations, sampling and in-situ testing meet with the recommendations set out in IS EN 1997-2:2007 and BS 1377:1990 and EN ISO 22476-3:2005. The shell and auger boring technique allows for continuous sampling in clay and silt above the water table and sand and gravel below the water table (Table 2 of IS EN ISO 22475-1:2006).

It is highlighted that some disturbance and variation is unavoidable in particular ground (e.g. blowing sands, gravel / cobble dominant glacial deposits etc). Attention is drawn to this condition, whenever it is suspected. Where cobbles and boulders are recorded, no conclusion should be drawn concerning the size, presence, lithological nature, or numbers per unit volume of ground.

In-Situ Testing

Where required, Standard Penetration Tests (SPT's) are conducted strictly in accordance with Section 4.6 of IS EN 1997-2:2007. The SPT equipment (hammer energy test) has been calibrated in accordance with EN ISO 22476-3:2005 and the Energy Ratio (E_r). A calibration certificate is available upon request. The E_r is defined as the ratio of the actual energy E_{meas} (measured energy during calibration) delivered to the drive weight assembly into the drive rod below the anvil, to the theoretical energy (E_{theor}) as calculated from the drive weight assembly. The measured number of blows (N) reported on the engineering logs are uncorrected. In sands, the energy losses due to rod

length and the effect of the overburden pressure should be taken into account (see IS EN ISO 22476-3:2005).

Soil Sampling

Three categories of sampling methods are outlined in EN ISO 22475-1:2006. The categories are referenced A, B and C for any given ground conditions and are shown in Tables 1 and 2 of EN ISO 22475-1:2006. Reference should be made to EN 1997-2:2002 for guidelines on sample class and quality for strength and compressibility testing. Samples of quality classes 1 or 2 can only be obtained by using Category A sampling methods.

Where appropriate, Class 1 thin wall undisturbed tube samples (UT100) are obtained in fine grained soils (not heterogeneous tills) and meet the requirements of EN 1997-2:2002 and EN ISO 22475-1:2006. Soil samples for laboratory tests are divided into five classes with respect to the soil properties that are assumed to remain unchanged during sampling, handling transport and storage. The minimum sample quality required for testing purposes to Eurocode 7 compatibility (EN 1997-2:2002) is shown in Table A.

Table A – Details of Sample Quality Requirements

EN 1997 Clause	Test	Minimum Sample Quality Class
5.5.3	Water Content	3
5.5.4	Bulk Density	2
5.5.5	Particle Density	N/S
5.5.6	Particle Size Analysis	N/S
5.5.7	Consistency Limits	4
5.5.8	Density Index	N/S
5.5.9	Soil Dispersivity	N/S
5.5.10	Frost Susceptibility	N/S
5.6.2	Organic Content	4
5.6.3	Carbonate Content	3
5.6.4	Sulphate Content	3
5.6.5	pH	3
5.6.6	Chloride Content	3
5.7	Strength Index	1
5.8	Strength Tests	1
5.9	Compressibility Tests	1
5.10	Compaction Tests	N/S
5.11	Permeability	2

N/S – not stated. Presume a representative sample of appropriate size.

Samples recovered from trial pits or trenches meet the requirements of IS EN ISO 22475-1. It is highlighted that unforeseen circumstances such as variations in geological strata may lead to lower quality sample classes being obtained.

Groundwater

The depth of entry of any influx of groundwater is recorded during the course of boring operations. However, the normal rate of boring does not usually permit the recording of an equilibrium level for any one water strike. Where possible, drilling is suspended for a period of twenty minutes to monitor the subsequent rise in water level. Groundwater conditions observed in the borings or pits 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, tidal variations etc.

Engineering Logging

Soil and rock identification has been based on the examination of the samples recovered and conforms with IS EN ISO 14688-1:2018 and IS EN ISO 14689-1:2018. Rock weathering classification conforms to IS EN ISO 14689-1:2003 while discontinuities (bedding planes, joints, cleavages, faults etc) are classified in accordance with 4.3.3 of IS EN ISO 14689-1:2003. Rock mechanical indices (TCR, SCR, RQD) are defined in accordance with IS EN ISO 22475-1:2006.

Where peat has been encountered, samples have been logged in accordance with the Von Post Classification (ref. Von Post, L. 1992. Sveriges Gologiska Undersoknings torvinventering och nogra av dess hittils vunna resultat (SGU peat inventory and some preliminary results) Svenska Mosskulturforeningens Tidskrift, Jonkoping, Swedden, 36, 1-37 and Hobbs N. B. Mire morphology and the properties of some British and foreign peats. QJEG, Vol. 19, 1986.

Retention of Samples

After satisfactory completion of all the scheduled laboratory tests on any sample, the remaining material will be discarded. Unless a period of retention of samples is agreed, it is our normal practice to discard all soil samples one month after submission of our final report.

1. INTRODUCTION

At the instruction of Donnachadh O'Brien & Associates (DOBA) Consulting Engineers, IGSL has undertaken a ground investigation for a proposed bioenergy facility at Lisheen, Co. Tipperary. It is understood that the scheme will include the construction of a tank farm (primary and secondary digesters), feedstock clamps, compost storage building, gas filling unit with external paved areas and associated infrastructure. The proposed development is at the former Lisheen Mine and the footprint of the underground access ramp / decline was uncovered during the investigations.

Figure 1 - Site Location & IGSL Exploratory Locations

The ground investigations comprised trial pits, cable percussive boreholes, rotary core drillholes, plate load tests, soakaway tests and a geophysical survey. The investigations were executed in accordance with BS 5930, Code of Practice for Site Investigations (2015+A1:2020) and EN 1997-2 Eurocode 7 Part 2 Ground Investigation & Testing. The fieldworks were supervised by an IGSL engineering geologist.

Geotechnical soils laboratory testing has been carried out on selected trial pit and borehole samples while point load strength index tests were conducted on rock core specimens. Environmental and chemical testing (BRE SD 1) was also undertaken on selected samples. The 'as-built' co-ordinates and ground levels are shown on the exploratory hole logs with locations plotted on the exploratory hole plan (Appendix 12).

This report presents the findings from the field and laboratory testing. An evaluation of the ground and groundwater conditions and engineering properties ('ground assessment') is presented. Recommendations are provided on foundation solutions, pavement construction, slopes / batters, groundwater and protection of buried concrete. A waste classification report has been prepared by O'Callaghan Moran and is included in Appendix 11.

2. FIELDWORKS

2.1 General

The ground investigations were carried out during July and August 2024 and comprised the following:

- Trial pits (11 No.)
- Cable percussive boreholes (8 No.)
- Rotary core drillholes (8 No.)
- Plate load tests (5 No.)
- Soakaway tests (5 No.)
- Geophysical surveying
- Groundwater monitoring& installation of data loggers
- Surveying of exploratory hole locations

2.2 Trial Pits

Trial pitting was performed using a 6T tracked excavator. The trial pits are denoted TP 01 to 11 and were logged and sampled by an IGSL engineering geologist in accordance with BS 5930 (2015+A1:2020) and EN 14688-1:2017. The pits extended to depths of between 1.5 and 2.8m with termination due to obstructions or suspected bedrock / rockhead. Bulk disturbed samples (typically 20 to 25 kg) were taken as the pits progressed. The bulk samples were placed in heavy-duty polyethylene bags and sealed before being transported to Naas for laboratory testing.

The trial pits were backfilled with the as-dug arisings and reinstated to the satisfaction of IGSL's site representative. The trial pit logs and photos are presented in Appendix 1 and include descriptions of the soils encountered, groundwater conditions and stability of the pit sidewalls.

2.3 Cable Percussive Boreholes

Cable percussive boring (200mm diameter) was undertaken at eight locations using a Dando 2000 rig. The boreholes extended to depths of between 0.70m (BH 5) and 5.10m (BH 7). At each location, boring commenced through a hand-dug service inspection pit. Throughout boring, disturbed bulk samples were recovered at 1m intervals or change of strata during boring and these are denoted 'B' on the engineering logs. The boreholes were backfilled with the arisings and capped with bentonite pellets.

Standard Penetration Tests (SPT's) were performed in the boreholes and given the nature of the soils, a solid cone was used. It is noted that the SPT N-Values reported are the number of blows for 300mm increment penetration (e.g. BH01 at 1.0m where N=23). These exclude the seating blow values, which represent the initial 150mm depth of penetration. Where partial penetration was achieved during testing, the number of blows is shown for the actual penetration depth achieved (e.g. BH01 at 3m where N=25/75mm). In accordance with Eurocode 7, the SPT hammer has been calibrated and the energy ratio (Er) value is incorporated on the engineering logs. It is highlighted that the SPT N-Values reported on the engineering logs are uncorrected for energy ratio. The hammer calibration certificate is presented in Appendix 2 with the logs.

Descriptions of the soils encountered, in-situ tests undertaken and samples recovered are presented on the borehole records in Appendix 2. Details of groundwater strikes and hard strata boring (i.e. chiselling) are also presented on the aforementioned records.

2.4 Rotary Core Drillholes

Rotary core drilling was carried out at eight locations (denoted RC 01 to 08) using a Beretta T44 top drive rig. Symmetrex / odex drilling was utilised within the overlying superficial deposits with coring techniques used in the underlying bedrock. Drillholes were taken to depths ranging from 10.15m in RC 04 to 18.55m in RC06. SPT's were conducted in the superficial deposits and the arisings examined by the driller to assess soil composition.

The rotary drilling in bedrock produced 78mm diameter cores and they were placed in 3m capacity timber boxes and logged by an IGSL engineering geologist. This included photography of the cores with a digital camera. Where rock core was recovered, a graphic fracture log is also presented alongside the mechanical indices. This illustrates the fracture state of the rock cores and allows easy identification of highly fractured / non-intact zones and discontinuity spacings. It should be noted that no correction for dip of the joints has been made and that the spacings shown are successive joint / core intersections within the core.

Groundwater monitoring standpipes were installed in five of the eight rotary drillholes and included a 50mm diameter uPVC proprietary pipe, pea gravel response zone and bentonite grout seal. Protective upright covers were concreted in place. The core log records are presented in Appendix 3 and includes engineering geological descriptions, details of the bedding / discontinuities and mechanical indices (TCR, SCR and RQD's) for each core run. Core photographs are also presented in Appendix 3 and these illustrate the structure and fracture state of the bedrock.

2.5 Plate Load Tests

The plate load tests were conducted on the shallow or near surface materials (0.5m below existing ground level) and undertaken to evaluate the modulus of sub-grade reaction (Ks) and derive equivalent CBR values in accordance with HD26-26/10. A 450mm diameter plate was used with kentledge provided by a 6T excavator. Two load cycle tests were performed and the load / settlement plots, Ks and equivalent CBR values are presented in Appendix 4.

2.6 Soakaway Tests

Infiltration tests were performed to assess the suitability of the sub-soils for dispersion of storm water through a soakaway system. The infiltration tests were undertaken in accordance with BRE Digest 365 'Soakaway Design'. To obtain a measure of the infiltration rate of the sub-soils, water was poured into each test pit, with records taken of the fall in water level against time. The infiltration rate is the volume of water dispersed per unit of exposed area per unit of time, and is generally expressed as metres / minute or metres / second. Designs are based on the slowest infiltration rate, which is generally calculated from the final soak cycle. The soakaway test results are presented in Appendix 5.

2.7 Groundwater Monitoring

Groundwater levels in the rotary drillhole standpipes were monitored and results are enclosed in Appendix 6. Data loggers were subsequently inserted in the standpipes on 16th October 2024 to provide continuous groundwater levels. The groundwater levels and early data logger results for October 2024 are incorporated in Appendix 6.

2.8 Geophysical Survey

A geophysical survey was carried out by Minerex Geophysics Ltd. A number of techniques were employed including EM31 ground conductivity, 2D resistivity (ERT) and seismic refraction. Details of the methodologies used, test results and findings are incorporated in the Minerex report in Appendix 7.

2.9 Surveying of Exploratory Hole Locations

Following completion of the exploratory works, surveying was carried out using GPS techniques. Co-ordinates (x, y) were measured to Irish National Grid and ground levels (z) established to Malin Head. The co-ordinates and ground levels are shown on the exploratory hole logs with the locations plotted on the exploratory hole plan in Appendix 12.

3. LABORATORY TESTING

Geotechnical laboratory testing was carried out on selected trial pit and borehole samples. The testing included moisture content, Atterberg Limits (Liquid / Plastic Limits) and sieve analysis (PSD) and the results are presented in Appendix 8.

Point load strength index tests were performed on rock core specimens and the results are enclosed in Appendix 9.

Environmental WAC and chemical analysis tests (BRE SD 1 suite) were conducted on selected samples and the results are incorporated in Appendix 10.

4. GROUND CONDITIONS & GROUNDWATER

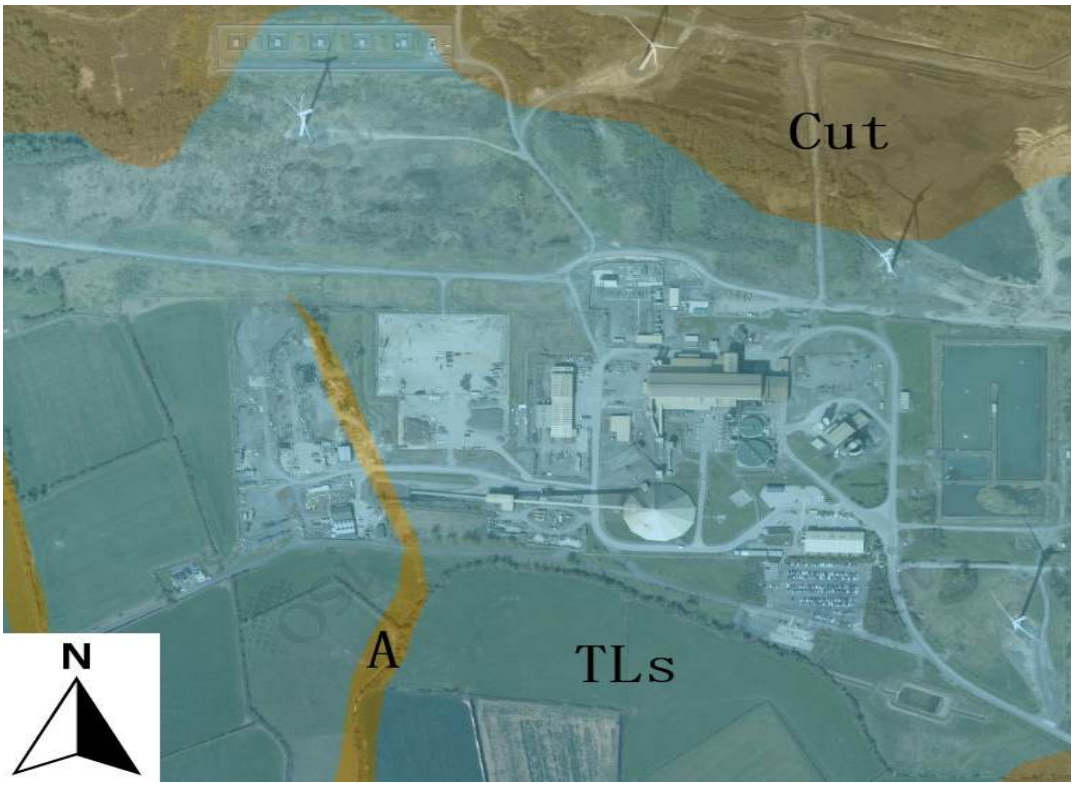
4.1 Ground Profile

The ground profile at the Lisheen site can be categorized as follows:

- Made Ground / Fill
- Glacial Till consisting of grey and brown sandy very gravelly CLAY with low to high cobble and low boulder content and clayey gravelly SAND with cobbles and boulders
- Limestone bedrock (dolomitized or argillaceous / muddy limestone)

The quaternary geological map for the area is shown in Figure 2. The indigenous deposits comprise heterogeneous glacial and fluvio-glacial soils (TLs) consisting of till derived from limestone with thin or narrow veins of Alluvium (A). It is noted that the area to be developed was formerly part of the Lisheen underground mine and the access ramp portal was identified during the ground investigations.

Figure 2 - Quaternary Geology Map for the Area



4.2 Superficial Deposits

Made Ground / Fill (Anthropogenic Deposits)

The trial pits encountered pockets or zones of MADE GROUND extending to depths of up to 1.10m (TP 6). The material is heterogeneous and dominated by re-worked sandy gravelly / cobbly clay with organics or roots. The matrix is described as firm and the material is thought to have originated from excavations associated with the mine development.

Glacial Deposits

The glacially derived soils are heterogeneous and referred to as glacial till. The material is characterized by grey brown and reddish brown sandy gravelly CLAY with low to high cobble

content and clayey / silty gravelly SAND with cobbles and boulders (proportions vary greatly). Lenses or horizons of sandy GRAVEL or gravelly SAND occur within the glacial deposits.

Figure 3 - Images showing glacial soils in Trial Pits

TP 03

TP 08

A series of index or classification tests were carried out on selected samples and results are presented in Appendix 7. Moisture contents mostly lie in the 8 to 16% envelope while the particle size distributions show the fine grained glacial soils to be well graded with typical 'straight-line' type profiles (refer to Figure 4). Fines contents (<425micron) were typically between 50 and 60%. The Atterberg Limits (Refer to Figure 5) established the fine grained soils to be mainly low plasticity (CL) CLAY plotting above the A-Line on the Casagrande Chart. It is noted that number of samples were found to be non-plastic where the fines are dominated by silt and fine sand.

Figure 4 - Particle Size Distribution Envelope

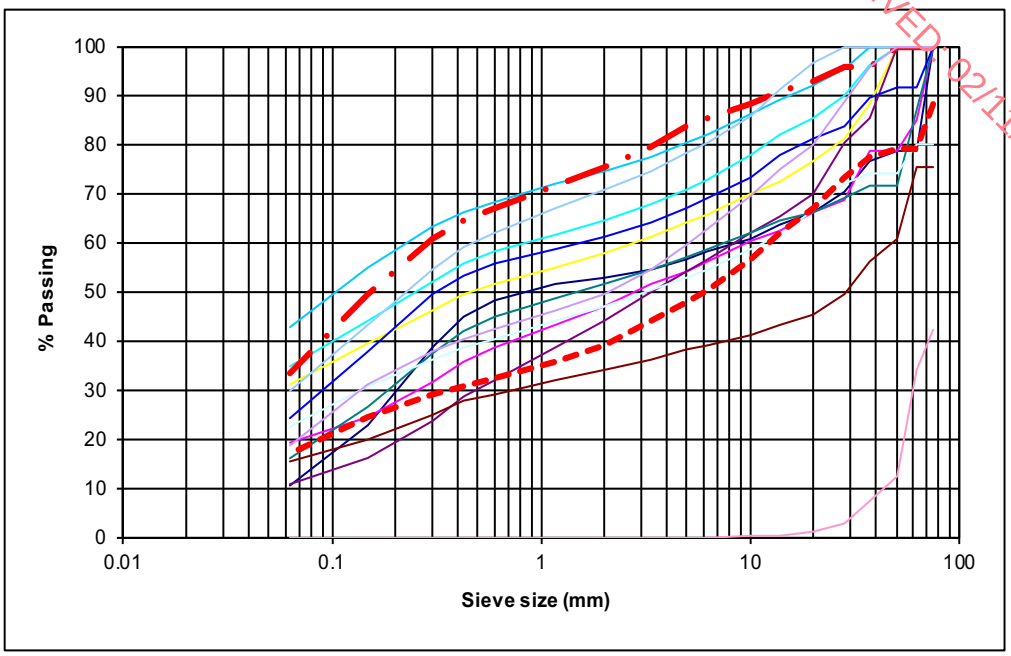
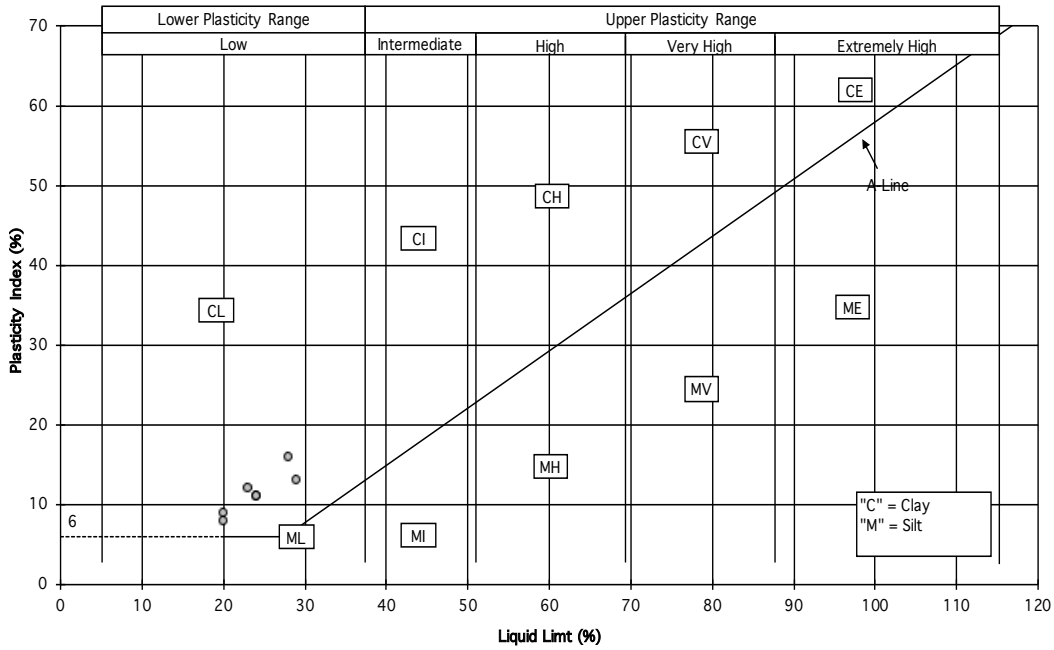


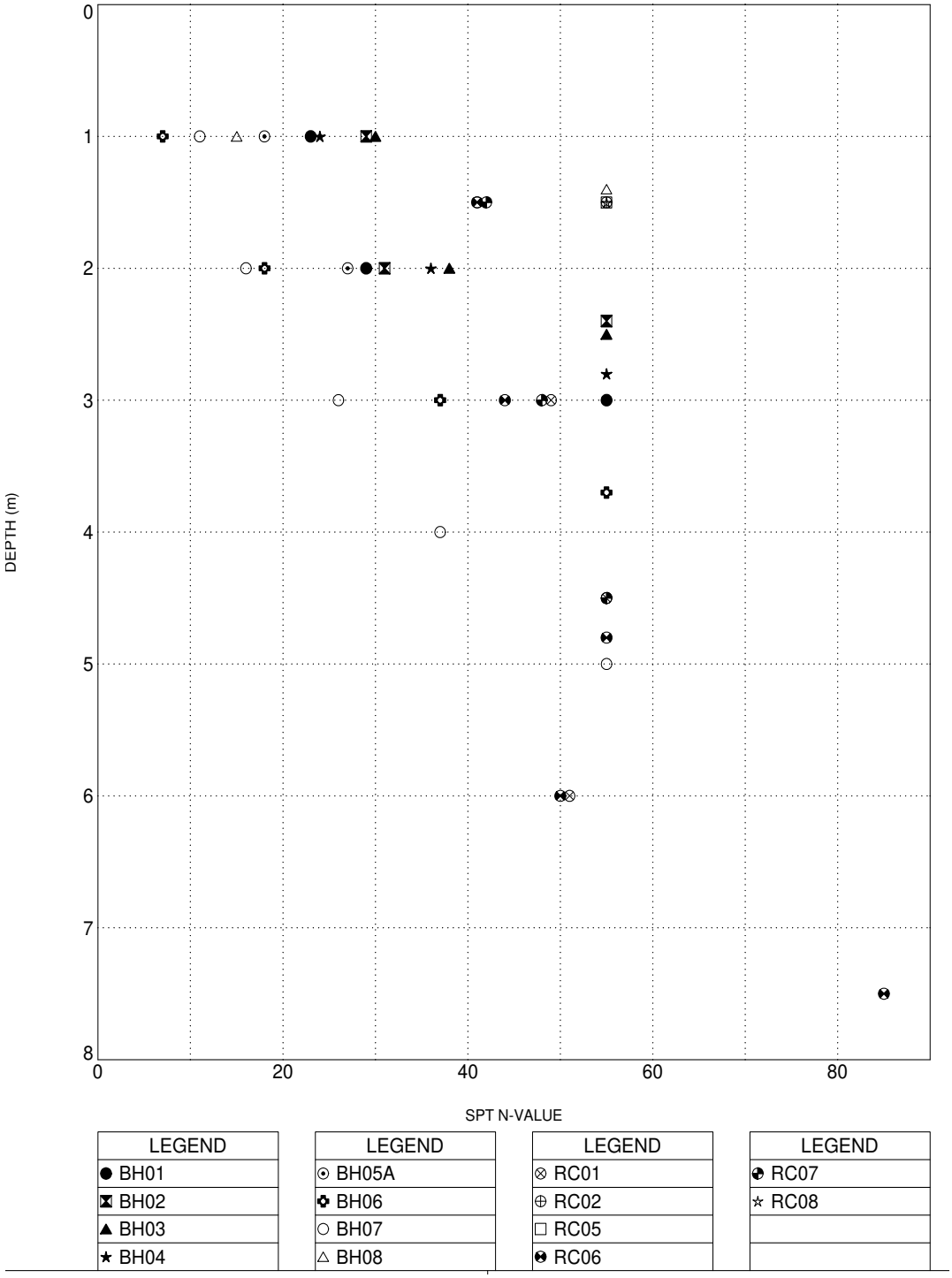
Figure 5 - Atterberg Limit Plot (Casagrande Chart)



Standard Penetration Tests (SPT's) were conducted in both the cable percussive boreholes and IGSL rotary drillholes to establish stiffness or shear strength. An SPT data plot has been prepared using both data sets and is presented in Figure 6. Using the Stroud & Butler correlation between SPT N-Value and undrained shear strength (where Cu ≈ 4 to 6N) the upper indigenous soils range from low strength (20 to 40 kPa) to medium strength (40 to 75 kPa) and high strength (75 to 150 kPa) as defined in Table 6 of EN 14688-2:2017. The SPT's show quite a data scatter with an

increase in strength apparent from approximately 3m, thereafter the majority of the N-Values fall within the 25 to 50 envelope and suggest the soils are high strength with shear strengths of the order of 120 to 150 kPa (stiff and very stiff).

Figure 6 - SPT N-Value v Depth Plot



4.3 Bedrock

Reference to the GSI map for the area (Figure 7, 1:100,000 Solid Geology series) shows that the site is underlain by Waulsortian Limestone (WA) which consists of dolomitized fine grained limestone. The Waulsortian Limestone formation is known to be particularly susceptible to solution (karst) weathering with open voids or clay infill common within the bedrock sequence. The Crosspatrick Formation (CS) lies to the north of the site and is characterised by cherty crinoidal limestone.

Figure 7 - Bedrock Geology Map for the Area

The rotary holes extended to depths of between 10.15 and 18.55m and despite the fracture state, core recovery was generally high with 100% recovery in the majority of the runs. Rockhead was proven at depths varying from approximately 1.5 to 8m. Summary details of the rotary drillhole findings are presented in Table 1.

Table 1 - Summary of Rotary Drillholes

Rotary Hole No.	Final Depth (m)	Rockhead Depth (m bgl)	Rock Core Characteristics
RC 01	12.50	6.80	Medium strong to strong light grey blue slightly dolomitized LIMESTONE, slight solution weathering present.
RC 02	10.20	2.80	Strong to very strong light blue/grey slightly dolomitized LIMESTONE, slight solution weathering.
RC 03	10.50	2.45	Strong to very strong (where intact) light blue/grey LIMESTONE locally moderately/highly weathered attributable to solution weathering from c4.5 to 9m.
RC 04	10.15	2.40	Medium string to strong light blue/grey slightly dolomitized LIMESTONE, slight solution weathering.

RC 05	12.50	2.60	Very weak to strong slightly dolomitized LIMSTONE, some solution weathering and locally heavily fractured / non-intact.
RC 06	18.55	8.00	Moderately weak to very strong dark grey / black argillaceous / muddy LIMESTONE fresh to slightly weathered.
RC 07	15.10	5.90	Medium strong to very strong dark grey / black argillaceous / muddy LIMESTONE, fresh to slightly weathered.
RC 08	11.70	1.50	Moderately weak to very strong dark grey / black argillaceous / muddy LIMESTONE, fresh to slightly weathered.

The recovered cores consist of light grey/blue slightly dolomitized LIMESTONE with solution weathering and dark grey / black argillaceous / muddy LIMESTONE (images illustrated in Figure 8). Weathering grades vary within the sequence and the light grey / blue limestone (which belongs to the Waulsortian Formation) exhibits solution or karst weathering. The graphic fracture log illustrates non-intact or heavily fractured zones often associated with very poor core recovery (e.g. RC 5 from c7.7 to 12.5m). Iron staining and discolouration are associated with solution weathering where water movement has caused the original limestone fabric to be altered.

The discontinuity spacings range from closely spaced to medium spaced while the surfaces are typically smooth to locally rough and planar to undulose with slight iron oxide staining and clay infilling or smearing. Apertures are tight to partly open with local clay smearing and dips vary from 45 to 50° and irregular.

Figure 8 - Images Showing Core Recovery in Rotary Holes

RC 01 (7.5 to 10.5m)

RC 05 (2.6 to 5.215m)

RC 06 (4.0 to 9.83m)

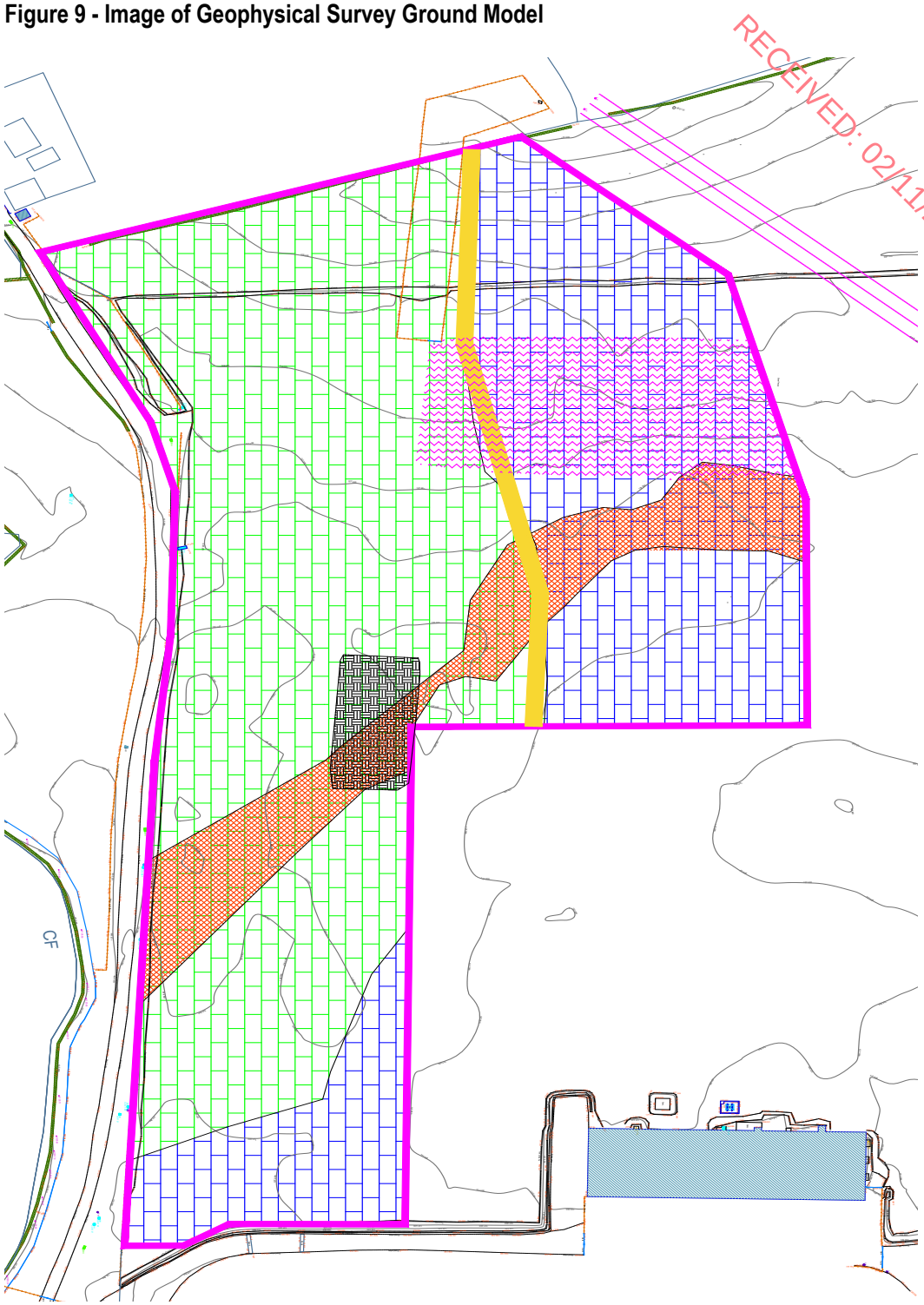
RC08 (1.5 to 4.1m)

The point load strength index (PLSI) tests produced $I_s(50)$ values ranging from 0.40 to 6.4 MPa with a mean value of 3.3 MPa. Using a correlation factor (K) of 20 the PLSI strengths show the intact cores have average compressive strengths of the order of 60 to 70MPa. The overall PLSI data set suggests the intact core specimens vary from weak (5 to 12.5 MPa) to very strong (100 to 200 MPa).

The geophysical survey utilized a combination of techniques (EM31, 2D resistivity & seismic refraction) to assess the composition of the superficial deposits, depth to rockhead and evaluate the presence of open voids or features within the upper bedrock. The rotary drillhole records were integrated with the geophysical information to develop an interpreted ground model. Reference should be made to the geophysical survey report (Appendix 7) for full details on the findings. The geophysics modelled three layers with Layer 4 noted to represent the underground mine entrance or access ramp which was also proven in RC 7 (refer to core box 1 which shows concrete recovered from 5 to 5.9m). Layer 2 is described as variably weathered or karstified limestone with Layer 3 denoted as representing high strength (strong) competent limestone bedrock with seismic velocities >4,000 m/s.

The survey confirms the presence of karstified limestone within the dolomitized Waulsortian Formation which are characterized by zones of lower resistivity and seismic velocities, mainly occurring at the northern end of survey Line 2. A geological fault has been interpreted between the dolomitized limestone and the argillaceous / muddy limestone where the muddy / argillaceous limestone appears to be have been thrusted upwards or uplifted by the fault. Images showing interpreted x-sections are included in the geophysical report with an interpreted ground model presented in Map 3 and illustrated below in Figure 9.

Figure 9 - Image of Geophysical Survey Ground Model



4.4 Groundwater & Infiltration

Groundwater strikes or inflows were encountered in two of the eleven trial pits (i.e. TP 2 & 9). In the cable percussive boreholes, groundwater was only met in BH 7 (3.60m) with the remainder noted as dry to termination depth. During rotary drilling, groundwater was intercepted in RC 04, 05, 06, 07 and 08 and depths ranging from 3.0 to 7.80m. Standpipes were installed in the five of the eight rotary drillholes and groundwater levels during October 2024 are shown in Table 2. The monitoring shows groundwater varying from 1.71 to 6.20m in late October 2024.

Soakaway tests were conducted to evaluate the infiltration characteristics for potential dispersion of storm water through a soakaway system. The tests demonstrated significant variability with no movement or dissipation recorded in some instances (SA02 & SA04) while the other tests determined infiltration rates (f) of 1.4 to 6.4x 10^{-6} m/s.

Table 2 - Summary of Groundwater Levels in Rotary Hole Standpipes

Rotary Hole No.	Ground Elevation (m OD)	Standpipe Response Zone (m)	Groundwater Levels in Standpipes (16.10.2024)	Groundwater Levels in Standpipes (23.10.2024
RC 02	129.72	1.00 to 10.20	6.22	6.20
RC 03	127.39	2.00 to 10.50	3.17	3.10
RC 05	127.71	2.60 to 12.50	3.76	3.70
RC 06	127.46	8.00 to 18.55	3.38	3.28
RC 08	126.53	1.50 to 11.70	1.37	1.71

5. GROUND ASSESSMENT & ENGINEERING RECOMMENDATIONS

5.1 General

On foot of the findings from the ground investigations, the following issues are discussed and recommendations provided:

- Foundation solutions
- Pavement construction
- Groundwater
- Slopes / batters
- Buried concrete

5.2 Foundation Solutions

The ground investigation identified a mantle of MADE GROUND across the site which is underlain by firm / stiff glacial deposits with bedrock established at depths largely ranging from approximately 1.5 to 2.8m but deepens at the north-eastern corner of the site (RC 01) to 6.8m while RC 07 identified concrete backfill at the underground mine entrance (decline / ramp). A large tank farm is proposed which will consist of four Primary Digester tanks and three Secondary Digester tanks along with storage clamps, gas filing unit, compost storage building, attenuation pond and a host of ancillary buildings or structures. A discussion on foundation options and bearing capacity for the main structures or buildings is presented below.

Primary & Secondary Digester Tanks

Given the geophysical and intrusive borehole investigation findings, expected column loads and stress distribution for the digester tanks (9m height) and most importantly the heterogeneity of the glacial soils (including re-worked till), the tank foundations could be placed on the upper bedrock using either modified / stabilized fill or imported granular fill (T0 / T1) to achieve a high strength fill.

Piles could also be considered to transfer the loadings into the upper bedrock. If soil modification and stabilization is selected, this would entail excavating the upper soils to rockhead and treating the excavated material with lime or cement binders (or a combination of both) followed by controlled compaction in layers to produce a high strength engineering fill to support the tanks and most significantly limit settlement to small magnitudes (<5mm expected if a CBR of 30% is achieved and air voids <5%). Screening of the larger constituents (75 to 100mm) would be necessary before the excavated material is placed and treated with lime or cement binders. Based on the rotary cores relevant to the tank area, the upper competent limestone bedrock should provide a safe or allowable bearing capacity of 1250 to 1500 kPa. Where pockets or zones of moderately or highly weathered limestone are uncovered these should be removed and replaced with low grade concrete or granular fill with geogrid (if they are associated with solution weathering).

If piles are selected, then odex drilled piling techniques would be advised to achieve penetration into the upper bedrock or rock mass. It is thought that either 450 or 600mm diameter CFA piles would be appropriate and the expectation is that a 450mm diameter pile with a rock socket of at least 2m in competent limestone (medium strong) should provide a safe working load (SWL) of the order of 1000kN. Higher SWL's would be possible with a 600mm diameter pile of a similar length offering a SWL of c1500 kN. However, the rotary holes subsequently showed bedrock or rockhead at varying depths and this would have to be considered in pile design. If piles prove to be cost effective, then trial piling is strongly advised to assess the constructability of the pile along with at least one static load test to validate safe working load (SWL) and settlement characteristics. This should be carried out before production piling to demonstrate the feasibility of the piling method.

A granular fill platform would be required to support piling plant. For 75 to 80T piling rigs a granular fill thickness of 650 to 700mm is envisaged and should be designed in accordance with BRE 447. T0 Struc complying with Annex E of SR21:2014+A1:2016 is recommended as unbound granular fill

for the piling platform. This is to ensure that the granular fill does not present a risk for pyrite induced swelling or expansion. Following compaction of the T0 material it should achieve a minimum CBR value of 30% (re-load cycle) when tested by plate load method to BS 1377. The piling platform should be maintained to ensure a safe working surface and any softened or degraded material as a consequence of the piling operations should be removed and replenished (particularly important if piling operations are carried out during periods of heavy rainfall or winter months).

Covered Storage Building & Storage Clamps

The findings from TP's 3, 7 and 8 suggest that strip footing or pad foundations for these structures could be constructed on the indigenous glacial soils. The firm / stiff glacial till should provide a safe or allowable bearing capacity of 150 to 175 kPa and limit settlement to <15 to 20mm. Given the historical mine development works at the site, it is vital that any re-worked soils (MADE GROUND) are removed and foundations are not placed on this material. Where re-worked soils are present, they should be removed and replaced with low grade or 'lean mix' concrete.

Compost Storage Building

TP's 9 and 10 and BH 08/RC08 are pertinent to this area of the site. TP 10 encountered MADE GROUND to 0.7m with refusal on suspected bedrock. RC 08 subsequently proved rockhead at a depth of 1.5m with moderately weak to very strong argillaceous LIMESTONE confirmed. With bedrock appearing to be quite shallow at the eastern corner of the site, foundations for the Compost Storage Building could be placed on the upper bedrock.

Biogas Upgrade Building & Gas Filling Unit

TP 6 and BH03/RC03 cover this portion of the site. Rockhead was established at c2.45m in RC03 and TP 6 terminated at 2.50m in boulder obstructions or presumed bedrock. The SPT N-Values in the cable percussive borehole (BH03) demonstrate high strength glacial soils (mixture of fine and coarse glacial till) occur. It would be reasonable to assume that foundations for these structures could be placed on the stiff glacial soils at shallow depths with the indigenous till providing a safe or allowable bearing capacity of 150 to 175 kPa. Again, the potential exists for possible re-worked soils to be present and foundations (strip footings, pads or bases) should not be placed on MADE GROUND deposits.

Dirty Water & Clean Water Storage

This will involve the construction of attenuation ponds or storage facilities for the bioenergy plant. Excavation depths are unknown but the expectation is that lined ponds would be formed to store both dirty and clean water. Excavation depths of 2.5 to 3m are envisaged and based on the findings from TP 5, 8, 11, these would be within the glacial deposits and perhaps transitioning into the upper bedrock if excavations are deeper then c2.5m (trial pits refused at 1.5 to 2.7m in aforementioned trial pits).

5.3 Pavement Construction

CBR values were established by plate load test method and the results are summmarised in Table 3. Inspection of the data shows CBR values at Cycle 1 (initial load) range from 2.2 to 13.8 while at Cycle 2 (re-load) the values increased to between 4.8 and 89.9%.

Table 3 - Summary Details of Plate Load Tests

Plate Test Location	Test Depth (m bgl)	CBR Cycle 1 (%)	CBR Cycle 2 (%)
PT 01	0.5	2.2	7.1
PT 02	0.5	10.2	46.1
PT 03	0.5	2.7	4.8
PT 04	0.5	4.5	48.3

PT 05	0.5	13.8	89.9

In accordance with the Design Guidance for Road Pavement (HD 25), the lower-end equilibrium CBR values should be used to determine appropriate capping layer thickness for flexible pavements. Given the plate test derived CBR values, a subgrade CBR design value of 2.5 to 3% would not be unreasonable for determination of capping and sub-base pavement thickness for asphalt roads and car parking. It is highlighted that the CBR value on the indigenous soil formation would depend greatly on the effectiveness of drainage and water management. If drainage is inadequate then the sub-grade stiffness would diminish greatly and a greater thickness of capping (or the use of a starter layer) would have to be implemented.

Taking a design CBR value of c3%, then a minimum 6F capping thickness of 450mm with a sub-base thickness of 200mm would be advised to support flexible road or car park pavements. However, given the sensitivity of upper glacial soils to degradation and potential for rutting ('traffickability') with rubber wheeled dump trucks, consideration should be given to using a starter layer (i.e. TII SRW Series 6B/6C granular fill). For heavily trafficked roads (especially access roads) to build the tank farm and laydown areas, approximately 500mm of Class 6A / 6B material could be used in conjunction with 300mm of 6F capping. This may appear somewhat conservative but is recommended from our experience of earthworks in silt dominant glacial till.

Where concrete pavements are required, the quality and compaction of granular fills will be even more critical to ensure that such rigid pavements do not crack or weaken under repeated trafficking or heavy vehicle movement. The use of geogrid reinforcement should be considered to strengthen or stiffen the foundation layer (e.g. Thrace TG4040S or equivalent) and consultation should be sought from geosynthetic specialists on the position and number of geogrid layers within the pavement foundation build-up.

5.4 Slopes & Batters

A slope angle of 1V to 2H (26º) is recommended for long term cut slopes or batters formed within the upper soils. For short term or temporary excavations, slopes or batters of 1V to 1.5H (33°) should be feasible. Consideration should be given to the potential for perched water to be present within the MADE GROUND and this would have significant implications for stability.

For confined excavation works (e.g. service trenches etc), the upper soils will be susceptible to instability and sidewall collapse and spalling, therefore ground support measures (e.g. trench box) are advised to ensure safe excavation works. Site operatives or personnel should not enter unsupported excavations and should be informed of the potential risks. Where site operatives or engineering staff work in close proximity to temporary slopes or batters, these should be inspected daily by a suitably experienced geotechnical engineer or engineering geologist.

In relation to retaining walls and ground retention, an angle of shearing resistence or friction (∅) of 34° is recommended for determining (calculating) sliding of retaining walls or pads constructed on the indigenous fine grained (cohesive) glacial till. Large shear box tests on this type of material generally produce ∅ values of 34 to 36° but the effects of water (softening) should be considered in design against sliding. Where reinforced concrete retaining walls are required these should be founded on firm / stiff soils (CBR value of at least 3% or Dynamic Probe N_{100} values consistently >3).

5.5 Groundwater

As noted in Section 4.4, groundwater strikes or seepages were only encountered in two of the eleven trial pits. Groundwater was intercepted in one of the cable percussive boreholes during boring (BH 7) while groundwater was met in five of the eight rotary drillholes. The standpipes installed in the rotary drillhole standpipes showed water levels of 1.71 to 6.20m in late October 2024. Given the groundwater conditions observed in the trial pits and measured standing water levels

groundwater ingress is unlikely to be an issue for shallow excavations (e.g. utility trenches etc). If excavate and replace is selected for the Digester Tanks and other heavy structures then localized sump pumping is anticipated to control groundwater and surface water ingress.

5.6 Buried Concrete

The chemical analysis tests show pH values ranging from 8.6 to 8.7. The sulphate aqueous extract (SO_4) tests determined values of <0.010 g/l and categorises as BRE Design Sulphate Class DS-1. Table C2 ACEC for brownfield sites in BRE SD 1 (2005) can be used in the selection and design of concrete. If mobile groundwater conditions prevail at the site and given the pH values obtained from the testing, then ACEC class AC-1s would be expected to be appropriate for buried concrete and piles. In line with I.S. EN 206-1:2013, concrete could be manufactured to Class XA1 (Class XA1 being ≥ 2000 and ≤ 3000 SO_4^{2-} mg/kg).

5.7 Further Investigations

The proposed bioenegy project will entail the construction of a number of large tanks in tandem with storage buildings, gas filing units, attenuation ponds and ancillary structures. The geophysical and geotechnical investigations have identified a degree of variability in the thickness of the superficial deposits and rock mass quality, most notably the effects of karst weathering on the dolomitised limestone. Foundation options or solutions for the primary and secondary digester tanks have been discussed in Section 5.2.

In light of the scale and size of these tanks, additional rotary holes across the tank farm footprint would be prudent to ascertain potential variations or anomalies in depth to rockhead and rock mass characteristics. In addition to rotary drilholes, further trial pits or trenches (linear) could be considered to validate the presence or absence of re-worked soils. Once the final layout has been completed, positioning of additional exploratory pounts could be undertaken and a scope of works developed.

If soil modification / stabilization is to be considered feasible and cost effective, then a programme of earthworks laboratory testing and trial mix tests are recommended. The samples could be generated by further trial pits at specific areas and testing should include MCV, CBR and Proctor compaction at both natural moisture and following mixing and curing with lime, cement or a combination of both.

References

1. BS 5930 (2015+A1:2020) Code of Practice for Site Investigation, British Standards Institution (BSI).
2. BS 1377 (1990) Methods of Testing of Soils for Civil Engineering Purposes, BSI.
3. BRE Special Digest SD 1, Concrete in Aggressive Ground, 2005
4. Eurocode 7, Part 2: Ground Investigation & Testing (EN 1997-2:2007)
5. Geological Survey of Ireland, !:100,000 Series
6. IS EN 13242:2002+A1:2007 – Aggregates for unbound and hydraulically bound materials for use in civil engineering work and road construction
7. Site Investigation Practice: Assessing BS 5930 (1986), Geological Society Special Publication, No. 2.
8. Standard Recommendation SR21:2014:+A1:2016, NSAI
9. Stroud, M.A & Butler, F.G (1975) 'The SPT and the Engineering properties of Glacial Materials". Proceedings of the Symposium on Engineering Behaviour of Glacial Materials, Birmingham
10. Tomlinson, M.J. Foundation Design & Construction, 7th Ed

Appendix 1

Trial Pit Records & Photographs

TRIAL PIT RECORD

REPORT NUMBER 25517

CONTRACT Lisheen Mine

TRIAL PIT NO. TP01
SHEET Sheet 1 of 1

LOGGED BY I.Reder

CO-ORDINATES 621,012.20 E 666,724.97 N

DATE STARTED 17/07/2024
DATE COMPLETED 17/07/2024

CLIENT

GROUND LEVEL (m) 130.56

ENGINEER DOBA

EXCAVATION METHOD 5T tracked machine

Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples: Sample Ref	Samples: Type	Samples: Depth	Vane Test (KPa)	Hand Penetrometer (KPa)
TOPSOIL		0.30	130.26						
Firm to stiff, redish brown, slightly sandy gravelly CLAY with medium cobble content. Sand is fine to coarse, gravel is fine to coarse subangular to subrounded, cobbles are subanglar to subrounded of various lithology.		0.80	129.76		AA203976	B	0.60		
Dense, brown, very clayey very gravelly fine to coarse SAND with high subangular to subrounded cobbles content (possible very sandy very gravelly clay)		1.80	128.76		AA203977	B	1.50		
Dense, light brown, slightly clayey/silty very gravelly fine to coarse SAND with high subangular to subrounded cobbles and low boulders content content		2.50	128.06		AA203978	B	2.30		
End of Trial Pit at 2.50m									

0.0
1.0
2.0
3.0
4.0

Groundwater Conditions
TP dry

Stability
TP stable

General Remarks
CAT scanned for services; SA01 and PBT01 done in location - for all details see SA01 and PBT01 logs

TRIAL PIT RECORD

REPORT NUMBER 25517

CONTRACT	Lisheen Mine	**TRIAL PIT NO.**	**TP02**
		SHEET	Sheet 1 of 1
LOGGED BY	I.Reder	**CO-ORDINATES**	621,256.43 E 666,555.23 N
		DATE STARTED	17/07/2024
		DATE COMPLETED	17/07/2024
CLIENT		**GROUND LEVEL (m)**	126.74
ENGINEER	DOBA	**EXCAVATION METHOD**	5T tracked machine

Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples: Sample Ref	Samples: Type	Samples: Depth	Vane Test (KPa)	Hand Penetrometer (KPa)
MADE GROUND (comprised of brown silty sandy gravel, cobbles, organic matter, roots)		0.50	126.24		AA203982	B	0.40		
Dense, yellowish light brown, very gravelly very silty/clayey fine to coarse SAND with high subangular to subrounded cobbles and boulders content (possible very sandy very gravelly silty clay)				1 (Slow)	AA203983	B	1.40		
TP terminated due to boulder obstructions. End of Trial Pit at 1.80m		1.80	124.94						

Groundwater Conditions
Slow water flow at 1.7m

Stability
TP stable

General Remarks
CAT scanned for services; SA02 and PBT02 done in location - for all details see SA02 and PBT02 logs

TRIAL PIT RECORD

REPORT NUMBER 25517

CONTRACT Lisheen Mine

TRIAL PIT NO. TP03
SHEET Sheet 1 of 1

LOGGED BY I.Reder

CO-ORDINATES 621,081.88 E 666,513.38 N

DATE STARTED 17/07/2024
DATE COMPLETED 17/07/2024

CLIENT

GROUND LEVEL (m) 129.70

ENGINEER DOBA

EXCAVATION METHOD 5T tracked machine

Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples: Sample Ref	Samples: Type	Samples: Depth	Vane Test (KPa)	Hand Penetrometer (KPa)
0.0 TOPSOIL		0.30	129.40						
Firm to stiff, redish brown, sandy gravelly CLAY with medium cobble content. Sand is fine to coarse, gravel is fine to coarse subangular to subrounded, cobbles are subanglar to subrounded of various lithology (Possible MADE GROUND)					AA203979	B	0.70		
1.0 Stiff to very stiff, light brown, sandy gravelly CLAY with high cobbles, low boulders and lenses of grey sandy gravel between 1.1m - 1.5m content. Sand is fine to coarse, gravel is fine to coarse subangular to subrounded, cobbles and boulders are subangular to subrounded of various lithology.		1.10	128.60						
2.0					AA203980	B	1.60		
					AA203981	B	2.60		
End of Trial Pit at 2.80m		2.80	126.90						
3.0									
4.0									

Groundwater Conditions
TP dry

Stability
TP stable

General Remarks
CAT scanned for services

TRIAL PIT RECORD

REPORT NUMBER 25517

CONTRACT Lisheen Mine

TRIAL PIT NO. TP04
SHEET Sheet 1 of 1

LOGGED BY I.Reder

CO-ORDINATES 621,213.44 E 666,419.01 N

DATE STARTED 17/07/2024
DATE COMPLETED 17/07/2024

GROUND LEVEL (m) 126.84

CLIENT

ENGINEER DOBA

EXCAVATION METHOD 5T tracked machine

Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples: Sample Ref	Samples: Type	Samples: Depth	Vane Test (KPa)	Hand Penetrometer (KPa)
0.0 TOPSOIL		0.30	126.54						
Stiff, brown, sandy gravelly CLAY with high cobbles and low boulders content. Sand is fine to coarse, gravel is fine to coarse subangular to subrounded, cobbles and boulders are subangular to subrounded of various lithology.		0.90	125.94		AA203986	B	0.70		
1.0 Firm to stiff, brown, sandy gravelly slightly silty CLAY with medium cobbles content. Sand is fine to coarse, gravel is fine to coarse subangular to subrounded, cobbles are subangular to subrounded of various lithology.		1.80	125.04		AA203987	B	1.50		
2.0 Stiff to very stiff, yellowish light brown, sandy very gravelly slightly silty CLAY with high cobbles and low boulders content. Sand is fine to coarse, gravel is fine to coarse subangular to subrounded, cobbles and boulders are subangular to subrounded of various lithology.		2.70	124.14		AA203988	B	2.50		
End of Trial Pit at 2.70m									
3.0									
4.0									

Groundwater Conditions
TP dry

Stability
TP stable

General Remarks
CAT scanned for services; SA04 and PBT04 done in location - for all details see SA04 and PBT04 logs

TRIAL PIT RECORD

REPORT NUMBER 25517

CONTRACT Lisheen Mine

TRIAL PIT NO. TP05
SHEET Sheet 1 of 1

LOGGED BY I.Reder

CO-ORDINATES 621,207.88 E 666,471.36 N

DATE STARTED 17/07/2024
DATE COMPLETED 17/07/2024

GROUND LEVEL (m) 127.04

CLIENT

ENGINEER DOBA

EXCAVATION METHOD 5T tracked machine

Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples: Sample Ref	Samples: Type	Samples: Depth	Vane Test (KPa)	Hand Penetrometer (KPa)
MADE GROUND (comprised of topsoil, brown sandy gravelly clay, cobbles, roots)		0.30	126.74						
Firm to stiff, brown, very sandy very gravelly slightly silty CLAY with high cobbles content. Sand is fine to coarse, gravel is fine to coarse subangular to subrounded, cobbles are subangular to subrounded of various lithologies.					AA203984	B	1.00		
Stiff to very stiff, yellowish light brown becoming brown, sandy very gravelly slightly silty CLAY with high cobbles and medium boulders content. Sand is fine to coarse, gravel is fine to coarse subangular to subrounded, cobbles and boulders are subangular to subrounded of various lithology.		1.50	125.54		AA203985	B	2.00		
End of Trial Pit at 2.70m		2.70	124.34						

0.0
1.0
2.0
3.0
4.0

Groundwater Conditions
TP dry

Stability
TP stable

General Remarks
CAT scanned for services

IGSL TP LOG 25517.GPJ IGSL.GDT 16/10/24

TRIAL PIT RECORD

REPORT NUMBER 25517

CONTRACT Lisheen Mine

TRIAL PIT NO. TP06
SHEET Sheet 1 of 1

LOGGED BY I.Reder

CO-ORDINATES 621,152.79 E 666,625.18 N

DATE STARTED 27/08/2024
DATE COMPLETED 27/08/2024

GROUND LEVEL (m) 127.33

CLIENT

ENGINEER DOBA

EXCAVATION METHOD 6T tracked machine

Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples: Sample Ref	Samples: Type	Samples: Depth	Vane Test (KPa)	Hand Penetrometer (KPa)
0.0 MADE GROUND (comprised of brown sandy gravelly clay, sandy gravel, organic matter, roots, cobbles)									
MADE GROUND (comprised of yellowish brown/grey sandy gravelly clay, sandy gravel, cobbles, boulders)		0.25	127.08		AA208996	B	0.50		
1.0 Dense, light greyish brown, silty/clayey very sandy fine to coarse subangular to sibrounded GRAVEL with high subangular to subrounded cobbles and boulders content (possible original ground)		1.10	126.23		AA208997	B	1.50		
2.0 TP terminated due to possible big boulders or rock End of Trial Pit at 2.50m		2.50	124.83		AA208998	B	2.50		
3.0									
4.0									

Groundwater Conditions
TP dry

Stability
TP stable

General Remarks
CAT scanned for services

TRIAL PIT RECORD

REPORT NUMBER 25517

CONTRACT Lisheen Mine

TRIAL PIT NO. TP07
SHEET Sheet 1 of 1

LOGGED BY I.Reder

CO-ORDINATES 621,103.10 E 666,502.98 N

DATE STARTED 27/08/2024
DATE COMPLETED 27/08/2024

GROUND LEVEL (m) 128.59

CLIENT

ENGINEER DOBA

EXCAVATION METHOD 6T tracked machine

Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples: Sample Ref	Samples: Type	Samples: Depth	Vane Test (KPa)	Hand Penetrometer (KPa)
0.0 TOPSOIL		0.30	128.29						
Firm to stiff, brown sandy gravelly slightly silty CLAY with medium subangular to subrounded cobbles content (Possible MADE GROUND).		0.80	127.79		AA208993	B	0.60		
1.0 Dense, brown, very silty/clayey very gravelly fine to coarse SAND with high subangular cobbles content (possible very sandy gravel)					AA208994	B	1.40		
Stiff, light brown, very sandy very gravelly silty CLAY with high cobbles and boulders content. Sand is fine to coarse, gravel is fine to coarse subangular to subrounded, cobbles and boulders are subangular to subrounded.		1.70	126.89						
2.0					AA208995	B	2.40		
TP terminated due to boulder obstructions. End of Trial Pit at 2.70m		2.70	125.89						
3.0									
4.0									

Groundwater Conditions
TP dry

Stability
TP stable

General Remarks
CAT scanned for services

TRIAL PIT RECORD

REPORT NUMBER 25517

CONTRACT	Lisheen Mine	**TRIAL PIT NO.**	**TP08**
		SHEET	Sheet 1 of 1
LOGGED BY	I.Reder	**CO-ORDINATES**	621,192.70 E 666,492.95 N
		DATE STARTED	27/08/2024
		DATE COMPLETED	27/08/2024
CLIENT		**GROUND LEVEL (m)**	126.62
ENGINEER	DOBA	**EXCAVATION METHOD**	6T tracked machine

Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples: Sample Ref	Samples: Type	Samples: Depth	Vane Test (KPa)	Hand Penetrometer (KPa)
0.0 MADE GROUND (comprised of brown sandy gravelly clay, cobbles, organic pieces, roots)									
		0.30	126.32						
Stiff to very stiff, brown, sandy very gravelly CLAY with high subangular cobbles and low boulders content (Possible MADE GROUND)					AA208991	B	1.00		
1.0									
Very stiff, light yellowish brown, sandy very gravelly CLAY with high cobbles and boulders content. Sand is fine to coarse, gravel is fine to coarse subangular to subrounded, cobbles and boulders are subangulr of various lithology.		1.70	124.92						
2.0					AA208992	B	2.00		
TP terminated due to boulder obstructions. End of Trial Pit at 2.50m		2.50	124.12						
3.0									
4.0									

Groundwater Conditions
TP dry

Stability
TP stable

General Remarks
CAT scanned for services

TRIAL PIT RECORD

REPORT NUMBER 25517

CONTRACT Lisheen Mine

TRIAL PIT NO. TP09
SHEET Sheet 1 of 1

LOGGED BY I.Reder

CO-ORDINATES 621,282.55 E 666,486.20 N

DATE STARTED 27/08/2024
DATE COMPLETED 27/08/2024

CLIENT

GROUND LEVEL (m) 126.37

ENGINEER DOBA

EXCAVATION METHOD 6T tracked machine

Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples: Sample Ref	Samples: Type	Samples: Depth	Vane Test (KPa)	Hand Penetrometer (KPa)
MADE GROUND (comprised of light brown/brown sandy gravelly clay, cobbles, organic pieces, roots)		0.10	126.27						
Firm to stiff, light brown/grey mottled, very sandy very gravelly silty CLAY with high cobbles and boulders content. Sand is fine to coarse, gravel is fine to coarse subangular to subrounded, cobbles and boulders are subangular of various lithology.					AA208986	B	0.60		
					AA208987	B	1.60		
Dense, light grey, very silty, very sandy fine to coarse subangular to subrounded GRAVEL with high subangular to angular cobbles and boulders content		2.20	124.17						
TP terminated due to boulder obstructions. End of Trial Pit at 2.60m		2.60	123.77	1 (Slow)	AA208988	B	2.50		

Groundwater Conditions
Slow water flow at 2.5m

Stability
TP stable

General Remarks
CAT scanned for services

TRIAL PIT RECORD

REPORT NUMBER 25517

CONTRACT Lisheen Mine

TRIAL PIT NO. TP10
SHEET Sheet 1 of 1

LOGGED BY I.Reder

CO-ORDINATES 621,391.04 E 666,485.94 N

DATE STARTED 27/08/2024
DATE COMPLETED 27/08/2024

GROUND LEVEL (m) 126.76

CLIENT

ENGINEER DOBA

EXCAVATION METHOD 6T tracked machine

Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples: Sample Ref	Samples: Type	Samples: Depth	Vane Test (KPa)	Hand Penetrometer (KPa)
0.0 MADE GROUND (comprised of light brown sandy gravelly silty clay, angular cobbles and boulders, roots, organic pieces)					AA208985	B	0.50		
TP terminated due to boulder obstructions. End of Trial Pit at 0.70m		0.70	126.06						

1.0
2.0
3.0
4.0

Groundwater Conditions
TP dry

Stability
TP stable

General Remarks
CAT scanned for services

TRIAL PIT RECORD

REPORT NUMBER 25517

CONTRACT	Lisheen Mine	**TRIAL PIT NO.**	**TP11**
		SHEET	Sheet 1 of 1
LOGGED BY	I.Reder	**CO-ORDINATES**	621,224.14 E 666,500.70 N
		DATE STARTED	27/08/2024
		DATE COMPLETED	27/08/2024
CLIENT		**GROUND LEVEL (m)**	126.33
ENGINEER	DOBA	**EXCAVATION METHOD**	6T tracked machine

Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples: Sample Ref	Samples: Type	Samples: Depth	Vane Test (KPa)	Hand Penetrometer (KPa)
MADE GROUND (comprised of light brown/grey very sandy very gravelly clay, cobbles, boulders, roots)					AA208989	B	0.50		
Firm to stiff, light greyish/yellowish brown, very sandy very gravelly silty CLAY with high cobbles and boulders content. Sand is fine to coarse, gravel is fine to coarse subangular to subrounded, cobbles and boulders are subangular to subrounded of various lithology.		0.80	125.53		AA208990	B	1.10		
Dense, brownish grey, very silty/clayey very sandy fine to coarse subangular to subrounded GRAVEL with high subangular cobbles and boulders content		1.30	125.03						
TP terminated due to boulder obstructions. End of Trial Pit at 1.50m		1.50	124.83						

Groundwater Conditions
TP dry

Stability
TP stable

General Remarks
CAT scanned for services

Project Number: 25517
Site: Lisheen Mine

TRIAL PIT PHOTOGRAPHS

TP 01

TP 02

TP 03

TP 04

TP 05

TP 06

TP07

TP 08

TP 09

TP 10

TP 11

Appendix 2

Cable Percussive Borehole Records

GEOTECHNICAL BORING RECORD

REPORT NUMBER 25517

CONTRACT Lisheen Mine

BOREHOLE NO. BH01
SHEET Sheet 1 of 1

CO-ORDINATES 621,215.75 E, 666,738.35 N
GROUND LEVEL (mOD) 127.20

RIG TYPE Dando 2000
BOREHOLE DIAMETER (mm) 200
BOREHOLE DEPTH (m) 3.10

DATE COMMENCED 30/07/2024
DATE COMPLETED 30/07/2024

CLIENT
ENGINEER DOBA

SPT HAMMER REF. NO.
ENERGY RATIO (%)

BORED BY P.Allan
PROCESSED BY F.C

RECEIVED: 02/11/2024

Depth (m)	Description	Legend	Elevation	Depth (m)	Samples: Ref. Number	Samples: Sample Type	Samples: Depth (m)	Samples: Recovery	Field Test Results	Standpipe Details
0	Firm grey/brown sandy SILT/CLAY with low gravel content (Probable MADE GROUND)									
1			126.10	1.10	AA228304	B	1.00		N = 23 (4, 6, 4, 7, 7, 5)	
	Stiff to very stiff gravelly CLAY with medium cobble content									
2					AA228305	B	2.00		N = 29 (5, 7, 7, 8, 7, 7)	
3			124.10	3.10	AA228306	B	3.00		N = 25/75 mm (10, 25, 25)	
	Obstruction End of Borehole at 3.10 m									
4										
5										
6										
7										
8										
9										

HARD STRATA BORING/CHISELLING

From (m)	To (m)	Time (h)	Comments
1.30	1.50	1	
2.90	3.10	1.5	

WATER STRIKE DETAILS

Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments
					No water strike

GROUNDWATER PROGRESS

Date	Hole Depth	Casing Depth	Depth to Water	Comments

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type

REMARKS CAT scanned location and hand dug inspection pit was carried out .

Sample Legend
D - Small Disturbed (tub)
B - Bulk Disturbed
LB - Large Bulk Disturbed
Env - Environmental Sample (Jar + Vial + Tub)
UT - Undisturbed 100mm Diameter Sample
P - Undisturbed Piston Sample
W - Water Sample

IGSL BH LOG 25517.GPJ IGSL.GDT 16/10/24

GEOTECHNICAL BORING RECORD

REPORT NUMBER 25517

CONTRACT Lisheen Mine

BOREHOLE NO. BH02
SHEET Sheet 1 of 1

CO-ORDINATES 621,042.35 E
666,682.77 N
GROUND LEVEL (mOD) 129.72

RIG TYPE Dando 2000
BOREHOLE DIAMETER (mm) 200
BOREHOLE DEPTH (m) 2.70

DATE COMMENCED 26/07/2024
DATE COMPLETED 29/07/2024

CLIENT
ENGINEER DOBA

SPT HAMMER REF. NO.
ENERGY RATIO (%)

BORED BY P.Allan
PROCESSED BY F.C

Depth (m)	Description	Legend	Elevation	Depth (m)	Samples: Ref. Number	Samples: Sample Type	Samples: Depth (m)	Samples: Recovery	Field Test Results	Standpipe Details
0	TOPSOIL		129.42	0.30						
	Firm brown sandy SILT/CLAY		128.92	0.80						
1	Stiff to very stiff grey/brown sandy SILT/CLAY with low cobble and boulder content				AA228310	B	1.00		N = 29 (4, 4, 5, 6, 9, 9)	
2					AA228311	B	2.00		N = 31 (5, 7, 7, 7, 8, 9) N = 50/75 mm (25, 50)	
			127.02	2.70						
3	Obstruction End of Borehole at 2.70 m									
4										
5										
6										
7										
8										
9										

HARD STRATA BORING/CHISELLING

From (m)	To (m)	Time (h)	Comments
1.80	1.90	1	
2.50	2.70	1.5	

WATER STRIKE DETAILS

Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments
					No water strike

GROUNDWATER PROGRESS

Date	Hole Depth	Casing Depth	Depth to Water	Comments

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type

REMARKS CAT scanned location and hand dug inspection pit was carried out .

Sample Legend
D - Small Disturbed (tub)
B - Bulk Disturbed
LB - Large Bulk Disturbed
Env - Environmental Sample (Jar + Vial + Tub)
UT - Undisturbed 100mm Diameter Sample
P - Undisturbed Piston Sample
W - Water Sample

IGSL BH LOG 25517.GPJ IGSL.GDT 16/10/24

GEOTECHNICAL BORING RECORD

REPORT NUMBER 25517

CONTRACT Lisheen Mine

BOREHOLE NO. BH03
SHEET Sheet 1 of 1

CO-ORDINATES 621,224.65 E
666,634.11 N
GROUND LEVEL (mOD) 127.39

RIG TYPE Dando 2000
BOREHOLE DIAMETER (mm) 200
BOREHOLE DEPTH (m) 2.50

DATE COMMENCED 30/07/2024
DATE COMPLETED 30/07/2024

CLIENT
ENGINEER DOBA

SPT HAMMER REF. NO.
ENERGY RATIO (%)

BORED BY P.Allan
PROCESSED BY F.C

RECEIVED: 02/11/2024

Depth (m)	Description	Legend	Elevation	Depth (m)	Samples: Ref. Number	Samples: Sample Type	Samples: Depth (m)	Samples: Recovery	Field Test Results	Standpipe Details
0	Firm brown SILT/CLAY with low cobble content		126.49	0.90						
1	Very stiff grey/brown sandy gravelly CLAY with low cobble content				AA228300	B	1.00		N = 30 (5, 5, 7, 8, 8, 7)	
2					AA228301	B	2.00		N = 38 (6, 7, 10, 9, 9, 10)	
			124.89	2.50					N = 50/75 mm (18, 20, 50)	
3	Obstruction End of Borehole at 2.50 m									
4										
5										
6										
7										
8										
9										

HARD STRATA BORING/CHISELLING

From (m)	To (m)	Time (h)	Comments
2.10	2.50	2	

WATER STRIKE DETAILS

Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments
					No water strike

GROUNDWATER PROGRESS

Date	Hole Depth	Casing Depth	Depth to Water	Comments

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type

REMARKS CAT scanned location and hand dug inspection pit was carried out .

Sample Legend
D - Small Disturbed (tub)
B - Bulk Disturbed
LB - Large Bulk Disturbed
Env - Environmental Sample (Jar + Vial + Tub)
UT - Undisturbed 100mm Diameter Sample
P - Undisturbed Piston Sample
W - Water Sample

IGSL BH LOG 25517.GPJ IGSL.GDT 16/10/24

GEOTECHNICAL BORING RECORD

REPORT NUMBER 25517

CONTRACT Lisheen Mine

BOREHOLE NO. BH04
SHEET Sheet 1 of 1

CO-ORDINATES 621,082.02 E
666,580.48 N
GROUND LEVEL (mOD) 129.73

RIG TYPE Dando 2000
BOREHOLE DIAMETER (mm) 200
BOREHOLE DEPTH (m) 2.80

DATE COMMENCED 29/07/2024
DATE COMPLETED 29/07/2024

CLIENT
ENGINEER DOBA

SPT HAMMER REF. NO.
ENERGY RATIO (%)

BORED BY P.Allan
PROCESSED BY F.C

RECEIVED: 02/11/2024

Depth (m)	Description	Legend	Elevation	Depth (m)	Samples: Ref. Number	Samples: Sample Type	Samples: Depth (m)	Samples: Recovery	Field Test Results	Standpipe Details
0	TOPSOIL		129.43	0.30						
1	Firm brown SILT/CLAY with low to medium cobble content		128.53	1.20	AA228302	B	1.00		N = 24 (6, 8, 9, 5, 5, 5)	
2	Stiff to very stiff grey/brown sandy gravelly CLAY with low cobble content		126.93	2.80	AA228303	B	2.00		N = 36 (6, 7, 7, 10, 10, 9)	
3	Obstruction End of Borehole at 2.80 m								N = 50/75 mm (25, 50)	
4										
5										
6										
7										
8										
9										

HARD STRATA BORING/CHISELLING

From (m)	To (m)	Time (h)	Comments
1.50	1.60	1	
2.60	2.80	1.5	

WATER STRIKE DETAILS

Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments
					No water strike

GROUNDWATER PROGRESS

Date	Hole Depth	Casing Depth	Depth to Water	Comments

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type

REMARKS CAT scanned location and hand dug inspection pit was carried out .

Sample Legend
D - Small Disturbed (tub)
B - Bulk Disturbed
LB - Large Bulk Disturbed
Env - Environmental Sample (Jar + Vial + Tub)
UT - Undisturbed 100mm Diameter Sample
P - Undisturbed Piston Sample
W - Water Sample

IGSL BH LOG 25517.GPJ IGSL.GDT 16/10/24

GEOTECHNICAL BORING RECORD

REPORT NUMBER 25517

CONTRACT Lisheen Mine

BOREHOLE NO. BH05
SHEET Sheet 1 of 1

CO-ORDINATES 621,150.80 E
666,579.94 N
GROUND LEVEL (mOD) 127.71

RIG TYPE Dando 2000
BOREHOLE DIAMETER (mm) 200
BOREHOLE DEPTH (m) 0.70

DATE COMMENCED 28/08/2024
DATE COMPLETED 28/08/2024

CLIENT
ENGINEER DOBA

SPT HAMMER REF. NO.
ENERGY RATIO (%)

BORED BY D.Tolster
PROCESSED BY F.C

RECEIVED: 02/11/2024

Depth (m)	Description	Legend	Elevation	Depth (m)	Samples: Ref. Number	Samples: Sample Type	Samples: Depth (m)	Samples: Recovery	Field Test Results	Standpipe Details
0	TOPSOIL		127.61	0.10						
	Soft brown sandy SILT/CLAY with occasional gravel (Probable MADE GROUND)		127.41	0.30						
	Firm light brown very sandy SILT/CLAY with high cobble content		127.01	0.70	AA219546	B	0.50			
1	Obstruction - Possible boulder End of Borehole at 0.70 m									
2										
3										
4										
5										
6										
7										
8										
9										

HARD STRATA BORING/CHISELLING

From (m)	To (m)	Time (h)	Comments
0.60	0.70	1	

WATER STRIKE DETAILS

Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments
					No water strike

GROUNDWATER PROGRESS

Date	Hole Depth	Casing Depth	Depth to Water	Comments

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type

REMARKS CAT scanned location and hand dug inspection pit was carried out . Obstruction encountered at 0.70m. Moved rig to BH05A and attempted rebore.

Sample Legend
D - Small Disturbed (tub)
B - Bulk Disturbed
LB - Large Bulk Disturbed
Env - Environmental Sample (Jar + Vial + Tub)
UT - Undisturbed 100mm Diameter Sample
P - Undisturbed Piston Sample
W - Water Sample

IGSL BH LOG 25517.GPJ IGSL.GDT 16/10/24

GEOTECHNICAL BORING RECORD

REPORT NUMBER 25517

CONTRACT Lisheen Mine

BOREHOLE NO. BH05A
SHEET Sheet 1 of 1

CO-ORDINATES 621,150.80 E
666,579.94 N
GROUND LEVEL (mOD) 127.71

RIG TYPE Dando 2000
BOREHOLE DIAMETER (mm) 200
BOREHOLE DEPTH (m) 2.50

DATE COMMENCED 28/08/2024
DATE COMPLETED 28/08/2024

CLIENT
ENGINEER DOBA

SPT HAMMER REF. NO.
ENERGY RATIO (%)

BORED BY D.Tolster
PROCESSED BY F.C

Depth (m)	Description	Legend	Elevation	Depth (m)	Samples: Ref. Number	Samples: Sample Type	Samples: Depth (m)	Samples: Recovery	Field Test Results	Standpipe Details
0	TOPSOIL		127.61	0.10						
	Soft/firm brown sandy SILT/CLAY with occasional gravel (Probable MADE GROUND)		127.41	0.30						
1	Firm to tiff light brown very sandy SILT/CLAY with low cobble content				AA211709	B	1.00		N = 18 (3, 2, 3, 4, 4, 7)	
2					AA211710	B	2.00		N = 27 (5, 4, 6, 7, 7, 7)	
			125.21	2.50						
3	Obstruction End of Borehole at 2.50 m									
4										
5										
6										
7										
8										
9										

HARD STRATA BORING/CHISELLING

From (m)	To (m)	Time (h)	Comments
2.40	2.50	1.5	

WATER STRIKE DETAILS

Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments
					No water strike

GROUNDWATER PROGRESS

Date	Hole Depth	Casing Depth	Depth to Water	Comments

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type

REMARKS CAT scanned location and hand dug inspection pit was carried out .

Sample Legend
D - Small Disturbed (tub)
B - Bulk Disturbed
LB - Large Bulk Disturbed
Env - Environmental Sample (Jar + Vial + Tub)
UT - Undisturbed 100mm Diameter Sample
P - Undisturbed Piston Sample
W - Water Sample

IGSL BH LOG 25517.GPJ IGSL.GDT 16/10/24

GEOTECHNICAL BORING RECORD

REPORT NUMBER 25517

CONTRACT Lisheen Mine

BOREHOLE NO. BH06
SHEET Sheet 1 of 1

CO-ORDINATES 621,117.29 E
666,389.67 N
GROUND LEVEL (mOD) 127.46

RIG TYPE Dando 2000
BOREHOLE DIAMETER (mm) 200
BOREHOLE DEPTH (m) 3.80

DATE COMMENCED 29/08/2024
DATE COMPLETED 29/08/2024

CLIENT
ENGINEER DOBA

SPT HAMMER REF. NO.
ENERGY RATIO (%)

BORED BY D.Tolster
PROCESSED BY F.C

RECEIVED: 02/11/2024

Depth (m)	Description	Legend	Elevation	Depth (m)	Samples: Ref. Number	Samples: Sample Type	Samples: Depth (m)	Samples: Recovery	Field Test Results	Standpipe Details
0	TOPSOIL		127.26	0.20						
1	Soft mottled brown sandy SILT/CLAY with low cobble content		125.96	1.50	AA219547	B	1.00		N = 7 (1, 2, 2, 1, 2, 2)	
2	Firm mottled grey sandy SILT/CLAY with low gravel and cobble content		124.86	2.60	AA219548	B	2.00		N = 18 (2, 2, 4, 4, 5, 5)	
3	Very stiff brown sandy silty gravelly CLAY with low cobble and boulder content		123.66	3.80	AA219549	B	3.00		N = 37 (4, 4, 8, 10, 10, 9)	
4	Obstruction - Possible boulder End of Borehole at 3.80 m								N = 50/75 mm (18, 21, 50)	
5										
6										
7										
8										
9										

HARD STRATA BORING/CHISELLING

From (m)	To (m)	Time (h)	Comments
3.70	3.80	1.5	

WATER STRIKE DETAILS

Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments
					No water strike

GROUNDWATER PROGRESS

Date	Hole Depth	Casing Depth	Depth to Water	Comments

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type

REMARKS CAT scanned location and hand dug inspection pit was carried out .

Sample Legend
D - Small Disturbed (tub)
B - Bulk Disturbed
LB - Large Bulk Disturbed
Env - Environmental Sample (Jar + Vial + Tub)
UT - Undisturbed 100mm Diameter Sample
P - Undisturbed Piston Sample
W - Water Sample

IGSL BH LOG 25517.GPJ IGSL.GDT 16/10/24

GEOTECHNICAL BORING RECORD

REPORT NUMBER 25517

CONTRACT Lisheen Mine

BOREHOLE NO. BH07
SHEET Sheet 1 of 1

CO-ORDINATES 621,259.03 E
666,518.46 N
GROUND LEVEL (mOD) 126.71

RIG TYPE Dando 2000
BOREHOLE DIAMETER (mm) 200
BOREHOLE DEPTH (m) 5.10

DATE COMMENCED 27/08/2024
DATE COMPLETED 28/08/2024

CLIENT
ENGINEER DOBA

SPT HAMMER REF. NO.
ENERGY RATIO (%)

BORED BY D.Tolster
PROCESSED BY F.C

RECEIVED: 02/11/2024

Depth (m)	Description	Legend	Elevation	Depth (m)	Samples: Ref. Number	Sample Type	Depth (m)	Recovery	Field Test Results	Standpipe Details
0	TOPSOIL		126.61	0.10						
	Firm grey/brown sandy SILT/CLAY with low gravel content (Probable MADE GROUND)		125.51	1.20	AA229644	B	1.00		N = 11 (2, 2, 2, 2, 3, 4)	
1	Firm grey/black sandy SILT/CLAY with low cobble content (Probable MADE GROUND)		124.41	2.30	AA229645	B	1.50			
					AA229646	B	2.00		N = 16 (4, 4, 6, 3, 4, 3)	
2	Stiff grey/brown sandy silty gravelly CLAY with low cobble and boulder content		122.81	3.90	AA229647	B	3.00		N = 26 (4, 6, 6, 7, 6, 7)	
3					AA229648	B	3.50			
	Dense grey fine to coarse sandy angular GRAVEL		121.61	5.10	AA229649	B	4.00		N = 37 (6, 8, 10, 10, 8, 9)	
4					AA229650	B	5.00		N = 50/75 mm (25, 50)	
	Obstruction End of Borehole at 5.10 m									
5										
6										
7										
8										
9										

HARD STRATA BORING/CHISELLING

From (m)	To (m)	Time (h)	Comments
2.10	2.40	1	
5.00	5.10	1.5	

WATER STRIKE DETAILS

Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments
3.60	3.60	No	2.40	20	Moderate

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type

GROUNDWATER PROGRESS

Date	Hole Depth	Casing Depth	Depth to Water	Comments
28-09-24	5.10	Nil	2.30	End of BH

REMARKS CAT scanned location and hand dug inspection pit was carried out .

Sample Legend
D - Small Disturbed (tub)
B - Bulk Disturbed
LB - Large Bulk Disturbed
Env - Environmental Sample (Jar + Vial + Tub)
UT - Undisturbed 100mm Diameter Sample
P - Undisturbed Piston Sample
W - Water Sample

IGSL BH LOG 25517.GPJ IGSL.GDT 16/10/24

GEOTECHNICAL BORING RECORD

REPORT NUMBER 25517

CONTRACT Lisheen Mine

BOREHOLE NO. BH08
SHEET Sheet 1 of 1

CO-ORDINATES 621,334.77 E
666,486.83 N
GROUND LEVEL (mOD) 126.53

RIG TYPE Dando 2000
BOREHOLE DIAMETER (mm) 200
BOREHOLE DEPTH (m) 1.40

DATE COMMENCED 27/08/2024
DATE COMPLETED 27/08/2024

CLIENT
ENGINEER DOBA

SPT HAMMER REF. NO.
ENERGY RATIO (%)

BORED BY D.Tolster
PROCESSED BY F.C

RECEIVED: 02/11/2024

Depth (m)	Description	Legend	Elevation	Depth (m)	Samples: Ref. Number	Samples: Sample Type	Samples: Depth (m)	Samples: Recovery	Field Test Results	Standpipe Details
0	TOPSOIL		126.43	0.10						
	Soft mottled brown sandy SILT/CLAY with low gravel content		126.23	0.30						
1	Firm grey/brown sandy SILT/CLAY with low cobble and boulder content				AA219500	B	0.80		N = 15 (4, 3, 3, 5, 4, 3)	
			125.13	1.40					N = 50/75 mm (25, 50)	
2	Obstruction End of Borehole at 1.40 m									
3										
4										
5										
6										
7										
8										
9										

HARD STRATA BORING/CHISELLING

From (m)	To (m)	Time (h)	Comments
1.30	1.40	1.5	

WATER STRIKE DETAILS

Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments
					No water strike

GROUNDWATER PROGRESS

Date	Hole Depth	Casing Depth	Depth to Water	Comments

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type

REMARKS CAT scanned location and hand dug inspection pit was carried out .

Sample Legend
D - Small Disturbed (tub)
B - Bulk Disturbed
LB - Large Bulk Disturbed
Env - Environmental Sample (Jar + Vial + Tub)
UT - Undisturbed 100mm Diameter Sample
P - Undisturbed Piston Sample
W - Water Sample

IGSL BH LOG 25517.GPJ IGSL.GDT 16/10/24

Appendix 3

Rotary Drillhole Records & Photographs

GEOTECHNICAL CORE LOG RECORD

REPORT NUMBER 255517

CONTRACT Lisheen Mine , Co.Tipperary

DRILLHOLE NO RC01
SHEET Sheet 1 of 2

CO-ORDINATES 621,215.75 E
666,738.35 N
GROUND LEVEL (mOD) 127.20

RIG TYPE BT-440
FLUSH Air/Mist
INCLINATION (deg) -90
CORE DIAMETER (mm) 78

DATE DRILLED 02/08/2024
DATE LOGGED 06/08/2024

CLIENT
ENGINEER DOBA

DRILLED BY IGSL - JK
LOGGED BY D. O' Shea

Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Fracture Spacing Log (mm) 0 250 500	Non-intact Zone	Legend	Description	Depth (m)	Elevation	Standpipe Details	SPT (N Value)
0								SYMMETRIX DRILLING: No recovery, observed by driller as returns of gravelly CLAY.				
1									1.50	125.70		
2								SYMMETRIX DRILLING: No recovery, observed by driller as returns of clayey GRAVEL with cobbles				N = 41 (4, 7, 8, 9, 12, 12)
3												N = 49 (7, 9, 12, 13, 12, 12)
4									4.30	122.90		
5								SYMMETRIX DRILLING: No recovery, observed by driller as returns of clayey GRAVEL				N = 52/225 mm (5, 9, 17, 22, 13)
6									6.00	121.20		
								SYMMETRIX DRILLING: No recovery, observed by driller as returns of sandy GRAVEL				N = 51 (7, 8, 12, 13, 13, 13)
7									6.80	120.40		
								SYMMETRIX DRILLING: No recovery, observed by driller as returns of possible ROCK				
	7.50								7.50	119.70		
8		100	4	0				Medium strong to strong, medium to thinly bedded, light blue/grey, fine-grained LIMESTONE (stromatactic structure, possibly slightly metamorphosed, locally slightly dolomitised), fresh to slightly (solution) weathered.				
	8.32											
9		100	17	11				Discontinuities are medium to closely spaced, smooth to locally rough, fractures are planar to locally undulose. Apertures are tight to moderately open, locally clay smeared, commonly calcite/dolomite-veined, slightly iron stained. Dips are subhorizontal to locally 40-50°, 70° & irregular.				
	9.62											

REMARKS
Hole cased from 0.00-7.50m

WATER STRIKE DETAILS

Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments
6.80	6.80	N/S			Seepage

GROUNDWATER DETAILS

Date	Hole Depth	Casing Depth	Depth to Water	Comments

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type

GEOTECHNICAL CORE LOG RECORD

REPORT NUMBER 255517

CONTRACT Lisheen Mine , Co.Tipperary

DRILLHOLE NO RC01
SHEET Sheet 2 of 2

CO-ORDINATES 621,215.75 E
666,738.35 N
GROUND LEVEL (mOD) 127.20

RIG TYPE BT-440
FLUSH Air/Mist
INCLINATION (deg) -90
CORE DIAMETER (mm) 78

DATE DRILLED 02/08/2024
DATE LOGGED 06/08/2024

CLIENT
ENGINEER DOBA

DRILLED BY IGSL - JK
LOGGED BY D. O' Shea

Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Fracture Spacing Log (mm) 0 250 500	Non-intact Zone	Legend	Description	Depth (m)	Elevation	Standpipe Details	SPT (N Value)
10	10.70	100	37	35				Medium strong to strong, medium to thinly bedded, light blue/grey, fine-grained LIMESTONE (stromatactic structure, possibly slightly metamorphosed, locally slightly dolomitised), fresh to slightly (solution) weathered. Discontinuities are medium to closely spaced, smooth to locally rough, fractures are planar to locally undulose. Apertures are tight to moderately open, locally clay smeared, commonly calcite/dolomite-veined, slightly iron stained. Dips are subhorizontal to locally 40-50°, 70° & irregular. *(continued)*				
11	11.66	100	46	35								
12	12.50	100	25	17					12.50	114.70		
13								End of Borehole at 12.50 m				
14												
15												
16												
17												
18												
19												

REMARKS
Hole cased from 0.00-7.50m

WATER STRIKE DETAILS

Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments
6.80	6.80	N/S			Seepage

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type

GROUNDWATER DETAILS

Date	Hole Depth	Casing Depth	Depth to Water	Comments
06-08-24	12.50	7.50	5.05	Water levels recorded 5 mins after end of drilling

GEOTECHNICAL CORE LOG RECORD

REPORT NUMBER 255517

CONTRACT Lisheen Mine , Co.Tipperary

DRILLHOLE NO RC02
SHEET Sheet 1 of 2

CO-ORDINATES 621,042.35 E
666,682.77 N
GROUND LEVEL (mOD) 129.72

RIG TYPE BT-440
FLUSH Air/Mist
INCLINATION (deg) -90
CORE DIAMETER (mm) 78

DATE DRILLED 31/07/2024
DATE LOGGED 01/08/2024

CLIENT
ENGINEER DOBA

DRILLED BY IGSL - JK
LOGGED BY D. O' Shea

Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Fracture Spacing Log (mm) 0 250 500	Non-intact Zone	Legend	Description	Depth (m)	Elevation	Standpipe Details	SPT (N Value)
0								SYMMETRIX DRILLING: No recovery, observed by driller as returns of CLAY				
1									1.50	128.22		
2								SYMMETRIX DRILLING: No recovery, observed by driller as returns of gravelly CLAY.	2.55	127.17		N = 54/225 mm (5, 9, 18, 17, 19)
	2.80							SYMMETRIX DRILLING: No recovery, observed by driller as returns of possible ROCK	2.80	126.92		
3		100	71	44				Strong to very strong, thickly to thinly bedded, light blue/grey, fine-grained LIMESTONE (stromatactic structure, possibly slightly metamorphosed, locally slightly dolomitised), fresh to slightly (solution) weathered.				
4	4.30							Discontinuities are widely to closely spaced, smooth to locally rough, fractures are planar to locally undulose. Apertures are tight to locally moderately open, locally clay smeared, commonly calcite/dolomite-veined, slightly iron stained. Dips are subhorizontal to locally 40-50°.				
5		100	77	69		640.0000000000001						
	5.80											
6		100	61	57		520						
7	7.30											
8		100	79	70		510						
	8.80											
9		100	71	66		830						

REMARKS
Hole cased from 0.00-2.80m

WATER STRIKE DETAILS

Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments
					No water strike recorded

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type
01-08-24	10.20	1.00	10.20	50mm SP

GROUNDWATER DETAILS

Date	Hole Depth	Casing Depth	Depth to Water	Comments
01-08-24	5.90	2.80	5.90	Water levels recorded 5 mins after end of drilling

GEOTECHNICAL CORE LOG RECORD

REPORT NUMBER 255517

CONTRACT Lisheen Mine , Co.Tipperary

DRILLHOLE NO RC02
SHEET Sheet 2 of 2

CO-ORDINATES 621,042.35 E
666,682.77 N
GROUND LEVEL (mOD) 129.72

RIG TYPE BT-440
FLUSH Air/Mist
INCLINATION (deg) -90
CORE DIAMETER (mm) 78

DATE DRILLED 31/07/2024
DATE LOGGED 01/08/2024

CLIENT
ENGINEER DOBA

DRILLED BY IGSL - JK
LOGGED BY D. O' Shea

Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Fracture Spacing Log (mm) 0 250 500	Non-intact Zone	Legend	Description	Depth (m)	Elevation	Standpipe Details	SPT (N Value)
10	10.20							End of Borehole at 10.20 m	10.20	119.52		

REMARKS
Hole cased from 0.00-2.80m

WATER STRIKE DETAILS

Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments
					No water strike recorded

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type
01-08-24	10.20	1.00	10.20	50mm SP

GROUNDWATER DETAILS

Date	Hole Depth	Casing Depth	Depth to Water	Comments

IGSL RC FI 10M 25517.GPJ IGSL.GDT 25/9/24

GEOTECHNICAL CORE LOG RECORD

REPORT NUMBER 255517

CONTRACT Lisheen Mine , Co.Tipperary

DRILLHOLE NO RC03
SHEET Sheet 1 of 2

CO-ORDINATES 621,224.65 E
666,634.11 N
GROUND LEVEL (mOD) 127.39

RIG TYPE BT-440
FLUSH Air/Mist
INCLINATION (deg) -90
CORE DIAMETER (mm) 78

DATE DRILLED 06/08/2024
DATE LOGGED 07/08/2024

CLIENT
ENGINEER DOBA

DRILLED BY IGSL - JK
LOGGED BY D. O' Shea

Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Fracture Spacing Log (mm) 0 250 500	Non-intact Zone	Legend	Description	Depth (m)	Elevation	Standpipe Details	SPT (N Value)
0								SYMMETRIX DRILLING: No recovery, observed by driller as returns of gravelly SAND.				
1									1.50	125.89		
2								SYMMETRIX DRILLING: No recovery, observed by driller as returns of GRAVEL with boulders	2.45	124.94		
	3.00							SYMMETRIX DRILLING: No recovery, observed by driller as returns of possible ROCK	3.00	124.39		
3		93	44	38				Strong to very strong (where competent), thickly to thinly bedded, light blue/grey to brown grey, fine-grained LIMESTONE (stromatactic structure, possibly slightly metamorphosed, locally slightly dolomitised), slightly (solution) weathered to locally moderately/highly weathered (to a brown clayey gravelly sand at 4.50-6.75m, 7.00-7.38m & 7.50-8.20m)				
4	4.50											
5		40	15	15				Discontinuities are widely to closely spaced, smooth to locally rough, fractures are planar to irregular. Apertures are tight to locally open locally clay smeared, commonly calcite/dolomite-veined, locally sandy clay-filled, locally moderately iron stained. Dips are subhorizontal to locally 30°, 70° & irregular.				
	6.00											
6		20	5	0								
7	7.50											
8		70	27	21								
	8.50											
		100	40	30								
9	9.00											
		100	75	69								

REMARKS

Hole cased from 0.00-3.00m

WATER STRIKE DETAILS

Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments
					No water strike recorded

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type
07-08-24	8.50	2.00	10.50	50mm SP

GROUNDWATER DETAILS

Date	Hole Depth	Casing Depth	Depth to Water	Comments

IGSL RC FI 10M 25517.GPJ IGSL.GDT 25/9/24

GEOTECHNICAL CORE LOG RECORD

REPORT NUMBER 255517

CONTRACT Lisheen Mine , Co.Tipperary

DRILLHOLE NO RC03
SHEET Sheet 2 of 2

CO-ORDINATES 621,224.65 E
666,634.11 N
GROUND LEVEL (mOD) 127.39

RIG TYPE BT-440
FLUSH Air/Mist
INCLINATION (deg) -90
CORE DIAMETER (mm) 78

DATE DRILLED 06/08/2024
DATE LOGGED 07/08/2024

CLIENT
ENGINEER DOBA

DRILLED BY IGSL - JK
LOGGED BY D. O' Shea

Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Fracture Spacing Log (mm) 0 250 500	Non-intact Zone	Legend	Description	Depth (m)	Elevation	Standpipe Details	SPT (N Value)
10	10.50							End of Borehole at 10.50 m	10.50	116.89		
11												
12												
13												
14												
15												
16												
17												
18												
19												

REMARKS
Hole cased from 0.00-3.00m

WATER STRIKE DETAILS

Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments
					No water strike recorded

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type
07-08-24	8.50	2.00	10.50	50mm SP

GROUNDWATER DETAILS

Date	Hole Depth	Casing Depth	Depth to Water	Comments
07-08-24	10.50	3.00	4.05	Water levels recorded 5 mins after end of drilling

GEOTECHNICAL CORE LOG RECORD

REPORT NUMBER 255517

CONTRACT Lisheen Mine , Co.Tipperary

DRILLHOLE NO RC04
SHEET Sheet 1 of 2

CO-ORDINATES 621,082.02 E
666,580.48 N
GROUND LEVEL (mOD) 129.73

RIG TYPE BT-440
FLUSH Air/Mist
INCLINATION (deg) -90
CORE DIAMETER (mm) 78

DATE DRILLED 01/08/2024
DATE LOGGED 02/08/2024

CLIENT
ENGINEER DOBA

DRILLED BY IGSL - JK
LOGGED BY D. O' Shea

Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Fracture Spacing Log (mm) 0 250 500	Non-intact Zone	Legend	Description	Depth (m)	Elevation	Standpipe Details	SPT (N Value)
0								SYMMETRIX DRILLING: No recovery, observed by driller as returns of CLAY				
1									1.50	128.23		
2								SYMMETRIX DRILLING: No recovery, observed by driller as returns of gravelly CLAY.	2.40	127.33		
								SYMMETRIX DRILLING: No recovery, observed by driller as returns of possible ROCK	3.00	126.73		
3	3.00	100	0	0				Medium strong to strong, thick to thinly bedded, light blue/grey, fine-grained LIMESTONE (stromatactic structure, possibly slightly metamorphosed, locally slightly dolomitised), fresh to slightly (solution) weathered.				
	3.58	100	41	32				Discontinuities are widely to closely spaced, smooth to locally rough, fractures are planar to locally undulose. Apertures are tight to moderately open, locally clay smeared, commonly calcite/dolomite-veined, frequent incipient fractures, locally iron stained. Dips are subhorizontal to locally 50-70°.				
4												
	4.91	100	64	55								
5												
	6.00	100	82	73		600						
6												
	7.00	100	52	41								
7	7.66											
		100	66	66		590						
8												
	9.00											
9	9.14	100	64	0								
		100	89	89								

REMARKS
Hole cased from 0.00-3.00m

WATER STRIKE DETAILS

Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments
					No water strike recorded

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type

GROUNDWATER DETAILS

Date	Hole Depth	Casing Depth	Depth to Water	Comments

IGSL RC FI 10M 25517.GPJ IGSL.GDT 25/9/24

GEOTECHNICAL CORE LOG RECORD

REPORT NUMBER 255517

CONTRACT Lisheen Mine , Co.Tipperary

DRILLHOLE NO RC04
SHEET Sheet 2 of 2

CO-ORDINATES 621,082.02 E
666,580.48 N
GROUND LEVEL (mOD) 129.73

RIG TYPE BT-440
FLUSH Air/Mist
INCLINATION (deg) -90
CORE DIAMETER (mm) 78

DATE DRILLED 01/08/2024
DATE LOGGED 02/08/2024

CLIENT
ENGINEER DOBA

DRILLED BY IGSL - JK
LOGGED BY D. O' Shea

Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Fracture Spacing Log (mm) 0 250 500	Non-intact Zone	Legend	Description	Depth (m)	Elevation	Standpipe Details	SPT (N Value)
10	10.15							End of Borehole at 10.15 m	10.15	119.58		
11												
12												
13												
14												
15												
16												
17												
18												
19												

REMARKS
Hole cased from 0.00-3.00m

WATER STRIKE DETAILS

Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments
					No water strike recorded

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type

GROUNDWATER DETAILS

Date	Hole Depth	Casing Depth	Depth to Water	Comments
02-08-24	10.15	3.00	6.50	Water levels recorded 5 mins after end of drilling

IGSL RC FI 10M 25517.GPJ IGSL.GDT 25/9/24

GEOTECHNICAL CORE LOG RECORD

REPORT NUMBER 255517

CONTRACT	Lisheen Mine , Co.Tipperary	**DRILLHOLE NO**	**RC05**
		SHEET	Sheet 1 of 2
CO-ORDINATES	621,150.80 E 666,579.94 N	**DATE DRILLED**	22/07/2024
GROUND LEVEL (mOD)	127.71	**DATE LOGGED**	22/07/2024
CLIENT		**DRILLED BY**	IGSL - JK
ENGINEER	DOBA	**LOGGED BY**	D. O' Shea
RIG TYPE	BT-440		
FLUSH	Air/Mist		
INCLINATION (deg)	-90		
CORE DIAMETER (mm)	78		

Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Fracture Spacing Log (mm) 0 250 500	Non-intact Zone	Legend	Description	Depth (m)	Elevation	Standpipe Details	SPT (N Value)
0								SYMMETRIX DRILLING: No recovery, observed by driller as returns of sandy GRAVEL	0.80	126.91		
1								SYMMETRIX DRILLING: No recovery, observed by driller as returns of cobbly SAND				N = 50/225 mm (5, 8, 9, 18, 19, 4)
2	2.60								2.60	125.11		
3		100	64	60		600		Weak to strong, thickly to thinly bedded, light blue/grey to brown grey, fine-grained LIMESTONE (stromatactic structure, possibly slightly metamorphosed, locally slightly dolomitised), fresh to locally slightly (solution) weathered. Discontinuities are widely to closely spaced, smooth to locally rough, fractures are planar to curviplanar. Apertures are tight to open, locally clay smeared, locally calcite/dolomite-veined, frequent incipient fractures, locally iron oxide stained. Dips are subhorizontal to locally 45°.				
4	4.70											
5	5.15	100	96	96								
		90	35	29								
6	6.20					609.999999999999						
7		100	76	66								
	7.75											
8		100	16	16								
	8.70											
9		100	30	20								
	9.90											

REMARKS

Hole cased from 0.00-2.60m

WATER STRIKE DETAILS

Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments
3.80	2.60	N/S			Seepage

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type
22-07-24	12.50	2.60	12.50	50mm SP

GROUNDWATER DETAILS

Date	Hole Depth	Casing Depth	Depth to Water	Comments

IGSL RC FI 10M 25517.GPJ IGSL.GDT 25/9/24

GEOTECHNICAL CORE LOG RECORD

REPORT NUMBER 255517

CONTRACT Lisheen Mine , Co.Tipperary

DRILLHOLE NO RC05
SHEET Sheet 2 of 2

CO-ORDINATES 621,150.80 E
666,579.94 N
GROUND LEVEL (mOD) 127.71

RIG TYPE BT-440
FLUSH Air/Mist
INCLINATION (deg) -90
CORE DIAMETER (mm) 78

DATE DRILLED 22/07/2024
DATE LOGGED 22/07/2024

CLIENT
ENGINEER DOBA

DRILLED BY IGSL - JK
LOGGED BY D. O' Shea

Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Fracture Spacing Log (mm) 0 250 500	Non-intact Zone	Legend	Description	Depth (m)	Elevation	Standpipe Details	SPT (N Value)
10	10.25	100	46	31				Weak to strong, thickly to thinly bedded, light blue/grey to brown grey, fine-grained LIMESTONE (stromatactic structure, possibly slightly metamorphosed, locally slightly dolomitised), fresh to locally slightly (solution) weathered. Discontinuities are widely to closely spaced, smooth to locally rough, fractures are planar to curviplanar. Apertures are tight to open, locally clay smeared, locally calcite/dolomite-veined, frequent incipient fractures, locally iron oxide stained. Dips are subhorizontal to locally 45°. *(continued)*				
11	11.40	100	4	0								
12	12.50	100	3	0					12.50	115.21		
13								End of Borehole at 11.50 m				
14												
15												
16												
17												
18												
19												

REMARKS
Hole cased from 0.00-2.60m

WATER STRIKE DETAILS

Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments
3.80	2.60	N/S			Seepage

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type
22-07-24	12.50	2.60	12.50	50mm SP

GROUNDWATER DETAILS

Date	Hole Depth	Casing Depth	Depth to Water	Comments
22-07-24	11.50	2.60	4.25	Water levels recorded 5 mins after end of drilling

IGSL RC FI 10M 25517.GPJ IGSL.GDT 25/9/24

GEOTECHNICAL CORE LOG RECORD

REPORT NUMBER 255517

CONTRACT Lisheen Mine , Co.Tipperary

DRILLHOLE NO RC06
SHEET Sheet 1 of 2

CO-ORDINATES 621,117.29 E
666,389.67 N
GROUND LEVEL (mOD) 127.46

RIG TYPE BT-440
FLUSH Air/Mist
INCLINATION (deg) -90
CORE DIAMETER (mm) 78

DATE DRILLED 23/07/2024
DATE LOGGED 26/07/2024

CLIENT
ENGINEER DOBA

DRILLED BY IGSL - JK
LOGGED BY D. O' Shea

Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Fracture Spacing Log (mm) 0 250 500	Non-intact Zone	Legend	Description	Depth (m)	Elevation	Standpipe Details	SPT (N Value)
0								SYMMETRIX DRILLING: No recovery, observed by driller as returns of CLAY	0.80	126.66		
1								SYMMETRIX DRILLING: No recovery, observed by driller as returns of sandy GRAVEL				N = 41 (5, 7, 8, 9, 11, 13)
2												
3	4.00								4.00	123.46		N = 44 (7, 8, 9, 11, 11, 13)
4	4.80	100	0	0				Returns of stiff brown gravelly sandy cobbly CLAY with boulders. Sand is fine to coarse. Gravel is angular to subrounded fine to coarse of limestone. Cobbles and boulders of limestone				
5	6.00	8	0	0								N = 50/225 mm (9, 9, 16, 17, 12, 5)
6	6.50	60	0	0								N = 50 (7, 9, 12, 14, 13, 11)
7	8.00	0	0	0					8.00	119.46		N = 85 (11, 12, 15, 16, 19, 35)
8	9.30	77	55	37								
9	9.83	100	100	100		529.999999999999						

REMARKS
Hole cased from 0.00-8.00m

WATER STRIKE DETAILS

Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments
7.50	7.50	N/S			Seepage

GROUNDWATER DETAILS

Date	Hole Depth	Casing Depth	Depth to Water	Comments

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type
26-07-24	18.55	8.00	18.55	50mm SP

GEOTECHNICAL CORE LOG RECORD

REPORT NUMBER 255517

CONTRACT Lisheen Mine , Co.Tipperary

DRILLHOLE NO RC06
SHEET Sheet 2 of 2

CO-ORDINATES 621,117.29 E
666,389.67 N
GROUND LEVEL (mOD) 127.46

RIG TYPE BT-440
FLUSH Air/Mist
INCLINATION (deg) -90
CORE DIAMETER (mm) 78

DATE DRILLED 23/07/2024
DATE LOGGED 26/07/2024

CLIENT
ENGINEER DOBA

DRILLED BY IGSL - JK
LOGGED BY D. O' Shea

Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Fracture Spacing Log (mm) 0 250 500	Non-intact Zone	Legend	Description	Depth (m)	Elevation	Standpipe Details	SPT (N Value)
10	10.40	100	100	100		570		Moderately weak to very strong, thickly to thinly bedded, light to dark grey/black, fine to medium-grained LIMESTONE (interbedded and interlaminated, predominantely argillcaeous/muddy limestone with occasional calci-siltite sandy limestone lenses & layers, commonly fossilierous), fresh to locally slightly weathered. Discontinuities are widely to closely spaced, smooth to locally rough, fractures are planar to curviplanare. Apertures are tight to moderately open, locally clay/gravel-filled (at 8.81-9.05m), locally slightly iron-oxide stained. Dips are subhorizontal to locally 30° & 60°. *(continued)*				
11	11.60	100	97	97								
12	12.65	100	94	94		540.000000000001						
	12.80	100	93	93								
13	13.80	100	98	98								
14		100	99	99		520.000000000001						
15	15.38					540.000000000001						
	15.95	100	95	84								
16		100	95	92		639.999999999997						
17	17.05											
		100	99	92		609.999999999999						
18	18.00											
	18.55	100	96	96					18.55	108.91		
19								End of Borehole at 18.55 m				

REMARKS

Hole cased from 0.00-8.00m

WATER STRIKE DETAILS

Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments
7.50	7.50	N/S			Seepage

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type
26-07-24	18.55	8.00	18.55	50mm SP

GROUNDWATER DETAILS

Date	Hole Depth	Casing Depth	Depth to Water	Comments
26-07-24	18.55	8.00	7.65	Water levels recorded 5 mins after end of drilling

IGSL RC FI 10M 25517.GPJ IGSL.GDT 25/9/24

GEOTECHNICAL CORE LOG RECORD

REPORT NUMBER 255517

CONTRACT	Lisheen Mine , Co.Tipperary	**DRILLHOLE NO**	**RC07**
		SHEET	Sheet 1 of 2
CO-ORDINATES	621,259.03 E 666,518.46 N	**DATE DRILLED**	20/07/2024
GROUND LEVEL (mOD)	126.71	**DATE LOGGED**	21/07/2024
CLIENT		**DRILLED BY**	IGSL - JK
ENGINEER	DOBA	**LOGGED BY**	D. O' Shea
RIG TYPE	BT-440		
FLUSH	Air/Mist		
INCLINATION (deg)	-90		
CORE DIAMETER (mm)	78		

Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Fracture Spacing Log (mm) 0 250 500	Non-intact Zone	Legend	Description	Depth (m)	Elevation	Standpipe Details	SPT (N Value)
0								SYMMETRIX DRILLING: No recovery, observed by driller as returns of MADE GROUND comprising of cobbly sandy GRAVEL				
1									1.50	125.21		
2								SYMMETRIX DRILLING: No recovery, observed by driller as returns of MADE GROUND comprising of sandy gravelly CLAY				N = 42 (5, 11, 9, 9, 11, 13)
3									3.00	123.71		
4								SYMMETRIX DRILLING: No recovery, observed by driller as returns of MADE GROUND comprising of sandy cobbly GRAVEL				N = 48 (7, 7, 12, 12, 13, 11)
5									4.50	122.21		
								SYMMETRIX DRILLING: No recovery, observed by driller as returns of MADE GROUND comprising of cobbly GRAVEL	5.00	121.71		N = 50/150 mm (5, 6, 18, 21, 11)
								MADE GROUND comprising of concrete				
6	5.90								5.90	120.81		
	6.35	100	82	76				Medium strong to very strong, thickly to thinly bedded, light to dark grey/black, fine to medium-grained LIMESTONE (interbedded and interlaminated, predominantely argillcaeous/muddy limestone with occasional calci-siltite sandy limestone lenses & layers, commonly fossilierous), fresh to locally slightly weathered. Discontinuities are widely to closely spaced, smooth to locally rough, fractures are planar to curviplanar. Apertures are tight to moderately open, locally clay-smeared, very locally slightly iron-oxide stained. Dips are subhorizontal to locally 30° & 40°.				
7		100	79	67								
	7.70											
	7.80	100	100	100								
8		100	92	82								
	8.65											
9		100	93	77		580						
	9.40											
		100	100	100								

REMARKS

Hole cased from 0.00-5.00m

WATER STRIKE DETAILS

Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments
3.00	3.00	N/S			Seepage

GROUNDWATER DETAILS

Date	Hole Depth	Casing Depth	Depth to Water	Comments

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type

GEOTECHNICAL CORE LOG RECORD

REPORT NUMBER 255517

CONTRACT Lisheen Mine , Co.Tipperary

DRILLHOLE NO RC07
SHEET Sheet 2 of 2

CO-ORDINATES 621,259.03 E
666,518.46 N
GROUND LEVEL (mOD) 126.71

RIG TYPE BT-440
FLUSH Air/Mist
INCLINATION (deg) -90
CORE DIAMETER (mm) 78

DATE DRILLED 20/07/2024
DATE LOGGED 21/07/2024

CLIENT
ENGINEER DOBA

DRILLED BY IGSL - JK
LOGGED BY D. O' Shea

Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Fracture Spacing Log (mm) 0 250 500	Non-intact Zone	Legend	Description	Depth (m)	Elevation	Standpipe Details	SPT (N Value)
10	10.30							Medium strong to very strong, thickly to thinly bedded, light to dark grey/black, fine to medium-grained LIMESTONE (interbedded and interlaminated, predominantely argillcaeous/muddy limestone with occasional calci-siltite sandy limestone lenses & layers, commonly fossilierous), fresh to locally slightly weathered. Discontinuities are widely to closely spaced, smooth to locally rough, fractures are planar to curviplanar. Apertures are tight to moderately open, locally clay-smeared, very locally slightly iron-oxide stained. Dips are subhorizontal to locally 30° & 40°. *(continued)*				
		100	93	86								
11	11.00											
		100	93	93								
12	12.00											
		100	100	95		580						
	12.58											
	12.95	100	100	89								
13												
		100	98	97								
14	14.15											
		100	99	93								
15	15.10								15.10	111.61		
								End of Borehole at 15.10 m				
16												
17												
18												
19												

REMARKS

Hole cased from 0.00-5.00m

WATER STRIKE DETAILS

Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments
3.00	3.00	N/S			Seepage

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type

GROUNDWATER DETAILS

Date	Hole Depth	Casing Depth	Depth to Water	Comments
21-07-24	15.10	5.00	2.12	Water levels recorded 5 mins after end of drilling

IGSL RC FI 10M 25517.GPJ IGSL.GDT 25/9/24

GEOTECHNICAL CORE LOG RECORD

REPORT NUMBER 255517

CONTRACT Lisheen Mine , Co.Tipperary

DRILLHOLE NO RC08
SHEET Sheet 1 of 2

CO-ORDINATES 621,334.77 E
666,486.83 N
GROUND LEVEL (mOD) 126.53

RIG TYPE BT-440
FLUSH Air/Mist
INCLINATION (deg) -90
CORE DIAMETER (mm) 78

DATE DRILLED 19/07/2024
DATE LOGGED 20/07/2024

CLIENT
ENGINEER DOBA

DRILLED BY IGSL - JK
LOGGED BY D. O' Shea

Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Fracture Spacing Log (mm) 0 250 500	Non-intact Zone	Legend	Description	Depth (m)	Elevation	Standpipe Details	SPT (N Value)
0								SYMMETRIX DRILLING: No recovery, observed by driller as returns of sandy cobbly GRAVEL				
1	1.50								1.50	125.03		
2	2.20	100	86	80				Moderately weak to very strong, thickly to thinly bedded, light to dark grey/black, fine to medium-grained LIMESTONE (interbedded and interlaminated, predominantely argillcaeous/muddy limestone with occasional calci-siltite sandy limestone lenses & layers, commonly fossilierous), fresh to locally slightly weathered. Discontinuities are widely to closely spaced, smooth to locally rough, fractures are planar to curviplanar. Apertures are tight to moderately open, locally clay-smeared, very locally slightly iron-oxide stained. Dips are subhorizontal to locally 30° & 40°.				N = 50/0 mm (25, 50)
3	3.80	100	80	64								
4	4.12	100	100	100								
	4.95	100	93	93								
5	5.72	100	98	87								
6	6.80	100	92	72								
7	8.08	100	91	91								
8	9.60	100	81	81								
9												

REMARKS

Hole cased from 0.00-1.50m

WATER STRIKE DETAILS

Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments
4.80	1.50	N/S			Seepage

GROUNDWATER DETAILS

Date	Hole Depth	Casing Depth	Depth to Water	Comments

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type
20-07-24	11.70	1.50	11.70	50mm SP

GEOTECHNICAL CORE LOG RECORD

REPORT NUMBER 255517

CONTRACT Lisheen Mine , Co.Tipperary

DRILLHOLE NO RC08
SHEET Sheet 2 of 2

CO-ORDINATES 621,334.77 E
666,486.83 N
GROUND LEVEL (mOD) 126.53

RIG TYPE BT-440
FLUSH Air/Mist
INCLINATION (deg) -90
CORE DIAMETER (mm) 78

DATE DRILLED 19/07/2024
DATE LOGGED 20/07/2024

CLIENT
ENGINEER DOBA

DRILLED BY IGSL - JK
LOGGED BY D. O' Shea

Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Fracture Spacing Log (mm) 0 250 500	Non-intact Zone	Legend	Description	Depth (m)	Elevation	Standpipe Details	SPT (N Value)
10		100	95	95	709.999999999999							
11	11.05	100	91	91								
	11.70							End of Borehole at 11.70 m	11.70	114.83		
12												
13												
14												
15												
16												
17												
18												
19												

REMARKS
Hole cased from 0.00-1.50m

WATER STRIKE DETAILS

Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments
4.80	1.50	N/S			Seepage

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type
20-07-24	11.70	1.50	11.70	50mm SP

GROUNDWATER DETAILS

Date	Hole Depth	Casing Depth	Depth to Water	Comments
20-07-24	11.70	1.50	5.70	Water levels recorded 5 mins after end of drilling

IGSL RC FI 10M 25517.GPJ IGSL.GDT 25/9/24

RC01 - Box 1 of 2 – 7.50-10.50m

RC01 - Box 2 of 2 – 10.50-12.50m

RC02 - Box 1 of 3 – 2.80-5.80m

RC02 - Box 2 of 3 – 5.80-8.80m

RC02 - Box 3 of 3 – 8.80-10.20m

RC03 - Box 1 of 2 – 3.00-8.50m

RC03 - Box 2 of 2 – 8.50-10.50m

RC04 - Box 1 of 3 – 3.00-6.00m

RC04 - Box 2 of 3 – 6.00-9.00m

RC04 - Box 3 of 3 – 9.00-10.15m

RC05 - Box 1 of 4 – 2.60-5.15m

RC05 - Box 2 of 4 – 5.15-7.75m

RC05 - Box 3 of 4 – 7.75-10.25m

RC05 - Box 4 of 4 – 10.25-12.50m

RC06 - Box 1 of 5 – 4.00-9.83m

RC06 - Box 2 of 5 – 9.83-12.65m

RC06 - Box 3 of 5 – 12.65-15.38m

RC06 - Box 4 of 5 – 15.38-18.00m

RC06 - Box 5 of 5 – 18.00-18.55m

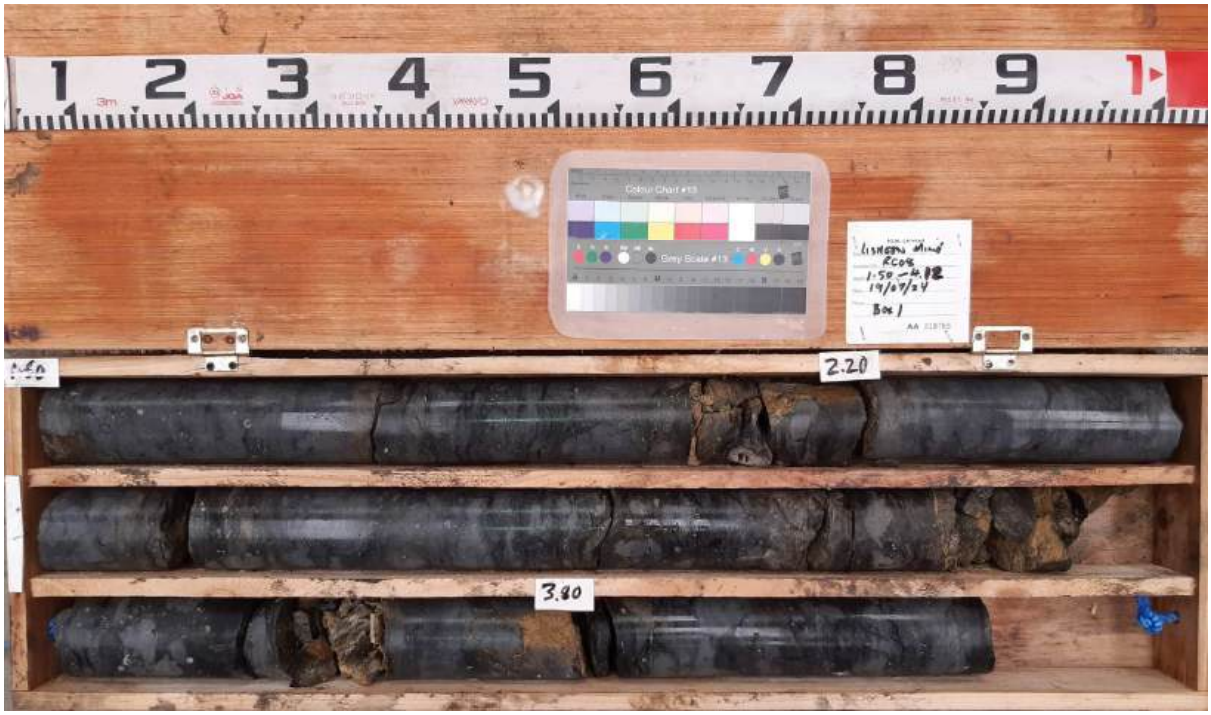
RC07 - Box 1 of 4 – 5.00-7.70m

RC07 - Box 2 of 4 – 7.70-10.30m

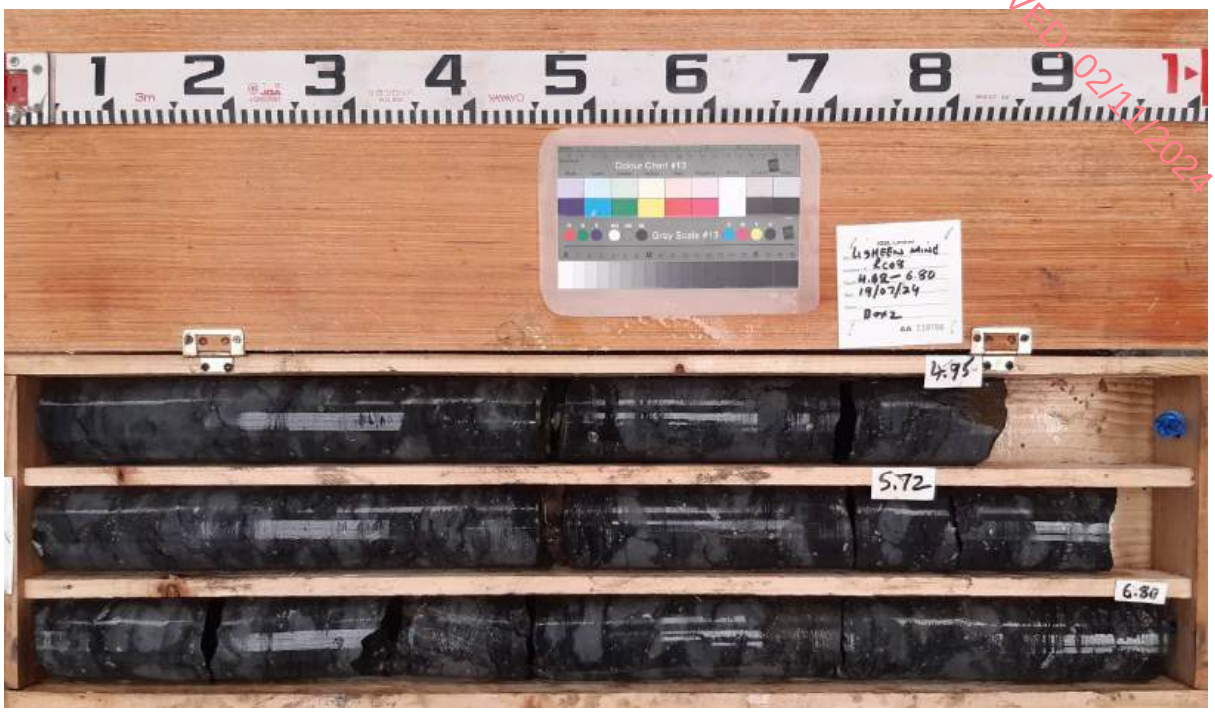
RC07 - Box 3 of 4 – 10.30-12.95m

RC07 - Box 4 of 4 – 12.95-15.10m

RC08 - Box 1 of 4 – 1.50-4.12m



RC08 - Box 2 of 4 – 4.12-6.80m



RC08 - Box 3 of 4 – 6.80-9.60m

RC08 - Box 4 of 4 – 9.60-11.70m

Appendix 4

Plate Load Test Records

PLATE TEST REPORT SHEET (F3.1)

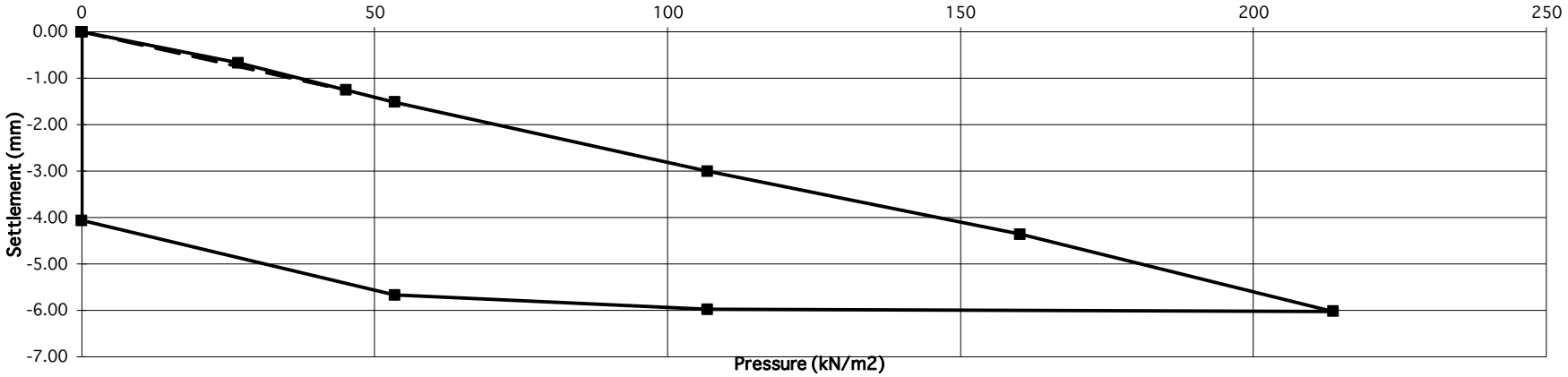
Applied Pressure/Settlement Curve

Reference No.	R159079
Contract	Lisheen Mine
Test No.	CBR01 Load
Location	TP01
Depth	0.5m bgl
Client	DOBA
Plate Diameter:	450 mm
Test Method	BS 1377: Part 9: 1990 Test4 - Incremental Loading Test
Technician	I.Reder
Authorised by	
Date	19/07/2024

Description of soil under test
(natural soil, placed fill, sub-base)
Redish brown, slightly sandy gravelly CLAY with some cobbl

Easting (m)
Northing (m)
Ground Level (mOD)

Sample Ref No. N/A
Depth 0.00 m bgl



Gradient at 1.25 mm settlement intersection = 36
Modulus of subgrade reaction = 23 MPa/m
Correction factor applied = 0.64 as per HD 25-26/10

Equivalent CBR value in accordance with NRA HD25-26/10 2.2 %

PLATE TEST REPORT SHEET (F3.1)

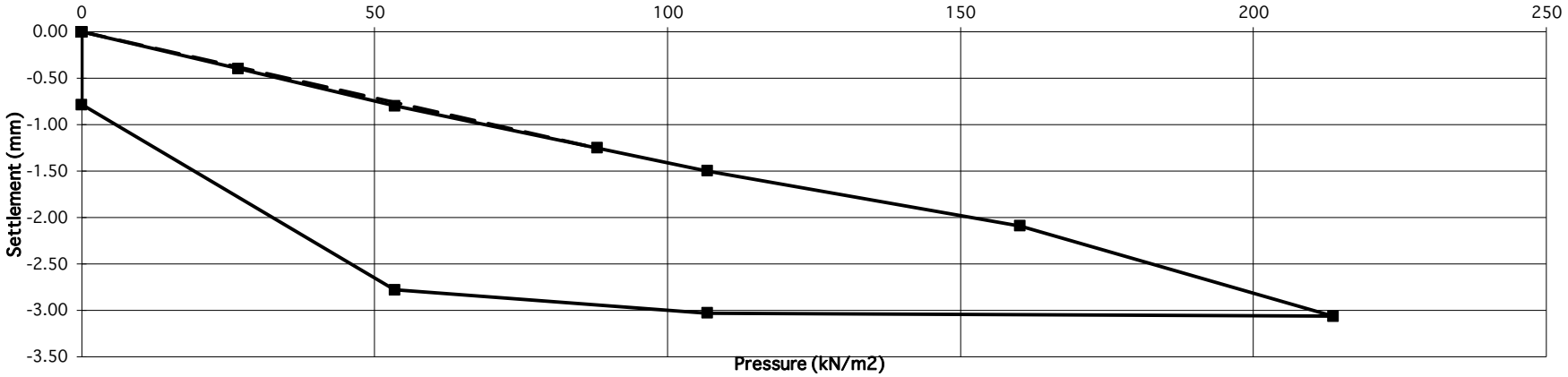
Applied Pressure/Settlement Curve

Reference No.	R159079
Contract	Lisheen Mine
Test No.	CBR01 ReLoad
Location	TP01
Depth	0.5m bgl
Client	DOBA
Plate Diameter:	450 mm
Test Method	BS 1377: Part 9: 1990 Test4 - Incremental Loading Test
Technician	I.Reder
Authorised by	
Date	19/07/2024

Description of soil under test
(natural soil, placed fill, sub-base)
Redish brown, slightly sandy gravelly CLAY with some cobbl

Easting (m)
Northing (m)
Ground Level (mOD)

Sample Ref No. N/A
Depth 0.00 m bgl



Gradient at 1.25 mm settlement intersection = 70
Modulus of subgrade reaction = 45 MPa/m
Correction factor applied = 0.64 as per HD 25-26/10

Equivalent CBR value in accordance with NRA HD25-26/10 7.1 %

PLATE TEST REPORT SHEET (F3.1)

Applied Pressure/Settlement Curve

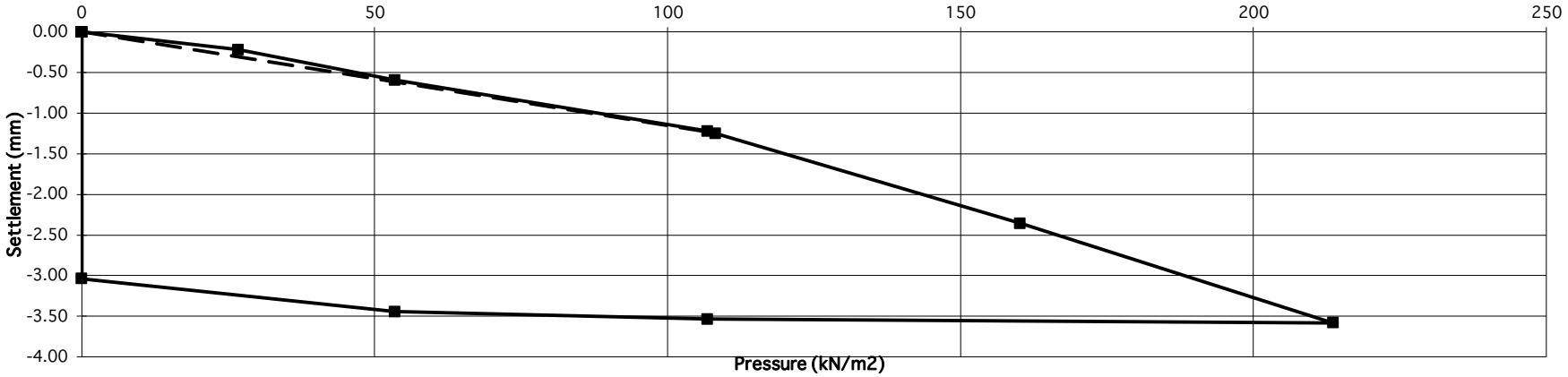
Reference No.	R159080
Contract	Lisheen Mine
Test No.	CBR02 Load
Location	TP02
Depth	0.5m bgl
Client	DOBA
Plate Diameter:	450 mm
Test Method	BS 1377: Part 9: 1990 Test4 - Incremental Loading Test
Technician	I.Reder
Authorised by	
Date	19/07/2024

Description of soil under test
(natural soil, placed fill, sub-base)

Light brown silty very gravelly SAND with many cobbles

Easting (m)
Northing (m)
Ground Level (mOD)

Sample Ref No. N/A
Depth 0.00 m bgl



Gradient at 1.25 mm settlement intersection = 87
Modulus of subgrade reaction = 56 MPa/m
Correction factor applied = 0.64 as per HD 25-26/10

Equivalent CBR value in accordance with NRA HD25-26/10 10.2 %

PLATE TEST REPORT SHEET (F3.1)

Applied Pressure/Settlement Curve

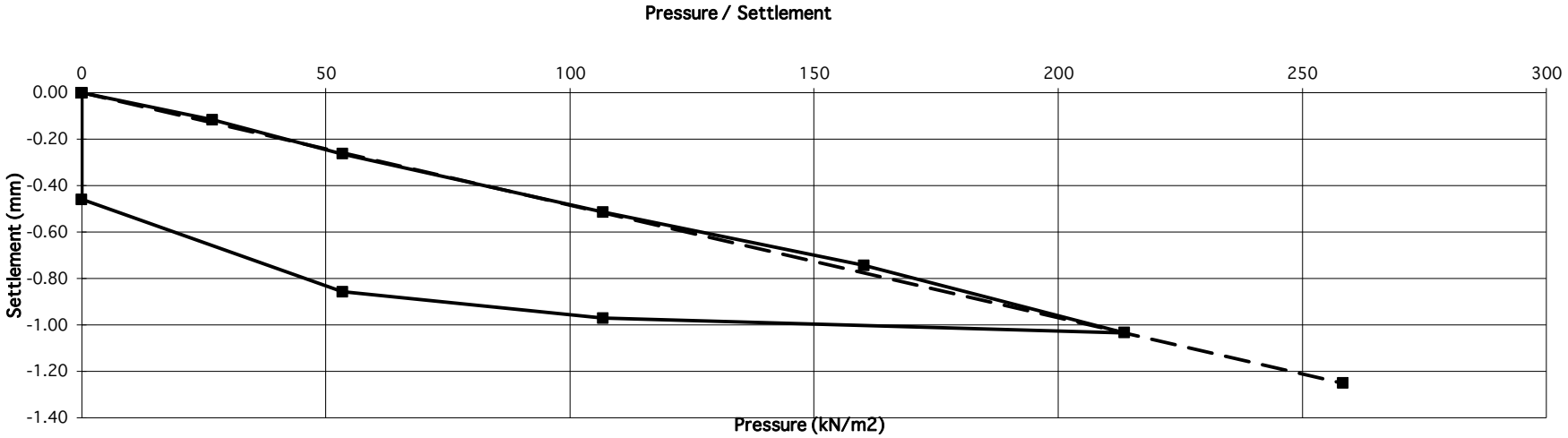
Reference No.	R159080
Contract	Lisheen Mine
Test No.	CBR02 ReLoad
Location	TP02
Depth	0.5m bgl
Client	DOBA
Plate Diameter:	450 mm
Test Method	BS 1377: Part 9: 1990 Test4 - Incremental Loading Test
Technician	I.Reder
Authorised by	
Date	19/07/2024

Description of soil under test
(natural soil, placed fill, sub-base)

Light brown silty very gravelly SAND with many cobbles

Easting (m)
Northing (m)
Ground Level (mOD)

Sample Ref No. N/A
Depth 0.00 m bgl



Gradient at 1.25 mm settlement intersection = 207
Modulus of subgrade reaction = 133 MPa/m
Correction factor applied = 0.64 as per HD 25-26/10

Equivalent CBR value in accordance with NRA HD25-26/10 46.1 %

PLATE TEST REPORT SHEET (F3.1)

Applied Pressure/Settlement Curve

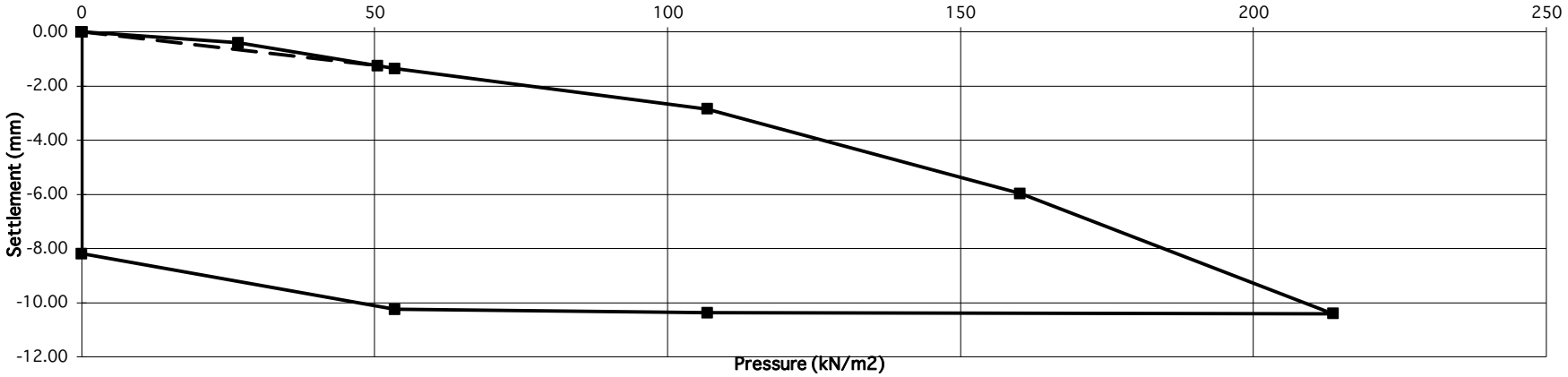
Reference No.	R159081
Contract	Lisheen Mine
Test No.	CBR03 Load
Location	SA03
Depth	0.5m bgl
Client	DOBA
Plate Diameter:	450 mm
Test Method	BS 1377: Part 9: 1990 Test4 - Incremental Loading Test
Technician	I.Reder
Authorised by	
Date	19/07/2024

Description of soil under test
(natural soil, placed fill, sub-base)

Brown sandy gravelly CLAY with some cobbles

Easting (m)
Northing (m)
Ground Level (mOD)

Sample Ref No. N/A
Depth 0.00 m bgl



Gradient at 1.25 mm settlement intersection = 40
Modulus of subgrade reaction = 26 MPa/m
Correction factor applied = 0.64 as per HD 25-26/10

Equivalent CBR value in accordance with NRA HD25-26/10 2.7 %

PLATE TEST REPORT SHEET (F3.1)

Applied Pressure/Settlement Curve

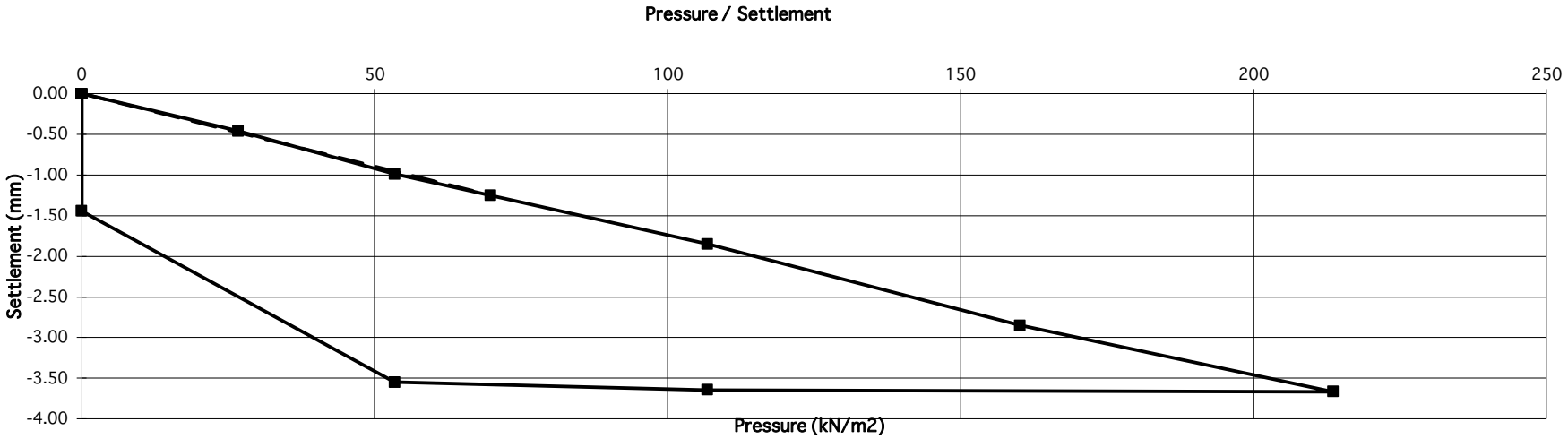
Reference No.	R159081
Contract	Lisheen Mine
Test No.	CBR03 ReLoad
Location	SA03
Depth	0.5m bgl
Client	DOBA
Plate Diameter:	450 mm
Test Method	BS 1377: Part 9: 1990 Test4 - Incremental Loading Test
Technician	I.Reder
Authorised by	
Date	19/07/2024

Description of soil under test (natural soil, placed fill, sub-base)

Brown sandy gravelly CLAY with some cobbles

Easting (m)
Northing (m)
Ground Level (mOD)

Sample Ref No. N/A
Depth 0.00 m bgl



Gradient at 1.25 mm settlement intersection = 56
Modulus of subgrade reaction = 36 MPa/m
Correction factor applied = 0.64 as per HD 25-26/10

Equivalent CBR value in accordance with NRA HD25-26/10 4.8 %

PLATE TEST REPORT SHEET (F3.1)

Applied Pressure/Settlement Curve

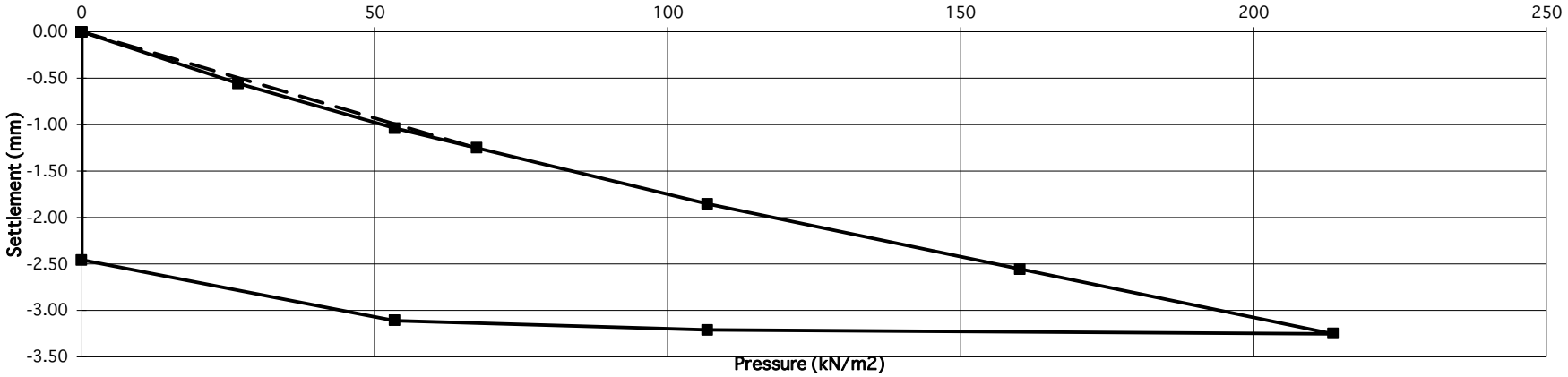
Reference No.	R159082
Contract	Lisheen Mine
Test No.	CBR04 Load
Location	TP04
Depth	0.5m bgl
Client	DOBA
Plate Diameter:	450 mm
Test Method	BS 1377: Part 9: 1990 Test4 - Incremental Loading Test
Technician	I.Reder
Authorised by	
Date	19/07/2024

Description of soil under test (natural soil, placed fill, sub-base)

Brown sandy gravelly CLAY with high cobble content

Easting (m)
Northing (m)
Ground Level (mOD)

Sample Ref No. N/A
Depth 0.00 m bgl



Gradient at 1.25 mm settlement intersection = 54
Modulus of subgrade reaction = 35 MPa/m
Correction factor applied = 0.64 as per HD 25-26/10

Equivalent CBR value in accordance with NRA HD25-26/10 4.5 %

PLATE TEST REPORT SHEET (F3.1)

Applied Pressure/Settlement Curve

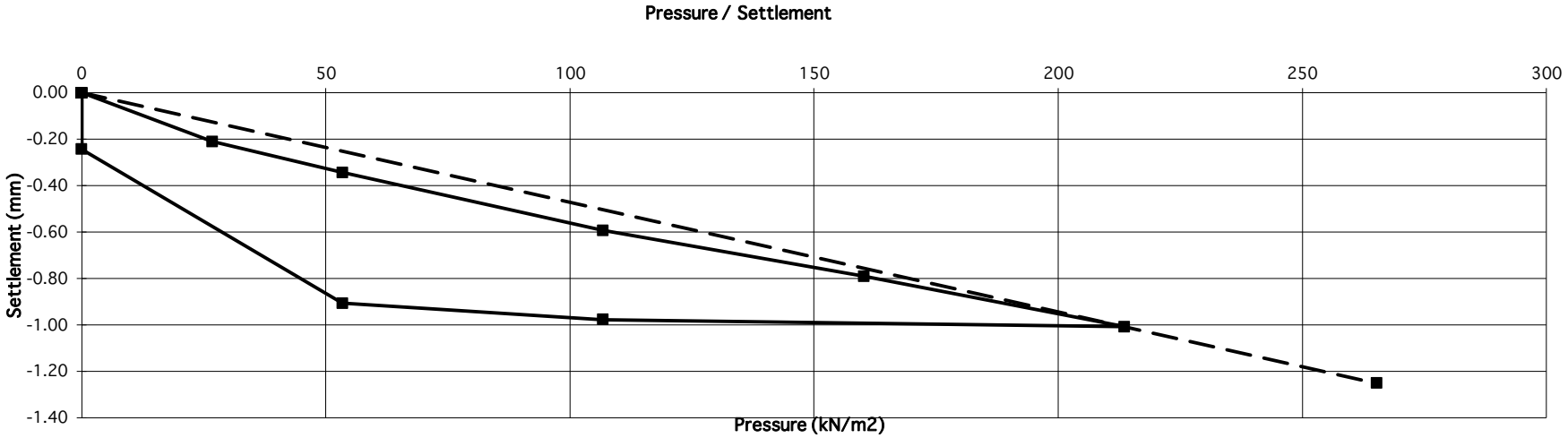
Reference No.	R159082
Contract	Lisheen Mine
Test No.	CBR04 ReLoad
Location	TP04
Depth	0.5m bgl
Client	DOBA
Plate Diameter:	450 mm
Test Method	BS 1377: Part 9: 1990 Test4 - Incremental Loading Test
Technician	I.Reder
Authorised by	
Date	19/07/2024

Description of soil under test
(natural soil, placed fill, sub-base)

Brown sandy gravelly CLAY with high cobble content

Easting (m)
Northing (m)
Ground Level (mOD)

Sample Ref No. N/A
Depth 0.00 m bgl



Gradient at 1.25 mm settlement intersection = 212
Modulus of subgrade reaction = 136 MPa/m
Correction factor applied = 0.64 as per HD 25-26/10

Equivalent CBR value in accordance with NRA HD25-26/10 48.3 %

PLATE TEST REPORT SHEET (F3.1)

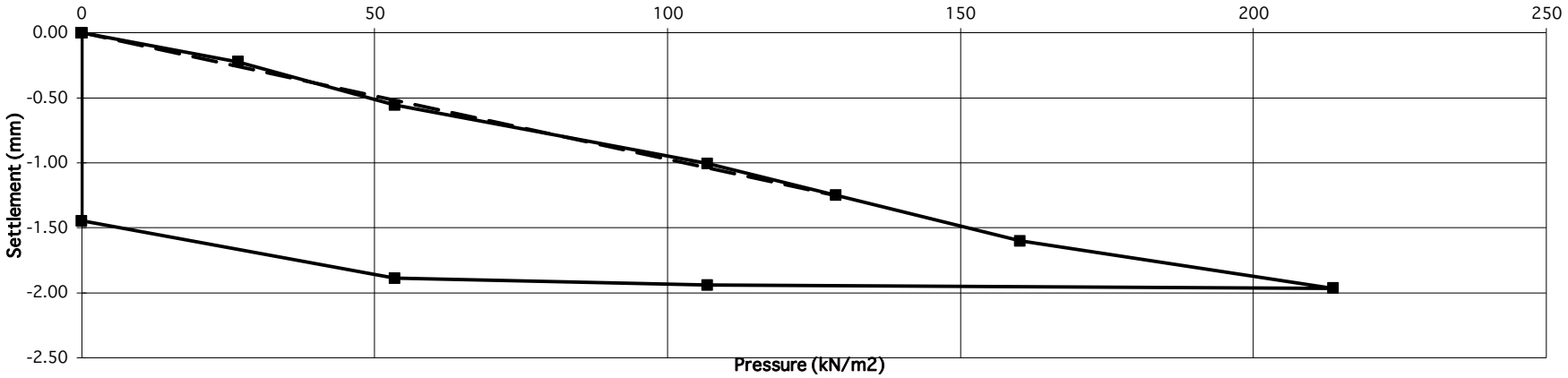
Applied Pressure/Settlement Curve

Reference No.	R159083
Contract	Lisheen Mine
Test No.	CBR05 Load
Location	SA05
Depth	0.5m bgl
Client	DOBA
Plate Diameter:	450 mm
Test Method	BS 1377: Part 9: 1990 Test4 - Incremental Loading Test
Technician	I.Reder
Authorised by	
Date	19/07/2024

Description of soil under test
(natural soil, placed fill, sub-base)
Brown/grey mottled sandy gravelly CLAY with many cobble

Easting (m)
Northing (m)
Ground Level (mOD)

Sample Ref No. N/A
Depth 0.00 m bgl



Gradient at 1.25 mm settlement intersection = 103
Modulus of subgrade reaction = 66 MPa/m
Correction factor applied = 0.64 as per HD 25-26/10

Equivalent CBR value in accordance with NRA HD25-26/10 13.8 %

PLATE TEST REPORT SHEET (F3.1)

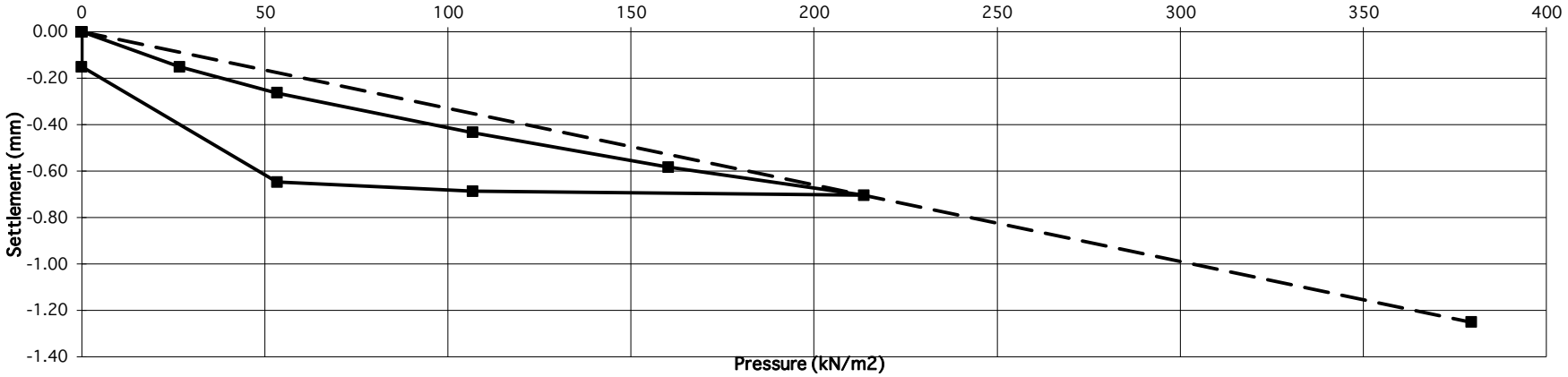
Applied Pressure/Settlement Curve

Reference No.	R159083
Contract	Lisheen Mine
Test No.	CBR05 ReLoad
Location	SA05
Depth	0.5m bgl
Client	DOBA
Plate Diameter:	450 mm
Test Method	BS 1377: Part 9: 1990 Test4 - Incremental Loading Test
Technician	I.Reder
Authorised by	
Date	19/07/2024

Description of soil under test
(natural soil, placed fill, sub-base)
Brown/grey mottled sandy gravelly CLAY with many cobble

Easting (m)
Northing (m)
Ground Level (mOD)

Sample Ref No. N/A
Depth 0.00 m bgl



Gradient at 1.25 mm settlement intersection = 304
Modulus of subgrade reaction = 195 MPa/m
Correction factor applied = 0.64 as per HD 25-26/10

Equivalent CBR value in accordance with NRA HD25-26/10 89.9 %

Appendix 5

Soakaway Test Records

Soakaway Design f -value from field tests

IGSL

Contract: Lisheen Mine
Test No. SA01
Engineer DOBA
Date: 18/07/2024

Contract No. **25517**

Summary of ground conditions

from	to	Description	Ground water
0.00	0.30	TOPSOIL	
0.10	0.80	Firm to stiff, redish brown, slightly sandy gravelly CLAY with medium cobble content	
0.80	1.80	Dense, brown, very clayey very gravelly SAND with high cobble content (possible very sandy very gravelly clay)	DRY

Notes: For all strata and sampling details see TP01 log

Field Data

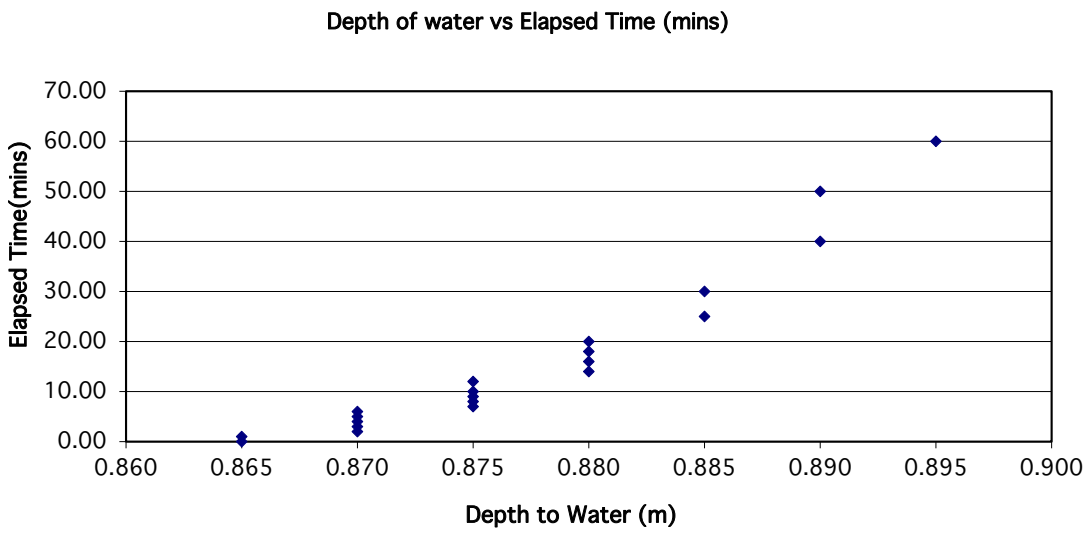
Depth to Water (m)	Elapsed Time (min)
0.865	0.00
0.865	1.00
0.870	2.00
0.870	3.00
0.870	4.00
0.870	5.00
0.870	6.00
0.875	7.00
0.875	8.00
0.875	9.00
0.875	10.00
0.875	12.00
0.880	14.00
0.880	16.00
0.880	18.00
0.880	20.00
0.885	25.00
0.885	30.00
0.890	40.00
0.890	50.00
0.895	60.00

Field Test

Depth of Pit (D)	1.80	m
Width of Pit (B)	0.50	m
Length of Pit (L)	2.00	m
Initial depth to Water =	0.865	m
Final depth to water =	0.895	m
Elapsed time (mins)=	60.00	
Top of permeable soil		m
Base of permeable soil		m
Base area=	1	m2
*Av. side area of permeable stratum over test perio	4.6	m2
Total Exposed area =	5.6	m2

Infiltration rate (f) = Volume of water used/unit exposed area / unit time

f= 8.9E-05 m/min or 1.4881E-06 m/sec



Soakaway Design f -value from field tests IGSL

Contract: Lisheen Mine Contract No. **25517**
Test No. SA02
Engineer DOBA
Date: 18/07/2024

Summary of ground conditions

from	to	Description	Ground water
0.00	0.50	MADE GROUND (brown silty sandy gravel, cobbles, organic pieces)	
0.50	1.50	Dense, yellowish light brown, silty/clayey very gravelly SAND (possible very sand	
		very gravelly silty CLAY)	DRY

Notes: For all strata and sampling details see TP02 log

Field Data

Depth to Water (m)	Elapsed Time (min)
0.675	0.00
0.675	1.00
0.675	2.00
0.675	3.00
0.675	4.00
0.675	5.00
0.675	6.00
0.675	7.00
0.680	8.00
0.680	9.00
0.680	10.00
0.680	12.00
0.680	14.00
0.680	16.00
0.680	18.00
0.680	20.00
0.680	25.00
0.680	30.00
0.680	40.00
0.680	50.00
0.680	60.00

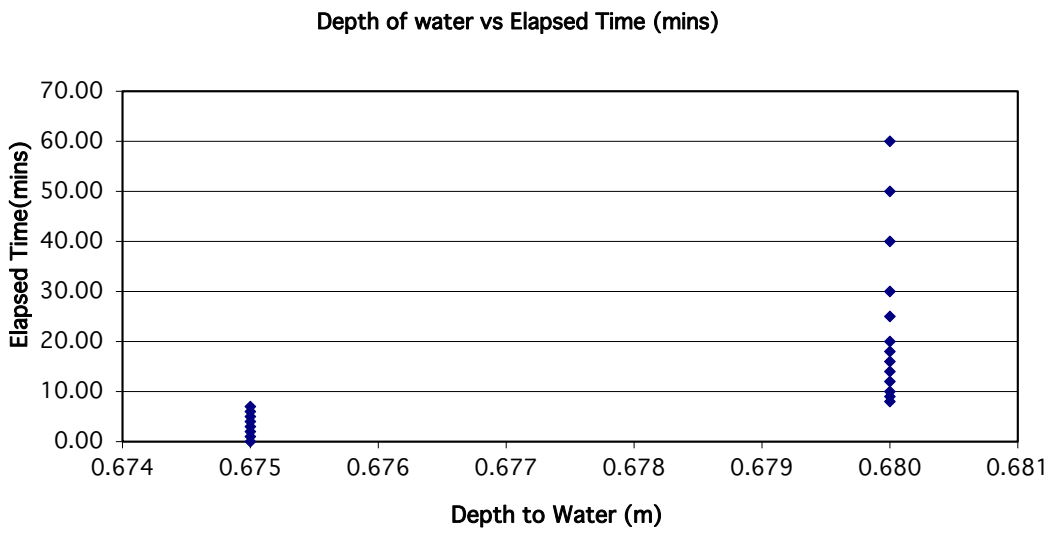
Field Test

Depth of Pit (D)	1.50	m
Width of Pit (B)	0.50	m
Length of Pit (L)	1.50	m
Initial depth to Water =	0.675	m
Final depth to water =	0.680	m
Elapsed time (mins)=	60.00	
Top of permeable soil		m
Base of permeable soil		m
Base area=	0.75	m2
*Av. side area of permeable stratum over test perio	3.29	m2
Total Exposed area =	4.04	m2

Infiltration rate (f) = Volume of water used/unit exposed area / unit time

f= 0 m/min or 0 m/sec

Negligible fall in water recorded during test



Soakaway Design f -value from field tests IGSL

Contract: Lisheen Mine
Test No. SA03
Engineer DOBA
Date: 18/07/2024

Contract No. **25517**

Summary of ground conditions

from	to	Description	Ground water
0.00	0.35	TOPSOIL	
0.35	1.40	Firm to stiff, brown, sandy gravelly CLAY with medium cobble content	
1.40	1.90	Firm, yellowish light brown to brown, very sandy very gravelly slightly silty CLAY	DRY
		with high cobble content	

Notes: For all strata and sampling details see TP-SA03 log

Field Data

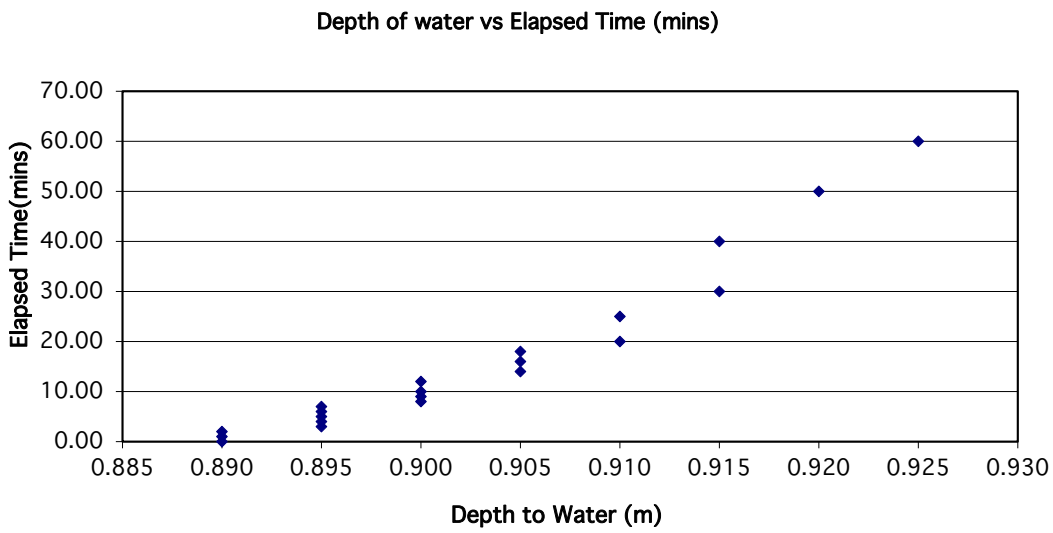
Depth to Water (m)	Elapsed Time (min)
0.890	0.00
0.890	1.00
0.890	2.00
0.895	3.00
0.895	4.00
0.895	5.00
0.895	6.00
0.895	7.00
0.900	8.00
0.900	9.00
0.900	10.00
0.900	12.00
0.905	14.00
0.905	16.00
0.905	18.00
0.910	20.00
0.910	25.00
0.915	30.00
0.915	40.00
0.920	50.00
0.925	60.00

Field Test

Depth of Pit (D)	1.90	m
Width of Pit (B)	0.50	m
Length of Pit (L)	2.00	m
Initial depth to Water =	0.890	m
Final depth to water =	0.925	m
Elapsed time (mins)=	60.00	
Top of permeable soil		m
Base of permeable soil		m
Base area=	1	m2
*Av. side area of permeable stratum over test perio	4.9625	m2
Total Exposed area =	5.9625	m2

Infiltration rate (f) = Volume of water used/unit exposed area / unit time

f= 9.8E-05 m/min or 1.63056E-06 m/sec



Soakaway Design f -value from field tests

IGSL

Contract: Lisheen Mine
Test No. SA04
Engineer DOBA
Date: 18/07/2024

Contract No. **25517**

Summary of ground conditions

from	to	Description	Ground water
0.00	0.30	TOPSOIL	
0.30	0.90	Stiff, brown, sandy gravelly CLAY with high cobbles content	
0.90	1.50	Firm to stiff, brown, sandy gravelly CLAY with medium cobble content	DRY

Notes: For all strata and sampling details see TP04 log

Field Data

Depth to Water (m)	Elapsed Time (min)
0.700	0.00
0.700	1.00
0.700	2.00
0.705	3.00
0.705	4.00
0.705	5.00
0.705	6.00
0.705	7.00
0.705	8.00
0.705	9.00
0.705	10.00
0.705	12.00
0.705	14.00
0.705	16.00
0.705	18.00
0.705	20.00
0.705	25.00
0.705	30.00
0.705	40.00
0.705	50.00
0.705	60.00

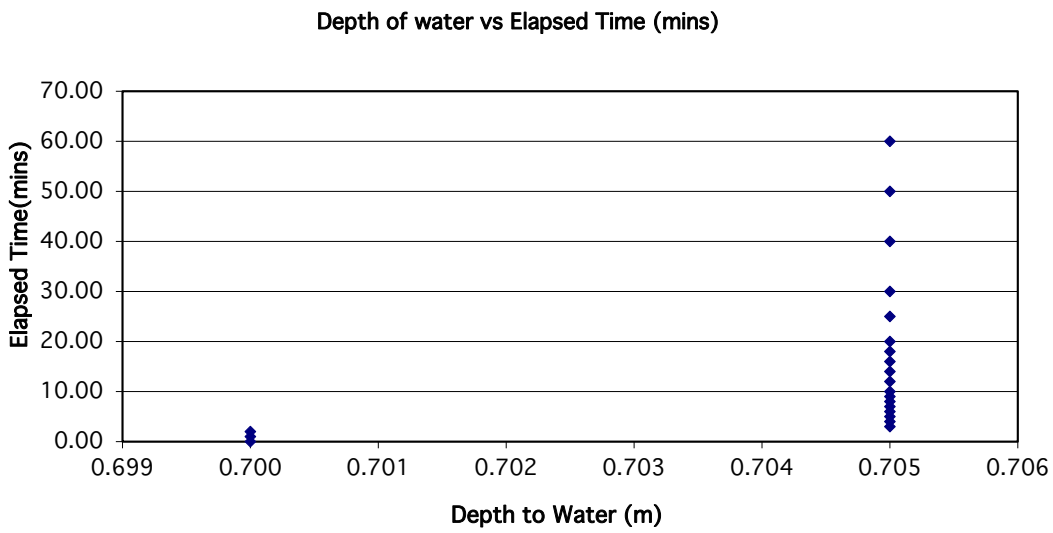
Field Test

Depth of Pit (D)	1.50	m
Width of Pit (B)	0.70	m
Length of Pit (L)	1.70	m
Initial depth to Water =	0.70	m
Final depth to water =	0.705	m
Elapsed time (mins)=	60.00	
Top of permeable soil		m
Base of permeable soil		m
Base area=	1.19	m2
*Av. side area of permeable stratum over test perio	3.828	m2
Total Exposed area =	5.018	m2

Infiltration rate (f) = Volume of water used/unit exposed area / unit time

f= 0 m/min or 0 m/sec

Negligible fall in water recorded during test



Soakaway Design f -value from field tests IGSL

Contract: Lisheen Mine
Test No. SA05 (cycle 1)
Engineer DOBA
Date: 18/07/2024

Contract No. **25517**

Summary of ground conditions

from	to	Description	Ground water
0.00	0.30	TOPSOIL	
0.30	0.70	Firm, brown/grey mottled, sandy gravelly CLAY with medium cobble content	
0.70	0.90	Firm, brown, sandy gravelly CLAY with high cobble content	DRY
0.90	1.50	Dense, brownish grey, sandy fine to coarse GRAVEL with high cobble content	
1.50	1.80	Firm, brown, sandy gravelly CLAY	

Notes: For all strata and sampling details see TP-SA05 log

Field Data

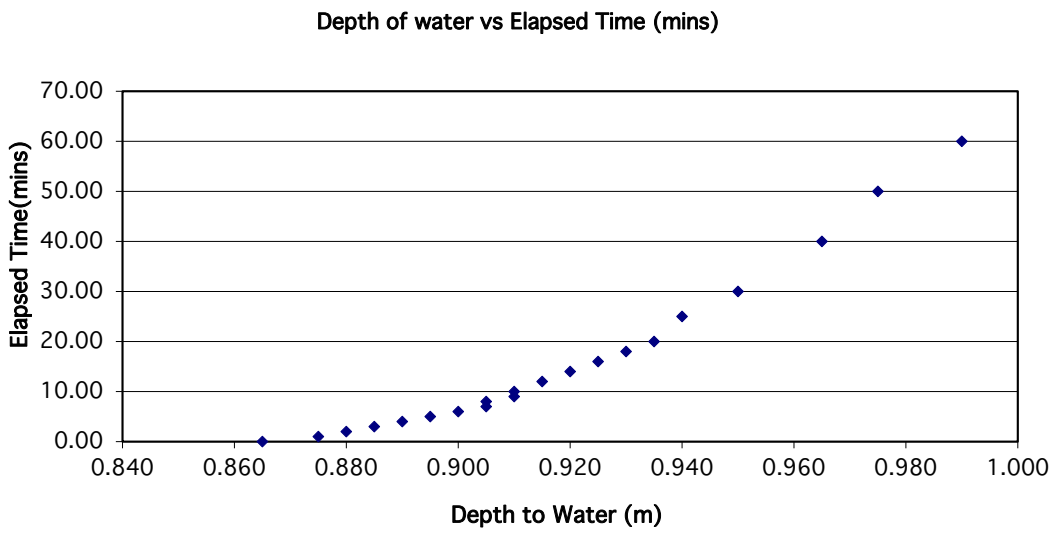
Depth to Water (m)	Elapsed Time (min)
0.865	0.00
0.875	1.00
0.880	2.00
0.885	3.00
0.890	4.00
0.895	5.00
0.900	6.00
0.905	7.00
0.905	8.00
0.910	9.00
0.910	10.00
0.915	12.00
0.920	14.00
0.925	16.00
0.930	18.00
0.935	20.00
0.940	25.00
0.950	30.00
0.965	40.00
0.975	50.00
0.990	60.00

Field Test

Depth of Pit (D)	1.80	m
Width of Pit (B)	0.50	m
Length of Pit (L)	2.00	m
Initial depth to Water =	0.865	m
Final depth to water =	0.990	m
Elapsed time (mins)=	60.00	
Top of permeable soil		m
Base of permeable soil		m
Base area=	1	m2
*Av. side area of permeable stratum over test perio	4.3625	m2
Total Exposed area =	5.3625	m2

Infiltration rate (f) = Volume of water used/unit exposed area / unit time

f= 0.00039 m/min or 6.47501E-06 m/sec



Soakaway Design f -value from field tests IGSL

Contract: Lisheen Mine
Test No. SA05 (cycle 2)
Engineer DOBA
Date: 18/07/2024

Contract No. **25517**

Summary of ground conditions

from	to	Description	Ground water
0.00	0.30	TOPSOIL	
0.30	0.70	Firm, brown/grey mottled, sandy gravelly CLAY with medium cobble content	
0.70	0.90	Firm, brown, sandy gravelly CLAY with high cobble content	DRY
0.90	1.50	Dense, brownish grey, sandy fine to coarse GRAVEL with high cobble content	
1.50	1.80	Firm, brown, sandy gravelly CLAY	

Notes: For all strata and sampling details see TP-SA05 log

Field Data

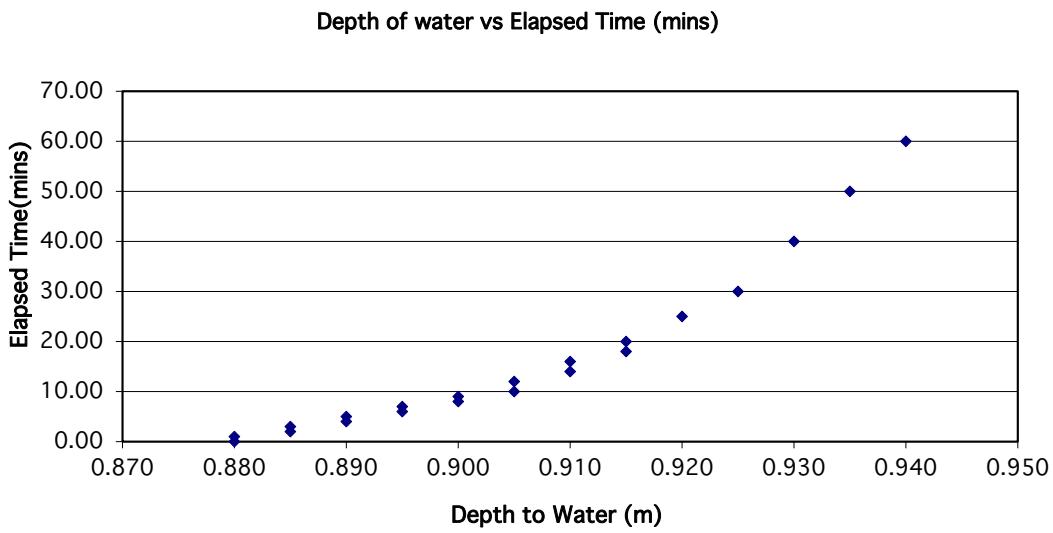
Depth to Water (m)	Elapsed Time (min)
0.880	0.00
0.880	1.00
0.885	2.00
0.885	3.00
0.890	4.00
0.890	5.00
0.895	6.00
0.895	7.00
0.900	8.00
0.900	9.00
0.905	10.00
0.905	12.00
0.910	14.00
0.910	16.00
0.915	18.00
0.915	20.00
0.920	25.00
0.925	30.00
0.930	40.00
0.935	50.00
0.940	60.00

Field Test

Depth of Pit (D)	1.80	m
Width of Pit (B)	0.50	m
Length of Pit (L)	2.00	m
Initial depth to Water =	0.880	m
Final depth to water =	0.940	m
Elapsed time (mins)=	60.00	
Top of permeable soil		m
Base of permeable soil		m
Base area=	1	m2
*Av. side area of permeable stratum over test perio	4.45	m2
Total Exposed area =	5.45	m2

Infiltration rate (f) = Volume of water used/unit exposed area / unit time

f= 0.00018 m/min or 3.0581E-06 m/sec



Appendix 6

Groundwater Monitoring & Data Logger Records

Project No. 25517	GROUNDWATER MONITORING DATA SHEET								

Project: Bioenergy Project, Lisheen, Co.Tipperary
Engineer: DOBA

Exploratory Hole No.	Hole Depth (m bgl)	Response Zone Top (m bgl)	Response Zone Base (m bgl)	Groundwater level (m bgl) **16.10.24**	Groundwater level (m bgl) **23.10.24**	Groundwater level (m bgl) -	Groundwater level (m bgl) -	Groundwater level (m bgl) -	Groundwater level (m bgl) -
RC 02	10.20	1.00	10.20	6.22	6.20				
RC 03	8.50	2.00	10.50	3.17	3.10				
RC 05	12.50	2.60	12.50	3.76	3.70				
RC 06	18.55	8.00	18.55	3.38	3.28				
RC 08	11.70	1.50	11.70	1.37	1.71				

Remarks: Water levels measured using electric dipmeter

Project.	**Bioenergy Project, Lisheen, Co.Tipperary**
Project No.	**25517**
Engineer .	**DOBA**
Borehole No.	**RC02**
Serial No.	**430436**
String Length	**10.1**

	DATE	BAROMETRIC PRESSURE (m)	LOGGER READINGS (m)	TEMPERATURE (c)	WATER LEVEL (m bgl)
1	**16/10/2024 13:00**	10.003649	**13.827**	11.032	**6.227**
2	**16/10/2024 14:00**	10.003649	**13.833**	11.032	**6.221**
3	**16/10/2024 15:00**	10.003649	**13.834**	10.980	**6.220**
4	**16/10/2024 16:00**	10.003649	**13.824**	10.980	**6.230**
5	**16/10/2024 17:00**	10.003649	**13.837**	10.928	**6.217**
6	**16/10/2024 18:00**	10.003649	**13.836**	10.928	**6.218**
7	**16/10/2024 19:00**	10.013847	**13.839**	10.928	**6.225**
8	**16/10/2024 20:00**	10.013847	**13.839**	10.928	**6.225**
9	**16/10/2024 21:00**	10.013847	**13.849**	10.928	**6.215**
10	**16/10/2024 22:00**	10.024044	**13.851**	10.928	**6.223**
11	**16/10/2024 23:00**	10.024044	**13.846**	10.928	**6.228**
12	**17/10/2024 00:00**	10.024044	**13.864**	10.928	**6.210**
13	**17/10/2024 01:00**	10.024044	**13.859**	10.928	**6.215**
14	**17/10/2024 02:00**	10.034242	**13.859**	10.928	**6.225**
15	**17/10/2024 03:00**	10.024044	**13.863**	10.928	**6.211**
16	**17/10/2024 04:00**	10.024044	**13.853**	10.928	**6.221**
17	**17/10/2024 05:00**	10.034242	**13.856**	10.928	**6.228**
18	**17/10/2024 06:00**	10.034242	**13.863**	10.928	**6.221**
19	**17/10/2024 07:00**	10.034242	**13.872**	10.928	**6.212**
20	**17/10/2024 08:00**	10.044439	**13.877**	10.928	**6.217**
21	**17/10/2024 09:00**	10.054636	**13.891**	10.928	**6.214**
22	**17/10/2024 10:00**	10.064834	**13.891**	10.928	**6.224**
23	**17/10/2024 11:00**	10.075031	**13.899**	10.928	**6.226**
24	**17/10/2024 12:00**	10.085229	**13.914**	10.980	**6.221**
25	**17/10/2024 13:00**	10.095426	**13.927**	10.928	**6.218**
26	**17/10/2024 14:00**	10.105623	**13.922**	10.980	**6.234**
27	**17/10/2024 15:00**	10.115821	**13.936**	10.928	**6.230**
28	**17/10/2024 16:00**	10.126018	**13.949**	10.980	**6.227**
29	**17/10/2024 17:00**	10.136216	**13.957**	10.928	**6.229**
30	**17/10/2024 18:00**	10.146413	**13.965**	10.928	**6.231**
31	**17/10/2024 19:00**	10.156610	**13.971**	10.928	**6.236**
32	**17/10/2024 20:00**	10.156610	**13.969**	10.928	**6.238**
33	**17/10/2024 21:00**	10.156610	**13.981**	10.876	**6.226**
34	**17/10/2024 22:00**	10.156610	**13.986**	10.980	**6.221**

Project.	**Bioenergy Project, Lisheen, Co.Tipperary**
Project No.	**25517**
Engineer .	**DOBA**
Borehole No.	**RC02**
Serial No.	**430436**
String Length	**10.1**

	DATE	BAROMETRIC PRESSURE (m)	LOGGER READINGS (m)	TEMPERATURE (c)	WATER LEVEL (m bgl)
35	**17/10/2024 23:00**	10.166808	**13.988**	10.980	**6.229**
36	**18/10/2024 00:00**	10.146413	**13.981**	10.928	**6.215**
37	**18/10/2024 01:00**	10.156610	**13.983**	10.980	**6.224**
38	**18/10/2024 02:00**	10.156610	**13.972**	10.980	**6.235**
39	**18/10/2024 03:00**	10.136216	**13.962**	10.980	**6.224**
40	**18/10/2024 04:00**	10.136216	**13.960**	10.928	**6.226**
41	**18/10/2024 05:00**	10.126018	**13.960**	10.928	**6.216**
42	**18/10/2024 06:00**	10.126018	**13.947**	10.928	**6.229**
43	**18/10/2024 07:00**	10.105623	**13.945**	10.928	**6.211**
44	**18/10/2024 08:00**	10.105623	**13.928**	10.980	**6.228**
45	**18/10/2024 09:00**	10.095426	**13.930**	10.876	**6.215**
46	**18/10/2024 10:00**	10.085229	**13.922**	10.980	**6.213**
47	**18/10/2024 11:00**	10.075031	**13.914**	10.928	**6.211**
48	**18/10/2024 12:00**	10.054636	**13.899**	10.928	**6.206**
49	**18/10/2024 13:00**	10.054636	**13.897**	10.928	**6.208**
50	**18/10/2024 14:00**	10.044439	**13.885**	10.876	**6.209**
51	**18/10/2024 15:00**	10.044439	**13.886**	10.928	**6.208**
52	**18/10/2024 16:00**	10.044439	**13.888**	10.876	**6.206**
53	**18/10/2024 17:00**	10.044439	**13.896**	11.032	**6.198**
54	**18/10/2024 18:00**	10.054636	**13.898**	10.876	**6.207**
55	**18/10/2024 19:00**	10.054636	**13.900**	11.032	**6.205**
56	**18/10/2024 20:00**	10.054636	**13.915**	11.032	**6.190**
57	**18/10/2024 21:00**	10.064834	**13.903**	11.032	**6.212**
58	**18/10/2024 22:00**	10.075031	**13.911**	10.980	**6.214**
59	**18/10/2024 23:00**	10.075031	**13.923**	11.032	**6.202**
60	**19/10/2024 00:00**	10.075031	**13.915**	10.824	**6.210**
61	**19/10/2024 01:00**	10.085229	**13.925**	11.032	**6.210**
62	**19/10/2024 02:00**	10.085229	**13.934**	10.824	**6.201**
63	**19/10/2024 03:00**	10.085229	**13.928**	10.824	**6.207**
64	**19/10/2024 04:00**	10.095426	**13.936**	10.928	**6.209**
65	**19/10/2024 05:00**	10.105623	**13.938**	10.928	**6.218**
66	**19/10/2024 06:00**	10.105623	**13.950**	10.980	**6.206**
67	**19/10/2024 07:00**	10.115821	**13.947**	11.032	**6.219**
68	**19/10/2024 08:00**	10.115821	**13.956**	11.032	**6.210**

Project.	**Bioenergy Project, Lisheen, Co.Tipperary**
Project No.	**25517**
Engineer .	**DOBA**
Borehole No.	**RC02**
Serial No.	**430436**
String Length	**10.1**

	DATE	BAROMETRIC PRESSURE (m)	LOGGER READINGS (m)	TEMPERATURE (c)	WATER LEVEL (m bgl)
69	**19/10/2024 09:00**	10.126018	**13.963**	10.928	**6.213**
70	**19/10/2024 10:00**	10.136216	**13.973**	11.032	**6.212**
71	**19/10/2024 11:00**	10.136216	**13.977**	10.980	**6.209**
72	**19/10/2024 12:00**	10.136216	**13.968**	11.032	**6.218**
73	**19/10/2024 13:00**	10.146413	**13.979**	10.980	**6.217**
74	**19/10/2024 14:00**	10.136216	**13.978**	10.980	**6.208**
75	**19/10/2024 15:00**	10.146413	**13.980**	11.032	**6.216**
76	**19/10/2024 16:00**	10.136216	**13.981**	10.876	**6.205**
77	**19/10/2024 17:00**	10.126018	**13.966**	11.032	**6.210**
78	**19/10/2024 18:00**	10.126018	**13.973**	11.032	**6.203**
79	**19/10/2024 19:00**	10.126018	**13.977**	10.980	**6.199**
80	**19/10/2024 20:00**	10.115821	**13.963**	10.980	**6.203**
81	**19/10/2024 21:00**	10.105623	**13.957**	10.928	**6.199**
82	**19/10/2024 22:00**	10.095426	**13.945**	10.980	**6.200**
83	**19/10/2024 23:00**	10.075031	**13.941**	10.980	**6.184**
84	**20/10/2024 00:00**	10.064834	**13.914**	10.980	**6.201**
85	**20/10/2024 01:00**	10.044439	**13.895**	10.980	**6.199**
86	**20/10/2024 02:00**	10.024044	**13.886**	10.928	**6.188**
87	**20/10/2024 03:00**	9.993452	**13.852**	10.980	**6.191**
88	**20/10/2024 04:00**	9.973057	**13.836**	10.980	**6.187**
89	**20/10/2024 05:00**	9.962860	**13.832**	10.928	**6.181**
90	**20/10/2024 06:00**	9.962860	**13.834**	10.980	**6.179**
91	**20/10/2024 07:00**	9.973057	**13.834**	10.928	**6.189**
92	**20/10/2024 08:00**	9.952662	**13.825**	10.928	**6.178**
93	**20/10/2024 09:00**	9.962860	**13.837**	10.928	**6.176**
94	**20/10/2024 10:00**	9.962860	**13.832**	10.980	**6.181**
95	**20/10/2024 11:00**	9.962860	**13.832**	10.980	**6.181**
96	**20/10/2024 12:00**	9.962860	**13.836**	10.980	**6.177**
97	**20/10/2024 13:00**	9.962860	**13.823**	10.928	**6.190**
98	**20/10/2024 14:00**	9.962860	**13.829**	10.980	**6.184**
99	**20/10/2024 15:00**	9.973057	**13.834**	10.928	**6.189**
100	**20/10/2024 16:00**	9.973057	**13.844**	10.980	**6.179**
101	**20/10/2024 17:00**	9.993452	**13.853**	10.928	**6.190**
102	**20/10/2024 18:00**	10.003649	**13.868**	10.928	**6.186**

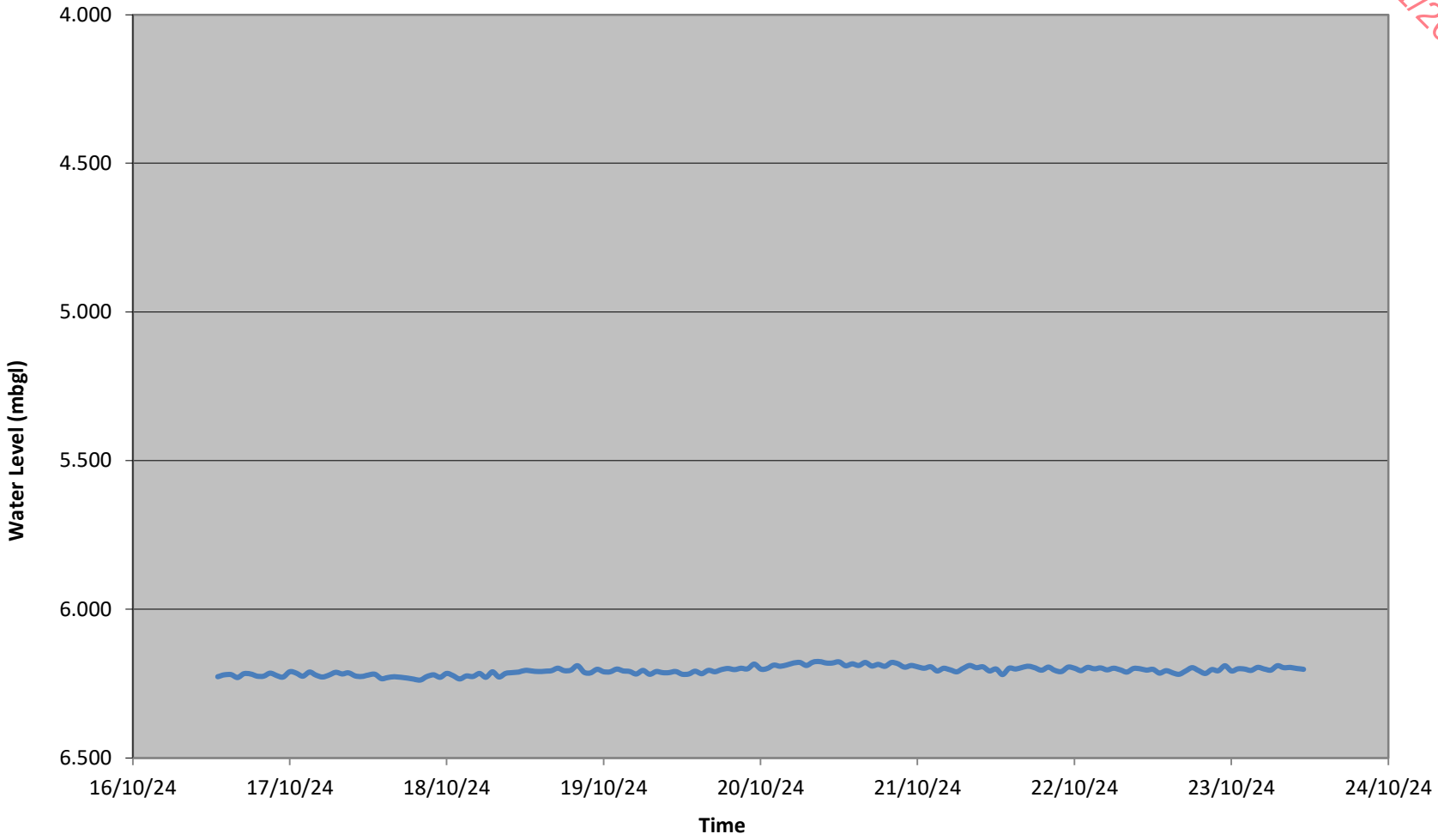
Project.	**Bioenergy Project, Lisheen, Co.Tipperary**
Project No.	**25517**
Engineer .	**DOBA**
Borehole No.	**RC02**
Serial No.	**430436**
String Length	**10.1**

	DATE	BAROMETRIC PRESSURE (m)	LOGGER READINGS (m)	TEMPERATURE (c)	WATER LEVEL (m bgl)
103	**20/10/2024 19:00**	10.024044	**13.882**	10.928	**6.192**
104	**20/10/2024 20:00**	10.034242	**13.905**	10.980	**6.179**
105	**20/10/2024 21:00**	10.044439	**13.911**	10.928	**6.183**
106	**20/10/2024 22:00**	10.075031	**13.930**	10.928	**6.195**
107	**20/10/2024 23:00**	10.095426	**13.956**	10.928	**6.189**
108	**21/10/2024 00:00**	10.105623	**13.962**	10.928	**6.194**
109	**21/10/2024 01:00**	10.126018	**13.978**	10.928	**6.198**
110	**21/10/2024 02:00**	10.136216	**13.993**	10.980	**6.193**
111	**21/10/2024 03:00**	10.146413	**13.989**	10.980	**6.207**
112	**21/10/2024 04:00**	10.156610	**14.008**	10.980	**6.199**
113	**21/10/2024 05:00**	10.166808	**14.013**	10.928	**6.204**
114	**21/10/2024 06:00**	10.177005	**14.017**	10.980	**6.210**
115	**21/10/2024 07:00**	10.177005	**14.029**	10.980	**6.198**
116	**21/10/2024 08:00**	10.177005	**14.038**	10.980	**6.189**
117	**21/10/2024 09:00**	10.187203	**14.041**	10.928	**6.196**
118	**21/10/2024 10:00**	10.197400	**14.054**	10.980	**6.193**
119	**21/10/2024 11:00**	10.207597	**14.050**	10.980	**6.208**
120	**21/10/2024 12:00**	10.207597	**14.057**	10.928	**6.201**
121	**21/10/2024 13:00**	10.217795	**14.048**	10.980	**6.220**
122	**21/10/2024 14:00**	10.207597	**14.059**	10.980	**6.199**
123	**21/10/2024 15:00**	10.207597	**14.057**	10.928	**6.201**
124	**21/10/2024 16:00**	10.207597	**14.062**	10.980	**6.196**
125	**21/10/2024 17:00**	10.207597	**14.066**	10.928	**6.192**
126	**21/10/2024 18:00**	10.217795	**14.070**	10.980	**6.198**
127	**21/10/2024 19:00**	10.217795	**14.063**	10.980	**6.205**
128	**21/10/2024 20:00**	10.217795	**14.073**	10.980	**6.195**
129	**21/10/2024 21:00**	10.227992	**14.072**	10.928	**6.206**
130	**21/10/2024 22:00**	10.227992	**14.069**	10.980	**6.209**
131	**21/10/2024 23:00**	10.227992	**14.083**	10.928	**6.195**
132	**22/10/2024 00:00**	10.227992	**14.080**	10.980	**6.198**
133	**22/10/2024 01:00**	10.238190	**14.082**	10.980	**6.206**
134	**22/10/2024 02:00**	10.238190	**14.093**	10.980	**6.195**
135	**22/10/2024 03:00**	10.248387	**14.098**	10.980	**6.200**
136	**22/10/2024 04:00**	10.248387	**14.101**	10.928	**6.197**

Project.	**Bioenergy Project, Lisheen, Co.Tipperary**
Project No.	**25517**
Engineer .	**DOBA**
Borehole No.	**RC02**
Serial No.	**430436**
String Length	**10.1**

	DATE	BAROMETRIC PRESSURE (m)	LOGGER READINGS (m)	TEMPERATURE (c)	WATER LEVEL (m bgl)
137	**22/10/2024 05:00**	10.258584	**14.105**	10.928	**6.204**
138	**22/10/2024 06:00**	10.258584	**14.110**	10.980	**6.199**
139	**22/10/2024 07:00**	10.268782	**14.115**	10.928	**6.204**
140	**22/10/2024 08:00**	10.278979	**14.118**	10.928	**6.211**
141	**22/10/2024 09:00**	10.278979	**14.130**	10.980	**6.199**
142	**22/10/2024 10:00**	10.289177	**14.139**	10.928	**6.200**
143	**22/10/2024 11:00**	10.299374	**14.145**	10.928	**6.204**
144	**22/10/2024 12:00**	10.299374	**14.147**	10.980	**6.202**
145	**22/10/2024 13:00**	10.309571	**14.145**	10.980	**6.215**
146	**22/10/2024 14:00**	10.309571	**14.153**	10.980	**6.207**
147	**22/10/2024 15:00**	10.309571	**14.146**	10.980	**6.214**
148	**22/10/2024 16:00**	10.309571	**14.141**	10.928	**6.219**
149	**22/10/2024 17:00**	10.309571	**14.152**	10.980	**6.208**
150	**22/10/2024 18:00**	10.309571	**14.163**	10.928	**6.197**
151	**22/10/2024 19:00**	10.319769	**14.163**	10.980	**6.207**
152	**22/10/2024 20:00**	10.329966	**14.164**	10.980	**6.216**
153	**22/10/2024 21:00**	10.329966	**14.177**	10.980	**6.203**
154	**22/10/2024 22:00**	10.329966	**14.173**	10.928	**6.207**
155	**22/10/2024 23:00**	10.319769	**14.180**	10.928	**6.190**
156	**23/10/2024 00:00**	10.329966	**14.172**	10.980	**6.208**
157	**23/10/2024 01:00**	10.329966	**14.180**	10.980	**6.200**
158	**23/10/2024 02:00**	10.329966	**14.179**	10.980	**6.201**
159	**23/10/2024 03:00**	10.329966	**14.174**	10.928	**6.206**
160	**23/10/2024 04:00**	10.319769	**14.174**	10.980	**6.196**
161	**23/10/2024 05:00**	10.319769	**14.169**	10.980	**6.201**
162	**23/10/2024 06:00**	10.319769	**14.165**	10.980	**6.205**
163	**23/10/2024 07:00**	10.309571	**14.170**	10.980	**6.190**
164	**23/10/2024 08:00**	10.309571	**14.163**	10.980	**6.197**
165	**23/10/2024 09:00**	10.309571	**14.164**	10.980	**6.196**
166	**23/10/2024 10:00**	10.309571	**14.160**	10.980	**6.200**
167	**23/10/2024 11:00**	10.309571	**14.158**	10.980	**6.202**

25517 - RC 02 Bioenergy Project, Lisheen, Co.Tipperary



Project.	**Bioenergy Project, Lisheen, Co.Tipperary**
Project No.	**25517**
Engineer .	**DOBA**
Borehole No.	**RC03**
Serial No.	**882598**
String Length	**8.7**

	DATE	BAROMETRIC PRESSURE (m)	LOGGER READINGS (m)	TEMPERATURE (c)	WATER LEVEL (m bgl)
1	**16/10/2024 13:00**	10.003649	**15.521**	12.246	**3.173**
2	**16/10/2024 14:00**	10.003649	**15.528**	12.246	**3.166**
3	**16/10/2024 15:00**	10.003649	**15.521**	12.246	**3.173**
4	**16/10/2024 16:00**	10.003649	**15.528**	12.246	**3.166**
5	**16/10/2024 17:00**	10.003649	**15.531**	12.246	**3.163**
6	**16/10/2024 18:00**	10.003649	**15.533**	12.193	**3.161**
7	**16/10/2024 19:00**	10.013847	**15.548**	12.193	**3.156**
8	**16/10/2024 20:00**	10.013847	**15.550**	12.193	**3.154**
9	**16/10/2024 21:00**	10.013847	**15.546**	12.246	**3.158**
10	**16/10/2024 22:00**	10.024044	**15.523**	12.193	**3.191**
11	**16/10/2024 23:00**	10.024044	**15.543**	12.246	**3.171**
12	**17/10/2024 00:00**	10.024044	**15.565**	12.193	**3.149**
13	**17/10/2024 01:00**	10.024044	**15.553**	12.193	**3.161**
14	**17/10/2024 02:00**	10.034242	**15.550**	12.193	**3.174**
15	**17/10/2024 03:00**	10.024044	**15.555**	12.193	**3.159**
16	**17/10/2024 04:00**	10.024044	**15.556**	12.246	**3.158**
17	**17/10/2024 05:00**	10.034242	**15.578**	12.246	**3.146**
18	**17/10/2024 06:00**	10.034242	**15.556**	12.246	**3.168**
19	**17/10/2024 07:00**	10.034242	**15.568**	12.193	**3.156**
20	**17/10/2024 08:00**	10.044439	**15.583**	12.193	**3.151**
21	**17/10/2024 09:00**	10.054636	**15.588**	12.193	**3.157**
22	**17/10/2024 10:00**	10.064834	**15.595**	12.193	**3.160**
23	**17/10/2024 11:00**	10.075031	**15.618**	12.193	**3.147**
24	**17/10/2024 12:00**	10.085229	**15.624**	12.246	**3.151**
25	**17/10/2024 13:00**	10.095426	**15.641**	12.193	**3.144**
26	**17/10/2024 14:00**	10.105623	**15.644**	12.246	**3.152**
27	**17/10/2024 15:00**	10.115821	**15.641**	12.246	**3.165**
28	**17/10/2024 16:00**	10.126018	**15.651**	12.246	**3.165**
29	**17/10/2024 17:00**	10.136216	**15.659**	12.246	**3.167**
30	**17/10/2024 18:00**	10.146413	**15.656**	12.193	**3.180**
31	**17/10/2024 19:00**	10.156610	**15.686**	12.246	**3.161**
32	**17/10/2024 20:00**	10.156610	**15.681**	12.246	**3.166**
33	**17/10/2024 21:00**	10.156610	**15.694**	12.193	**3.153**
34	**17/10/2024 22:00**	10.156610	**15.683**	12.193	**3.164**

Project.	**Bioenergy Project, Lisheen, Co.Tipperary**
Project No.	**25517**
Engineer .	**DOBA**
Borehole No.	**RC03**
Serial No.	**882598**
String Length	**8.7**

	DATE	BAROMETRIC PRESSURE (m)	LOGGER READINGS (m)	TEMPERATURE (c)	WATER LEVEL (m bgl)
35	**17/10/2024 23:00**	10.166808	**15.694**	12.193	**3.163**
36	**18/10/2024 00:00**	10.146413	**15.686**	12.246	**3.150**
37	**18/10/2024 01:00**	10.156610	**15.696**	12.246	**3.151**
38	**18/10/2024 02:00**	10.156610	**15.702**	12.246	**3.145**
39	**18/10/2024 03:00**	10.136216	**15.686**	12.246	**3.140**
40	**18/10/2024 04:00**	10.136216	**15.681**	12.193	**3.145**
41	**18/10/2024 05:00**	10.126018	**15.679**	12.246	**3.137**
42	**18/10/2024 06:00**	10.126018	**15.674**	12.246	**3.142**
43	**18/10/2024 07:00**	10.105623	**15.661**	12.246	**3.135**
44	**18/10/2024 08:00**	10.105623	**15.656**	12.193	**3.140**
45	**18/10/2024 09:00**	10.095426	**15.659**	12.246	**3.126**
46	**18/10/2024 10:00**	10.085229	**15.649**	12.246	**3.126**
47	**18/10/2024 11:00**	10.075031	**15.651**	12.246	**3.114**
48	**18/10/2024 12:00**	10.054636	**15.619**	12.246	**3.126**
49	**18/10/2024 13:00**	10.054636	**15.631**	12.246	**3.114**
50	**18/10/2024 14:00**	10.044439	**15.608**	12.246	**3.126**
51	**18/10/2024 15:00**	10.044439	**15.621**	12.246	**3.113**
52	**18/10/2024 16:00**	10.044439	**15.619**	12.246	**3.115**
53	**18/10/2024 17:00**	10.044439	**15.611**	12.246	**3.123**
54	**18/10/2024 18:00**	10.054636	**15.639**	12.246	**3.106**
55	**18/10/2024 19:00**	10.054636	**15.619**	12.246	**3.126**
56	**18/10/2024 20:00**	10.054636	**15.636**	12.193	**3.109**
57	**18/10/2024 21:00**	10.064834	**15.646**	12.246	**3.109**
58	**18/10/2024 22:00**	10.075031	**15.644**	12.246	**3.121**
59	**18/10/2024 23:00**	10.075031	**15.636**	12.246	**3.129**
60	**19/10/2024 00:00**	10.075031	**15.636**	12.246	**3.129**
61	**19/10/2024 01:00**	10.085229	**15.654**	12.246	**3.121**
62	**19/10/2024 02:00**	10.085229	**15.671**	12.193	**3.104**
63	**19/10/2024 03:00**	10.085229	**15.651**	12.246	**3.124**
64	**19/10/2024 04:00**	10.095426	**15.673**	12.193	**3.112**
65	**19/10/2024 05:00**	10.105623	**15.681**	12.246	**3.115**
66	**19/10/2024 06:00**	10.105623	**15.696**	12.246	**3.100**
67	**19/10/2024 07:00**	10.115821	**15.684**	12.246	**3.122**
68	**19/10/2024 08:00**	10.115821	**15.691**	12.246	**3.115**

Project.	**Bioenergy Project, Lisheen, Co.Tipperary**
Project No.	**25517**
Engineer .	**DOBA**
Borehole No.	**RC03**
Serial No.	**882598**
String Length	**8.7**

	DATE	BAROMETRIC PRESSURE (m)	LOGGER READINGS (m)	TEMPERATURE (c)	WATER LEVEL (m bgl)
69	**19/10/2024 09:00**	10.126018	**15.686**	12.246	**3.130**
70	**19/10/2024 10:00**	10.136216	**15.702**	12.246	**3.124**
71	**19/10/2024 11:00**	10.136216	**15.709**	12.246	**3.117**
72	**19/10/2024 12:00**	10.136216	**15.702**	12.246	**3.124**
73	**19/10/2024 13:00**	10.146413	**15.712**	12.246	**3.124**
74	**19/10/2024 14:00**	10.136216	**15.722**	12.246	**3.104**
75	**19/10/2024 15:00**	10.146413	**15.707**	12.246	**3.129**
76	**19/10/2024 16:00**	10.136216	**15.714**	12.246	**3.112**
77	**19/10/2024 17:00**	10.126018	**15.717**	12.246	**3.099**
78	**19/10/2024 18:00**	10.126018	**15.729**	12.193	**3.087**
79	**19/10/2024 19:00**	10.126018	**15.707**	12.246	**3.109**
80	**19/10/2024 20:00**	10.115821	**15.729**	12.246	**3.077**
81	**19/10/2024 21:00**	10.105623	**15.727**	12.246	**3.069**
82	**19/10/2024 22:00**	10.095426	**15.696**	12.246	**3.089**
83	**19/10/2024 23:00**	10.075031	**15.696**	12.246	**3.069**
84	**20/10/2024 00:00**	10.064834	**15.686**	12.246	**3.069**
85	**20/10/2024 01:00**	10.044439	**15.671**	12.246	**3.063**
86	**20/10/2024 02:00**	10.024044	**15.644**	12.246	**3.070**
87	**20/10/2024 03:00**	9.993452	**15.639**	12.246	**3.044**
88	**20/10/2024 04:00**	9.973057	**15.601**	12.246	**3.062**
89	**20/10/2024 05:00**	9.962860	**15.598**	12.246	**3.055**
90	**20/10/2024 06:00**	9.962860	**15.611**	12.246	**3.042**
91	**20/10/2024 07:00**	9.973057	**15.593**	12.246	**3.070**
92	**20/10/2024 08:00**	9.952662	**15.614**	12.246	**3.029**
93	**20/10/2024 09:00**	9.962860	**15.614**	12.246	**3.039**
94	**20/10/2024 10:00**	9.962860	**15.581**	12.246	**3.072**
95	**20/10/2024 11:00**	9.962860	**15.591**	12.246	**3.062**
96	**20/10/2024 12:00**	9.962860	**15.588**	12.246	**3.065**
97	**20/10/2024 13:00**	9.962860	**15.593**	12.246	**3.060**
98	**20/10/2024 14:00**	9.962860	**15.598**	12.246	**3.055**
99	**20/10/2024 15:00**	9.973057	**15.583**	12.246	**3.080**
100	**20/10/2024 16:00**	9.973057	**15.601**	12.246	**3.062**
101	**20/10/2024 17:00**	9.993452	**15.624**	12.246	**3.059**
102	**20/10/2024 18:00**	10.003649	**15.621**	12.246	**3.073**

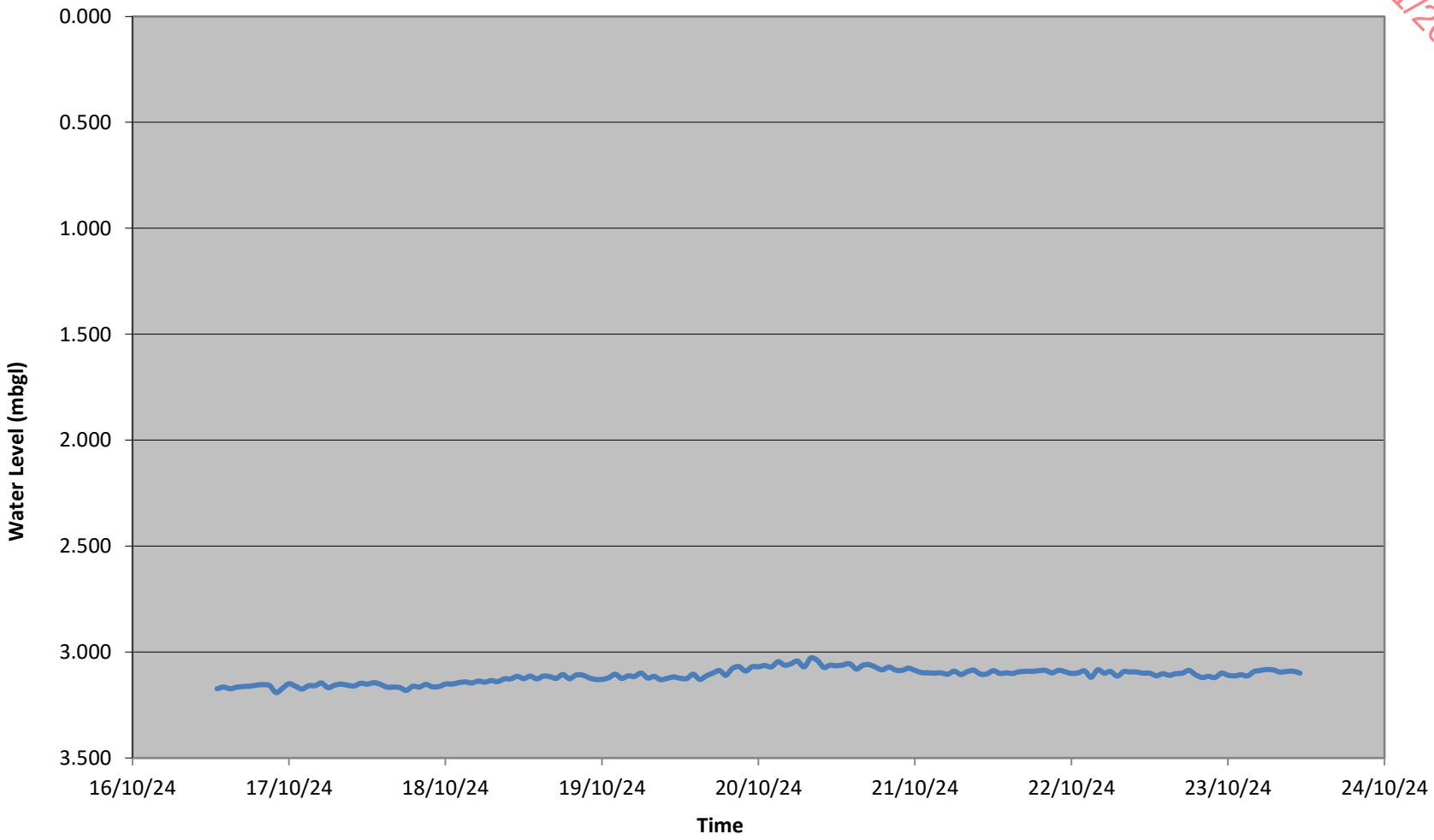
Project.	**Bioenergy Project, Lisheen, Co.Tipperary**
Project No.	**25517**
Engineer .	**DOBA**
Borehole No.	**RC03**
Serial No.	**882598**
String Length	**8.7**

	DATE	BAROMETRIC PRESSURE (m)	LOGGER READINGS (m)	TEMPERATURE (c)	WATER LEVEL (m bgl)
103	**20/10/2024 19:00**	10.024044	**15.631**	12.246	**3.083**
104	**20/10/2024 20:00**	10.034242	**15.654**	12.246	**3.070**
105	**20/10/2024 21:00**	10.044439	**15.649**	12.246	**3.085**
106	**20/10/2024 22:00**	10.075031	**15.679**	12.246	**3.086**
107	**20/10/2024 23:00**	10.095426	**15.709**	12.246	**3.076**
108	**21/10/2024 00:00**	10.105623	**15.709**	12.246	**3.087**
109	**21/10/2024 01:00**	10.126018	**15.719**	12.246	**3.097**
110	**21/10/2024 02:00**	10.136216	**15.729**	12.246	**3.097**
111	**21/10/2024 03:00**	10.146413	**15.737**	12.246	**3.099**
112	**21/10/2024 04:00**	10.156610	**15.749**	12.246	**3.098**
113	**21/10/2024 05:00**	10.166808	**15.752**	12.246	**3.105**
114	**21/10/2024 06:00**	10.177005	**15.777**	12.246	**3.090**
115	**21/10/2024 07:00**	10.177005	**15.762**	12.246	**3.105**
116	**21/10/2024 08:00**	10.177005	**15.774**	12.246	**3.093**
117	**21/10/2024 09:00**	10.187203	**15.792**	12.246	**3.085**
118	**21/10/2024 10:00**	10.197400	**15.784**	12.246	**3.103**
119	**21/10/2024 11:00**	10.207597	**15.795**	12.246	**3.103**
120	**21/10/2024 12:00**	10.207597	**15.810**	12.246	**3.088**
121	**21/10/2024 13:00**	10.217795	**15.807**	12.246	**3.101**
122	**21/10/2024 14:00**	10.207597	**15.800**	12.246	**3.098**
123	**21/10/2024 15:00**	10.207597	**15.797**	12.246	**3.101**
124	**21/10/2024 16:00**	10.207597	**15.805**	12.299	**3.093**
125	**21/10/2024 17:00**	10.207597	**15.807**	12.246	**3.091**
126	**21/10/2024 18:00**	10.217795	**15.817**	12.246	**3.091**
127	**21/10/2024 19:00**	10.217795	**15.820**	12.246	**3.088**
128	**21/10/2024 20:00**	10.217795	**15.822**	12.246	**3.086**
129	**21/10/2024 21:00**	10.227992	**15.820**	12.246	**3.098**
130	**21/10/2024 22:00**	10.227992	**15.832**	12.246	**3.086**
131	**21/10/2024 23:00**	10.227992	**15.825**	12.246	**3.093**
132	**22/10/2024 00:00**	10.227992	**15.817**	12.246	**3.101**
133	**22/10/2024 01:00**	10.238190	**15.830**	12.246	**3.098**
134	**22/10/2024 02:00**	10.238190	**15.840**	12.246	**3.088**
135	**22/10/2024 03:00**	10.248387	**15.820**	12.246	**3.118**
136	**22/10/2024 04:00**	10.248387	**15.855**	12.246	**3.083**

Project.	**Bioenergy Project, Lisheen, Co.Tipperary**
Project No.	**25517**
Engineer .	**DOBA**
Borehole No.	**RC03**
Serial No.	**882598**
String Length	**8.7**

	DATE	BAROMETRIC PRESSURE (m)	LOGGER READINGS (m)	TEMPERATURE (c)	WATER LEVEL (m bgl)
137	**22/10/2024 05:00**	10.258584	**15.850**	12.246	**3.099**
138	**22/10/2024 06:00**	10.258584	**15.857**	12.246	**3.092**
139	**22/10/2024 07:00**	10.268782	**15.845**	12.246	**3.114**
140	**22/10/2024 08:00**	10.278979	**15.877**	12.246	**3.092**
141	**22/10/2024 09:00**	10.278979	**15.875**	12.246	**3.094**
142	**22/10/2024 10:00**	10.289177	**15.885**	12.246	**3.094**
143	**22/10/2024 11:00**	10.299374	**15.890**	12.246	**3.099**
144	**22/10/2024 12:00**	10.299374	**15.890**	12.246	**3.099**
145	**22/10/2024 13:00**	10.309571	**15.888**	12.246	**3.112**
146	**22/10/2024 14:00**	10.309571	**15.898**	12.246	**3.102**
147	**22/10/2024 15:00**	10.309571	**15.890**	12.246	**3.110**
148	**22/10/2024 16:00**	10.309571	**15.898**	12.246	**3.102**
149	**22/10/2024 17:00**	10.309571	**15.900**	12.246	**3.100**
150	**22/10/2024 18:00**	10.309571	**15.913**	12.246	**3.087**
151	**22/10/2024 19:00**	10.319769	**15.903**	12.246	**3.107**
152	**22/10/2024 20:00**	10.329966	**15.900**	12.246	**3.120**
153	**22/10/2024 21:00**	10.329966	**15.905**	12.246	**3.115**
154	**22/10/2024 22:00**	10.329966	**15.900**	12.246	**3.120**
155	**22/10/2024 23:00**	10.319769	**15.910**	12.246	**3.100**
156	**23/10/2024 00:00**	10.329966	**15.911**	12.299	**3.109**
157	**23/10/2024 01:00**	10.329966	**15.908**	12.246	**3.112**
158	**23/10/2024 02:00**	10.329966	**15.913**	12.246	**3.107**
159	**23/10/2024 03:00**	10.329966	**15.908**	12.246	**3.112**
160	**23/10/2024 04:00**	10.319769	**15.918**	12.299	**3.092**
161	**23/10/2024 05:00**	10.319769	**15.923**	12.246	**3.087**
162	**23/10/2024 06:00**	10.319769	**15.928**	12.246	**3.082**
163	**23/10/2024 07:00**	10.309571	**15.915**	12.246	**3.085**
164	**23/10/2024 08:00**	10.309571	**15.905**	12.246	**3.095**
165	**23/10/2024 09:00**	10.309571	**15.908**	12.246	**3.092**
166	**23/10/2024 10:00**	10.309571	**15.910**	12.246	**3.090**
167	**23/10/2024 11:00**	10.309571	**15.900**	12.246	**3.100**

25517 - RC 03 Bioenergy Project, Lisheen, Co.Tipperary



Project.	**Bioenergy Project, Lisheen, Co.Tipperary**
Project No.	**25517**
Engineer .	**DOBA**
Borehole No.	**RC05**
Serial No.	**856586**
String Length	**11.6**

	DATE	BAROMETRIC PRESSURE (m)	LOGGER READINGS (m)	TEMPERATURE (c)	WATER LEVEL (m bgl)
1	**16/10/2024 13:00**	10.003649	**17.829**	11.774	**3.755**
2	**16/10/2024 14:00**	10.003649	**17.829**	11.774	**3.755**
3	**16/10/2024 15:00**	10.003649	**17.830**	11.670	**3.754**
4	**16/10/2024 16:00**	10.003649	**17.827**	11.566	**3.757**
5	**16/10/2024 17:00**	10.003649	**17.832**	11.463	**3.752**
6	**16/10/2024 18:00**	10.003649	**17.842**	11.566	**3.742**
7	**16/10/2024 19:00**	10.013847	**17.843**	11.566	**3.751**
8	**16/10/2024 20:00**	10.013847	**17.847**	11.463	**3.747**
9	**16/10/2024 21:00**	10.013847	**17.853**	11.566	**3.741**
10	**16/10/2024 22:00**	10.024044	**17.860**	11.618	**3.744**
11	**16/10/2024 23:00**	10.024044	**17.863**	11.463	**3.741**
12	**17/10/2024 00:00**	10.024044	**17.862**	11.411	**3.742**
13	**17/10/2024 01:00**	10.024044	**17.866**	11.566	**3.738**
14	**17/10/2024 02:00**	10.034242	**17.869**	11.515	**3.745**
15	**17/10/2024 03:00**	10.024044	**17.871**	11.618	**3.733**
16	**17/10/2024 04:00**	10.024044	**17.871**	11.566	**3.733**
17	**17/10/2024 05:00**	10.034242	**17.875**	11.566	**3.739**
18	**17/10/2024 06:00**	10.034242	**17.872**	11.515	**3.742**
19	**17/10/2024 07:00**	10.034242	**17.883**	11.618	**3.731**
20	**17/10/2024 08:00**	10.044439	**17.888**	11.618	**3.736**
21	**17/10/2024 09:00**	10.054636	**17.893**	11.463	**3.742**
22	**17/10/2024 10:00**	10.064834	**17.905**	11.566	**3.740**
23	**17/10/2024 11:00**	10.075031	**17.916**	11.411	**3.739**
24	**17/10/2024 12:00**	10.085229	**17.922**	11.566	**3.743**
25	**17/10/2024 13:00**	10.095426	**17.929**	11.618	**3.746**
26	**17/10/2024 14:00**	10.105623	**17.938**	11.618	**3.748**
27	**17/10/2024 15:00**	10.115821	**17.946**	11.463	**3.750**
28	**17/10/2024 16:00**	10.126018	**17.959**	11.515	**3.747**
29	**17/10/2024 17:00**	10.136216	**17.971**	11.670	**3.745**
30	**17/10/2024 18:00**	10.146413	**17.971**	11.463	**3.755**
31	**17/10/2024 19:00**	10.156610	**17.984**	11.515	**3.753**
32	**17/10/2024 20:00**	10.156610	**17.988**	11.463	**3.749**
33	**17/10/2024 21:00**	10.156610	**17.991**	11.515	**3.746**
34	**17/10/2024 22:00**	10.156610	**17.993**	11.566	**3.744**

Project.	**Bioenergy Project, Lisheen, Co.Tipperary**
Project No.	**25517**
Engineer .	**DOBA**
Borehole No.	**RC05**
Serial No.	**856586**
String Length	**11.6**

	DATE	BAROMETRIC PRESSURE (m)	LOGGER READINGS (m)	TEMPERATURE (c)	WATER LEVEL (m bgl)
35	**17/10/2024 23:00**	10.166808	**17.995**	11.515	**3.752**
36	**18/10/2024 00:00**	10.146413	**17.987**	11.515	**3.739**
37	**18/10/2024 01:00**	10.156610	**17.988**	11.618	**3.749**
38	**18/10/2024 02:00**	10.156610	**17.985**	11.515	**3.752**
39	**18/10/2024 03:00**	10.136216	**17.979**	11.463	**3.737**
40	**18/10/2024 04:00**	10.136216	**17.978**	11.670	**3.738**
41	**18/10/2024 05:00**	10.126018	**17.967**	11.618	**3.739**
42	**18/10/2024 06:00**	10.126018	**17.969**	11.463	**3.737**
43	**18/10/2024 07:00**	10.105623	**17.956**	11.515	**3.730**
44	**18/10/2024 08:00**	10.105623	**17.951**	11.411	**3.735**
45	**18/10/2024 09:00**	10.095426	**17.948**	11.515	**3.727**
46	**18/10/2024 10:00**	10.085229	**17.943**	11.618	**3.722**
47	**18/10/2024 11:00**	10.075031	**17.935**	11.670	**3.720**
48	**18/10/2024 12:00**	10.054636	**17.923**	11.618	**3.712**
49	**18/10/2024 13:00**	10.054636	**17.918**	11.670	**3.717**
50	**18/10/2024 14:00**	10.044439	**17.906**	11.618	**3.718**
51	**18/10/2024 15:00**	10.044439	**17.899**	11.515	**3.725**
52	**18/10/2024 16:00**	10.044439	**17.909**	11.463	**3.715**
53	**18/10/2024 17:00**	10.044439	**17.915**	11.463	**3.709**
54	**18/10/2024 18:00**	10.054636	**17.919**	11.566	**3.716**
55	**18/10/2024 19:00**	10.054636	**17.923**	11.618	**3.712**
56	**18/10/2024 20:00**	10.054636	**17.927**	11.618	**3.708**
57	**18/10/2024 21:00**	10.064834	**17.930**	11.618	**3.715**
58	**18/10/2024 22:00**	10.075031	**17.936**	11.566	**3.719**
59	**18/10/2024 23:00**	10.075031	**17.944**	11.618	**3.711**
60	**19/10/2024 00:00**	10.075031	**17.941**	11.463	**3.714**
61	**19/10/2024 01:00**	10.085229	**17.949**	11.618	**3.716**
62	**19/10/2024 02:00**	10.085229	**17.951**	11.618	**3.714**
63	**19/10/2024 03:00**	10.085229	**17.958**	11.618	**3.707**
64	**19/10/2024 04:00**	10.095426	**17.962**	11.566	**3.713**
65	**19/10/2024 05:00**	10.105623	**17.969**	11.618	**3.717**
66	**19/10/2024 06:00**	10.105623	**17.969**	11.515	**3.717**
67	**19/10/2024 07:00**	10.115821	**17.982**	11.670	**3.714**
68	**19/10/2024 08:00**	10.115821	**17.986**	11.515	**3.710**

Project.	**Bioenergy Project, Lisheen, Co.Tipperary**
Project No.	**25517**
Engineer .	**DOBA**
Borehole No.	**RC05**
Serial No.	**856586**
String Length	**11.6**

	DATE	BAROMETRIC PRESSURE (m)	LOGGER READINGS (m)	TEMPERATURE (c)	WATER LEVEL (m bgl)
69	**19/10/2024 09:00**	10.126018	**17.992**	11.515	**3.714**
70	**19/10/2024 10:00**	10.136216	**17.997**	11.515	**3.719**
71	**19/10/2024 11:00**	10.136216	**18.002**	11.515	**3.714**
72	**19/10/2024 12:00**	10.136216	**18.002**	11.618	**3.714**
73	**19/10/2024 13:00**	10.146413	**18.009**	11.463	**3.717**
74	**19/10/2024 14:00**	10.136216	**18.009**	11.670	**3.707**
75	**19/10/2024 15:00**	10.146413	**18.007**	11.566	**3.719**
76	**19/10/2024 16:00**	10.136216	**18.007**	11.618	**3.709**
77	**19/10/2024 17:00**	10.126018	**18.002**	11.670	**3.704**
78	**19/10/2024 18:00**	10.126018	**17.999**	11.566	**3.707**
79	**19/10/2024 19:00**	10.126018	**18.002**	11.566	**3.704**
80	**19/10/2024 20:00**	10.115821	**17.998**	11.566	**3.698**
81	**19/10/2024 21:00**	10.105623	**17.990**	11.463	**3.696**
82	**19/10/2024 22:00**	10.095426	**17.987**	11.566	**3.688**
83	**19/10/2024 23:00**	10.075031	**17.965**	11.670	**3.690**
84	**20/10/2024 00:00**	10.064834	**17.955**	11.566	**3.690**
85	**20/10/2024 01:00**	10.044439	**17.939**	11.566	**3.685**
86	**20/10/2024 02:00**	10.024044	**17.924**	11.515	**3.680**
87	**20/10/2024 03:00**	9.993452	**17.903**	11.566	**3.670**
88	**20/10/2024 04:00**	9.973057	**17.884**	11.566	**3.669**
89	**20/10/2024 05:00**	9.962860	**17.878**	11.566	**3.665**
90	**20/10/2024 06:00**	9.962860	**17.876**	11.566	**3.667**
91	**20/10/2024 07:00**	9.973057	**17.880**	11.515	**3.673**
92	**20/10/2024 08:00**	9.952662	**17.876**	11.566	**3.657**
93	**20/10/2024 09:00**	9.962860	**17.880**	11.566	**3.663**
94	**20/10/2024 10:00**	9.962860	**17.879**	11.566	**3.664**
95	**20/10/2024 11:00**	9.962860	**17.879**	11.566	**3.664**
96	**20/10/2024 12:00**	9.962860	**17.880**	11.670	**3.663**
97	**20/10/2024 13:00**	9.962860	**17.880**	11.618	**3.663**
98	**20/10/2024 14:00**	9.962860	**17.878**	11.515	**3.665**
99	**20/10/2024 15:00**	9.973057	**17.882**	11.566	**3.671**
100	**20/10/2024 16:00**	9.973057	**17.891**	11.618	**3.662**
101	**20/10/2024 17:00**	9.993452	**17.902**	11.566	**3.671**
102	**20/10/2024 18:00**	10.003649	**17.914**	11.670	**3.670**

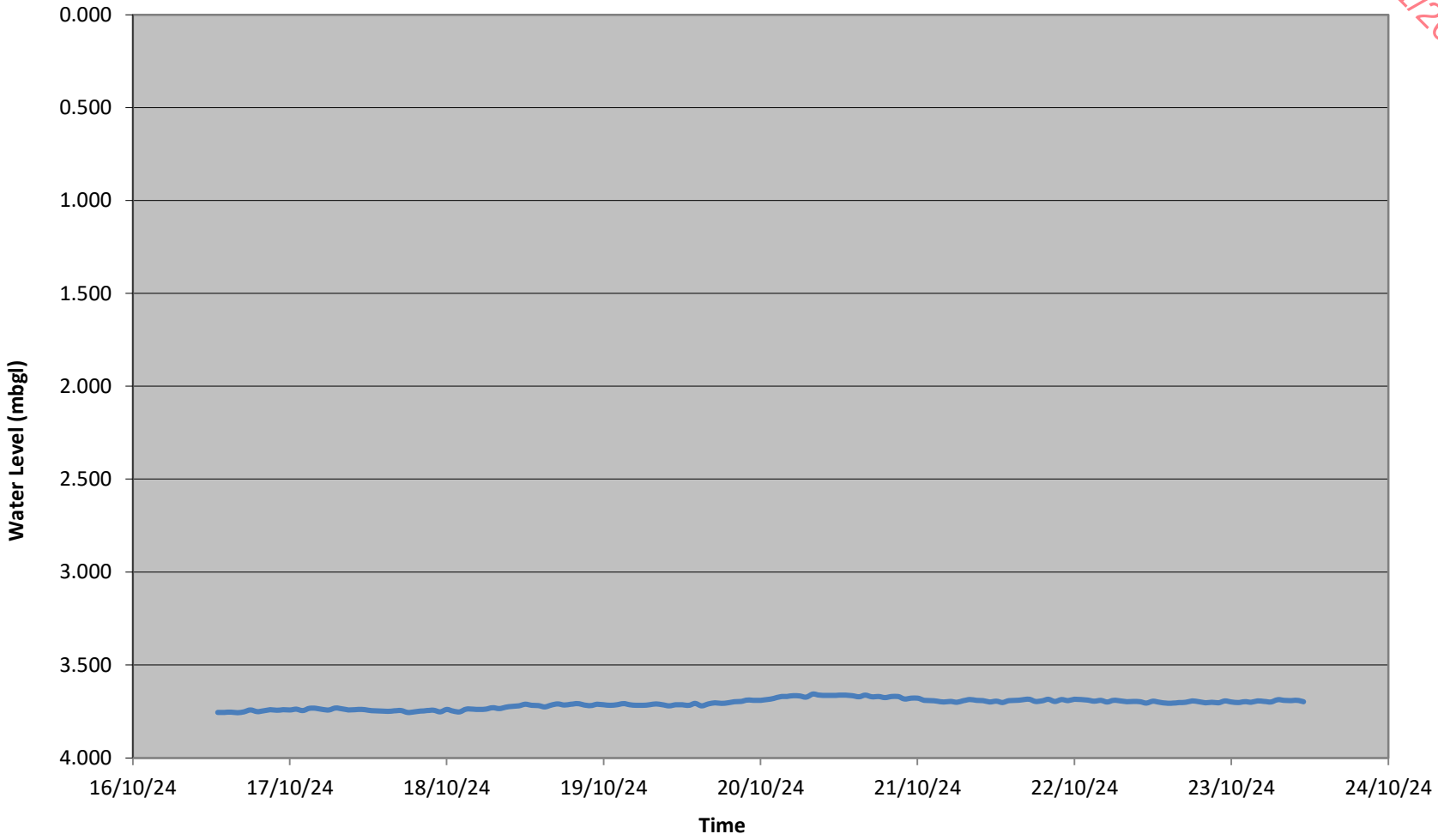
Project.	**Bioenergy Project, Lisheen, Co.Tipperary**
Project No.	**25517**
Engineer .	**DOBA**
Borehole No.	**RC05**
Serial No.	**856586**
String Length	**11.6**

	DATE	BAROMETRIC PRESSURE (m)	LOGGER READINGS (m)	TEMPERATURE (c)	WATER LEVEL (m bgl)
103	**20/10/2024 19:00**	10.024044	**17.929**	11.566	**3.675**
104	**20/10/2024 20:00**	10.034242	**17.944**	11.670	**3.670**
105	**20/10/2024 21:00**	10.044439	**17.955**	11.566	**3.669**
106	**20/10/2024 22:00**	10.075031	**17.972**	11.566	**3.683**
107	**20/10/2024 23:00**	10.095426	**17.997**	11.618	**3.678**
108	**21/10/2024 00:00**	10.105623	**18.007**	11.670	**3.679**
109	**21/10/2024 01:00**	10.126018	**18.016**	11.566	**3.690**
110	**21/10/2024 02:00**	10.136216	**18.025**	11.515	**3.691**
111	**21/10/2024 03:00**	10.146413	**18.032**	11.618	**3.694**
112	**21/10/2024 04:00**	10.156610	**18.038**	11.515	**3.699**
113	**21/10/2024 05:00**	10.166808	**18.051**	11.618	**3.696**
114	**21/10/2024 06:00**	10.177005	**18.057**	11.515	**3.700**
115	**21/10/2024 07:00**	10.177005	**18.065**	11.618	**3.692**
116	**21/10/2024 08:00**	10.177005	**18.071**	11.515	**3.686**
117	**21/10/2024 09:00**	10.187203	**18.077**	11.566	**3.690**
118	**21/10/2024 10:00**	10.197400	**18.086**	11.618	**3.691**
119	**21/10/2024 11:00**	10.207597	**18.089**	11.618	**3.699**
120	**21/10/2024 12:00**	10.207597	**18.093**	11.515	**3.695**
121	**21/10/2024 13:00**	10.217795	**18.096**	11.566	**3.702**
122	**21/10/2024 14:00**	10.207597	**18.096**	11.463	**3.692**
123	**21/10/2024 15:00**	10.207597	**18.097**	11.566	**3.691**
124	**21/10/2024 16:00**	10.207597	**18.100**	11.566	**3.688**
125	**21/10/2024 17:00**	10.207597	**18.104**	11.618	**3.684**
126	**21/10/2024 18:00**	10.217795	**18.102**	11.566	**3.696**
127	**21/10/2024 19:00**	10.217795	**18.105**	11.566	**3.693**
128	**21/10/2024 20:00**	10.217795	**18.113**	11.618	**3.685**
129	**21/10/2024 21:00**	10.227992	**18.112**	11.566	**3.696**
130	**21/10/2024 22:00**	10.227992	**18.122**	11.515	**3.686**
131	**21/10/2024 23:00**	10.227992	**18.117**	11.566	**3.691**
132	**22/10/2024 00:00**	10.227992	**18.123**	11.566	**3.685**
133	**22/10/2024 01:00**	10.238190	**18.132**	11.618	**3.686**
134	**22/10/2024 02:00**	10.238190	**18.130**	11.566	**3.688**
135	**22/10/2024 03:00**	10.248387	**18.134**	11.566	**3.694**
136	**22/10/2024 04:00**	10.248387	**18.138**	11.566	**3.690**

Project.	**Bioenergy Project, Lisheen, Co.Tipperary**
Project No.	**25517**
Engineer .	**DOBA**
Borehole No.	**RC05**
Serial No.	**856586**
String Length	**11.6**

	DATE	BAROMETRIC PRESSURE (m)	LOGGER READINGS (m)	TEMPERATURE (c)	WATER LEVEL (m bgl)
137	**22/10/2024 05:00**	10.258584	**18.139**	11.618	**3.700**
138	**22/10/2024 06:00**	10.258584	**18.149**	11.566	**3.690**
139	**22/10/2024 07:00**	10.268782	**18.156**	11.618	**3.693**
140	**22/10/2024 08:00**	10.278979	**18.162**	11.670	**3.697**
141	**22/10/2024 09:00**	10.278979	**18.163**	11.618	**3.696**
142	**22/10/2024 10:00**	10.289177	**18.171**	11.566	**3.698**
143	**22/10/2024 11:00**	10.299374	**18.175**	11.566	**3.704**
144	**22/10/2024 12:00**	10.299374	**18.184**	11.618	**3.695**
145	**22/10/2024 13:00**	10.309571	**18.189**	11.618	**3.701**
146	**22/10/2024 14:00**	10.309571	**18.184**	11.566	**3.706**
147	**22/10/2024 15:00**	10.309571	**18.184**	11.618	**3.706**
148	**22/10/2024 16:00**	10.309571	**18.187**	11.566	**3.703**
149	**22/10/2024 17:00**	10.309571	**18.189**	11.566	**3.701**
150	**22/10/2024 18:00**	10.309571	**18.196**	11.618	**3.694**
151	**22/10/2024 19:00**	10.319769	**18.202**	11.618	**3.698**
152	**22/10/2024 20:00**	10.329966	**18.207**	11.618	**3.703**
153	**22/10/2024 21:00**	10.329966	**18.209**	11.618	**3.701**
154	**22/10/2024 22:00**	10.329966	**18.207**	11.618	**3.703**
155	**22/10/2024 23:00**	10.319769	**18.206**	11.618	**3.694**
156	**23/10/2024 00:00**	10.329966	**18.211**	11.618	**3.699**
157	**23/10/2024 01:00**	10.329966	**18.208**	11.566	**3.702**
158	**23/10/2024 02:00**	10.329966	**18.213**	11.618	**3.697**
159	**23/10/2024 03:00**	10.329966	**18.210**	11.618	**3.700**
160	**23/10/2024 04:00**	10.319769	**18.206**	11.618	**3.694**
161	**23/10/2024 05:00**	10.319769	**18.204**	11.566	**3.696**
162	**23/10/2024 06:00**	10.319769	**18.201**	11.566	**3.699**
163	**23/10/2024 07:00**	10.309571	**18.203**	11.618	**3.687**
164	**23/10/2024 08:00**	10.309571	**18.200**	11.618	**3.690**
165	**23/10/2024 09:00**	10.309571	**18.198**	11.566	**3.692**
166	**23/10/2024 10:00**	10.309571	**18.200**	11.670	**3.690**
167	**23/10/2024 11:00**	10.309571	**18.192**	11.566	**3.698**

25517 - RC 05 Bioenergy Project, Lisheen, Co.Tipperary



Project.	**Bioenergy Project, Lisheen, Co.Tipperary**
Project No.	**25517**
Engineer .	**DOBA**
Borehole No.	**RC06**
Serial No.	**807165**
String Length	**17.5**

	DATE	BAROMETRIC PRESSURE (m)	LOGGER READINGS (m)	TEMPERATURE (c)	WATER LEVEL (m bgl)
1	**16/10/2024 13:00**	10.003649	**24.074**	10.452	**3.380**
2	**16/10/2024 14:00**	10.003649	**24.074**	10.452	**3.380**
3	**16/10/2024 15:00**	10.003649	**24.074**	10.348	**3.380**
4	**16/10/2024 16:00**	10.003649	**24.079**	10.452	**3.375**
5	**16/10/2024 17:00**	10.003649	**24.084**	10.557	**3.370**
6	**16/10/2024 18:00**	10.003649	**24.080**	10.557	**3.374**
7	**16/10/2024 19:00**	10.013847	**24.088**	10.400	**3.376**
8	**16/10/2024 20:00**	10.013847	**24.079**	10.452	**3.385**
9	**16/10/2024 21:00**	10.013847	**24.084**	10.452	**3.380**
10	**16/10/2024 22:00**	10.024044	**24.096**	10.452	**3.378**
11	**16/10/2024 23:00**	10.024044	**24.096**	10.400	**3.378**
12	**17/10/2024 00:00**	10.024044	**24.110**	10.452	**3.364**
13	**17/10/2024 01:00**	10.024044	**24.105**	10.452	**3.369**
14	**17/10/2024 02:00**	10.034242	**24.122**	10.452	**3.362**
15	**17/10/2024 03:00**	10.024044	**24.117**	10.505	**3.357**
16	**17/10/2024 04:00**	10.024044	**24.105**	10.452	**3.369**
17	**17/10/2024 05:00**	10.034242	**24.126**	10.400	**3.358**
18	**17/10/2024 06:00**	10.034242	**24.122**	10.452	**3.362**
19	**17/10/2024 07:00**	10.034242	**24.124**	10.505	**3.360**
20	**17/10/2024 08:00**	10.044439	**24.124**	10.452	**3.370**
21	**17/10/2024 09:00**	10.054636	**24.143**	10.452	**3.362**
22	**17/10/2024 10:00**	10.064834	**24.134**	10.505	**3.381**
23	**17/10/2024 11:00**	10.075031	**24.153**	10.452	**3.372**
24	**17/10/2024 12:00**	10.085229	**24.138**	10.452	**3.397**
25	**17/10/2024 13:00**	10.095426	**24.183**	10.452	**3.362**
26	**17/10/2024 14:00**	10.105623	**24.172**	10.452	**3.384**
27	**17/10/2024 15:00**	10.115821	**24.169**	10.452	**3.397**
28	**17/10/2024 16:00**	10.126018	**24.198**	10.452	**3.378**
29	**17/10/2024 17:00**	10.136216	**24.186**	10.452	**3.400**
30	**17/10/2024 18:00**	10.146413	**24.205**	10.452	**3.391**
31	**17/10/2024 19:00**	10.156610	**24.217**	10.452	**3.390**
32	**17/10/2024 20:00**	10.156610	**24.221**	10.452	**3.386**
33	**17/10/2024 21:00**	10.156610	**24.224**	10.452	**3.383**
34	**17/10/2024 22:00**	10.156610	**24.207**	10.400	**3.400**

Project.	**Bioenergy Project, Lisheen, Co.Tipperary**
Project No.	**25517**
Engineer .	**DOBA**
Borehole No.	**RC06**
Serial No.	**807165**
String Length	**17.5**

	DATE	BAROMETRIC PRESSURE (m)	LOGGER READINGS (m)	TEMPERATURE (c)	WATER LEVEL (m bgl)
35	**17/10/2024 23:00**	10.166808	**24.238**	10.452	**3.379**
36	**18/10/2024 00:00**	10.146413	**24.217**	10.452	**3.379**
37	**18/10/2024 01:00**	10.156610	**24.245**	10.452	**3.362**
38	**18/10/2024 02:00**	10.156610	**24.259**	10.452	**3.348**
39	**18/10/2024 03:00**	10.136216	**24.231**	10.452	**3.355**
40	**18/10/2024 04:00**	10.136216	**24.243**	10.452	**3.343**
41	**18/10/2024 05:00**	10.126018	**24.231**	10.452	**3.345**
42	**18/10/2024 06:00**	10.126018	**24.226**	10.452	**3.350**
43	**18/10/2024 07:00**	10.105623	**24.226**	10.452	**3.330**
44	**18/10/2024 08:00**	10.105623	**24.221**	10.452	**3.335**
45	**18/10/2024 09:00**	10.095426	**24.207**	10.452	**3.338**
46	**18/10/2024 10:00**	10.085229	**24.226**	10.505	**3.309**
47	**18/10/2024 11:00**	10.075031	**24.202**	10.452	**3.323**
48	**18/10/2024 12:00**	10.054636	**24.183**	10.452	**3.322**
49	**18/10/2024 13:00**	10.054636	**24.188**	10.452	**3.317**
50	**18/10/2024 14:00**	10.044439	**24.169**	10.452	**3.325**
51	**18/10/2024 15:00**	10.044439	**24.165**	10.452	**3.329**
52	**18/10/2024 16:00**	10.044439	**24.198**	10.452	**3.296**
53	**18/10/2024 17:00**	10.044439	**24.191**	10.452	**3.303**
54	**18/10/2024 18:00**	10.054636	**24.162**	10.452	**3.343**
55	**18/10/2024 19:00**	10.054636	**24.172**	10.452	**3.333**
56	**18/10/2024 20:00**	10.054636	**24.191**	10.452	**3.314**
57	**18/10/2024 21:00**	10.064834	**24.181**	10.505	**3.334**
58	**18/10/2024 22:00**	10.075031	**24.193**	10.452	**3.332**
59	**18/10/2024 23:00**	10.075031	**24.183**	10.452	**3.342**
60	**19/10/2024 00:00**	10.075031	**24.186**	10.452	**3.339**
61	**19/10/2024 01:00**	10.085229	**24.207**	10.452	**3.328**
62	**19/10/2024 02:00**	10.085229	**24.210**	10.452	**3.325**
63	**19/10/2024 03:00**	10.085229	**24.202**	10.452	**3.333**
64	**19/10/2024 04:00**	10.095426	**24.217**	10.452	**3.328**
65	**19/10/2024 05:00**	10.105623	**24.219**	10.452	**3.337**
66	**19/10/2024 06:00**	10.105623	**24.221**	10.452	**3.335**
67	**19/10/2024 07:00**	10.115821	**24.221**	10.452	**3.345**
68	**19/10/2024 08:00**	10.115821	**24.217**	10.452	**3.349**

Project.	**Bioenergy Project, Lisheen, Co.Tipperary**
Project No.	**25517**
Engineer .	**DOBA**
Borehole No.	**RC06**
Serial No.	**807165**
String Length	**17.5**

	DATE	BAROMETRIC PRESSURE (m)	LOGGER READINGS (m)	TEMPERATURE (c)	WATER LEVEL (m bgl)
69	**19/10/2024 09:00**	10.126018	**24.255**	10.452	**3.321**
70	**19/10/2024 10:00**	10.136216	**24.224**	10.452	**3.362**
71	**19/10/2024 11:00**	10.136216	**24.257**	10.452	**3.329**
72	**19/10/2024 12:00**	10.136216	**24.233**	10.452	**3.353**
73	**19/10/2024 13:00**	10.146413	**24.233**	10.452	**3.363**
74	**19/10/2024 14:00**	10.136216	**24.245**	10.452	**3.341**
75	**19/10/2024 15:00**	10.146413	**24.238**	10.452	**3.358**
76	**19/10/2024 16:00**	10.136216	**24.255**	10.452	**3.331**
77	**19/10/2024 17:00**	10.126018	**24.252**	10.452	**3.324**
78	**19/10/2024 18:00**	10.126018	**24.221**	10.452	**3.355**
79	**19/10/2024 19:00**	10.126018	**24.240**	10.452	**3.336**
80	**19/10/2024 20:00**	10.115821	**24.238**	10.452	**3.328**
81	**19/10/2024 21:00**	10.105623	**24.217**	10.452	**3.339**
82	**19/10/2024 22:00**	10.095426	**24.226**	10.452	**3.319**
83	**19/10/2024 23:00**	10.075031	**24.226**	10.452	**3.299**
84	**20/10/2024 00:00**	10.064834	**24.219**	10.452	**3.296**
85	**20/10/2024 01:00**	10.044439	**24.214**	10.452	**3.280**
86	**20/10/2024 02:00**	10.024044	**24.200**	10.452	**3.274**
87	**20/10/2024 03:00**	9.993452	**24.160**	10.452	**3.283**
88	**20/10/2024 04:00**	9.973057	**24.176**	10.452	**3.247**
89	**20/10/2024 05:00**	9.962860	**24.162**	10.452	**3.251**
90	**20/10/2024 06:00**	9.962860	**24.150**	10.452	**3.263**
91	**20/10/2024 07:00**	9.973057	**24.141**	10.452	**3.282**
92	**20/10/2024 08:00**	9.952662	**24.138**	10.452	**3.265**
93	**20/10/2024 09:00**	9.962860	**24.136**	10.452	**3.277**
94	**20/10/2024 10:00**	9.962860	**24.129**	10.452	**3.284**
95	**20/10/2024 11:00**	9.962860	**24.129**	10.452	**3.284**
96	**20/10/2024 12:00**	9.962860	**24.117**	10.452	**3.296**
97	**20/10/2024 13:00**	9.962860	**24.115**	10.452	**3.298**
98	**20/10/2024 14:00**	9.962860	**24.141**	10.452	**3.272**
99	**20/10/2024 15:00**	9.973057	**24.129**	10.452	**3.294**
100	**20/10/2024 16:00**	9.973057	**24.134**	10.452	**3.289**
101	**20/10/2024 17:00**	9.993452	**24.138**	10.452	**3.305**
102	**20/10/2024 18:00**	10.003649	**24.150**	10.452	**3.304**

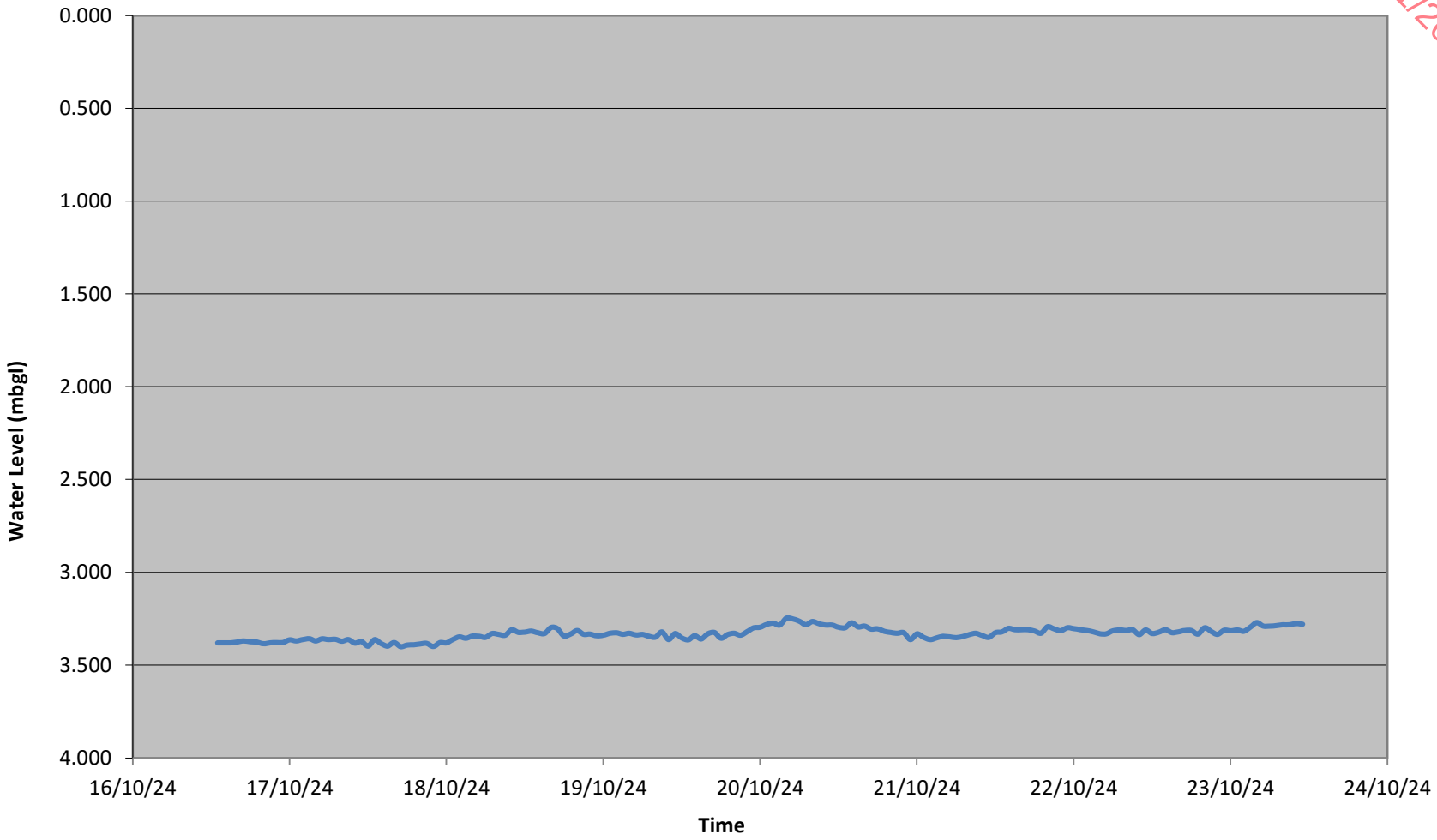
Project.	**Bioenergy Project, Lisheen, Co.Tipperary**
Project No.	**25517**
Engineer .	**DOBA**
Borehole No.	**RC06**
Serial No.	**807165**
String Length	**17.5**

	DATE	BAROMETRIC PRESSURE (m)	LOGGER READINGS (m)	TEMPERATURE (c)	WATER LEVEL (m bgl)
103	**20/10/2024 19:00**	10.024044	**24.157**	10.452	**3.317**
104	**20/10/2024 20:00**	10.034242	**24.160**	10.452	**3.324**
105	**20/10/2024 21:00**	10.044439	**24.167**	10.452	**3.327**
106	**20/10/2024 22:00**	10.075031	**24.200**	10.452	**3.325**
107	**20/10/2024 23:00**	10.095426	**24.183**	10.452	**3.362**
108	**21/10/2024 00:00**	10.105623	**24.224**	10.452	**3.332**
109	**21/10/2024 01:00**	10.126018	**24.226**	10.452	**3.350**
110	**21/10/2024 02:00**	10.136216	**24.224**	10.452	**3.362**
111	**21/10/2024 03:00**	10.146413	**24.243**	10.452	**3.353**
112	**21/10/2024 04:00**	10.156610	**24.262**	10.452	**3.345**
113	**21/10/2024 05:00**	10.166808	**24.269**	10.452	**3.348**
114	**21/10/2024 06:00**	10.177005	**24.276**	10.452	**3.351**
115	**21/10/2024 07:00**	10.177005	**24.281**	10.452	**3.346**
116	**21/10/2024 08:00**	10.177005	**24.292**	10.452	**3.335**
117	**21/10/2024 09:00**	10.187203	**24.309**	10.452	**3.328**
118	**21/10/2024 10:00**	10.197400	**24.307**	10.452	**3.340**
119	**21/10/2024 11:00**	10.207597	**24.307**	10.452	**3.351**
120	**21/10/2024 12:00**	10.207597	**24.333**	10.452	**3.325**
121	**21/10/2024 13:00**	10.217795	**24.347**	10.452	**3.321**
122	**21/10/2024 14:00**	10.207597	**24.356**	10.452	**3.302**
123	**21/10/2024 15:00**	10.207597	**24.349**	10.452	**3.309**
124	**21/10/2024 16:00**	10.207597	**24.349**	10.452	**3.309**
125	**21/10/2024 17:00**	10.207597	**24.349**	10.452	**3.309**
126	**21/10/2024 18:00**	10.217795	**24.352**	10.452	**3.316**
127	**21/10/2024 19:00**	10.217795	**24.340**	10.452	**3.328**
128	**21/10/2024 20:00**	10.217795	**24.375**	10.452	**3.293**
129	**21/10/2024 21:00**	10.227992	**24.373**	10.452	**3.305**
130	**21/10/2024 22:00**	10.227992	**24.364**	10.452	**3.314**
131	**21/10/2024 23:00**	10.227992	**24.380**	10.452	**3.298**
132	**22/10/2024 00:00**	10.227992	**24.375**	10.452	**3.303**
133	**22/10/2024 01:00**	10.238190	**24.380**	10.452	**3.308**
134	**22/10/2024 02:00**	10.238190	**24.375**	10.452	**3.313**
135	**22/10/2024 03:00**	10.248387	**24.378**	10.452	**3.320**
136	**22/10/2024 04:00**	10.248387	**24.368**	10.452	**3.330**

Project.	**Bioenergy Project, Lisheen, Co.Tipperary**
Project No.	**25517**
Engineer .	**DOBA**
Borehole No.	**RC06**
Serial No.	**807165**
String Length	**17.5**

	DATE	BAROMETRIC PRESSURE (m)	LOGGER READINGS (m)	TEMPERATURE (c)	WATER LEVEL (m bgl)
137	**22/10/2024 05:00**	10.258584	**24.378**	10.452	**3.331**
138	**22/10/2024 06:00**	10.258584	**24.394**	10.452	**3.315**
139	**22/10/2024 07:00**	10.268782	**24.409**	10.452	**3.310**
140	**22/10/2024 08:00**	10.278979	**24.416**	10.452	**3.313**
141	**22/10/2024 09:00**	10.278979	**24.420**	10.452	**3.309**
142	**22/10/2024 10:00**	10.289177	**24.404**	10.452	**3.335**
143	**22/10/2024 11:00**	10.299374	**24.439**	10.452	**3.310**
144	**22/10/2024 12:00**	10.299374	**24.420**	10.452	**3.329**
145	**22/10/2024 13:00**	10.309571	**24.437**	10.452	**3.323**
146	**22/10/2024 14:00**	10.309571	**24.451**	10.452	**3.309**
147	**22/10/2024 15:00**	10.309571	**24.435**	10.452	**3.325**
148	**22/10/2024 16:00**	10.309571	**24.439**	10.452	**3.321**
149	**22/10/2024 17:00**	10.309571	**24.447**	10.505	**3.313**
150	**22/10/2024 18:00**	10.309571	**24.446**	10.452	**3.314**
151	**22/10/2024 19:00**	10.319769	**24.437**	10.452	**3.333**
152	**22/10/2024 20:00**	10.329966	**24.482**	10.452	**3.298**
153	**22/10/2024 21:00**	10.329966	**24.463**	10.505	**3.317**
154	**22/10/2024 22:00**	10.329966	**24.446**	10.452	**3.334**
155	**22/10/2024 23:00**	10.319769	**24.458**	10.452	**3.312**
156	**23/10/2024 00:00**	10.329966	**24.465**	10.452	**3.315**
157	**23/10/2024 01:00**	10.329966	**24.470**	10.452	**3.310**
158	**23/10/2024 02:00**	10.329966	**24.463**	10.452	**3.317**
159	**23/10/2024 03:00**	10.329966	**24.484**	10.452	**3.296**
160	**23/10/2024 04:00**	10.319769	**24.499**	10.452	**3.271**
161	**23/10/2024 05:00**	10.319769	**24.480**	10.452	**3.290**
162	**23/10/2024 06:00**	10.319769	**24.480**	10.452	**3.290**
163	**23/10/2024 07:00**	10.309571	**24.473**	10.452	**3.287**
164	**23/10/2024 08:00**	10.309571	**24.477**	10.452	**3.283**
165	**23/10/2024 09:00**	10.309571	**24.477**	10.452	**3.283**
166	**23/10/2024 10:00**	10.309571	**24.484**	10.452	**3.276**
167	**23/10/2024 11:00**	10.309571	**24.480**	10.452	**3.280**

25517 - RC 06 Bioenergy Project, Lisheen, Co.Tipperary



Project.	**Bioenergy Project, Lisheen, Co.Tipperary**
Project No.	**25517**
Engineer .	**DOBA**
Borehole No.	**RC08**
Serial No.	**1002640**
String Length	**11.3**

	DATE	BAROMETRIC PRESSURE (m)	LOGGER READINGS (m)	TEMPERATURE (c)	WATER LEVEL (m bgl)
1	**16/10/2024 13:00**	10.003649	**19.936**	11.517	**1.368**
2	**16/10/2024 14:00**	10.003649	**19.938**	11.465	**1.366**
3	**16/10/2024 15:00**	10.003649	**19.922**	11.569	**1.382**
4	**16/10/2024 16:00**	10.003649	**19.914**	11.517	**1.390**
5	**16/10/2024 17:00**	10.003649	**19.915**	11.206	**1.389**
6	**16/10/2024 18:00**	10.003649	**19.925**	11.206	**1.379**
7	**16/10/2024 19:00**	10.013847	**19.913**	11.206	**1.401**
8	**16/10/2024 20:00**	10.013847	**19.911**	11.362	**1.403**
9	**16/10/2024 21:00**	10.013847	**19.894**	11.206	**1.420**
10	**16/10/2024 22:00**	10.024044	**19.902**	11.413	**1.422**
11	**16/10/2024 23:00**	10.024044	**19.897**	11.362	**1.427**
12	**17/10/2024 00:00**	10.024044	**19.897**	11.413	**1.427**
13	**17/10/2024 01:00**	10.024044	**19.892**	11.362	**1.432**
14	**17/10/2024 02:00**	10.034242	**19.897**	11.413	**1.437**
15	**17/10/2024 03:00**	10.024044	**19.881**	11.362	**1.443**
16	**17/10/2024 04:00**	10.024044	**19.872**	11.465	**1.452**
17	**17/10/2024 05:00**	10.034242	**19.878**	11.413	**1.456**
18	**17/10/2024 06:00**	10.034242	**19.855**	11.413	**1.479**
19	**17/10/2024 07:00**	10.034242	**19.855**	11.362	**1.479**
20	**17/10/2024 08:00**	10.044439	**19.864**	11.413	**1.480**
21	**17/10/2024 09:00**	10.054636	**19.866**	11.362	**1.489**
22	**17/10/2024 10:00**	10.064834	**19.871**	11.413	**1.494**
23	**17/10/2024 11:00**	10.075031	**19.871**	11.362	**1.504**
24	**17/10/2024 12:00**	10.085229	**19.862**	11.413	**1.523**
25	**17/10/2024 13:00**	10.095426	**19.867**	11.413	**1.528**
26	**17/10/2024 14:00**	10.105623	**19.869**	11.362	**1.537**
27	**17/10/2024 15:00**	10.115821	**19.864**	11.362	**1.552**
28	**17/10/2024 16:00**	10.126018	**19.878**	11.413	**1.548**
29	**17/10/2024 17:00**	10.136216	**19.876**	11.413	**1.560**
30	**17/10/2024 18:00**	10.146413	**19.871**	11.413	**1.575**
31	**17/10/2024 19:00**	10.156610	**19.876**	11.413	**1.581**
32	**17/10/2024 20:00**	10.156610	**19.878**	11.362	**1.579**
33	**17/10/2024 21:00**	10.156610	**19.876**	11.413	**1.581**
34	**17/10/2024 22:00**	10.156610	**19.895**	11.362	**1.562**

Project.	**Bioenergy Project, Lisheen, Co.Tipperary**
Project No.	**25517**
Engineer .	**DOBA**
Borehole No.	**RC08**
Serial No.	**1002640**
String Length	**11.3**

	DATE	BAROMETRIC PRESSURE (m)	LOGGER READINGS (m)	TEMPERATURE (c)	WATER LEVEL (m bgl)
35	**17/10/2024 23:00**	10.166808	**19.897**	11.413	**1.570**
36	**18/10/2024 00:00**	10.146413	**19.885**	11.362	**1.561**
37	**18/10/2024 01:00**	10.156610	**19.859**	11.362	**1.598**
38	**18/10/2024 02:00**	10.156610	**19.869**	11.362	**1.588**
39	**18/10/2024 03:00**	10.136216	**19.859**	11.362	**1.577**
40	**18/10/2024 04:00**	10.136216	**19.847**	11.362	**1.589**
41	**18/10/2024 05:00**	10.126018	**19.838**	11.413	**1.588**
42	**18/10/2024 06:00**	10.126018	**19.819**	11.362	**1.607**
43	**18/10/2024 07:00**	10.105623	**19.822**	11.413	**1.584**
44	**18/10/2024 08:00**	10.105623	**19.798**	11.413	**1.608**
45	**18/10/2024 09:00**	10.095426	**19.777**	11.362	**1.618**
46	**18/10/2024 10:00**	10.085229	**19.786**	11.413	**1.599**
47	**18/10/2024 11:00**	10.075031	**19.751**	11.362	**1.624**
48	**18/10/2024 12:00**	10.054636	**19.748**	11.413	**1.607**
49	**18/10/2024 13:00**	10.054636	**19.732**	11.362	**1.623**
50	**18/10/2024 14:00**	10.044439	**19.725**	11.413	**1.619**
51	**18/10/2024 15:00**	10.044439	**19.727**	11.362	**1.617**
52	**18/10/2024 16:00**	10.044439	**19.725**	11.362	**1.619**
53	**18/10/2024 17:00**	10.044439	**19.729**	11.362	**1.615**
54	**18/10/2024 18:00**	10.054636	**19.751**	11.362	**1.604**
55	**18/10/2024 19:00**	10.054636	**19.777**	11.413	**1.578**
56	**18/10/2024 20:00**	10.054636	**19.808**	11.413	**1.547**
57	**18/10/2024 21:00**	10.064834	**19.831**	11.413	**1.534**
58	**18/10/2024 22:00**	10.075031	**19.836**	11.362	**1.539**
59	**18/10/2024 23:00**	10.075031	**19.867**	11.413	**1.508**
60	**19/10/2024 00:00**	10.075031	**19.876**	11.413	**1.499**
61	**19/10/2024 01:00**	10.085229	**19.893**	11.413	**1.492**
62	**19/10/2024 02:00**	10.085229	**19.883**	11.362	**1.502**
63	**19/10/2024 03:00**	10.085229	**19.902**	11.362	**1.483**
64	**19/10/2024 04:00**	10.095426	**19.909**	11.362	**1.486**
65	**19/10/2024 05:00**	10.105623	**19.916**	11.413	**1.490**
66	**19/10/2024 06:00**	10.105623	**19.926**	11.413	**1.480**
67	**19/10/2024 07:00**	10.115821	**19.930**	11.413	**1.486**
68	**19/10/2024 08:00**	10.115821	**19.935**	11.413	**1.481**

Project.	**Bioenergy Project, Lisheen, Co.Tipperary**
Project No.	**25517**
Engineer .	**DOBA**
Borehole No.	**RC08**
Serial No.	**1002640**
String Length	**11.3**

	DATE	BAROMETRIC PRESSURE (m)	LOGGER READINGS (m)	TEMPERATURE (c)	WATER LEVEL (m bgl)
69	**19/10/2024 09:00**	10.126018	**19.940**	11.413	**1.486**
70	**19/10/2024 10:00**	10.136216	**19.945**	11.413	**1.491**
71	**19/10/2024 11:00**	10.136216	**19.940**	11.413	**1.496**
72	**19/10/2024 12:00**	10.136216	**19.942**	11.413	**1.494**
73	**19/10/2024 13:00**	10.146413	**19.952**	11.413	**1.494**
74	**19/10/2024 14:00**	10.136216	**19.926**	11.413	**1.510**
75	**19/10/2024 15:00**	10.146413	**19.935**	11.413	**1.511**
76	**19/10/2024 16:00**	10.136216	**19.930**	11.413	**1.506**
77	**19/10/2024 17:00**	10.126018	**19.911**	11.413	**1.515**
78	**19/10/2024 18:00**	10.126018	**19.914**	11.413	**1.512**
79	**19/10/2024 19:00**	10.126018	**19.909**	11.362	**1.517**
80	**19/10/2024 20:00**	10.115821	**19.923**	11.413	**1.493**
81	**19/10/2024 21:00**	10.105623	**19.888**	11.413	**1.518**
82	**19/10/2024 22:00**	10.095426	**19.867**	11.413	**1.528**
83	**19/10/2024 23:00**	10.075031	**19.871**	11.413	**1.504**
84	**20/10/2024 00:00**	10.064834	**19.843**	11.413	**1.522**
85	**20/10/2024 01:00**	10.044439	**19.836**	11.413	**1.508**
86	**20/10/2024 02:00**	10.024044	**19.815**	11.413	**1.509**
87	**20/10/2024 03:00**	9.993452	**19.777**	11.362	**1.516**
88	**20/10/2024 04:00**	9.973057	**19.753**	11.413	**1.520**
89	**20/10/2024 05:00**	9.962860	**19.744**	11.413	**1.519**
90	**20/10/2024 06:00**	9.962860	**19.748**	11.362	**1.515**
91	**20/10/2024 07:00**	9.973057	**19.741**	11.413	**1.532**
92	**20/10/2024 08:00**	9.952662	**19.746**	11.413	**1.507**
93	**20/10/2024 09:00**	9.962860	**19.739**	11.413	**1.524**
94	**20/10/2024 10:00**	9.962860	**19.741**	11.413	**1.522**
95	**20/10/2024 11:00**	9.962860	**19.725**	11.413	**1.538**
96	**20/10/2024 12:00**	9.962860	**19.715**	11.362	**1.548**
97	**20/10/2024 13:00**	9.962860	**19.722**	11.362	**1.541**
98	**20/10/2024 14:00**	9.962860	**19.722**	11.413	**1.541**
99	**20/10/2024 15:00**	9.973057	**19.730**	11.413	**1.543**
100	**20/10/2024 16:00**	9.973057	**19.734**	11.362	**1.539**
101	**20/10/2024 17:00**	9.993452	**19.753**	11.413	**1.540**
102	**20/10/2024 18:00**	10.003649	**19.746**	11.413	**1.558**

Project.	**Bioenergy Project, Lisheen, Co.Tipperary**
Project No.	**25517**
Engineer .	**DOBA**
Borehole No.	**RC08**
Serial No.	**1002640**
String Length	**11.3**

	DATE	BAROMETRIC PRESSURE (m)	LOGGER READINGS (m)	TEMPERATURE (c)	WATER LEVEL (m bgl)
103	**20/10/2024 19:00**	10.024044	**19.763**	11.413	**1.561**
104	**20/10/2024 20:00**	10.034242	**19.784**	11.362	**1.550**
105	**20/10/2024 21:00**	10.044439	**19.779**	11.413	**1.565**
106	**20/10/2024 22:00**	10.075031	**19.798**	11.362	**1.577**
107	**20/10/2024 23:00**	10.095426	**19.810**	11.413	**1.585**
108	**21/10/2024 00:00**	10.105623	**19.852**	11.413	**1.554**
109	**21/10/2024 01:00**	10.126018	**19.838**	11.413	**1.588**
110	**21/10/2024 02:00**	10.136216	**19.864**	11.413	**1.572**
111	**21/10/2024 03:00**	10.146413	**19.859**	11.362	**1.587**
112	**21/10/2024 04:00**	10.156610	**19.871**	11.413	**1.586**
113	**21/10/2024 05:00**	10.166808	**19.876**	11.413	**1.591**
114	**21/10/2024 06:00**	10.177005	**19.895**	11.413	**1.582**
115	**21/10/2024 07:00**	10.177005	**19.878**	11.413	**1.599**
116	**21/10/2024 08:00**	10.177005	**19.888**	11.413	**1.589**
117	**21/10/2024 09:00**	10.187203	**19.893**	11.413	**1.594**
118	**21/10/2024 10:00**	10.197400	**19.893**	11.413	**1.604**
119	**21/10/2024 11:00**	10.207597	**19.888**	11.413	**1.620**
120	**21/10/2024 12:00**	10.207597	**19.900**	11.413	**1.608**
121	**21/10/2024 13:00**	10.217795	**19.907**	11.413	**1.611**
122	**21/10/2024 14:00**	10.207597	**19.888**	11.413	**1.620**
123	**21/10/2024 15:00**	10.207597	**19.883**	11.413	**1.625**
124	**21/10/2024 16:00**	10.207597	**19.885**	11.413	**1.623**
125	**21/10/2024 17:00**	10.207597	**19.890**	11.413	**1.618**
126	**21/10/2024 18:00**	10.217795	**19.876**	11.413	**1.642**
127	**21/10/2024 19:00**	10.217795	**19.893**	11.413	**1.625**
128	**21/10/2024 20:00**	10.217795	**19.897**	11.413	**1.621**
129	**21/10/2024 21:00**	10.227992	**19.888**	11.413	**1.640**
130	**21/10/2024 22:00**	10.227992	**19.885**	11.413	**1.643**
131	**21/10/2024 23:00**	10.227992	**19.902**	11.413	**1.626**
132	**22/10/2024 00:00**	10.227992	**19.909**	11.413	**1.619**
133	**22/10/2024 01:00**	10.238190	**19.890**	11.413	**1.648**
134	**22/10/2024 02:00**	10.238190	**19.900**	11.413	**1.638**
135	**22/10/2024 03:00**	10.248387	**19.888**	11.413	**1.660**
136	**22/10/2024 04:00**	10.248387	**19.897**	11.413	**1.651**

Project.	**Bioenergy Project, Lisheen, Co.Tipperary**
Project No.	**25517**
Engineer .	**DOBA**
Borehole No.	**RC08**
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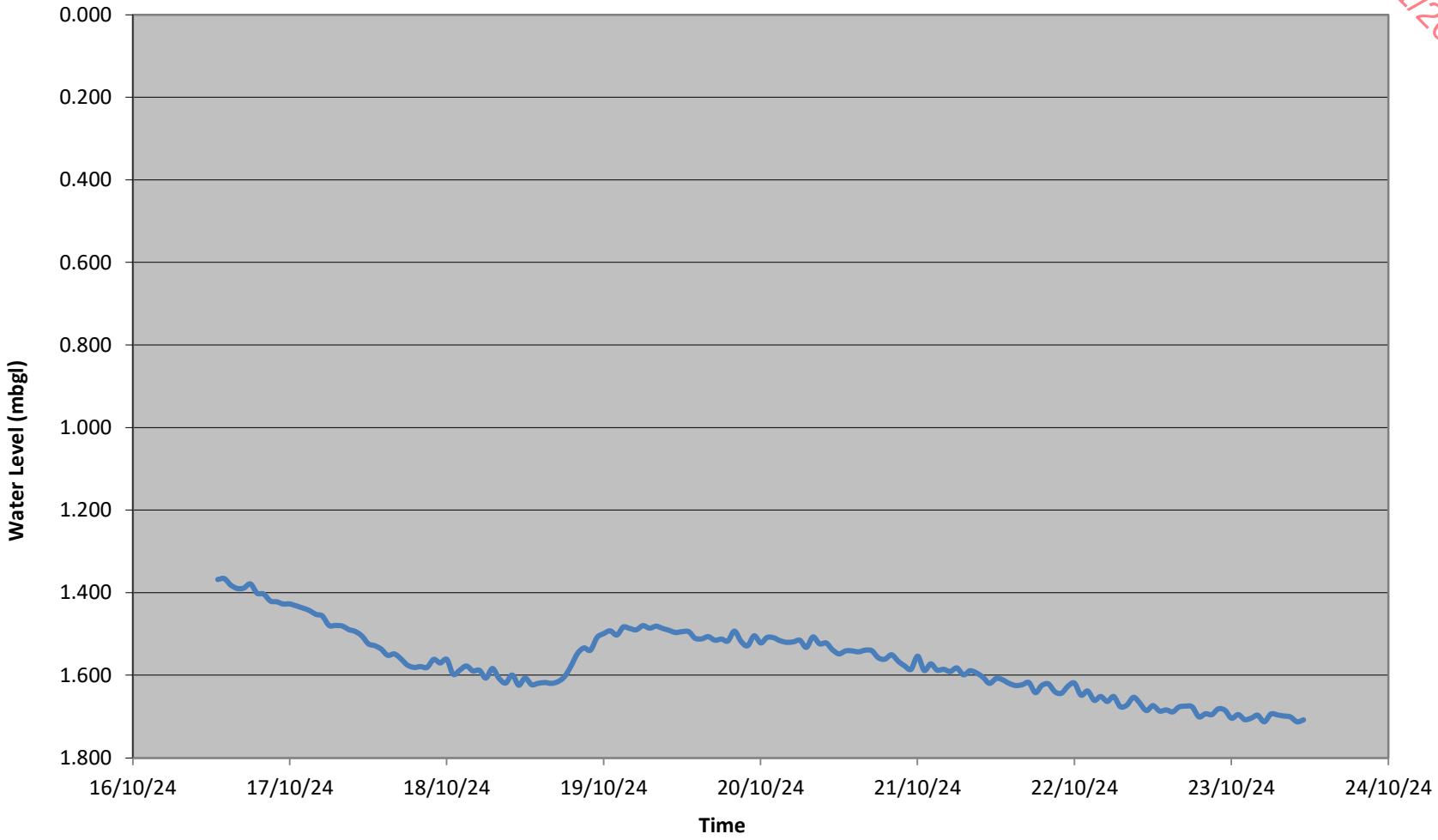
	DATE	BAROMETRIC PRESSURE (m)	LOGGER READINGS (m)	TEMPERATURE (c)	WATER LEVEL (m bgl)
137	**22/10/2024 05:00**	10.258584	**19.895**	11.413	**1.664**
138	**22/10/2024 06:00**	10.258584	**19.907**	11.413	**1.652**
139	**22/10/2024 07:00**	10.268782	**19.893**	11.413	**1.676**
140	**22/10/2024 08:00**	10.278979	**19.907**	11.413	**1.672**
141	**22/10/2024 09:00**	10.278979	**19.926**	11.413	**1.653**
142	**22/10/2024 10:00**	10.289177	**19.921**	11.413	**1.668**
143	**22/10/2024 11:00**	10.299374	**19.914**	11.413	**1.685**
144	**22/10/2024 12:00**	10.299374	**19.926**	11.413	**1.673**
145	**22/10/2024 13:00**	10.309571	**19.923**	11.413	**1.687**
146	**22/10/2024 14:00**	10.309571	**19.926**	11.413	**1.684**
147	**22/10/2024 15:00**	10.309571	**19.921**	11.413	**1.689**
148	**22/10/2024 16:00**	10.309571	**19.933**	11.413	**1.677**
149	**22/10/2024 17:00**	10.309571	**19.935**	11.413	**1.675**
150	**22/10/2024 18:00**	10.309571	**19.933**	11.413	**1.677**
151	**22/10/2024 19:00**	10.319769	**19.919**	11.413	**1.701**
152	**22/10/2024 20:00**	10.329966	**19.937**	11.413	**1.693**
153	**22/10/2024 21:00**	10.329966	**19.935**	11.413	**1.695**
154	**22/10/2024 22:00**	10.329966	**19.949**	11.413	**1.681**
155	**22/10/2024 23:00**	10.319769	**19.935**	11.413	**1.685**
156	**23/10/2024 00:00**	10.329966	**19.926**	11.413	**1.704**
157	**23/10/2024 01:00**	10.329966	**19.935**	11.413	**1.695**
158	**23/10/2024 02:00**	10.329966	**19.923**	11.413	**1.707**
159	**23/10/2024 03:00**	10.329966	**19.926**	11.413	**1.704**
160	**23/10/2024 04:00**	10.319769	**19.923**	11.413	**1.697**
161	**23/10/2024 05:00**	10.319769	**19.907**	11.413	**1.713**
162	**23/10/2024 06:00**	10.319769	**19.926**	11.413	**1.694**
163	**23/10/2024 07:00**	10.309571	**19.914**	11.413	**1.696**
164	**23/10/2024 08:00**	10.309571	**19.911**	11.413	**1.699**
165	**23/10/2024 09:00**	10.309571	**19.909**	11.413	**1.701**
166	**23/10/2024 10:00**	10.309571	**19.897**	11.413	**1.713**
167	**23/10/2024 11:00**	10.309571	**19.902**	11.413	**1.708**

25517 - RC 08 Bioenergy Project, Lisheen, Co.Tipperary



Appendix 7

Geophysical Survey Report

National Bioeconomy Campus
Lisheen, Co. Tipperary

Geophysical Survey

Report Status: Final

MGX Project Number: 6807

MGX File Reference: 6807f-005.doc

16th October 2024

Confidential Report To:

IGSL
Unit F
M7 Business Campus
Naas
Co/ Kildare

Report submitted by:
Minerex Geophysics Limited

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Issued by:

Author: John Connaughton (Geophysicist)

Reviewer: Hartmut Krahn (Senior Geophysicist)

Minerex Geophysics Limited

Subsurface Geophysical Investigations

EXECUTIVE SUMMARY

1. Minerex Geophysics Ltd. (MGX) carried out a geophysical survey consisting of EM31 Ground Conductivity, 2D-Resistivity (ERT) and seismic refraction (p-wave) for the ground investigation for a proposed development at the former Lisheen mine site, County Tipperary.
2. The main objectives of the survey were to gain information on the location of the former mine entrance, determine the ground conditions under the site, to determine the depth to rock and the overburden thickness, to estimate the strength or stiffness or compaction of overburden and the rock quality and to detect possible karstified rock.
3. The data was modelled with a total of eight layers (Layers 1a, 1b, 2a, 2b, 2c, 3a, 3b, 4) including a layer identifying the backfilled mine entrance (Layer 4) using the seismic refraction and 2D-Resistivty models.
4. Layers 1a and 1b are described as soft or loose alluvium or soil/fill. The alluvium (1a) is noted crossing the site from south to north and is shown on the interpretation Map 3.
5. Layers 2a and 2b are described as poor argillaceous/muddy limestone or very stiff to hard sandy gravelly clay and silt in the south (Layer 2a) and poor dolomitized limestone or very dense clayey silty sand and gravel in the north (Layer 2b).
6. Layer 2c is interpreted as poor karstified dolomitized limestone. The location of this karstified limestone is shown on Map 3.
7. Layer 3a is described as good to very good argillaceous/muddy limestone. The depth to the top of this layer ranges from 3 – 10m below ground level (bgl).
8. Layer 3b is interpreted as good to very good dolomitized limestone. The depth to the top of this layer ranges from 3 - 10m but is up to 19m deep under the karstified limestone layer.
9. The lateral extent of the two rock types are shown on Map 3.
10. The boundary between both rock types is interpreted as a geological fault.
11. Rotary core logs provided after the survey show the two distinct rock types and tie in well with the interpretation presented here.

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List of Tables, Maps, Figures, Plans and Appendices:

Title	Pages	Document Reference
Table 1: Geophysical Survey Locations and Acquisition Parameters	In text	In text
Table 2: Summary of Interpretation (Conductivity Only)	In text	In text
Table 3: Summary of Interpretation	In text	In text
Map 1: Geophysical Survey Location Map	1 x A3	6807f_Drawings.dwg
Map 2: EM31 Ground Conductivity Contour Map	1 x A3	6807f_Drawings.dwg
Map 3: Geophysical Survey Interpretation Map	1 x A3	6807f_Drawings.dwg
Figure 1: Models of Geophysical Survey	1 x A3	6807f_Drawings.dwg
Figure 2: Interpretation of Geophysical Survey	1 x A3	6807f_Drawings.dwg

1. INTRODUCTION

1.1 Background

Minerex Geophysics Ltd. (MGX) carried out a geophysical survey for the National Bioeconomy Campus at the former Lisheen Mine in Co. Tipperary. The survey consisted of EM31 ground conductivity, 2D-Resistivity (ERT) and seismic refraction (p-wave). The survey was commissioned by IGSL.

This survey utilized various complementary geophysical methods to improve final interpretations. The role of geophysics as a non-destructive fast method is to provide a geological interpretation over a wide area to complement direct ground investigations at specific locations. The direct ground investigation results can be used to improve the initial geophysical results and interpretation.

The survey was aimed both at gaining information on the entrance to the former mine as well as determining the depth to rock across the site.

1.2 Objectives

The main objectives of the geophysical survey were:

- Gain information on the location of the entrance to the former mine
- To determine the ground conditions under the site
- To determine the depth to rock and the overburden thickness
- To estimate the strength or stiffness or compaction of overburden materials and the rock quality
- To determine the type of overburden and rock
- To detect lateral changes within the geological layers
- To detect possible karstified rock zones within the rock

1.3 Site Description

The site is located on the grounds of the former Lisheen Mine. According to the report titled “The Lisheen Mine - Closure, Restoration & Aftercare Management Plan” (GAIL, 2020) and the report “Closure, restoration & aftercare management plan – C.R.A.M.P” (The Lisheen Mine, 2016) and the accompanying backfill map, the mine entrance is clearly marked. On the location map (Map 1), the mine's main decline road is represented by black lines.

To the west of the site, there is a fenced-off area, indicated by a cyan line on Map 1, which is designated as a Cautionary Zone (GAIL, 2020). This area is open, relatively flat, and currently unused. Surrounding the site are private roads and tracks to the north, east, and south, while grass fields stretch out to the west.

1.4 Geology

Eight Rotary Corehole logs were provided after the survey. Four are within the survey area (RC5 – RC8).

RC 5, in the north of the area describes a light blue/grey to brown grey fine grained slightly metamorphosed, slightly dolomitised limestone. Low RQD values and mentioning of solution show significant weathering and karstification within the rock. The dolomitised limestone is liable to karstification.

RC 6 – 8, in the south of the site describe a light to dark grey/black, fine to medium grained argillaceous/muddy limestone. There is much less weathering noted within these rotary cores. The depth to the top of rock ranges from 1.5 – 8m bgl. This limestone is not liable to karstification.

The rotary core hole locations are indicated on Map 1 and the abbreviated borehole logs are shown on the figures.

Online geological maps of Ireland (GSI, 2024) give the following information:

The overburden geology consists of till derived from limestones with a linear zone of alluvium crossing the site in NNW to SSE direction.

In terms of rock the survey area is underlain by Waulsortian Limestones, described in this area as dolomitised massive fine-grained limestone. There is a W-E fault close to the south of the site and a second close to the north as well as a N-S Fault close to the west of the site.

The Crosspatrick Formation, described as pale-grey cherty crinoidal limestone is present to the north of the northern W-E fault.

There are no karst features recorded near the site.

Image 1: Geological Bedrock Geology 100k, GSI

1.5 Report

This report includes the results and interpretation of the geophysical survey. Maps, figures and tables are included to illustrate the results of the survey. More detailed descriptions of geophysical methods and measurements can be found in GSEG (2002), Milsom (1989) and Reynolds (1997).

The description of soil, rock and the use of geotechnical terms (soft, stiff, dense etc) follows Eurocode (2007) and BSI (2020) standards. The terms are defined in the standards and the physical parameters are related from experience. This geophysical survey has been acquired, processed, interpreted and reported in accordance with these guidelines.

The client provided maps of the site and the digital version was used as the background map in this report. Elevations were surveyed on site and are used in the vertical sections.

The interpretative nature and the non-invasive survey methods must be taken into account when considering the results of this survey and Minerex Geophysics Limited, while using appropriate practice to execute, interpret and present the data, give no guarantees in relation to the existing subsurface.

2. GEOPHYSICAL SURVEY

2.1 Methodology

The methodology consisted of using EM31 Ground Conductivity measurements across the survey area, followed by 2D-Resistivity and Seismic Refraction surveying along lines proposed by the client.

Across the whole site, a total of 5 ha of EM31 Ground Conductivity survey was done.

The survey locations are indicated on Map 1. The lines and parameters are tabulated in Table 1.

Table 1: Geophysical Survey Locations and Acquisition Parameters

Resistivity Line	**Electrode Spacing/m**	**Number of Electrodes**	**Line Length/m**
R1	5	38	185
R2	5	39	190
R3	5	38	185
R4	5	36	175
R5	5	18	85
R6	5	77	380
SUM			**1200**
Seismic Line	**Geophone Spacing/m**	**Number of Geophones**	**Line Length/m**
S1	3	63	186
S2	3	64	189
S3	3	62	183
S4	3	58	171
S5	3	30	87
S6	3	126	375
SUM			**1191**

2.2 EM31 Ground Conductivity

The EM31 ground conductivity survey was carried out over the area indicated in Map 1 on lines nominally 10 m apart. Along each line a reading of ground conductivity was taken every second while walking along,

thereby resulting in a survey grid of nominally 10 x 2 m. The locations were measured with a Carlson NR3 RTK-GPS sub-meter accuracy SERES DGPS system attached to the EM31 and all data was jointly stored in a data logger. The conductivity meter was a GEONICS EM31 with Archer2 data logger and NAV31 data acquisition software. The instrument was compared to base station readings and no EM drift was recorded.

EM31 ground conductivity determines the bulk conductivity of the subsurface over a typical depth between 0 and 6m bgl. and over a radius of approx. 5m around the instrument. When looking for clay, silt and water infill within rock occurring at relatively shallow depth the EM31 can find anomalous rock zones with a vertical extent of approx. 3m. The measurements are disturbed by metal and other conductive objects in close proximity to the instrument, and therefore no geological interpretations can be made in the vicinity of such man-made objects. Notes were taken by the surveyor in order to account for these in the interpretation.

2.3 2D-Resistivity (ERT)

2D-Resistivity lines were surveyed with electrode spacing of 5m, up to 64 electrodes per set-up and a maximum length of 315m per set-up. The readings were taken with a Tigre Resistivity Meter, Imager Cables, stainless steel electrodes and a laptop with ImagerPro acquisition software.

The data along line R6 was acquired in the roll-along mode to achieve continuous coverage to a depth of 25m between the ends of the lines.

During 2D-Resistivity surveying, data is acquired in the form of linear arrays using a suite of metal electrodes. A current is induced into the ground via a pair of electrodes whilst a potential difference is measured across a second pair of electrodes. This allows for the recording of the apparent resistivity in a two-dimensional arrangement below the line. The data is inverted after the survey to obtain a model of subsurface resistivities. The generated model resistivity values and their spatial distribution can then be related to typical values for different geological materials.

2D-Resistivity has previously proven zones of anomalous or karstified rock with lateral extents of 5m and more.

2.4 Seismic Refraction

Seismic refraction lines were surveyed with geophone spacing of 3m and 24 geophones per set-up resulting in a 69m length per set-up. The recording equipment consisted of a 24 Channel GEOMETRICS ES-3000 engineering seismograph with 4.5Hz vertical geophones. The seismic energy source consisted of a hammer and plate. A zero-delay trigger was used to start the recording. Normally 7 shot points per p-wave set-up were used.

Set-ups were acquired in longer continuous lines using common shot points between set-ups and concatenating into longer lines at the processing stage.

The seismic refraction survey method focuses on propagating p-waves travelling through the subsurface, which are generated by a seismic source. As the wave propagates through the subsurface, its velocity varies as it travels through overburden, rock with different elastic properties, and along geological boundaries. Velocity data is recorded via the surveying equipment, which is then processed, allowing geological layer thicknesses and boundaries to be established.

Seismic Refraction generally determines the depth to horizontal or near horizontal layers where the compaction or strength or rock quality changes with an accuracy of around 20% of the depth to that layer. Where the layers are shallower than the geophone spacing depth deviations of +- 1m to top of layers can occur. Where low velocity layers or shadow zones are present (e.g., below solid ground surface) or where layers dip with more than 20 degrees angles the accuracy becomes much less.

The seismic refraction set-ups with 69m individual length have a reasonable penetration depth of around 15m. An internationally accepted maximum depth estimate for a seismic refraction set-up is 1/6 of the set-up length including offshots. The depth penetration varies according to the velocity structure of the subsurface. In this report we used a depth of 15m bgl. where the seismic modelling was ended as deeper modelling becomes less meaningful.

2.5 Site Work

The data acquisition was carried out between the 28th of August and 4th of September 2023. The weather conditions were fair throughout the acquisition period. Health and safety standards were adhered to at all times. The locations and elevations were surveyed with a Carlson NR3 RTK-GPS to accuracy < 0.05m.

3. RESULTS AND INTERPRETATION

The interpretation of geophysical data was executed utilizing the known response of geophysical measurements, typical physical parameters for subsurface features that may underlay the site, and the experience of the authors.

Ground investigation results were available after the survey and the abbreviated borehole logs are indicated on the sections. The overburden was abbreviated as clay, sand and gravel. The rock was generally divided into weathered limestone (based on RQD value < 50%) and limestone (> 50%). There are two distinct limestone types noted in the logs. This can be done only to a certain extend as the rock can be very variable. RQD values, fracture indices and non-intact zones often change rapidly with depth. The small size of a borehole only represents a very small volume of ground while the geophysical survey on the other end of the scale averages over a large volume of ground. These are abbreviated as dolomitised limestone and muddy limestone in the drawings.

3.1 EM31 Ground Conductivity

The EM31 ground conductivity values were merged into one data file and contoured and gridded with the SURFER contouring package. The contours are created by gridding and interpolation and care must be taken when using the data. The contour map is overlaid over the location and base map (Map 2) and the values in milliSiemens/metre (mS/m) are indicated on the colour scale bar.

The conductivity is typical for certain geological material types. Dry and clean Sand and Gravel and most rock types (Dolomitised Limestone) have relatively low conductivities whist clay and clay-rich rock types (Argillaceous/muddy limestone) have high conductivities.

There are a number of variations in ground conductivities across this site. The low conductivities (<4mS/m) which are dominant in the north of the site are interpreted as being an area underlain by dolomitised limestone.

Medium conductivities (4 – 7mS/m) dominant in the south indicate a more argillaceous/muddy limestone.

The line of high (7 - 10mS/m) conductivities crossing SE-NW across the site and through the mine entrance appears to be related to a band of alluvium crossing the site.

There is a high conductivity (>10mS/m) feature in the middle of the site which is interpreted as being the former backfilled entrance to the mine. Other areas of very high conductivity in the west and south are due to fencing along the southern boundary of the site and around a cautionary zone in the west.

Interpretations of the EM31 and other geophysical data is shown on Map 3. The low conductivities (<4mS/m) indicate the dolomitised Limestone. The middle range (4 - 7mS/m) values indicate Argillaceous/Muddy Limestone. Values of 7 - 10mS/m crossing the site are interpreted as an Alluvium. The high (>10mS/m) values indicate interference from metal objects (like the fences) and the backfilled entrance to the mine.

Table 2: Summary of Interpretation (Conductivity only)

Layer	General Conductivity Range (mS/m)	Interpretation
A	<4	Dolomitised Limestone
B	4-7	Argillaceous/muddy Limestone
C	7 - 10	Alluvium Overburden
D	>10	Interference from metal including the backfilled mine entrance

3.2 2D-Resistivity (ERT)

The 2D-Resistivity data was positioned and inverted with the RES2DINV inversion package. Line R6, using the roll-along method was concatenated for a joint inversion. The programme uses a smoothness constrained least-squares inversion method to produce a 2D model of the subsurface resistivities from the recorded apparent resistivity values. Three variations of the least squares method are available and for this project the Jacobian Matrix was recalculated for the first three iterations, then a Quasi-Newton approximation was used for subsequent iterations. Each dataset was inverted using seven iterations resulting in a typical RMS error of <3.0%. The resulting models were colour contoured with the same resistivity scale for all lines and they are displayed as cross sections (Figure 1).

Resistivities are characteristic for certain overburden and rock types. If there is a high content of clay minerals (which are electrically conductive) then the overburden resistivity will be lower than as if there is a high content of clastic grains like sand or gravel. The purer the clay and the lower the sand and gravel content, the lower the resistivity. Water content in overburden layers can influence the resistivities, but generally clay content has a more dominating effect.

In limestone areas, karstified rock is defined in this report as a formerly intact clean limestone rock, liable to karstification, that has been partially dissolved by water over long geological time scales and where the cavities and voids have either remained empty (filled by air) or became filled by overburden sediment (clay, silt, sand), weathering product of the broken rock itself or water. This process would lead to a reduction of the resistivity of the overall rock and therefore karstified rock has a lower resistivity than intact clean limestone rock. This is generally indicated by lower resistivities embedded within high resistivity at depth.

The resistivities cover a range typical for materials from clay rich overburden (low resistivities) to fresh strong unweathered bedrock (high resistivities). The ranges have been taken into the consideration for the interpretation. Low resistivity values occur (<125 Ohmm) at the mine entrance and near the surface where alluvium is interpreted. Within the overburden, medium resistivity values (125 to 250 Ohmm) indicate a sandy gravelly clay and silt overburden while high values (>250 Ohmm) indicate a clayey silty sand and gravel. Within the rock, medium Resistivities (<1000Ohmm) are interpreted as a argillaceous/muddy limestone while high resistivities (>1000 Ohmm) indicate a dolomitised limestone. On Line R2 in the north

and at depth are lower resistivities at larger depth than on the rest of the site (<250 Ohmm) and these are interpreted as karstified dolomitised limestone.

3.3 Seismic Refraction

The seismic refraction data was positioned and processed with the SEISIMAGER software package to give a layered model of the subsurface. The number of layers has been determined by analysing the seismic traces and 3 layers were used in the models. All seismic lines were subject to a standardised processing sequence which consisted of a topographic correction which was based on integrated elevation data, first break picking, tomographic inversion, travel-time computation via ray-tracing and velocity modelling. Residual deviations of typically 0.4 to 1.8 msec RMS have been obtained for each line. Following each processing stage QC procedures were adhered to. The resulting layer boundaries are shown as thick lines overlaid on the 2D-Resistivity cross sections (Figure 1). The average seismic velocities obtained within the layers are annotated on the sections as bold black numbers.

The p-wave seismic velocity is closely linked to the density of subsurface materials and to parameters like compaction, stiffness, strength and rock quality. The higher the density of the subsurface materials the higher the seismic velocity. More compacted, stiffer, denser and stronger material will have a higher seismic velocity. For rock, the seismic velocity is higher when the rock is stronger, less weathered and has a higher quality. If the rock is more weathered, broken, fractured, fissured or karstified then the seismic velocity will be reduced compared to that of intact fresh rock.

Because of the above relationship, the seismic refraction method and seismic velocities are suitable to investigate ground where the layers get denser, more compacted and stronger with depth. A disadvantage is that some materials may have the same seismic velocity: Very stiff to hard or very dense highly consolidated overburden and a weathered rock can have the same seismic velocity range (as is the case in the layer 2 below).

The modelled seismic data has created the following layered ground model:

Layer 1 has a thickness of 0.8 - 3m and seismic velocities of 330-450m/s. This overburden would be made ground and soil with a soft or loose stiffness or compaction.

Layer 2 velocities of 2000 - 2200m/s indicate a weathered or karstified rock with poor rock quality or overburden with very stiff to hard or very dense stiffness or compaction. The thickness of this layer varies between 2 and 17m.

Good to very good rock (Layer 3) is indicated by seismic velocities of >4000m/s and the top of this rock varies between 3 and 19m.

3.4 Interpretation of Resistivity and Seismic Refraction

Table 3 summarises the interpretation. The stiffness or compaction of overburden and the rock strength or quality have been estimated from the seismic velocity. The estimation of the excavatability for the bedrock

has been made according to the caterpillar chart published in Reynolds (1997). The geotechnical assessment for rippability will have to take factors like rock type and jointing into account and the estimation in this report is solely based on the seismic velocities.

Interpreted cross sections are shown in Figure 2. The interpretation has been made from all available information. For overburden layers and the top of the rock, the seismic refraction data has been used as seismic refraction is the best method to delineate layer boundaries (denoted by numbers in the following table). The resistivity model values have been used to delineate overburden material and rock types (Denoted by letters in the following table). Resistivity data is better suited to show overburden material, rock types and features within the rock while seismic refraction velocities are indicating the change of compaction, stiffness or rock quality with depth. Layer 4 is simply the disturbed data that is interpreted as the backfilled mine entrance.

Table 3: Summary of Interpretation

Layer	General Seismic Velocity Range (m/sec)	General Resistivity Range (Ohmm)	Stiffness or Compaction or Rock Quality	Interpretation	Estimated Excavation Method
1a	350-450	<125	Soft	Alluvium	Diggable
1b	350-450	>125	Soft or loose	Soil, Fill or Made Ground	Diggable
2a	2000-2200	125 - 250	Poor Rock or Very Stiff to Hard Overburden	Weathered argillaceous/muddy Limestone or sandy gravelly Clay and Silt	Diggable or rippable to marginal rippable
2b	2000-2200	>250	Poor Rock or very dense overburden	Weathered dolomitised Limestone or clayey silty Sand and Gravel	Diggable or rippable to marginal rippable
2c	2000-2200 At depth	<250	Poor rock	Karstified dolomitised Limestone	Rippable to marginal rippable
3a	4000-4300	<1000	Good to very good rock	Argillaceous/Muddy Limestone	Breaking & Blasting
3b	4000-4300	>1000	Good to very good rock	Dolomitised Limestone	Breaking & Blasting
4	Any	<125	N/A	Backfilled Entrance to Mine	N/A

4. CONCLUSIONS

The following conclusions are made:

- Minerex Geophysics Ltd. (MGX) carried out a geophysical survey consisting of EM31 ground conductivity, 2D-Resistivity and seismic refraction (p-wave) surveying for the ground investigation at the former Lisheen Mine in Co. Tipperary.
- At all locations there was a strong correlation between all three geophysical survey methods and the rotary core holes.
- The data was modelled with 3 layers based on seismic velocities and all of the layers were divided using the electrical resistivities. Layer 4 is the backfilled mine entrance.
- The top layer 1 consists of soft or loose materials like alluvium and soil/fill, with thicknesses ranging from 0.8m to 3m.
- Layer 2 with seismic velocities of 2000-2200 was interpreted as weathered or karstified rock or overburden with very stiff to hard or very dense stiffness or compaction, and varying thicknesses from 2m to 17m.
- The deepest geological layer 3 consists of good to very good limestone rock, showing seismic velocities of over 4000 m/s, with top depths varying from 3m to 19m.
- Layer 4 is the disturbed geophysical data that represents the backfilled mine entrance.
- The EM31 conductivity data indicated a high conductivity feature, which corresponds to the former mine entrance. This location shows distinct anomalies due to the presence of metal objects related to the mine entrance.
- The survey highlighted variations in ground conditions across the site, with cleaner limestone to the north and more argillaceous/muddy limestone to the south. An alluvium band of shallow deposits crosses the site, where higher conductivity was observed.
- Both 2D-Resistivity and seismic refraction surveys indicated the potential presence of karstified limestone within the dolomitized limestone. These zones are characterized by lower resistivities and seismic velocities, suggesting poor rock quality or infill from overburden. This zone only occurs on the northern end of Line 2.
- Map 3 is the summary interpretation map made from the EM31 ground conductivity and the other geophysical data. It shows the dolomitised limestone to the north and the argillaceous/muddy limestone to the south.
- A geological fault is interpreted between these two limestone types. The Waulsortian dolomitised limestone is to the north of the fault, the argillaceous/muddy limestone seems to be uplifted by the

fault as it could be expected to come from the Ballysteen formation under the Waulsortian limestone.

- Map 3 also indicates the zone of karstified limestone within the dolomitised limestone on the northern end of Line R2.
- The interpreted alluvium is indicated on Map 3 along a zone stretching NNW to SSE and generally following the area from the geological map. At the mine entrance this soft layer would have been removed.
- The mine entrance on Map 3 has been interpreted from the anomalous data of the ground material and this location matches the backfill reports for the mine.

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2. **Eurocode, 2007.** EN 1997-2:2007. Eurocode 7. Part 2 Ground Investigation and Testing 2007
3. **GAIL, 2020.** The Lisheen Mine – Closure, Restoration & Aftercare Management Plan. Golder Associates Ireland Limited, 2020
4. **GSEG, 2002.** Geophysics in Engineering Investigations. Geological Society Engineering Geology Special Publication 19, London, 2002
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6. **Milsom, 1989.** Field Geophysics. John Wiley and Sons, 1989
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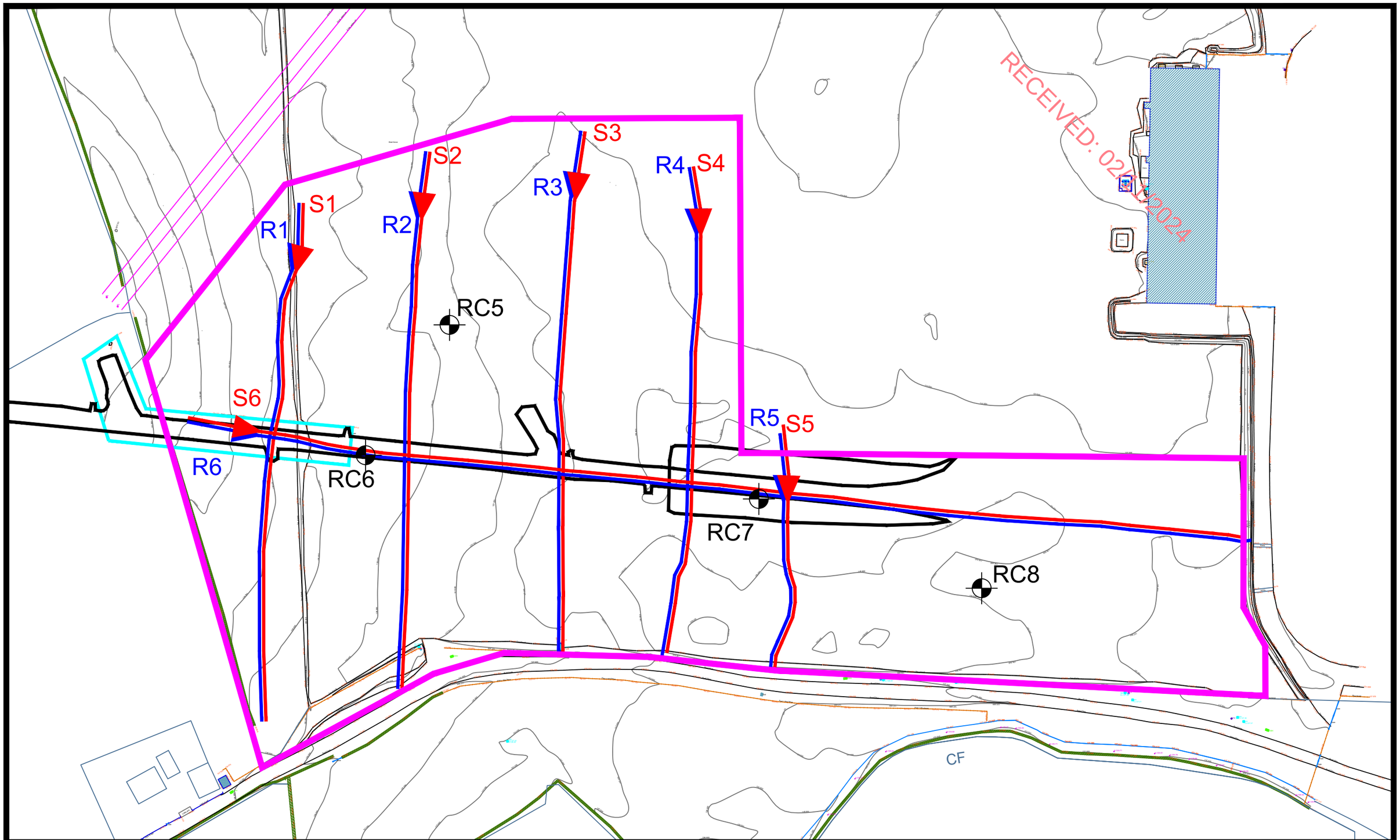
8. **The Lisheen Mine, 2016**. Closure, restoration & aftercare management plan – C.R.A.M.P"
9. **Weaver, 1975.** Geological Factors significant in the Assessment of Rippability, 1975



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CLIENT	IGSL National Bioeconomy Campus
PROJECT	Lisheen, County Tipperary Geophysical Survey
TITLE	Map 1: Geophysical Survey Location Map

SCALE:	1:1250 @ A3
PROJECT:	6807
DRAWN:	JMK
DATE:	16/10/2024
MGX FILE:	6807f_Drawings.dwg
STATUS:	Final

Geophysical Survey Locations:

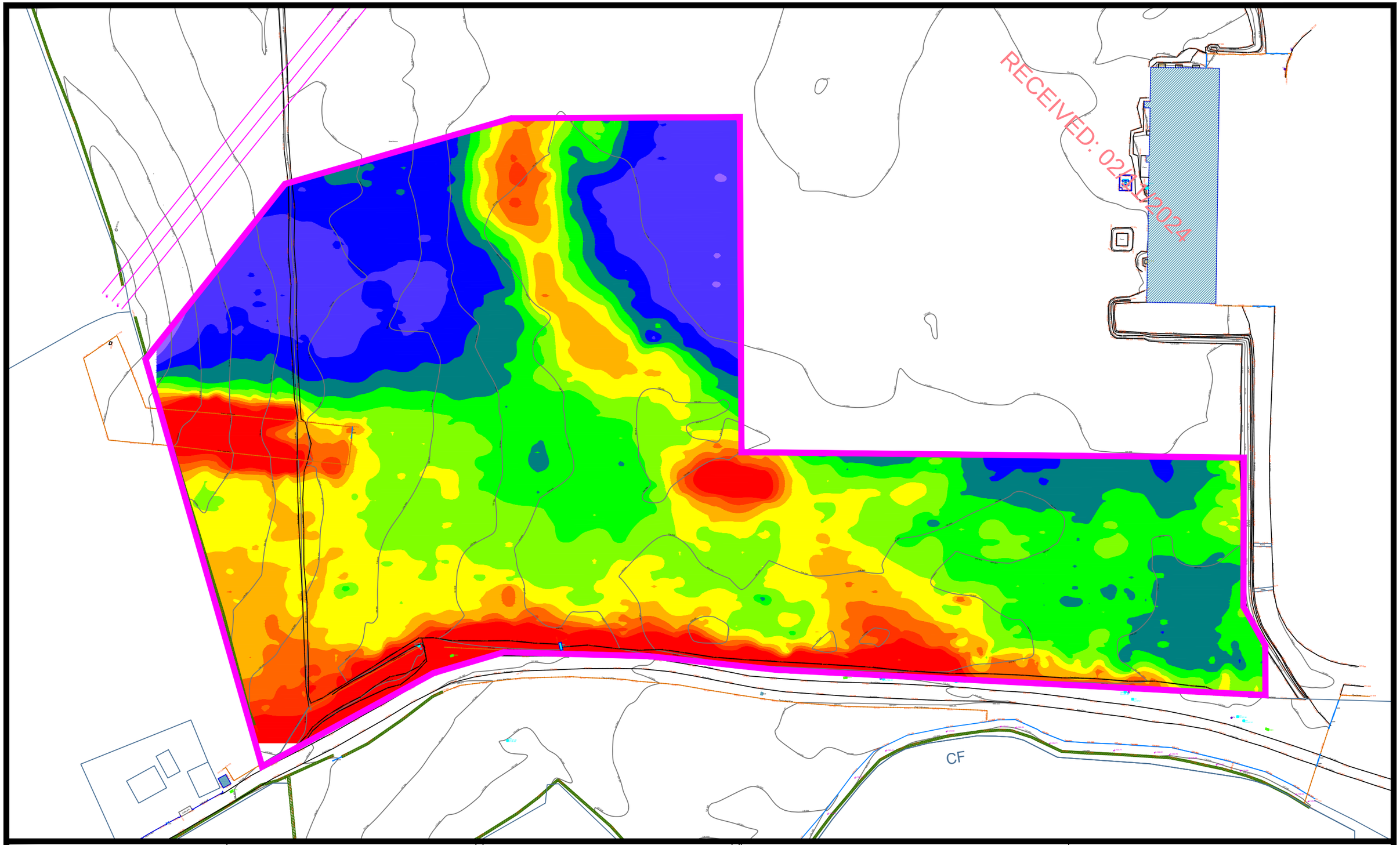
- R2 — 2D-Resistivity Line
- S1 — Seismic Refraction Line
- EM31 Survey Area
- Cautionary Zone*
- Decline*

Locations are in Irish Transverse Mercator (ITM), Elevations are in mOD (Malin Head)

* "The Lisheen Mine - Closure, Restoration & Aftercare Management Plan";Backfill Map

Direct Ground Investigation Locations:

- Rotary Core Hole



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CLIENT	IGSL National Bioeconomy Campus
PROJECT	Lisheen, County Tipperary Geophysical Survey
TITLE	Map 2: EM31 Ground Conductivity Contour Map

SCALE:	1:1250 @ A3
PROJECT:	6807
DRAWN:	JMK
DATE:	16/10/2024
MGX FILE:	6807f_Drawings.dwg
STATUS:	Final

EM31 Ground Conductivity Values:

Ground Conductivity in mS/m

0 1 2 3 4 5 6 7 8 9 10

The map shows the EM31 ground conductivity contours in mS/m. The low conductivities (<4mS/m) indicate the Clean Limestone. The middle range (4 - 7mS/m) values indicate Argillaceous/Muddy Limestone.
Values 7 - 10mS/m crossing the site are interpreted as as Alluvium. The very high (>10mS/m) values indicate interference from metal objects (like the fences) and the entrance to the mine.

CF

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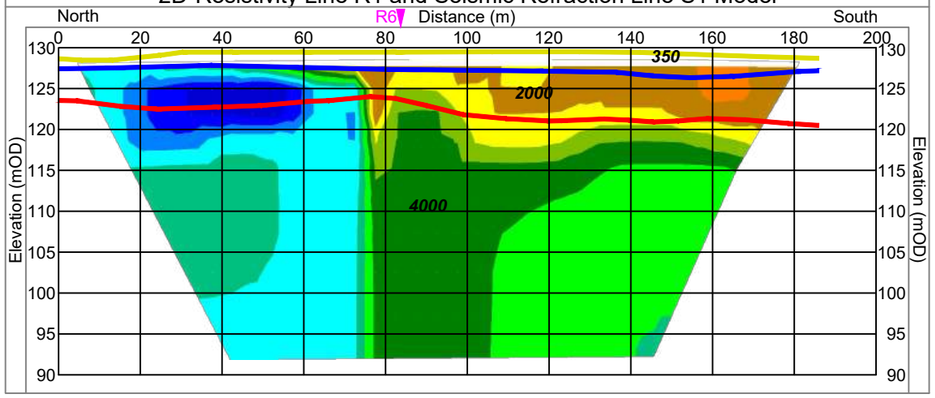
CLIENT	IGSL National Bioeconomy Campus
PROJECT	Lisheen, County Tipperary Geophysical Survey
TITLE	Map 3: Geophysical Survey Interpretation Map

SCALE:	1:1250 @ A3
PROJECT:	6807
DRAWN:	JS
DATE:	16/10/2024
MGX FILE:	6807f_Drawings.dwg
STATUS:	Final

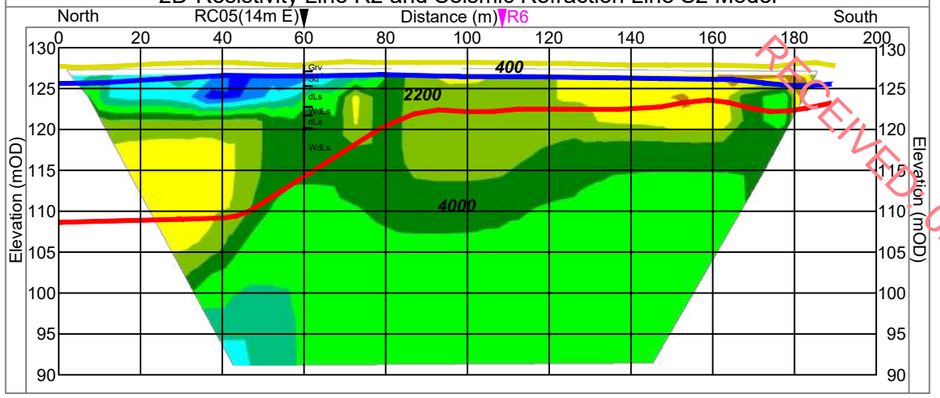
Interpretation:

- A Alluvium
- B Argillaceous/Muddy Limestone
- C Dolomitised Limestone
- D Backfilled Entrance to Mine
- Karstified dolomitised Limestone
- Fault

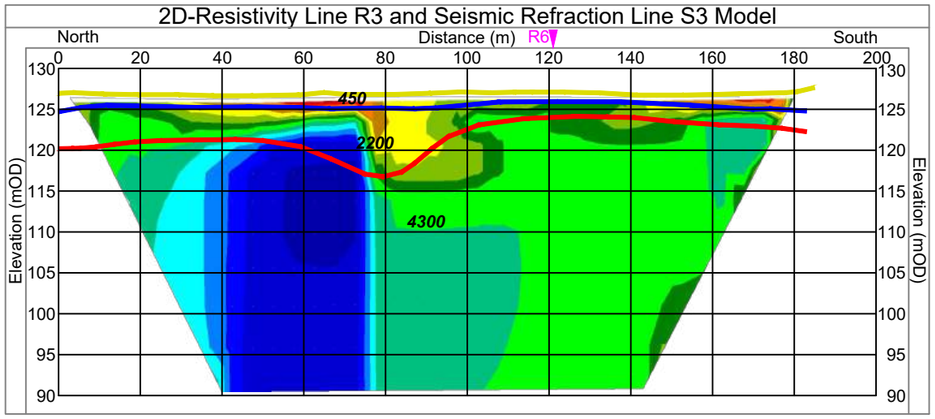
2D-Resistivity Line R1 and Seismic Refraction Line S1 Model



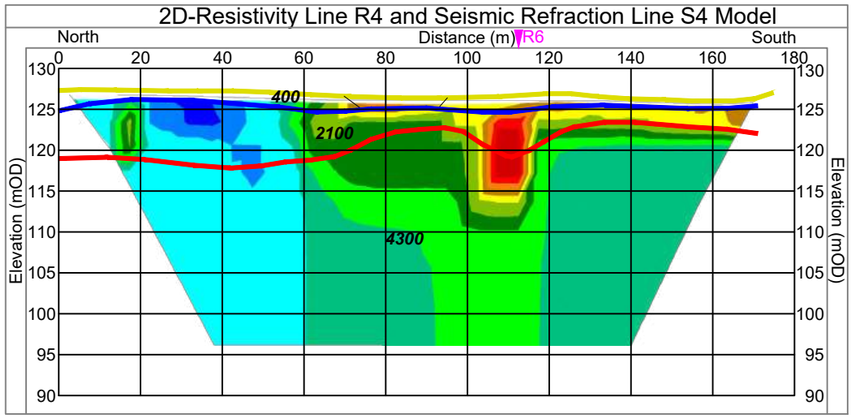
2D-Resistivity Line R2 and Seismic Refraction Line S2 Model



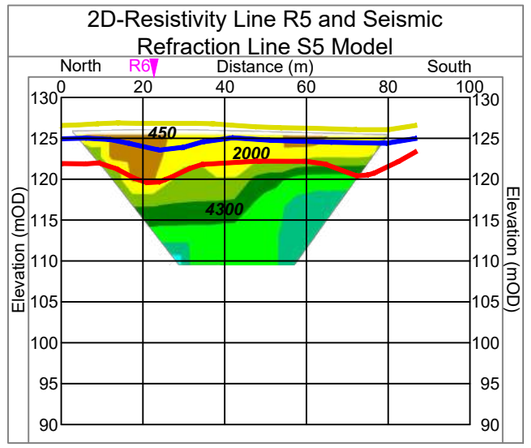
2D-Resistivity Line R3 and Seismic Refraction Line S3 Model



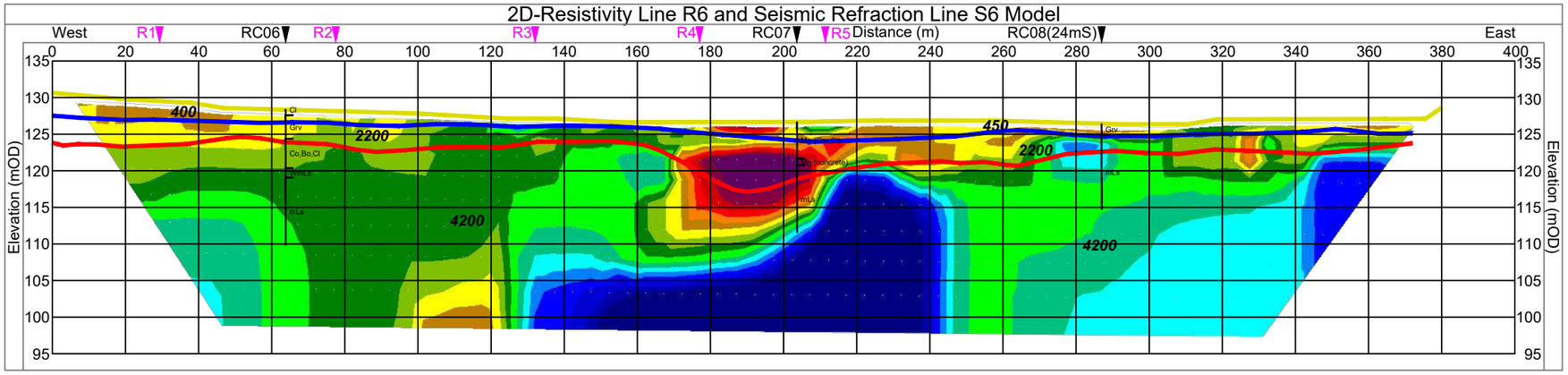
2D-Resistivity Line R4 and Seismic Refraction Line S4 Model



2D-Resistivity Line R5 and Seismic Refraction Line S5 Model



2D-Resistivity Line R6 and Seismic Refraction Line S6 Model



Abbreviated GI Logs:

Mg	Made Ground	Cl	Clay
Co	Cobbles	Bo	Boulders
Sd	Sand	Grv	Gravel
WdLs	Weathered dolomitised Limestone		
dLs	Dolomitised Limestone		
WmLs	Weathered muddy Limestone		
mLs	Muddy Limestone		

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CLIENT	IGSL National Bioeconomy Campus
PROJECT	Lisheen, County Tipperary Geophysical Survey
TITLE	Figure 1: Models of Geophysical Survey

SCALE:	1:1500 @ A3, VE x 2
PROJECT:	6807
DRAWN:	JMK
DATE:	16/10/2024
MGX FILE:	6807f_Drawings.dwg
STATUS:	Final

Layers from Seismic Refraction Model:

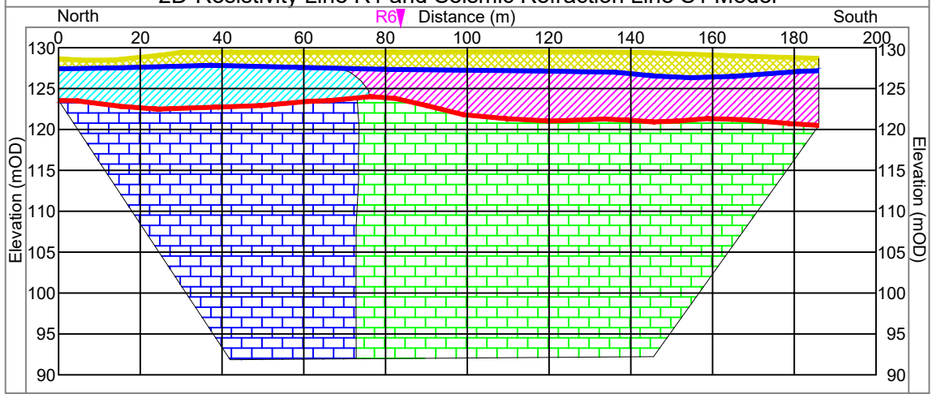
Ground Surface/Top of Layer 1 (350 - 450 m/s)
Top of Layer 2 (2000 - 2200 m/s)
Top of Layer 3 (4000 - 4300 m/s)
2200 Seismic Velocity in m/s

2D-Resistivity Model Values:

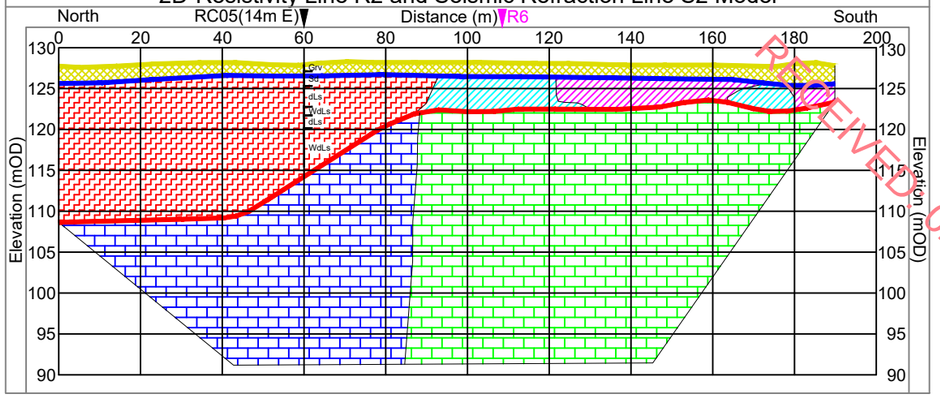
Resistivities (Ohmm)

31.2 62.5 125 250 500 1000 2000 4000

2D-Resistivity Line R1 and Seismic Refraction Line S1 Model



2D-Resistivity Line R2 and Seismic Refraction Line S2 Model



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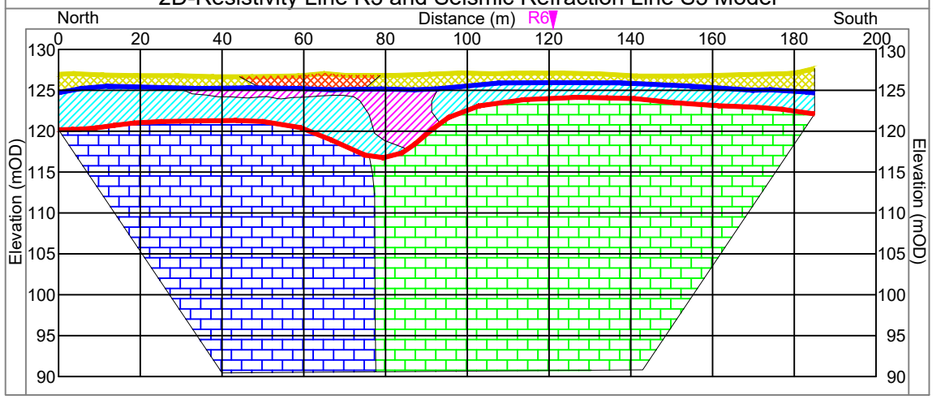
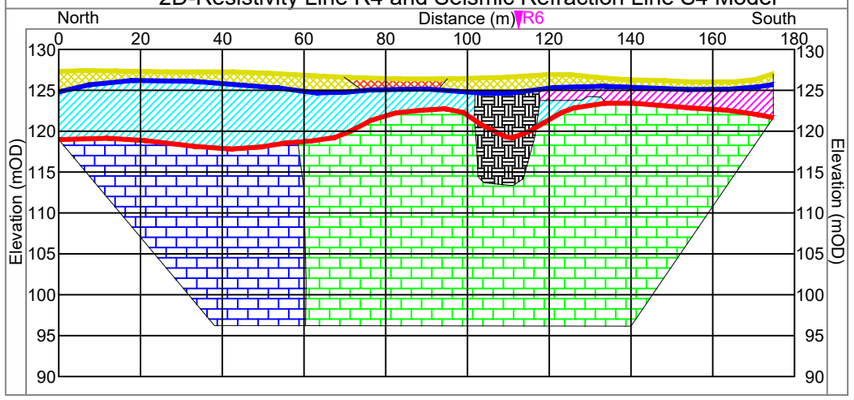
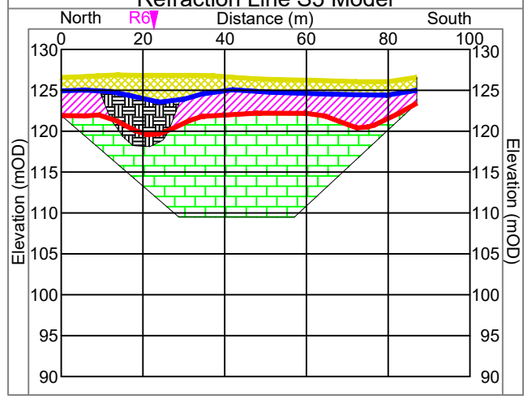


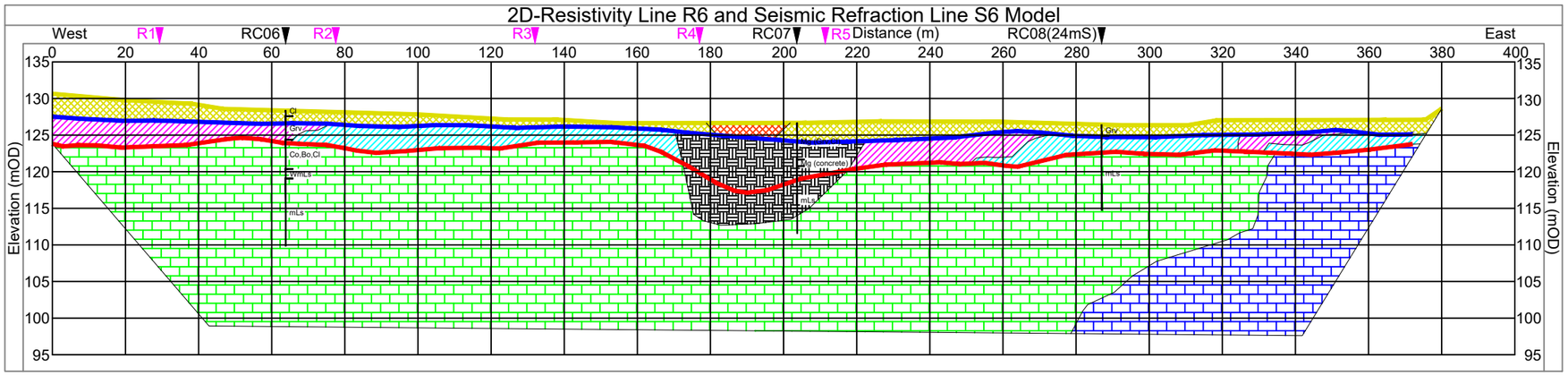
2D-Resistivity Line R4 and Seismic Refraction Line S4 Model



2D-Resistivity Line R5 and Seismic Refraction Line S5 Model



2D-Resistivity Line R6 and Seismic Refraction Line S6 Model



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Sd	Sand	Grv	Gravel
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dLs	Dolomitised Limestone		
WmLs	Weathered muddy Limestone		
mLs	Muddy Limestone		

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CLIENT	IGSL National Bioeconomy Campus
PROJECT	Lisheen, County Tipperary Geophysical Survey
TITLE	Figure 2: Interpretation of Geophysical Survey

SCALE:	1:1500 @ A3, VE x 2
PROJECT:	6807
DRAWN:	JMK
DATE:	16/10/2024
MGX FILE:	6807f_Drawings.dwg
STATUS:	Final

Interpretation:

- 1a Soft Alluvium
- 1b Soft or loose Soil, Fill or Made Ground
- 2a Poor weathered argillaceous/muddy Limestone or very stiff to hard sandy gravelly Clay and Silt
- 2b Poor weathered dolomitised Limestone or very dense clayey silty Sand and Gravel
- 2c Poor karstified dolomitised Limestone
- 3a Good to very good argillaceous/muddy Limestone
- 3b Good to very good dolomitised Limestone
- 4 Backfilled Entrance to Mine

Appendix 8

Geotechnical Laboratory Test Records (Soils)

IGSL Ltd
Materials Laboratory
Unit J5, M7 Business Park
Newhall, Naas
Co. Kildare
045 846176

Test Report

Determination of Moisture Content, Liquid & Plastic Limits

Tested in accordance with BS1377:Part 2:1990, clauses 3.2, 4.3, 4.4 & 5.3**

Report No. **R162099** Contract No. 25517 Contract Name: Lisheen Tipperary

Customer DOBA

Samples Received: 20/08/24 Date Tested: 20/08/24

BH/TP*	Sample No.	Depth* (m)	Lab. Ref	Sample Type*	Moisture Content %	Liquid Limit %	Plastic Limit %	Plasticity Index	% <425µm	Preparation	Liquid Limit Clause	Classification (BS5930)	Description
TP01	AA203976	0.6	A24/3872	B	13	35	NP	NP	82	WS	4.4		Brown sandy gravelly SILT
TP03	AA203980	1.6	A24/3876	B	8.6	25	NP	NP	54	WS	4.4		Brown sandy gravelly SILT
TP04	AA203987	1.5	A24/3877	B	6.4	20	11	9	59	WS	4.4		Brown sandy gravelly CLAY
TP05	AA203984	1.0	A24/3879	B	6.4	24	NP	NP	65	WS	4.4	C L	Brown sandy gravelly SILT
TP05	AA203985	2.0	A24/3880	B	9.0	23	11	12	64	WS	4.4	C L	Brown sandy gravelly CLAY
TP-SA03	AA203992	1.6	A24/3881	B	11	27	NP	NP	68	WS	4.4		Brown sandy gravelly SILT
TP-SA05	AA203989	0.6	A24/3882	B	13	39	NP	NP	59	WS	4.4		Brown sandy gravelly SILT
BH02	AA28311	2.0	A24/3884	B	10	24	NP	NP	62	WS	4.4		Brown sandy gravelly SILT
BH04	AA228303	1.0	A24/3885	B	12	32	NP	NP	58	WS	4.4		Brown sandy gravelly SILT
BH04	AA228304	2.0	A24/3886	B	16	29	16	13	59	WS	4.4	C L	Brown sandy gravelly CLAY

Preparation: WS - Wet sieved
AR - As received
NP - Non plastic

Liquid Limit Clause: 4.3 Cone Penetrometer definitive method
4.4 Cone Penetrometer one point method

Sample Type: B - Bulk Disturbed
U - Undisturbed

Remarks:
Results relate only to the specimen tested,in as received condition unless otherwise noted.
NOTE: **These clauses have been superceded by EN 17892-1 and EN17892-12.
Opinions and interpretations are outside the scope of accreditation. * denotes Customer supplied information.

IGSL Ltd Materials Laboratory

Persons authorized to approve reports

H Byrne (Laboratory Manager)

Approved by

Date: 14/10/24

TEST REPORT
Determination of Particle Size Distribution

Tested in accordance with: BS1377:Part2:1990 , clause 9.2 & 9.5**

(note: Sedimentation stage not accredited)

ISO 17025 INAB ACCREDITED TESTING DETAILED IN SCOPE REG NO.1331

particle size	% passing	
75	76	COBBLES
63	76	
50	61	GRAVEL
37.5	56	
28	50	
20	46	
14	44	
10	42	
6.3	39	
5	38	
3.35	36	
2	34	
1.18	32	SAND
0.6	29	
0.425	28	
0.3	25	
0.15	20	
0.063	16	SILT/CLAY

Contract No. 25517 Report No. R162100

Contract Name : Lisheen Tipperary

BH/TP No. TP01

Sample No.* AA203977 Lab. Sample No. A24/3873

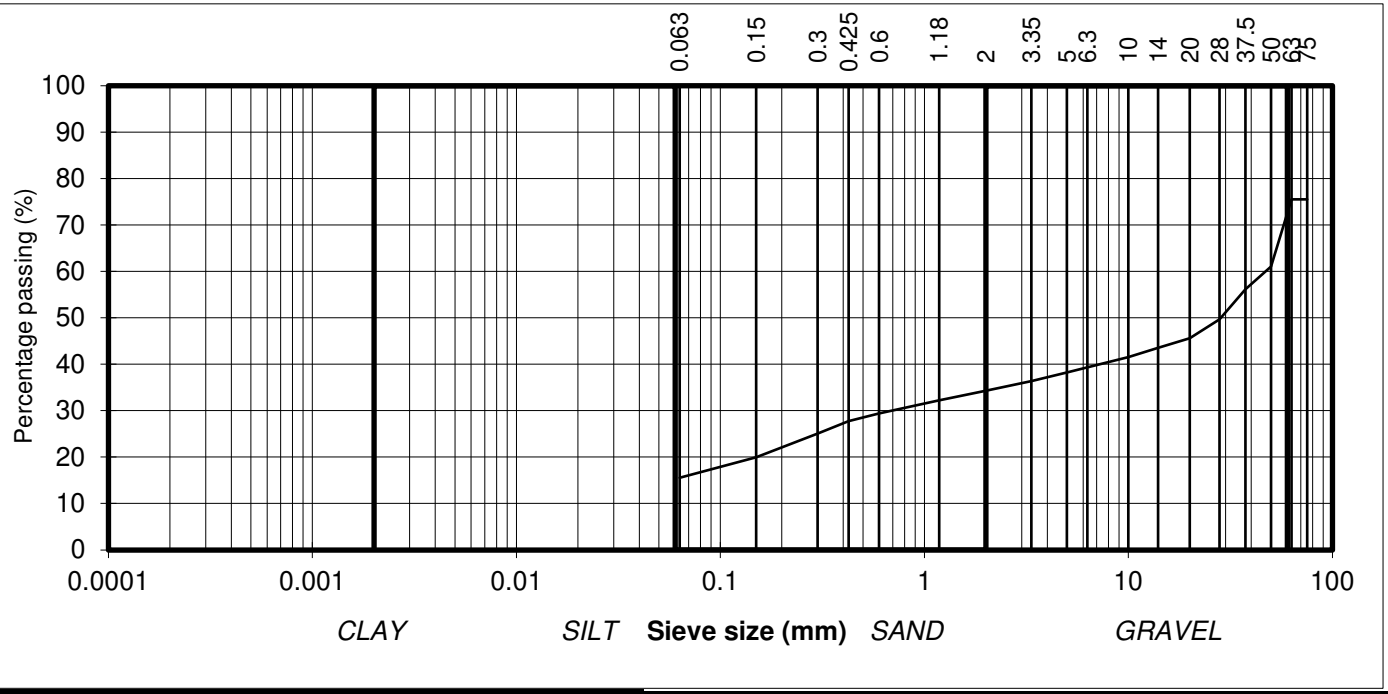
Sample Type: B

Depth* (m) 1.50 Customer: DOBA

Date Received 20/08/2024 Date Testing started 20/08/2024

Description: Brown clayey/silty, sandy, GRAVEL with many cobbles

Remarks Note: **Clause 9.2 and Clause 9.5 of BS1377:Part 2:1990 have been superseded by ISO17892-4:2016 . Sample size did not meet the requirements of BS1377



IGSL Ltd Materials Laboratory

Approved by:	Date:	Page no:
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Persons authorised to approve report: J Barrett (Quality Manager) H Byrne (Laboratory Manager)

TEST REPORT
Determination of Particle Size Distribution

Tested in accordance with: BS1377:Part2:1990 , clause 9.2 & 9.5**

(note: Sedimentation stage not accredited)

ISO 17025 INAB ACCREDITED TESTING DETAILED IN SCOPE REG NO.1331

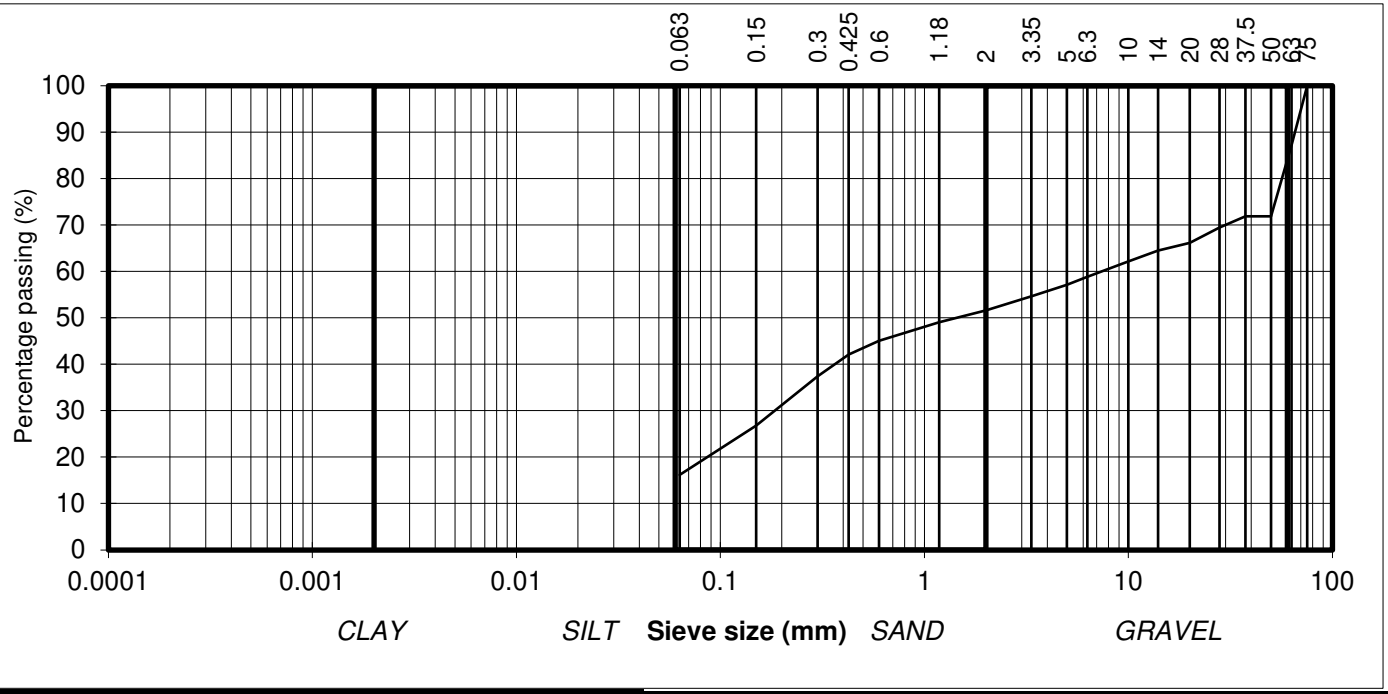
particle size	% passing	
75	100	COBBLES
63	87	
50	72	GRAVEL
37.5	72	
28	69	
20	66	
14	64	
10	62	
6.3	59	
5	57	
3.35	55	
2	52	
1.18	49	SAND
0.6	45	
0.425	42	
0.3	37	
0.15	27	
0.063	16	SILT/CLAY

Contract No.	25517	Report No.	R162101	
Contract Name :	Lisheen Tipperary			
BH/TP No.	TP01			
Sample No.*	AA203978	Lab. Sample No.		A24/3874
Sample Type:	B			
Depth* (m)	2.30	Customer:	DOBA	
Date Received	20/08/2024	Date Testing started		20/08/2024
Description:	Brown clayey/silty, very sandy, GRAVEL with some cobbles			

Results relate only to the specimen tested in as received condition unless otherwise noted. * denotes Customer supplied information. Opinions and interpretations are outside the scope of accreditation.

Remarks: Note: **Clause 9.2 and Clause 9.5 of BS1377:Part 2:1990 have been superseded by ISO17892-4:2016 .

Sample size did not meet the requirements of BS1377



IGSL Ltd Materials Laboratory

Approved by:	Date:	Page no:
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Persons authorised to approve report: J Barrett (Quality Manager) H Byrne (Laboratory Manager)

TEST REPORT
Determination of Particle Size Distribution

Tested in accordance with: BS1377:Part2:1990 , clause 9.2 & 9.5**

(note: Sedimentation stage not accredited)

ISO 17025 INAB ACCREDITED TESTING DETAILED IN SCOPE REG NO.1331

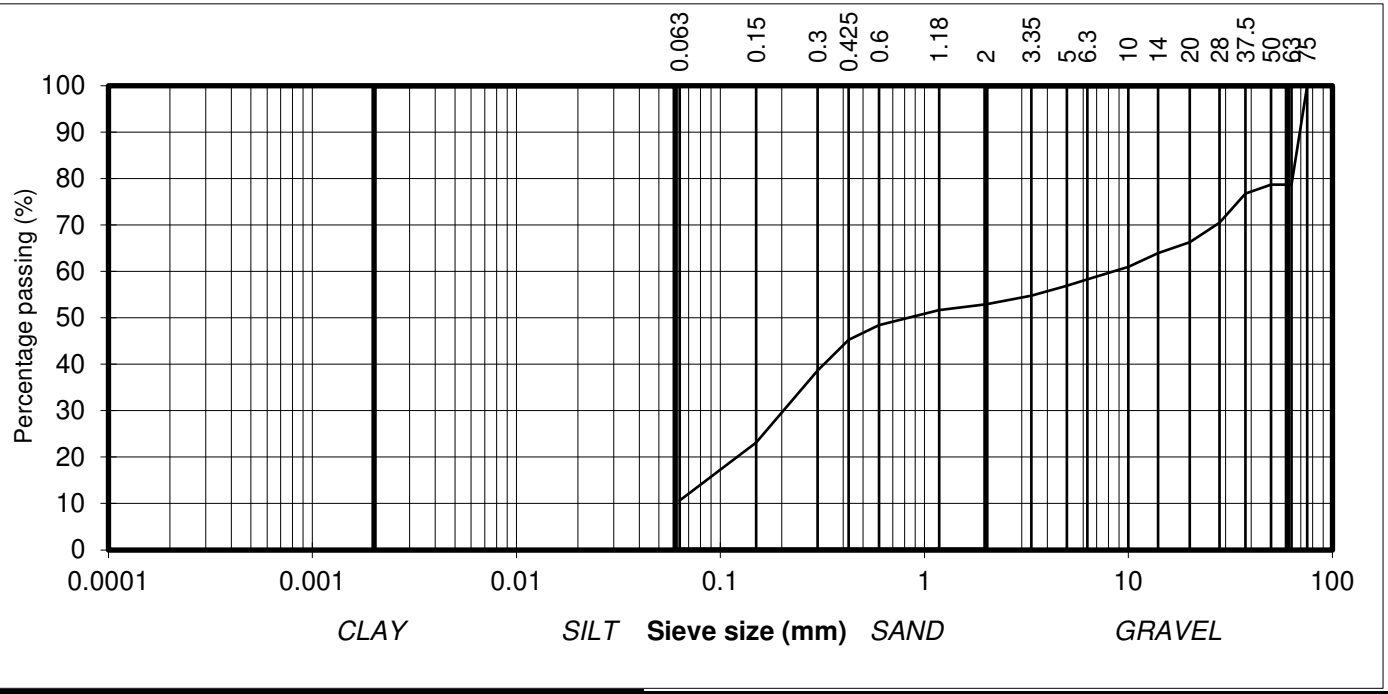
particle size	% passing	
75	100	COBBLES
63	79	
50	79	GRAVEL
37.5	77	
28	70	
20	66	
14	64	
10	61	
6.3	58	
5	57	
3.35	55	
2	53	
1.18	52	SAND
0.6	48	
0.425	45	
0.3	39	
0.15	23	
0.063	11	SILT/CLAY

Contract No.	25517	Report No.	R162102	
Contract Name :	Lisheen Tipperary			
BH/TP No.	TP02			
Sample No.*	AA203983	Lab. Sample No.		A24/3875
Sample Type:	B			
Depth* (m)	1.40	Customer:	DOBA	
Date Received	20/08/2024	Date Testing started		20/08/2024
Description:	Brown clayey/silty, very sandy, GRAVEL with many cobbles			

Results relate only to the specimen tested in as received condition unless otherwise noted. * denotes Customer supplied information. Opinions and interpretations are outside the scope of accreditation.

Remarks: Note: **Clause 9.2 and Clause 9.5 of BS1377:Part 2:1990 have been superseded by ISO17892-4:2016 .

Sample size did not meet the requirements of BS1377



IGSL Ltd Materials Laboratory

Approved by:	Date:	Page no:
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Persons authorised to approve report: J Barrett (Quality Manager) H Byrne (Laboratory Manager)

TEST REPORT
Determination of Particle Size Distribution

Tested in accordance with: BS1377:Part2:1990 , clause 9.2 & 9.5**

(note: Sedimentation stage not accredited)

ISO 17025 INAB ACCREDITED TESTING DETAILED IN SCOPE REG NO.1331

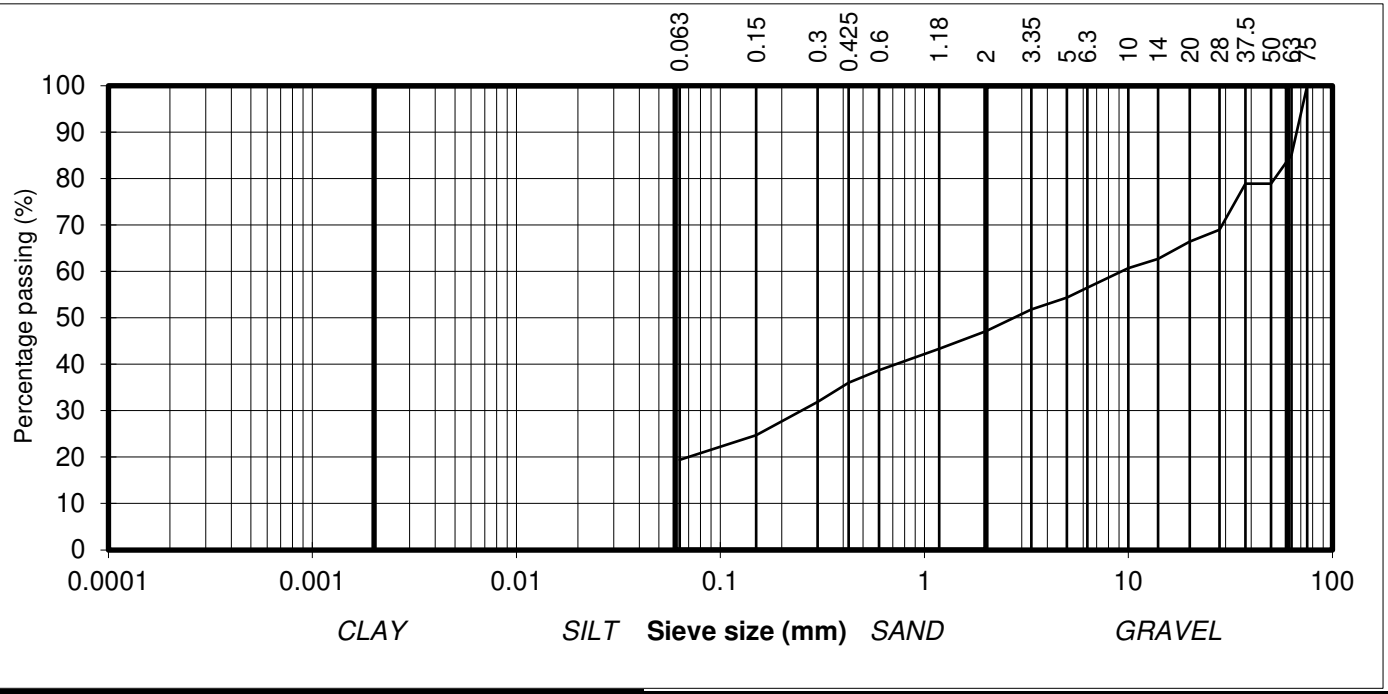
particle size	% passing	
75	100	COBBLES
63	85	
50	79	GRAVEL
37.5	79	
28	69	
20	66	
14	63	
10	61	
6.3	57	
5	54	
3.35	52	
2	47	
1.18	43	SAND
0.6	39	
0.425	36	
0.3	32	
0.15	25	
0.063	19	SILT/CLAY

Contract No.	25517	Report No.	R162103	
Contract Name :	Lisheen Tipperary			
BH/TP No.	TP03			
Sample No.*	AA203980	Lab. Sample No.		A24/3876
Sample Type:	B			
Depth* (m)	1.60	Customer:	DOBA	
Date Received	20/08/2024	Date Testing started		20/08/2024
Description:	Brown silty, very sandy, GRAVEL with some cobbles			

Results relate only to the specimen tested in as received condition unless otherwise noted. * denotes Customer supplied information. Opinions and interpretations are outside the scope of accreditation.

Remarks: Note: **Clause 9.2 and Clause 9.5 of BS1377:Part 2:1990 have been superseded by ISO17892-4:2016 .

Sample size did not meet the requirements of BS1377



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Approved by:	Date:	Page no:
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Persons authorised to approve report: J Barrett (Quality Manager) H Byrne (Laboratory Manager)

TEST REPORT
Determination of Particle Size Distribution

Tested in accordance with: BS1377:Part2:1990 , clause 9.2 & 9.5**
(note: Sedimentation stage not accredited)

ISO 17025 INAB ACCREDITED TESTING DETAILED IN SCOPE REG NO.1331

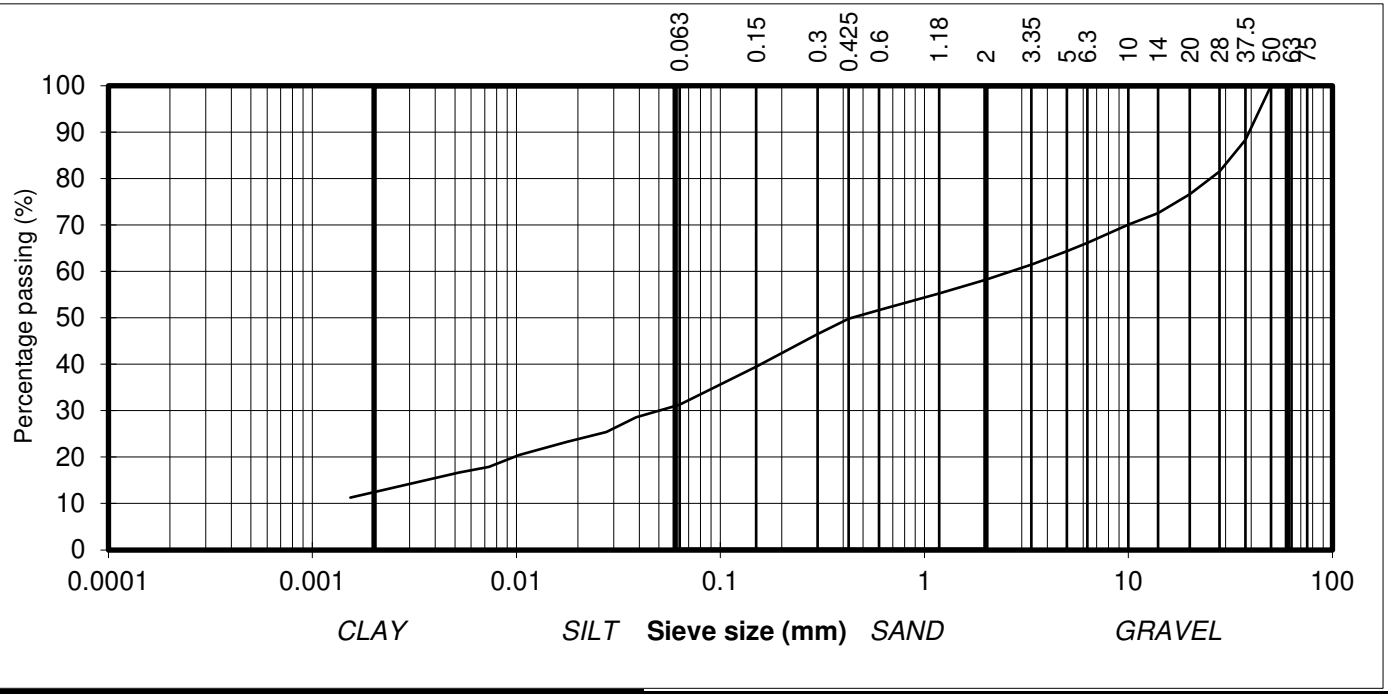
particle size	% passing	
75	100	COBBLES
63	100	
50	100	GRAVEL
37.5	88	
28	82	
20	77	
14	73	
10	70	
6.3	66	
5	64	
3.35	61	
2	58	
1.18	55	SAND
0.6	52	
0.425	50	
0.3	47	
0.15	39	
0.063	31	SILT/CLAY
0.039	29	
0.028	25	
0.018	23	
0.010	20	
0.007	18	
0.005	17	
0.002	11	

Contract No.	25517	Report No.	R162104	
Contract Name :	Lisheen Tipperary			
BH/TP No.	TP04			
Sample No.*	AA203980	Lab. Sample No.		A24/3876
Sample Type:	B			
Depth* (m)	2.50	Customer:	DOBA	
Date Received	20/08/2024	Date Testing started		20/08/2024
Description:	Brown slightly sandy, gravelly, SILT/CLAY			

Results relate only to the specimen tested in as received condition unless otherwise noted. * denotes Customer supplied information. Opinions and interpretations are outside the scope of accreditation.

Remarks: Note: **Clause 9.2 and Clause 9.5 of BS1377:Part 2:1990 have been superseded by ISO17892-4:2016 .

Sample size did not meet the requirements of BS1377



IGSL Ltd Materials Laboratory

Approved by:	Date:	Page no:
H Byrne	14/10/24	1 of 1

Persons authorised to approve report: J Barrett (Quality Manager) H Byrne (Laboratory Manager)

TEST REPORT
Determination of Particle Size Distribution

Tested in accordance with: BS1377:Part2:1990 , clause 9.2 & 9.5**

(note: Sedimentation stage not accredited)

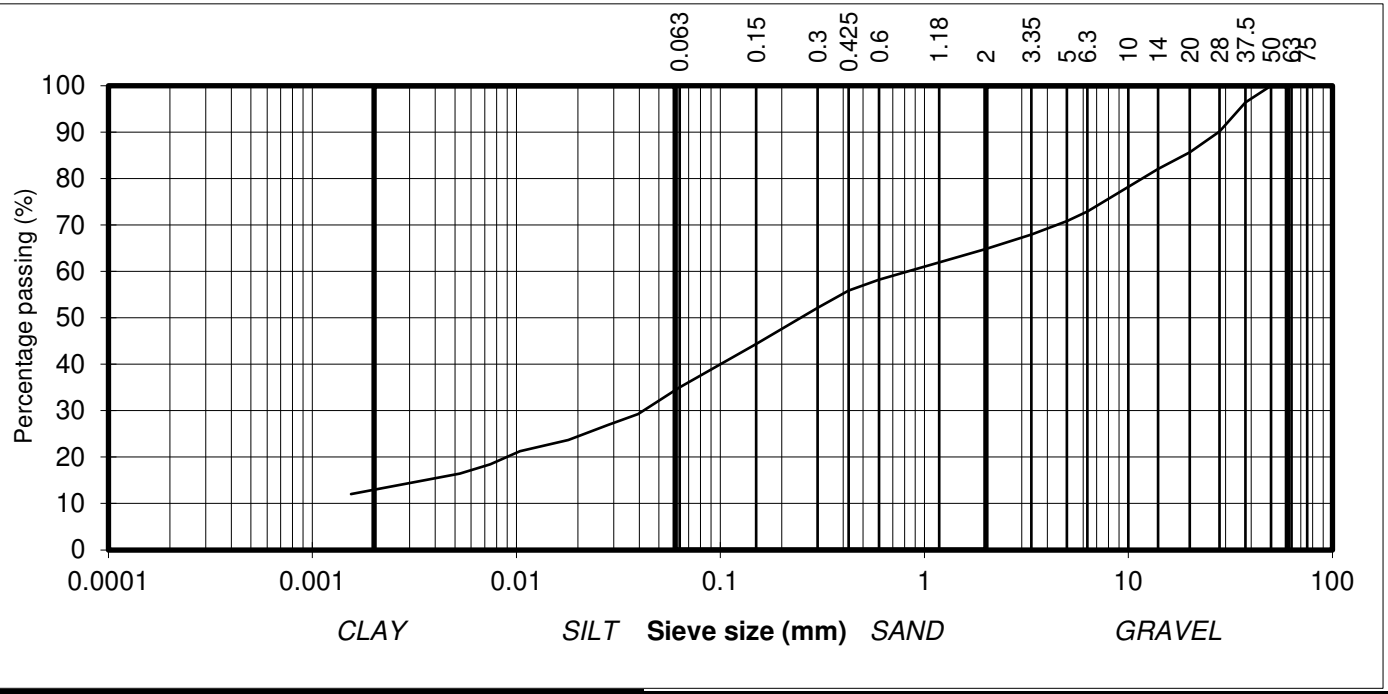
ISO 17025 INAB ACCREDITED TESTING DETAILED IN SCOPE REG NO.1331

Contract No.	25517	Report No.	R162105	
Contract Name :	Lisheen Tipperary			
BH/TP No.	TP05			
Sample No.*	AA203985	Lab. Sample No.		A24/3880
Sample Type:	B			
Depth* (m)	5.00	Customer:	DOBA	
Date Received	20/08/2024	Date Testing started		20/08/2024
Description:	Brown slightly sandy, gravelly, CLAY			
Remarks	Note: **Clause 9.2 and Clause 9.5 of BS1377:Part 2:1990 have been superseded by ISO17892-4:2016 .			

Results relate only to the specimen tested in as received condition unless otherwise noted. * denotes Customer supplied information. Opinions and interpretations are outside the scope of accreditation.

This report shall not be reproduced except in full without the written approval of the Laboratory.

particle size	% passing	
75	100	COBBLES
63	100	
50	100	GRAVEL
37.5	96	
28	90	
20	86	
14	82	
10	78	
6.3	73	
5	71	
3.35	68	
2	65	
1.18	62	SAND
0.6	58	
0.425	56	
0.3	52	
0.15	44	
0.063	35	SILT/CLAY
0.039	29	
0.028	27	
0.018	24	
0.010	21	
0.007	18	
0.005	16	
0.002	12	



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Persons authorised to approve report: J Barrett (Quality Manager) H Byrne (Laboratory Manager)

TEST REPORT
Determination of Particle Size Distribution

Tested in accordance with: BS1377:Part2:1990 , clause 9.2 & 9.5**

(note: Sedimentation stage not accredited)

ISO 17025 INAB ACCREDITED TESTING DETAILED IN SCOPE REG NO.1331

particle size	% passing	
75	100	COBBLES
63	100	
50	100	GRAVEL
37.5	86	
28	81	
20	70	
14	66	
10	62	
6.3	57	
5	54	
3.35	50	
2	44	
1.18	39	SAND
0.6	32	
0.425	29	
0.3	24	
0.15	16	
0.063	11	SILT/CLAY

Contract No. 25517 Report No. R162106

Contract Name : Lisheen Tipperary

BH/TP No. TP SA05

Sample No.* AA203990 Lab. Sample No. A24/3883

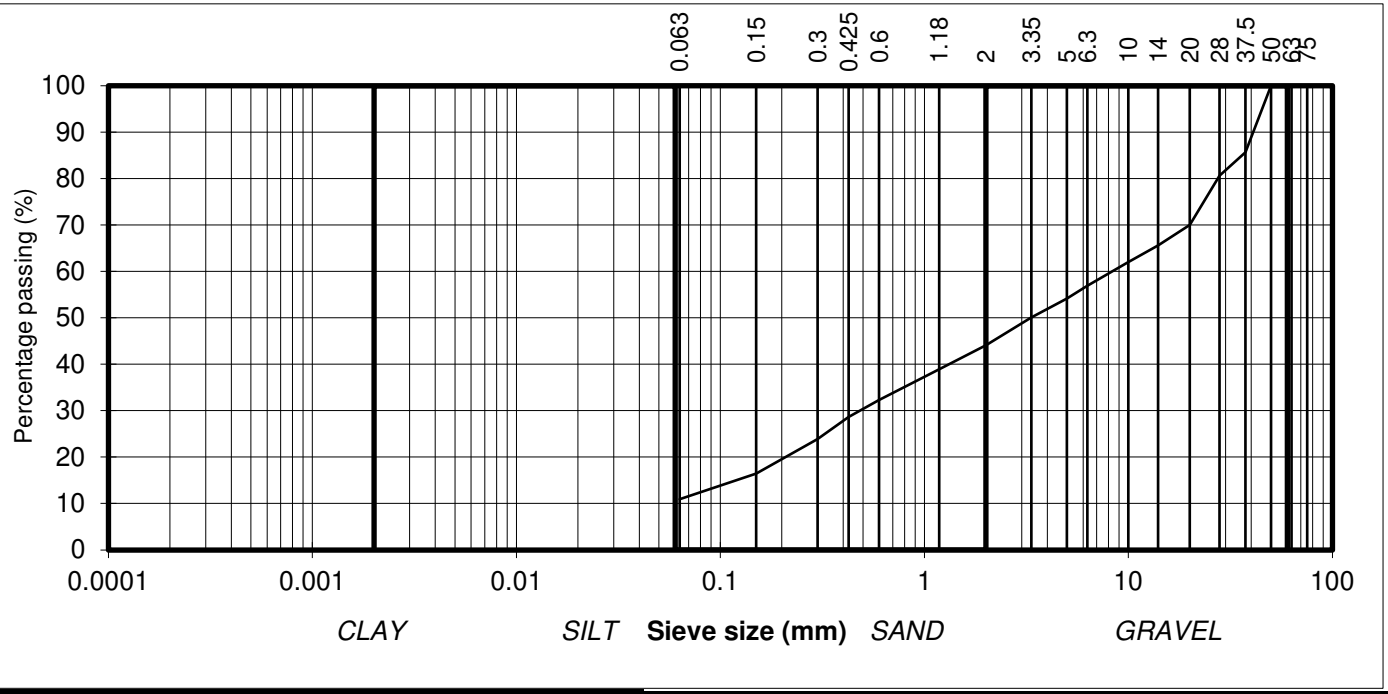
Sample Type: B

Depth* (m) 1.20 Customer: DOBA

Date Received 20/08/2024 Date Testing started 20/08/2024

Description: Brown clayey/silty, very sandy, GRAVEL

Remarks Note: **Clause 9.2 and Clause 9.5 of BS1377:Part 2:1990 have been superseded by ISO17892-4:2016 . Sample size did not meet the requirements of BS1377



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Approved by:	Date:	Page no:
H Byrne	14/10/24	1 of 1

Persons authorised to approve report: J Barrett (Quality Manager) H Byrne (Laboratory Manager)

IGSL Ltd
Materials Laboratory
Unit J5, M7 Business Park
Newhall, Naas
Co. Kildare
045 846176

Test Report

Determination of Moisture Content, Liquid & Plastic Limits

Tested in accordance with BS1377:Part 2:1990, clauses 3.2, 4.3, 4.4 & 5.3**

Report No. **R162106** Contract No. 25517 Contract Name: Lisheen Tipperary Phase 2

Customer DOBA

Samples Received: 23/09/24 Date Tested: 23/09/24

BH/TP*	Sample No.	Depth* (m)	Lab. Ref	Sample Type*	Moisture Content %	Liquid Limit %	Plastic Limit %	Plasticity Index	% <425µm	Preparation	Liquid Limit Clause	Classification (BS5930)	Description
TP06	AA208997	1.5	A24/4535	B	6.4	22	NP	NP	37	WS	4.4		Brown sandy gravelly SILT
TP08	AA208992	2.0	A24/4538	B	10	28	12	16	63	WS	4.4	C L	Brown silty, very sandy, GRAVEL with some cobbles
TP09	AA208987	1.6	A24/4539	B	7.1	24	13	11	57	WS	4.4	C L	Brown sandy gravelly CLAY
TP11	AA208990	1.1	A24/4541	B	9.6	20	12	8	50	WS	4.4	C L	Brown sandy gravelly SILT
BH06	AA219549	3.0	A24/4542	B	10	21	NP	NP	57	WS	4.4		Brown slightly sandy, gravelly, CLAY
BH07	AA229645	1.5	A24/4543	B	22	33	NP	NP	59	WS	4.4		Grey brown sandy gravelly SILT
BH07	AA229648	3.5	A24/4544	B	25	30	NP	NP	51	WS	4.4		Black/brown sandy gravelly SILT
BH08	AA219500	0.8	A24/4546	B	8.3	24	13	11	39	WS	4.4	C L	Brown sandy gravelly CLAY

Preparation: WS - Wet sieved
AR - As received
NP - Non plastic

Liquid Limit Clause: 4.3 Cone Penetrometer definitive method
4.4 Cone Penetrometer one point method

Sample Type: B - Bulk Disturbed
U - Undisturbed

Remarks:
Results relate only to the specimen tested,in as received condition unless otherwise noted.
NOTE: **These clauses have been superceded by EN 17892-1 and EN17892-12.
Opinions and interpretations are outside the scope of accreditation. * denotes Customer supplied information.

IGSL Ltd Materials Laboratory

Persons authorized to approve reports

H Byrne (Laboratory Manager)

Approved by: H Byrne

Date: 14/10/24

TEST REPORT
Determination of Particle Size Distribution

Tested in accordance with: BS1377:Part2:1990 , clause 9.2 & 9.5**

(note: Sedimentation stage not accredited)

ISO 17025 INAB ACCREDITED TESTING DETAILED IN SCOPE REG NO.1331

particle size	% passing	
75	100	COBBLES
63	100	
50	100	GRAVEL
37.5	96	
28	89	
20	80	
14	75	
10	70	
6.3	63	
5	60	
3.35	55	
2	50	
1.18	46	SAND
0.6	42	
0.425	41	
0.3	38	
0.15	31	
0.063	19	SILT/CLAY

Contract No. 25517 Report No. R162111

Contract Name : Lisheen Tipperary Phase 2

BH/TP No. TP06

Sample No.* AA208998 Lab. Sample No. A24/4536

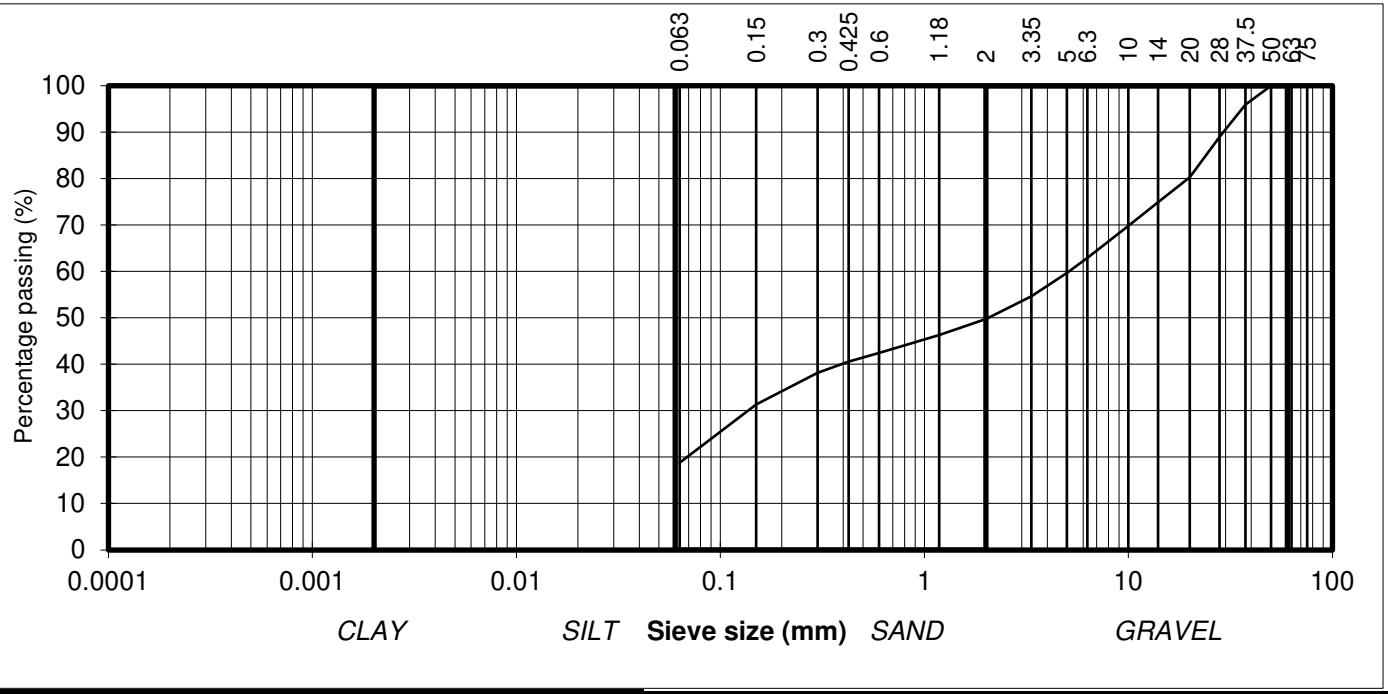
Sample Type: B

Depth* (m) 2.50 Customer: DOBA

Date Received 23/09/2024 Date Testing started 23/09/2024

Description: Brown clayey/silty, very sandy, GRAVEL

Remarks Note: **Clause 9.2 and Clause 9.5 of BS1377:Part 2:1990 have been superseded by ISO17892-4:2016 .



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Approved by:	Date:	Page no:
H Byrne	14/10/24	1 of 1

Persons authorised to approve report: J Barrett (Quality Manager) H Byrne (Laboratory Manager)

TEST REPORT
Determination of Particle Size Distribution

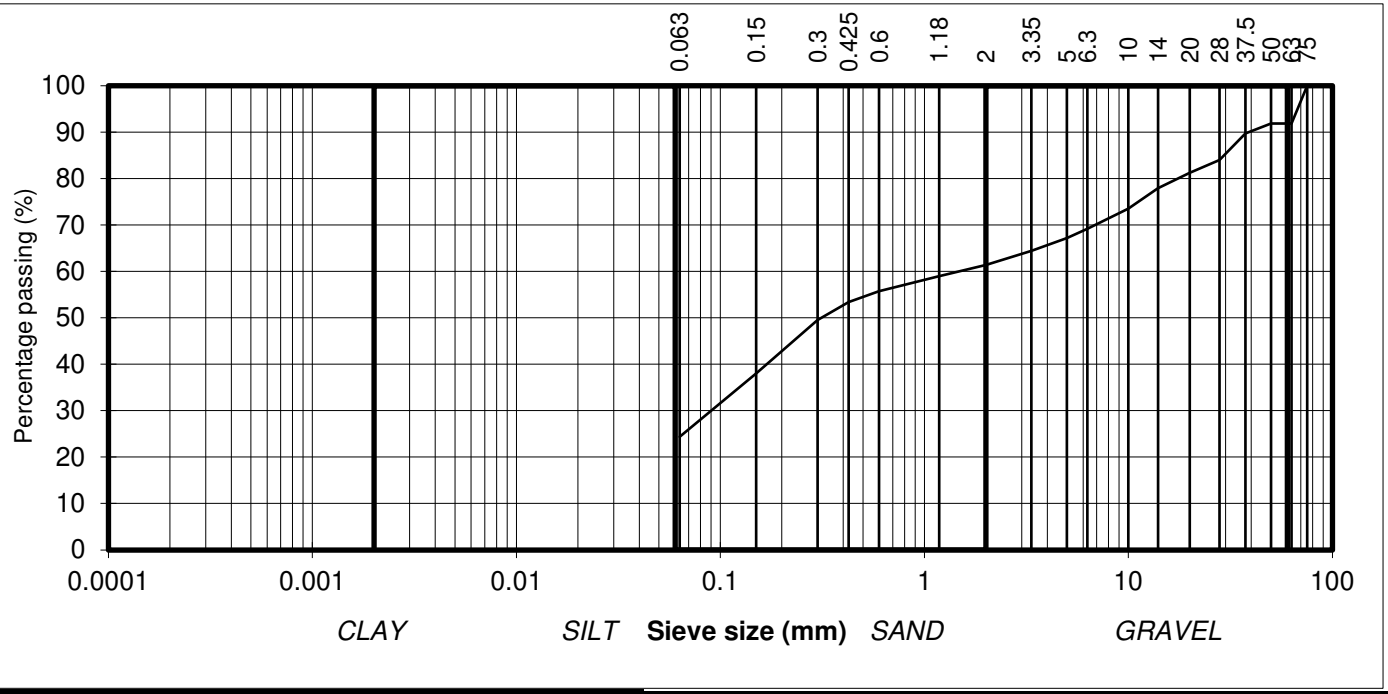
Tested in accordance with: BS1377:Part2:1990 , clause 9.2 & 9.5**

(note: Sedimentation stage not accredited)

ISO 17025 INAB ACCREDITED TESTING DETAILED IN SCOPE REG NO.1331

particle size	% passing	
75	100	COBBLES
63	92	
50	92	GRAVEL
37.5	90	
28	84	
20	81	
14	78	
10	74	
6.3	69	
5	67	
3.35	64	
2	61	
1.18	59	SAND
0.6	56	
0.425	53	
0.3	50	
0.15	38	
0.063	24	SILT/CLAY

Contract No.	25517	Report No.	R162112	
Contract Name :	Lisheen Tipperary Phase 2			
BH/TP No.	TP07			
Sample No.*	AA208994	Lab. Sample No.		A24/4537
Sample Type:	B			
Depth* (m)	1.40	Customer:	DOBA	
Date Received	23/09/2024	Date Testing started		23/09/2024
Description:	Brown sandy, gravelly, SILT/CLAY with some cobbles			
Remarks	Note: **Clause 9.2 and Clause 9.5 of BS1377:Part 2:1990 have been superseded by ISO17892-4:2016 .			



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Approved by:	Date:	Page no:
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Persons authorised to approve report: J Barrett (Quality Manager) H Byrne (Laboratory Manager)

TEST REPORT
Determination of Particle Size Distribution

Tested in accordance with: BS1377:Part2:1990 , clause 9.2 & 9.5**

(note: Sedimentation stage not accredited)

ISO 17025 INAB ACCREDITED TESTING DETAILED IN SCOPE REG NO.1331

particle size	% passing	
75	100	COBBLES
63	100	
50	100	GRAVEL
37.5	100	
28	95	
20	92	
14	89	
10	86	
6.3	82	
5	81	
3.35	77	
2	75	
1.18	72	SAND
0.6	69	
0.425	66	
0.3	63	
0.15	55	
0.063	43	SILT/CLAY
0.038	36	
0.027	32	
0.017	29	
0.010	25	
0.007	23	
0.005	20	
0.002	14	

Contract No. 25517 Report No. R162113

Contract Name : Lisheen Tipperary Phase 2

BH/TP No. TP08

Sample No.* AA208992 Lab. Sample No. A24/4538

Sample Type: B

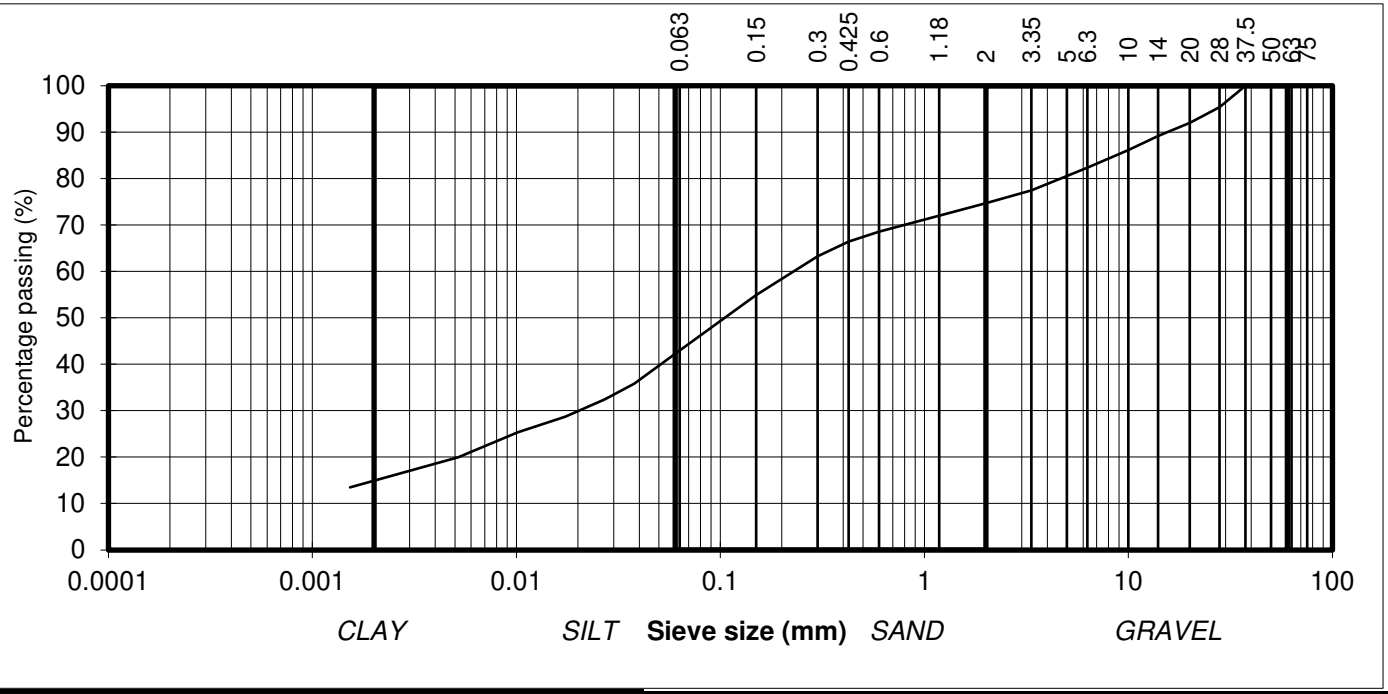
Depth* (m) 2.00 Customer: DOBA

Date Received 23/09/2024 Date Testing started 23/09/2024

Description: Brown slightly sandy, slightly gravelly, CLAY

Remarks Note: **Clause 9.2 and Clause 9.5 of BS1377:Part 2:1990 have been superseded by ISO17892-4:2016 .

Results relate only to the specimen tested in as received condition unless otherwise noted. * denotes Customer supplied information. Opinions and interpretations are outside the scope of accreditation.



IGSL Ltd Materials Laboratory

Approved by:	Date:	Page no:
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Persons authorised to approve report: J Barrett (Quality Manager) H Byrne (Laboratory Manager)

TEST REPORT
Determination of Particle Size Distribution

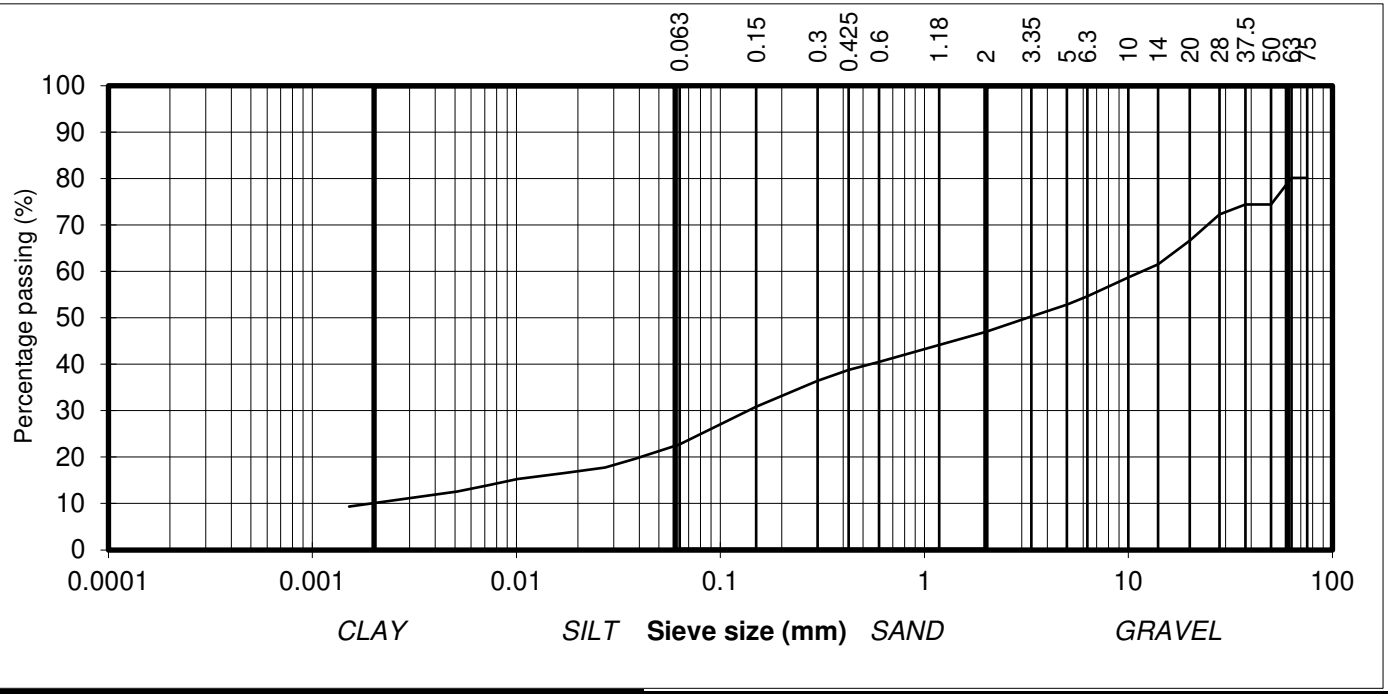
Tested in accordance with: BS1377:Part2:1990 , clause 9.2 & 9.5**
(note: Sedimentation stage not accredited)

ISO 17025 INAB ACCREDITED TESTING DETAILED IN SCOPE REG NO.1331

particle size	% passing	
75	80	COBBLES
63	80	
50	74	GRAVEL
37.5	74	
28	72	
20	67	
14	62	
10	59	
6.3	55	
5	53	
3.35	50	
2	47	
1.18	44	SAND
0.6	41	
0.425	39	
0.3	36	
0.15	31	
0.063	23	SILT/CLAY
0.038	20	
0.027	18	
0.017	17	
0.010	15	
0.007	14	
0.005	13	
0.002	9	

Contract No. 25517 Report No. R162114
Contract Name : Lisheen Tipperary Phase 2
BH/TP No. TP09
Sample No.* AA208987 Lab. Sample No. A24/4539
Sample Type: B
Depth* (m) 1.60 Customer: DOBA
Date Received 23/09/2024 Date Testing started 23/09/2024
Description: Brown slightly sandy, slightly gravelly, CLAY with some cobbles

Remarks Note: **Clause 9.2 and Clause 9.5 of BS1377:Part 2:1990 have been superseded by ISO17892-4:2016 . Sample size did not meet the requirements of BS1377



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Approved by:	Date:	Page no:
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Persons authorised to approve report: J Barrett (Quality Manager) H Byrne (Laboratory Manager)

TEST REPORT
Determination of Particle Size Distribution

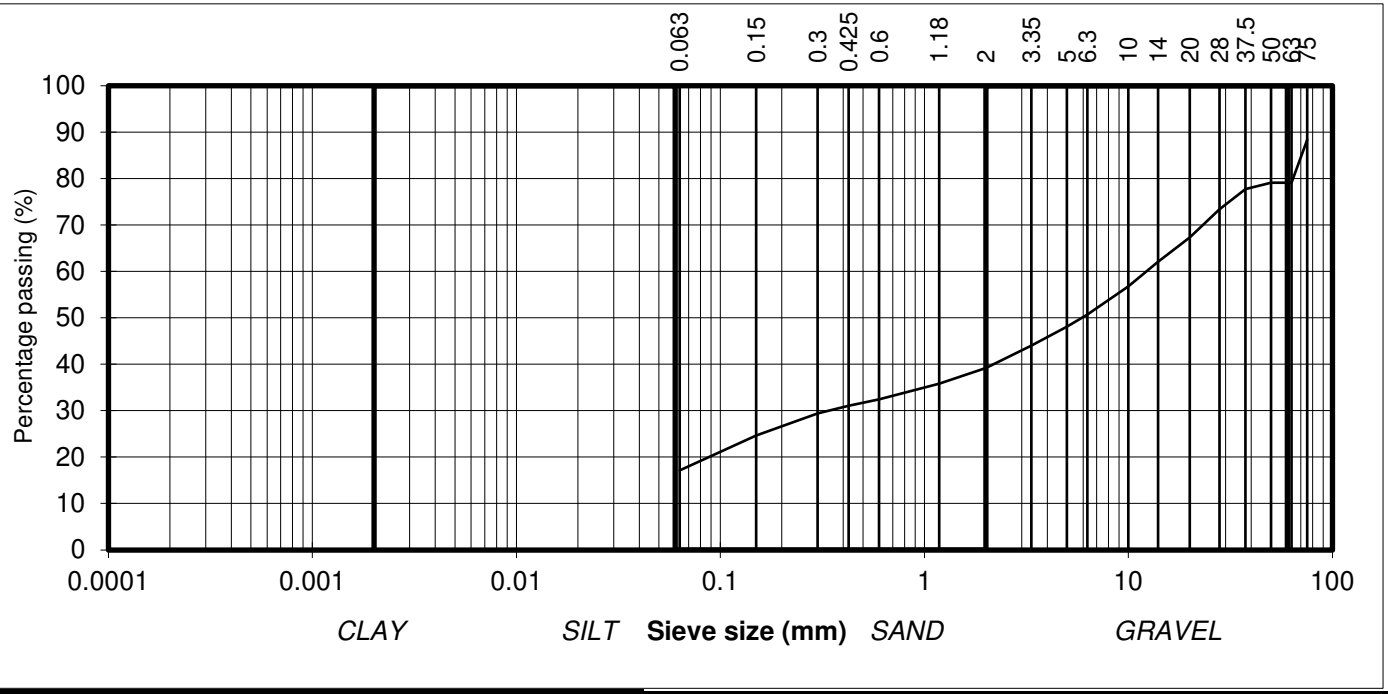
Tested in accordance with: BS1377:Part2:1990 , clause 9.2 & 9.5**
(note: Sedimentation stage not accredited)

ISO 17025 INAB ACCREDITED TESTING DETAILED IN SCOPE REG NO.1331

particle size	% passing	
75	88	COBBLES
63	79	
50	79	GRAVEL
37.5	78	
28	73	
20	67	
14	62	
10	57	
6.3	51	
5	48	
3.35	44	
2	39	
1.18	36	SAND
0.6	32	
0.425	31	
0.3	29	
0.15	25	
0.063	17	SILT/CLAY

Contract No. 25517 Report No. R162115
Contract Name : Lisheen Tipperary Phase 2
BH/TP No. TP09
Sample No.* AA208988 Lab. Sample No. A24/4540
Sample Type: B
Depth* (m) 2.50 Customer: DOBA
Date Received 23/09/2024 Date Testing started 23/09/2024
Description: Brown clayey/silty, very sandy, GRAVEL with many cobbles

Remarks Note: **Clause 9.2 and Clause 9.5 of BS1377:Part 2:1990 have been superseded by ISO17892-4:2016 . Sample size did not meet the requirements of BS1377



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Approved by:	Date:	Page no:
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Persons authorised to approve report: J Barrett (Quality Manager) H Byrne (Laboratory Manager)

TEST REPORT
Determination of Particle Size Distribution

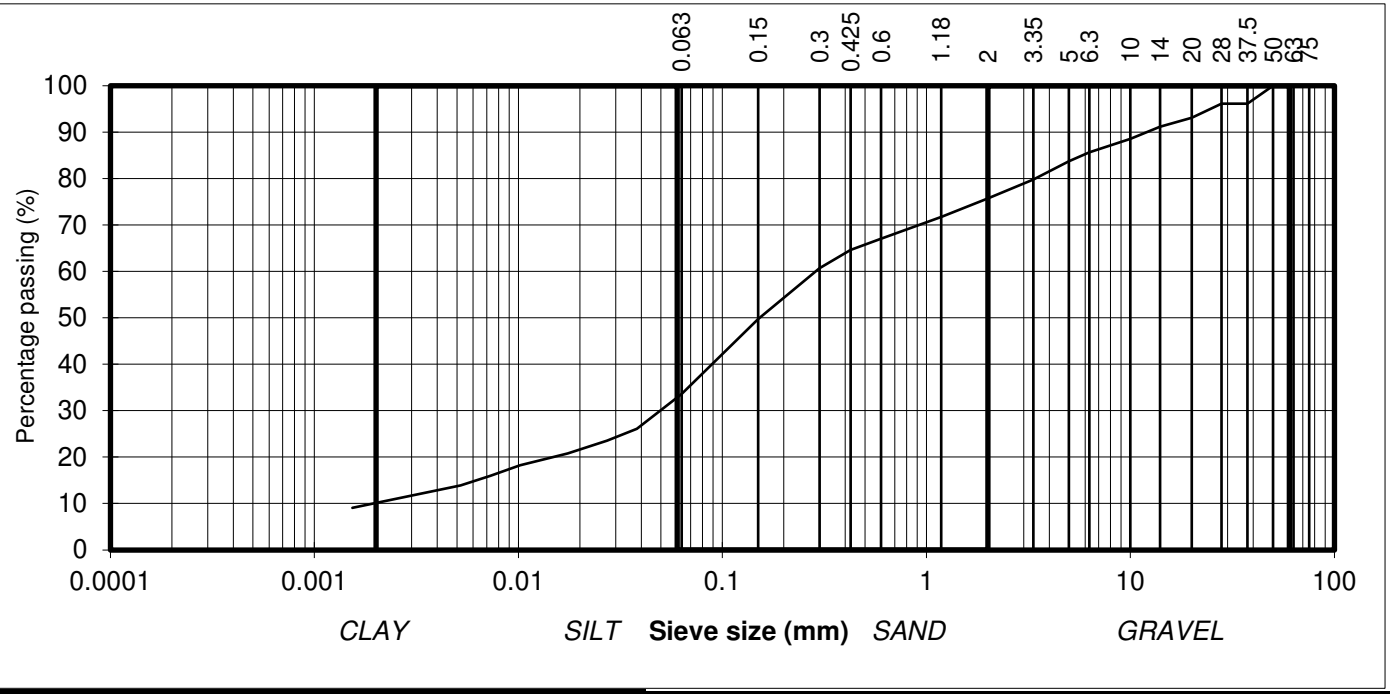
Tested in accordance with: BS1377:Part2:1990 , clause 9.2 & 9.5**

(note: Sedimentation stage not accredited)

ISO 17025 INAB ACCREDITED TESTING DETAILED IN SCOPE REG NO.1331

Contract No.	25517	Report No.	R162107	
Contract Name :	Lisheen Tipperary Phase 2			
BH/TP No.	BH06			
Sample No.*	AA219549	Lab. Sample No.		A24/4542
Sample Type:	B			
Depth* (m)	3.00	Customer:	DOBA	
Date Received	23/09/2024	Date Testing started		23/09/2024
Description:	Brown sandy, slightly gravelly, SILT			
Remarks	Note: **Clause 9.2 and Clause 9.5 of BS1377:Part 2:1990 have been superseded by ISO17892-4:2016 .			

particle size	% passing	
75	100	COBBLES
63	100	
50	100	GRAVEL
37.5	96	
28	96	
20	93	
14	91	
10	89	
6.3	86	
5	84	
3.35	80	
2	76	
1.18	72	SAND
0.6	67	
0.425	65	
0.3	61	
0.15	50	
0.063	34	SILT/CLAY
0.038	26	
0.027	24	
0.017	21	
0.010	18	
0.007	16	
0.005	14	
0.002	9	



IGSL Ltd Materials Laboratory

Approved by:	Date:	Page no:
H Byrne	14/10/24	1 of 1

Persons authorised to approve report: J Barrett (Quality Manager) H Byrne (Laboratory Manager)

TEST REPORT
Determination of Particle Size Distribution

Tested in accordance with: BS1377:Part2:1990 , clause 9.2 & 9.5**

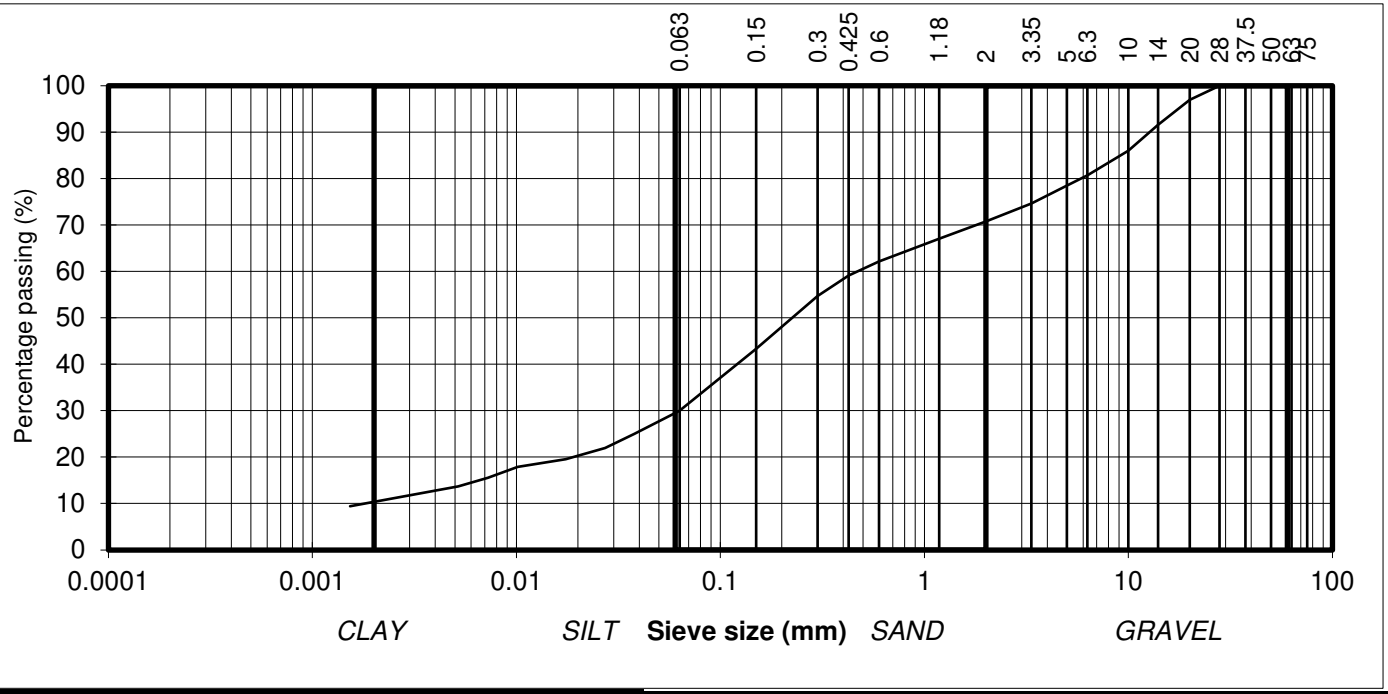
(note: Sedimentation stage not accredited)

ISO 17025 INAB ACCREDITED TESTING DETAILED IN SCOPE REG NO.1331

particle size	% passing	
75	100	COBBLES
63	100	
50	100	GRAVEL
37.5	100	
28	100	
20	97	
14	92	
10	86	
6.3	81	
5	78	
3.35	75	
2	71	
1.18	67	SAND
0.6	62	
0.425	59	
0.3	55	
0.15	43	
0.063	30	SILT/CLAY
0.038	25	
0.027	22	
0.017	20	
0.010	18	
0.007	16	
0.005	14	
0.002	9	

Contract No.	25517	Report No.	R162108	
Contract Name :	Lisheen Tipperary Phase 2			
BH/TP No.	BH07			
Sample No.*	AA229648	Lab. Sample No.		A24/4544
Sample Type:	B			
Depth* (m)	3.50	Customer:	DOBA	
Date Received	23/09/2024	Date Testing started		23/09/2024
Description:	Black brown sandy, slightly gravelly, SILT			

Remarks: Note: **Clause 9.2 and Clause 9.5 of BS1377:Part 2:1990 have been superseded by ISO17892-4:2016 .



IGSL Ltd Materials Laboratory

Approved by:	Date:	Page no:
H Byrne	14/10/24	1 of 1

Persons authorised to approve report: J Barrett (Quality Manager) H Byrne (Laboratory Manager)

TEST REPORT
Determination of Particle Size Distribution

Tested in accordance with: BS1377:Part2:1990 , clause 9.2 & 9.5**

(note: Sedimentation stage not accredited)

ISO 17025 INAB ACCREDITED TESTING DETAILED IN SCOPE REG NO.1331

particle size	% passing	
75	42	COBBLES
63	34	
50	13	GRAVEL
37.5	7	
28	3	
20	1	
14	1	
10	0	
6.3	0	
5	0	
3.35	0	
2	0	
1.18	0	SAND
0.6	0	
0.425	0	
0.3	0	
0.15	0	
0.063	0	SILT/CLAY

Contract No. 25517 Report No. R162109

Contract Name : Lisheen Tipperary Phase 2

BH/TP No. BH07

Sample No.* AA229650 Lab. Sample No. A24/4545

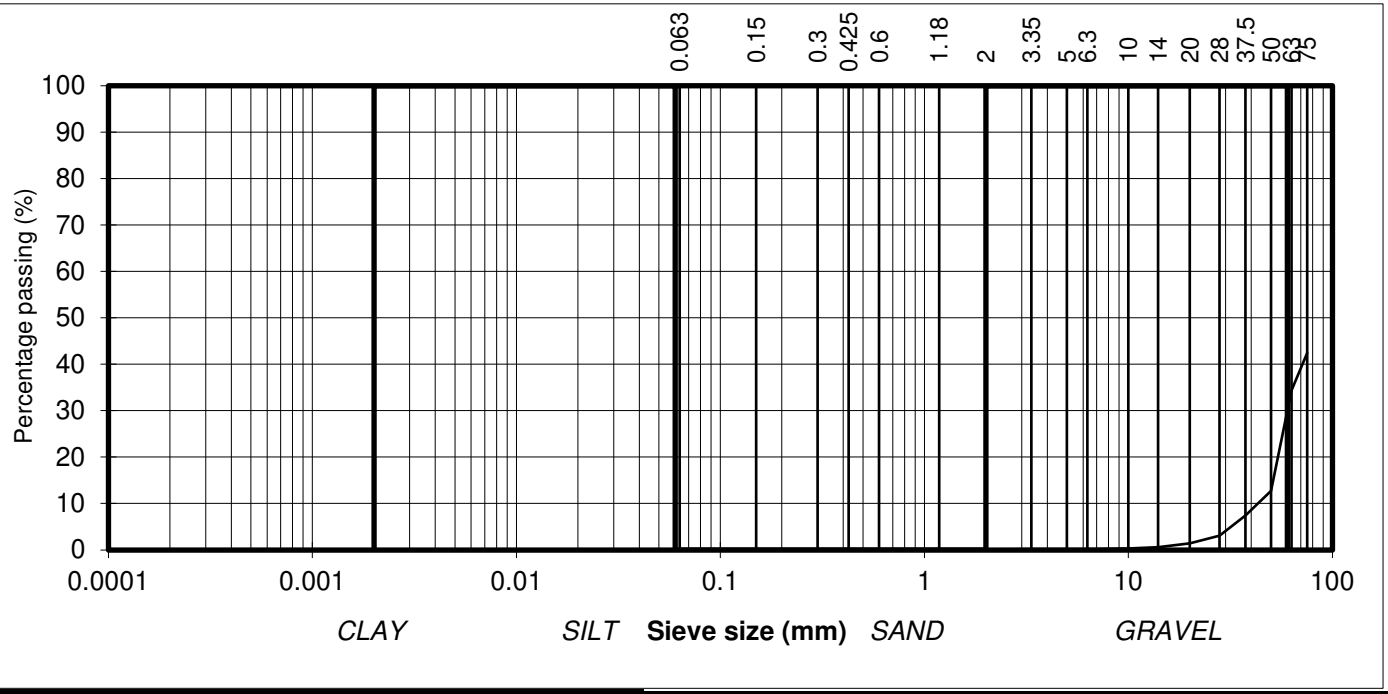
Sample Type: B

Depth* (m) 5.00 Customer: DOBA

Date Received 23/09/2024 Date Testing started 23/09/2024

Description: COBBLES with black brown gravel

Remarks Note: **Clause 9.2 and Clause 9.5 of BS1377:Part 2:1990 have been superseded by ISO17892-4:2016 . Sample size did not meet the requirements of BS1377



IGSL Ltd Materials Laboratory

Approved by:	Date:	Page no:
H Byrne	14/10/24	1 of 1

Persons authorised to approve report: J Barrett (Quality Manager) H Byrne (Laboratory Manager)

Appendix 9

Geotechnical Laboratory Test Records (Rock Cores)

(Diametrial) POINT LOAD STRENGTH INDEX TEST DATA

Contract: Lisheen Mines, Tipperary

Contract no. 25517

Sample Type: Core

Date of test: 19/8/24

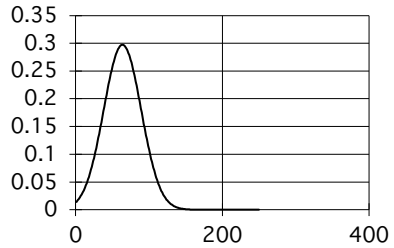
RC No.	Depth m	D (Diameter) mm	P (failure load) kN	F	Is (index strength) Mpa	Is(50) (index strength) Mpa	*UCS MPa	Type	Orienation
RC01	9.8	78	9.0	1.222	1.47	1.80	36	d	//
	10.5	78	12.5	1.222	2.05	2.51	50	d	//
	10.8	78	12.8	1.222	2.10	2.57	51	d	//
	12.3	78	11.7	1.222	1.92	2.35	47	d	//
RC02	3.0	78	17.6	1.222	2.90	3.54	71	d	//
	5.0	78	14.8	1.222	2.43	2.96	59	d	//
	6.0	78	10.0	1.222	1.64	2.01	40	d	//
	8.0	78	16.1	1.222	2.64	3.22	64	d	//
	8.8	78	31.9	1.222	5.24	6.40	128	d	//
	10.0	78	15.1	1.222	2.48	3.03	61	d	//
RC03	4.3	78	18.5	1.222	3.04	3.71	74	d	//
	8.4	78	15.3	1.222	2.52	3.08	62	d	//
	8.9	78	26.1	1.222	4.30	5.25	105	d	//
RC04	3.6	78	8.5	1.222	1.40	1.71	34	d	//
	5.7	78	15.6	1.222	2.56	3.12	62	d	//
	6.8	78	10.1	1.222	1.66	2.03	41	d	//
	8.4	78	24.1	1.222	3.96	4.83	97	d	//
	9.9	78	10.1	1.222	1.65	2.02	40	d	//
	10.0	78	22.4	1.222	3.68	4.50	90	d	//

Statistical Summary Data	Is(50)	UCS*
Number of Samples Tested	19	19
Minimum	1.71	34
Average	3.19	64
Maximum	6.40	128
Standard Dev.	1.27	25
Upper 95% Confidence Limit	5.69	113.78
Lower 95% Confidence Limit	0.69	13.86

Comments:

*UCS taken as k x Point Load Is(50): k= 20

*UCS Normal Distribution Curve



Abbreviations	
i	irregular
a	axial
b	block
d	diametral

approx. orientation to planes of weakness/bedding

U	unknown
P	perpendicular
//	parallel

(Diametrial) POINT LOAD STRENGTH INDEX TEST DATA

Contract: Lisheen Mines, Tipperary
Contract no. 25517

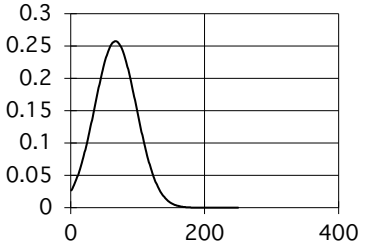
Sample Type: Core
Date of test: 19/8/24

RC No.	Depth m	D (Diameter) mm	P (failure load) kN	F	s (index strength Mpa	Is(50) (index strength) Mpa	*UCS MPa	Type	Orienation
RC05	3.2	78	22.0	1.222	3.62	4.42	88	d	//
	4.8	78	18.0	1.222	2.96	3.61	72	d	//
	6.3	78	16.0	1.222	2.63	3.21	64	d	//
	7.4	78	10.0	1.222	1.64	2.01	40	d	//
	10.0	78	2.0	1.222	0.33	0.40	8	d	//
	11.5	78	6.0	1.222	0.99	1.20	24	d	//
RC06	9.5	78	28.0	1.222	4.60	5.62	112	d	//
	10.5	78	18.0	1.222	2.96	3.61	72	d	//
	11.7	78	22.0	1.222	3.62	4.42	88	d	//
	14.1	78	16.0	1.222	2.63	3.21	64	d	//
	15.8	78	21.0	1.222	3.45	4.22	84	d	//
	17.6	78	30.0	1.222	4.93	6.02	120	d	//
	18.4	78	6.0	1.222	0.99	1.20	24	d	//
RC07	6.4	78	11.0	1.222	1.81	2.21	44	d	//
	8.1	78	26.0	1.222	4.27	5.22	104	d	//
	9.6	78	22.0	1.222	3.62	4.42	88	d	//
	11.9	78	10.0	1.222	1.64	2.01	40	d	//
	12.7	78	10.0	1.222	1.64	2.01	40	d	//
	14.3	78	19.0	1.222	3.12	3.81	76	d	//
	15.0	78	21.0	1.222	3.45	4.22	84	d	//

Statistical Summary Data	Is(50)	UCS*
Number of Samples Tested	20	20
Minimum	0.40	8
Average	3.35	67
Maximum	6.02	120
Standard Dev.	1.55	31
Upper 95% Confidence Limit	6.39	127.87
Lower 95% Confidence Limit	0.31	6.25

Comments:
*UCS taken as k x Point Load Is(50): k= 20

*UCS Normal Distribution Curve



Abbreviations	
i	irregular
a	axial
b	block
d	diametral

approx. orientation to planes of weakness/bedding

U	unknown
P	perpendicular
//	parallel

(Diametrial) POINT LOAD STRENGTH INDEX TEST DATA

Contract: Lisheen Mines, Tipperary

Contract no. 25517

Sample Type: Core

Date of test: 19/8/24

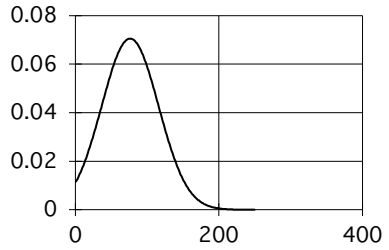
RC No.	Depth m	D (Diameter) mm	P (failure load) kN	F	Is (index strength) Mpa	Is(50) (index strength) Mpa	*UCS MPa	Type	Orienation
RC08	2.3	78	26.0	1.222	4.27	5.22	104	d	//
	4.0	78	21.0	1.222	3.45	4.22	84	d	//
	5.2	78	22.0	1.222	3.62	4.42	88	d	//
	6.7	78	7.0	1.222	1.15	1.41	28	d	//
	8.4	78	31.0	1.222	5.10	6.22	124	d	//
	9.5	78	4.0	1.222	0.66	0.80	16	d	//
	11.0	78	22.0	1.222	3.62	4.42	88	d	//

Statistical Summary Data	Is(50)	UCS*
Number of Samples Tested	7	7
Minimum	0.80	16
Average	3.81	76
Maximum	6.22	124
Standard Dev.	1.98	40
Upper 95% Confidence Limit	7.70	153.94
Lower 95% Confidence Limit	-0.07	-1.35

Comments:

*UCS taken as k x Point Load Is(50): k= 20

*UCS Normal Distribution Curve



Abbreviations	
i	irregular
a	axial
b	block
d	diametral

approx. orientation to planes of weakness/bedding

U	unknown
P	perpendicular
//	parallel

Appendix 10

Environmental & Chemical Laboratory Test Records

eurofins | Chemtest
Eurofins Chemtest Ltd
Depot Road
Newmarket
CB8 0AL
Tel: 01638 606070
Email: info@chemtest.com

Final Report

Report No.:	24-25300-1
Initial Date of Issue:	20-Aug-2024
Re-Issue Details:	
Client	IGSL
Client Address:	M7 Business Park Naas County Kildare Ireland
Contact(s):	Darren Keogh
Project	25517 Lisheen Tipperary (DOBA)

Quotation No.:		**Date Received:**	08-Aug-2024
Order No.:		**Date Instructed:**	08-Aug-2024
No. of Samples:	15		
Turnaround (Wkdays):	7	**Results Due:**	16-Aug-2024
Date Approved:	20-Aug-2024		

Approved By:

Details: David Smith, Technical Director

For details about application of accreditation to specific matrix types, please refer to the Table at the back of this report

Results - Leachate

Project: 25517 Lisheen Tipperary (DOBA)

Client: IGSL						**Chemtest Job No.:**	24-25300	24-25300	24-25300	24-25300	24-25300	24-25300	24-25300	24-25300	24-25300
Quotation No.:						**Chemtest Sample ID.:**	1847654	1847655	1847657	1847659	1847661	1847663	1847664	1847666	1847667
Order No.:						Client Sample Ref.:	TP01	TP02	TP04	TP05	TP-SA03	BH1	BH2	BH3	BH4
						Sample Type:	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
						Top Depth (m):	0.6	0.4	0.7	1.00	0.7	1.00	1.00	1.00	1.00
						Date Sampled:	07-Aug-2024	07-Aug-2024	07-Aug-2024	07-Aug-2024	07-Aug-2024	07-Aug-2024	07-Aug-2024	07-Aug-2024	07-Aug-2024
Determinand	**Accred.**	**SOP**	**Type**	**Units**	**LOD**										
Ammonium	U	1220	10:1	mg/l	0.050		0.17	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	< 0.050	0.10	0.063
Ammonium	N	1220	10:1	mg/kg	0.10		1.7	0.36	0.40	0.53	0.51	0.57	0.36	1.1	0.68

Results - Soil

Project: 25517 Lisheen Tipperary (DOBA)

Client: IGSL				**Chemtest Job No.:**		24-25300	24-25300	24-25300	24-25300	24-25300	24-25300	24-25300
Quotation No.:				**Chemtest Sample ID.:**		1847654	1847655	1847656	1847657	1847658	1847659	1847660
Order No.:				Client Sample Ref.:		TP01	TP02	TP03	TP04	TP04	TP05	TP05
				Sample Type:		SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
				Top Depth (m):		0.6	0.4	0.7	0.7	1.5	1.00	2.00
				Date Sampled:		07-Aug-2024	07-Aug-2024	07-Aug-2024	07-Aug-2024	07-Aug-2024	07-Aug-2024	07-Aug-2024
				Asbestos Lab:		DURHAM	DURHAM		DURHAM		DURHAM	
Determinand	**HWOL Code**	**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	
Moisture		N	2030	%	0.020	15	15	16	9.8	9.5	10	9.1
Soil Colour		N	2040		N/A	Brown	Brown	Brown	Brown	Brown	Brown	Brown
Other Material		N	2040		N/A	Stones and Roots	Stones and Roots	Stones and Roots	Stones	Stones	Stones	Stones
Soil Texture		N	2040		N/A	Sand	Sand	Sand	Sand	Sand	Sand	Sand
pH (2.5:1) at 20C		N	2010		4.0			8.4		8.6		8.3
Boron (Hot Water Soluble)		M	2120	mg/kg	0.40	< 0.40	< 0.40		< 0.40		< 0.40	
Magnesium (Water Soluble)		N	2120	g/l	0.010			< 0.010		< 0.010		< 0.010
Sulphate (2:1 Water Soluble) as SO4		M	2120	g/l	0.010			< 0.010		< 0.010		< 0.010
Total Sulphur		U	2175	%	0.010			0.010		0.020		0.020
Sulphur (Elemental)		M	2180	mg/kg	1.0	< 1.0	< 1.0		< 1.0		< 1.0	
Chloride (Water Soluble)		M	2220	g/l	0.010			< 0.010		< 0.010		< 0.010
Nitrate (Water Soluble)		N	2220	g/l	0.010			< 0.010		< 0.010		< 0.010
Cyanide (Total)		M	2300	mg/kg	0.50	< 0.50	< 0.50		< 0.50		< 0.50	
Sulphide (Easily Liberatable)		N	2325	mg/kg	0.50	4.0	3.9		21		3.7	
Ammonium (Water Soluble)		M	2220	g/l	0.01			< 0.01		< 0.01		< 0.01
Sulphate (Total)		U	2430	%	0.010	0.015	0.093		0.043		0.041	
Sulphate (Acid Soluble)		U	2430	%	0.010			0.021		0.016		0.010
Arsenic		M	2455	mg/kg	0.5	11	22		8.1		15	
Barium		M	2455	mg/kg	0.5	130	110		96		110	
Cadmium		M	2455	mg/kg	0.10	0.75	2.1		< 0.10		1.4	
Chromium		M	2455	mg/kg	0.5	16	9.2		78		19	
Molybdenum		M	2455	mg/kg	0.5	< 0.5	1.3		< 0.5		0.6	
Antimony		N	2455	mg/kg	2.0	3.1	< 2.0		< 2.0		2.6	
Copper		M	2455	mg/kg	0.50	14	11		11		18	
Mercury		M	2455	mg/kg	0.05	0.10	0.07		0.05		0.12	
Nickel		M	2455	mg/kg	0.50	38	43		24		51	
Lead		M	2455	mg/kg	0.50	29	110		19		33	
Selenium		M	2455	mg/kg	0.25	0.96	0.55		< 0.25		0.90	
Zinc		M	2455	mg/kg	0.50	63	430		53		100	
Chromium (Trivalent)		N	2490	mg/kg	1.0	16	9.2		78		19	
Chromium (Hexavalent)		N	2490	mg/kg	0.50	< 0.50	< 0.50		< 0.50		< 0.50	
Aliphatic VPH >C5-C6	HS_2D_AL	U	2780	mg/kg	0.05	< 0.05	< 0.05		< 0.05		< 0.05	
Aliphatic VPH >C6-C7	HS_2D_AL	U	2780	mg/kg	0.05	< 0.05	< 0.05		< 0.05		< 0.05	
Aliphatic VPH >C7-C8	HS_2D_AL	U	2780	mg/kg	0.05	< 0.05	< 0.05		< 0.05		< 0.05	
Aliphatic VPH >C8-C10	HS_2D_AL	U	2780	mg/kg	0.05	< 0.05	< 0.05		< 0.05		< 0.05	

Results - Soil

Project: 25517 Lisheen Tipperary (DOBA)

Client: IGSL				**Chemtest Job No.:**		24-25300	24-25300	24-25300	24-25300	24-25300	24-25300	24-25300
Quotation No.:				**Chemtest Sample ID.:**		1847654	1847655	1847656	1847657	1847658	1847659	1847660
Order No.:				Client Sample Ref.:		TP01	TP02	TP03	TP04	TP04	TP05	TP05
				Sample Type:		SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
				Top Depth (m):		0.6	0.4	0.7	0.7	1.5	1.00	2.00
				Date Sampled:		07-Aug-2024	07-Aug-2024	07-Aug-2024	07-Aug-2024	07-Aug-2024	07-Aug-2024	07-Aug-2024
				Asbestos Lab:		DURHAM	DURHAM		DURHAM		DURHAM	
Determinand	**HWOL Code**	**Accred.**	**SOP**	**Units**	**LOD**							
Total Aliphatic VPH >C5-C10	HS_2D_AL	U	2780	mg/kg	0.25	< 0.25	< 0.25		< 0.25		< 0.25	
Aliphatic EPH >C10-C12 MC	EH_2D_AL_#1	M	2690	mg/kg	2.00	< 2.0	< 2.0		< 2.0		< 2.0	
Aliphatic EPH >C12-C16 MC	EH_2D_AL_#1	M	2690	mg/kg	1.00	< 1.0	1.7		1.4		< 1.0	
Aliphatic EPH >C16-C21 MC	EH_2D_AL_#1	M	2690	mg/kg	2.00	< 2.0	< 2.0		< 2.0		< 2.0	
Aliphatic EPH >C21-C35 MC	EH_2D_AL_#1	M	2690	mg/kg	3.00	< 3.0	5.0		< 3.0		< 3.0	
Aliphatic EPH >C35-C40 MC	EH_2D_AL_#1	N	2690	mg/kg	10.00	< 10	< 10		< 10		< 10	
Total Aliphatic EPH >C10-C35 MC	EH_2D_AL_#1	M	2690	mg/kg	5.00	< 5.0	9.0		< 5.0		< 5.0	
Aromatic VPH >C5-C7	HS_2D_AR	U	2780	mg/kg	0.05	< 0.05	< 0.05		< 0.05		< 0.05	
Aromatic VPH >C7-C8	HS_2D_AR	U	2780	mg/kg	0.05	< 0.05	< 0.05		< 0.05		< 0.05	
Aromatic VPH >C8-C10	HS_2D_AR	U	2780	mg/kg	0.05	< 0.05	< 0.05		< 0.05		< 0.05	
Total Aromatic VPH >C5-C10	HS_2D_AR	U	2780	mg/kg	0.25	< 0.25	< 0.25		< 0.25		< 0.25	
Aromatic EPH >C10-C12 MC	EH_2D_AR_#1	U	2690	mg/kg	1.00	< 1.0	< 1.0		< 1.0		< 1.0	
Aromatic EPH >C12-C16 MC	EH_2D_AR_#1	U	2690	mg/kg	1.00	< 1.0	< 1.0		< 1.0		< 1.0	
Aromatic EPH >C16-C21 MC	EH_2D_AR_#1	U	2690	mg/kg	2.00	5.2	3.7		3.2		4.9	
Aromatic EPH >C21-C35 MC	EH_2D_AR_#1	U	2690	mg/kg	2.00	< 2.0	2.1		< 2.0		< 2.0	
Aromatic EPH >C35-C40 MC	EH_2D_AR_#1	N	2690	mg/kg	1.00	< 1.0	< 1.0		< 1.0		< 1.0	
Total Aromatic EPH >C10-C35 MC	EH_2D_AR_#1	U	2690	mg/kg	5.00	5.4	5.8		< 5.0		< 5.0	
Total VPH >C5-C10	HS_2D_Total	U	2780	mg/kg	0.50	< 0.50	< 0.50		< 0.50		< 0.50	
Total EPH >C10-C35 MC	EH_2D_Total_#1	U	2690	mg/kg	10.00	< 10	15		< 10		< 10	
Mineral Oil EPH		N	2670	mg/kg	10	< 10	< 10		< 10		< 10	
Benzene		M	2760	µg/kg	1.0	< 1.0	< 1.0		< 1.0		< 1.0	
Toluene		M	2760	µg/kg	1.0	< 1.0	< 1.0		< 1.0		< 1.0	
Ethylbenzene		M	2760	µg/kg	1.0	< 1.0	< 1.0		< 1.0		< 1.0	
m & p-Xylene		M	2760	µg/kg	1.0	< 1.0	< 1.0		< 1.0		< 1.0	
o-Xylene		M	2760	µg/kg	1.0	< 1.0	< 1.0		< 1.0		< 1.0	
Methyl Tert-Butyl Ether		M	2760	µg/kg	1.0	< 1.0	< 1.0		< 1.0		< 1.0	
Naphthalene		M	2800	mg/kg	0.10	< 0.10	< 0.10		< 0.10		< 0.10	
Acenaphthylene		N	2800	mg/kg	0.10	< 0.10	< 0.10		< 0.10		< 0.10	
Acenaphthene		M	2800	mg/kg	0.10	< 0.10	< 0.10		< 0.10		< 0.10	
Fluorene		M	2800	mg/kg	0.10	< 0.10	< 0.10		< 0.10		< 0.10	
Phenanthrene		M	2800	mg/kg	0.10	< 0.10	< 0.10		< 0.10		< 0.10	
Anthracene		M	2800	mg/kg	0.10	< 0.10	< 0.10		< 0.10		< 0.10	
Fluoranthene		M	2800	mg/kg	0.10	< 0.10	< 0.10		< 0.10		< 0.10	
Pyrene		M	2800	mg/kg	0.10	< 0.10	< 0.10		< 0.10		< 0.10	
Benzo[a]anthracene		M	2800	mg/kg	0.10	< 0.10	< 0.10		< 0.10		< 0.10	
Chrysene		M	2800	mg/kg	0.10	< 0.10	< 0.10		< 0.10		< 0.10	
Benzo[b]fluoranthene		M	2800	mg/kg	0.10	< 0.10	< 0.10		< 0.10		< 0.10	
Benzo[k]fluoranthene		M	2800	mg/kg	0.10	< 0.10	< 0.10		< 0.10		< 0.10	
Benzo[a]pyrene		M	2800	mg/kg	0.10	< 0.10	< 0.10		< 0.10		< 0.10	

Results - Soil

Project: 25517 Lisheen Tipperary (DOBA)

Client: IGSL				**Chemtest Job No.:**		24-25300	24-25300	24-25300	24-25300	24-25300	24-25300	24-25300
Quotation No.:				**Chemtest Sample ID.:**		1847654	1847655	1847656	1847657	1847658	1847659	1847660
Order No.:				Client Sample Ref.:		TP01	TP02	TP03	TP04	TP04	TP05	TP05
				Sample Type:		SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
				Top Depth (m):		0.6	0.4	0.7	0.7	1.5	1.00	2.00
				Date Sampled:		07-Aug-2024	07-Aug-2024	07-Aug-2024	07-Aug-2024	07-Aug-2024	07-Aug-2024	07-Aug-2024
				Asbestos Lab:		DURHAM	DURHAM		DURHAM		DURHAM	
Determinand	**HWOL Code**	**Accred.**	**SOP**	**Units**	**LOD**							
Indeno(1,2,3-c,d)Pyrene		M	2800	mg/kg	0.10	< 0.10	< 0.10		< 0.10		< 0.10	
Dibenz(a,h)Anthracene		N	2800	mg/kg	0.10	< 0.10	< 0.10		< 0.10		< 0.10	
Benzo[g,h,i]perylene		M	2800	mg/kg	0.10	< 0.10	< 0.10		< 0.10		< 0.10	
Coronene		N	2800	mg/kg	0.10	< 0.10	< 0.10		< 0.10		< 0.10	
PCB 28		U	2815	mg/kg	0.010	< 0.010	< 0.010		< 0.010		< 0.010	
PCB 52		U	2815	mg/kg	0.010	< 0.010	< 0.010		< 0.010		< 0.010	
PCB 101		U	2815	mg/kg	0.010	< 0.010	< 0.010		< 0.010		< 0.010	
PCB 118		U	2815	mg/kg	0.010	< 0.010	< 0.010		< 0.010		< 0.010	
PCB 153		U	2815	mg/kg	0.010	< 0.010	< 0.010		< 0.010		< 0.010	
PCB 138		U	2815	mg/kg	0.010	< 0.010	< 0.010		< 0.010		< 0.010	
PCB 180		U	2815	mg/kg	0.010	< 0.010	< 0.010		< 0.010		< 0.010	
Tot PCBs Low (7 Congeners)		N	2815	mg/kg	0.05	< 0.05	< 0.05		< 0.05		< 0.05	
Total Phenols		M	2920	mg/kg	0.10	< 0.10	< 0.10		< 0.10		< 0.10	

Results - Soil

Project: 25517 Lisheen Tipperary (DOBA)

Client: IGSL				**Chemtest Job No.:**		24-25300	24-25300	24-25300	24-25300	24-25300	24-25300	24-25300
Quotation No.:				**Chemtest Sample ID.:**		1847661	1847662	1847663	1847664	1847665	1847666	1847667
Order No.:				Client Sample Ref.:		TP-SA03	TP-SA05	BH1	BH2	BH2	BH3	BH4
				Sample Type:		SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
				Top Depth (m):		0.7	0.6	1.00	1.00	2.00	1.00	1.00
				Date Sampled:		07-Aug-2024	07-Aug-2024	07-Aug-2024	07-Aug-2024	07-Aug-2024	07-Aug-2024	07-Aug-2024
				Asbestos Lab:		DURHAM		DURHAM	DURHAM		DURHAM	DURHAM
Determinand	**HWOL Code**	**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
Moisture		N	2030	%	0.020	13	14	13	2.9	16	17	14
Soil Colour		N	2040		N/A	Brown	Brown	Brown	Brown	Brown	Brown	Brown
Other Material		N	2040		N/A	Stones	Roots	Stones	Stones and Roots	Stones and Roots	Stones and Roots	Stones and Roots
Soil Texture		N	2040		N/A	Sand	Sand	Sand	Sand	Sand	Sand	Clay
pH (2.5:1) at 20C		N	2010		4.0		8.3			8.4		
Boron (Hot Water Soluble)		M	2120	mg/kg	0.40	< 0.40		< 0.40	< 0.40		< 0.40	< 0.40
Magnesium (Water Soluble)		N	2120	g/l	0.010		< 0.010			< 0.010		
Sulphate (2:1 Water Soluble) as SO4		M	2120	g/l	0.010		0.013			< 0.010		
Total Sulphur		U	2175	%	0.010		0.030			0.010		
Sulphur (Elemental)		M	2180	mg/kg	1.0	< 1.0		< 1.0	< 1.0		< 1.0	< 1.0
Chloride (Water Soluble)		M	2220	g/l	0.010		< 0.010			0.013		
Nitrate (Water Soluble)		N	2220	g/l	0.010		0.012			< 0.010		
Cyanide (Total)		M	2300	mg/kg	0.50	< 0.50		< 0.50	< 0.50		< 0.50	< 0.50
Sulphide (Easily Liberatable)		N	2325	mg/kg	0.50	3.0		9.5	3.8		3.4	16
Ammonium (Water Soluble)		M	2220	g/l	0.01		< 0.01			< 0.01		
Sulphate (Total)		U	2430	%	0.010	0.031		0.036	0.049		0.034	0.036
Sulphate (Acid Soluble)		U	2430	%	0.010		0.040			0.010		
Arsenic		M	2455	mg/kg	0.5	10		17	12		12	11
Barium		M	2455	mg/kg	0.5	35		84	92		72	71
Cadmium		M	2455	mg/kg	0.10	0.11		< 0.10	< 0.10		< 0.10	< 0.10
Chromium		M	2455	mg/kg	0.5	5.2		43	32		15	10
Molybdenum		M	2455	mg/kg	0.5	3.2		2.8	< 0.5		< 0.5	2.5
Antimony		N	2455	mg/kg	2.0	< 2.0		< 2.0	< 2.0		< 2.0	< 2.0
Copper		M	2455	mg/kg	0.50	7.5		15	15		9.2	8.6
Mercury		M	2455	mg/kg	0.05	< 0.05		0.09	0.07		0.06	0.09
Nickel		M	2455	mg/kg	0.50	30		53	30		35	37
Lead		M	2455	mg/kg	0.50	12		29	38		19	18
Selenium		M	2455	mg/kg	0.25	< 0.25		< 0.25	< 0.25		< 0.25	< 0.25
Zinc		M	2455	mg/kg	0.50	52		98	84		72	70
Chromium (Trivalent)		N	2490	mg/kg	1.0	5.2		43	32		15	10
Chromium (Hexavalent)		N	2490	mg/kg	0.50	< 0.50		< 0.50	< 0.50		< 0.50	< 0.50
Aliphatic VPH >C5-C6	HS_2D_AL	U	2780	mg/kg	0.05	< 0.05		< 0.05	< 0.05		< 0.05	< 0.05
Aliphatic VPH >C6-C7	HS_2D_AL	U	2780	mg/kg	0.05	< 0.05		< 0.05	< 0.05		< 0.05	< 0.05
Aliphatic VPH >C7-C8	HS_2D_AL	U	2780	mg/kg	0.05	< 0.05		< 0.05	< 0.05		< 0.05	< 0.05
Aliphatic VPH >C8-C10	HS_2D_AL	U	2780	mg/kg	0.05	< 0.05		< 0.05	< 0.05		< 0.05	< 0.05

Results - Soil

Project: 25517 Lisheen Tipperary (DOBA)

Client: IGSL				**Chemtest Job No.:**		24-25300	24-25300	24-25300	24-25300	24-25300	24-25300	24-25300
Quotation No.:				**Chemtest Sample ID.:**		1847661	1847662	1847663	1847664	1847665	1847666	1847667
Order No.:				Client Sample Ref.:		TP-SA03	TP-SA05	BH1	BH2	BH2	BH3	BH4
				Sample Type:		SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
				Top Depth (m):		0.7	0.6	1.00	1.00	2.00	1.00	1.00
				Date Sampled:		07-Aug-2024	07-Aug-2024	07-Aug-2024	07-Aug-2024	07-Aug-2024	07-Aug-2024	07-Aug-2024
				Asbestos Lab:		DURHAM		DURHAM	DURHAM		DURHAM	DURHAM
Determinand	**HWOL Code**	**Accred.**	**SOP**	**Units**	**LOD**							
Total Aliphatic VPH >C5-C10	HS_2D_AL	U	2780	mg/kg	0.25	< 0.25		< 0.25	< 0.25		< 0.25	< 0.25
Aliphatic EPH >C10-C12 MC	EH_2D_AL_#1	M	2690	mg/kg	2.00	< 2.0		< 2.0	< 2.0		< 2.0	< 2.0
Aliphatic EPH >C12-C16 MC	EH_2D_AL_#1	M	2690	mg/kg	1.00	< 1.0		< 1.0	1.9		< 1.0	< 1.0
Aliphatic EPH >C16-C21 MC	EH_2D_AL_#1	M	2690	mg/kg	2.00	< 2.0		< 2.0	2.4		< 2.0	< 2.0
Aliphatic EPH >C21-C35 MC	EH_2D_AL_#1	M	2690	mg/kg	3.00	< 3.0		< 3.0	< 3.0		< 3.0	< 3.0
Aliphatic EPH >C35-C40 MC	EH_2D_AL_#1	N	2690	mg/kg	10.00	< 10		< 10	< 10		< 10	< 10
Total Aliphatic EPH >C10-C35 MC	EH_2D_AL_#1	M	2690	mg/kg	5.00	< 5.0		< 5.0	7.1		< 5.0	< 5.0
Aromatic VPH >C5-C7	HS_2D_AR	U	2780	mg/kg	0.05	< 0.05		< 0.05	< 0.05		< 0.05	< 0.05
Aromatic VPH >C7-C8	HS_2D_AR	U	2780	mg/kg	0.05	< 0.05		< 0.05	< 0.05		< 0.05	< 0.05
Aromatic VPH >C8-C10	HS_2D_AR	U	2780	mg/kg	0.05	< 0.05		< 0.05	< 0.05		< 0.05	< 0.05
Total Aromatic VPH >C5-C10	HS_2D_AR	U	2780	mg/kg	0.25	< 0.25		< 0.25	< 0.25		< 0.25	< 0.25
Aromatic EPH >C10-C12 MC	EH_2D_AR_#1	U	2690	mg/kg	1.00	< 1.0		< 1.0	< 1.0		< 1.0	< 1.0
Aromatic EPH >C12-C16 MC	EH_2D_AR_#1	U	2690	mg/kg	1.00	< 1.0		< 1.0	< 1.0		< 1.0	< 1.0
Aromatic EPH >C16-C21 MC	EH_2D_AR_#1	U	2690	mg/kg	2.00	4.7		3.7	3.5		3.5	3.6
Aromatic EPH >C21-C35 MC	EH_2D_AR_#1	U	2690	mg/kg	2.00	< 2.0		< 2.0	< 2.0		< 2.0	2.2
Aromatic EPH >C35-C40 MC	EH_2D_AR_#1	N	2690	mg/kg	1.00	< 1.0		< 1.0	< 1.0		< 1.0	< 1.0
Total Aromatic EPH >C10-C35 MC	EH_2D_AR_#1	U	2690	mg/kg	5.00	< 5.0		< 5.0	< 5.0		5.3	5.8
Total VPH >C5-C10	HS_2D_Total	U	2780	mg/kg	0.50	< 0.50		< 0.50	< 0.50		< 0.50	< 0.50
Total EPH >C10-C35 MC	EH_2D_Total_#1	U	2690	mg/kg	10.00	< 10		< 10	12		< 10	10
Mineral Oil EPH		N	2670	mg/kg	10	< 10		< 10	< 10		< 10	< 10
Benzene		M	2760	µg/kg	1.0	< 1.0		< 1.0	< 1.0		< 1.0	< 1.0
Toluene		M	2760	µg/kg	1.0	< 1.0		< 1.0	< 1.0		< 1.0	< 1.0
Ethylbenzene		M	2760	µg/kg	1.0	< 1.0		< 1.0	< 1.0		< 1.0	< 1.0
m & p-Xylene		M	2760	µg/kg	1.0	< 1.0		< 1.0	< 1.0		< 1.0	< 1.0
o-Xylene		M	2760	µg/kg	1.0	< 1.0		< 1.0	< 1.0		< 1.0	< 1.0
Methyl Tert-Butyl Ether		M	2760	µg/kg	1.0	< 1.0		< 1.0	< 1.0		< 1.0	< 1.0
Naphthalene		M	2800	mg/kg	0.10	< 0.10		< 0.10	< 0.10		< 0.10	< 0.10
Acenaphthylene		N	2800	mg/kg	0.10	< 0.10		< 0.10	< 0.10		< 0.10	< 0.10
Acenaphthene		M	2800	mg/kg	0.10	< 0.10		< 0.10	< 0.10		< 0.10	< 0.10
Fluorene		M	2800	mg/kg	0.10	< 0.10		< 0.10	< 0.10		< 0.10	< 0.10
Phenanthrene		M	2800	mg/kg	0.10	< 0.10		< 0.10	< 0.10		< 0.10	< 0.10
Anthracene		M	2800	mg/kg	0.10	< 0.10		< 0.10	< 0.10		< 0.10	< 0.10
Fluoranthene		M	2800	mg/kg	0.10	< 0.10		< 0.10	< 0.10		< 0.10	< 0.10
Pyrene		M	2800	mg/kg	0.10	< 0.10		< 0.10	< 0.10		< 0.10	< 0.10
Benzo[a]anthracene		M	2800	mg/kg	0.10	< 0.10		< 0.10	< 0.10		< 0.10	< 0.10
Chrysene		M	2800	mg/kg	0.10	< 0.10		< 0.10	< 0.10		< 0.10	< 0.10
Benzo[b]fluoranthene		M	2800	mg/kg	0.10	< 0.10		< 0.10	< 0.10		< 0.10	< 0.10
Benzo[k]fluoranthene		M	2800	mg/kg	0.10	< 0.10		< 0.10	< 0.10		< 0.10	< 0.10
Benzo[a]pyrene		M	2800	mg/kg	0.10	< 0.10		< 0.10	< 0.10		< 0.10	< 0.10

Results - Soil

Project: 25517 Lisheen Tipperary (DOBA)

Client: IGSL				**Chemtest Job No.:**		24-25300	24-25300	24-25300	24-25300	24-25300	24-25300	24-25300
Quotation No.:				**Chemtest Sample ID.:**		1847661	1847662	1847663	1847664	1847665	1847666	1847667
Order No.:				Client Sample Ref.:		TP-SA03	TP-SA05	BH1	BH2	BH2	BH3	BH4
				Sample Type:		SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
				Top Depth (m):		0.7	0.6	1.00	1.00	2.00	1.00	1.00
				Date Sampled:		07-Aug-2024	07-Aug-2024	07-Aug-2024	07-Aug-2024	07-Aug-2024	07-Aug-2024	07-Aug-2024
				Asbestos Lab:		DURHAM		DURHAM	DURHAM		DURHAM	DURHAM
Determinand	**HWOL Code**	**Accred.**	**SOP**	**Units**	**LOD**							
Indeno(1,2,3-c,d)Pyrene		M	2800	mg/kg	0.10	< 0.10		< 0.10	< 0.10		< 0.10	< 0.10
Dibenz(a,h)Anthracene		N	2800	mg/kg	0.10	< 0.10		< 0.10	< 0.10		< 0.10	< 0.10
Benzo[g,h,i]perylene		M	2800	mg/kg	0.10	< 0.10		< 0.10	< 0.10		< 0.10	< 0.10
Coronene		N	2800	mg/kg	0.10	< 0.10		< 0.10	< 0.10		< 0.10	< 0.10
PCB 28		U	2815	mg/kg	0.010	< 0.010		< 0.010	< 0.010		< 0.010	< 0.010
PCB 52		U	2815	mg/kg	0.010	< 0.010		< 0.010	< 0.010		< 0.010	< 0.010
PCB 101		U	2815	mg/kg	0.010	< 0.010		< 0.010	< 0.010		< 0.010	< 0.010
PCB 118		U	2815	mg/kg	0.010	< 0.010		< 0.010	< 0.010		< 0.010	< 0.010
PCB 153		U	2815	mg/kg	0.010	< 0.010		< 0.010	< 0.010		< 0.010	< 0.010
PCB 138		U	2815	mg/kg	0.010	< 0.010		< 0.010	< 0.010		< 0.010	< 0.010
PCB 180		U	2815	mg/kg	0.010	< 0.010		< 0.010	< 0.010		< 0.010	< 0.010
Tot PCBs Low (7 Congeners)		N	2815	mg/kg	0.05	< 0.05		< 0.05	< 0.05		< 0.05	< 0.05
Total Phenols		M	2920	mg/kg	0.10	< 0.10		< 0.10	< 0.10		< 0.10	< 0.10

Results - Soil

Project: 25517 Lisheen Tipperary (DOBA)

Client: IGSL				**Chemtest Job No.:**		24-25300
Quotation No.:				**Chemtest Sample ID.:**		1847668
Order No.:				Client Sample Ref.:		BH4
				Sample Type:		SOIL
				Top Depth (m):		2.00
				Date Sampled:		07-Aug-2024
				Asbestos Lab:		
Determinand	**HWOL Code**	**Accred.**	**SOP**	**Units**	**LOD**	
ACM Type		U	2192		N/A	
Asbestos Identification		U	2192		N/A	
Moisture		N	2030	%	0.020	18
Soil Colour		N	2040		N/A	Brown
Other Material		N	2040		N/A	Stones and Roots
Soil Texture		N	2040		N/A	Sand
pH (2.5:1) at 20C		N	2010		4.0	8.5
Boron (Hot Water Soluble)		M	2120	mg/kg	0.40	
Magnesium (Water Soluble)		N	2120	g/l	0.010	< 0.010
Sulphate (2:1 Water Soluble) as SO4		M	2120	g/l	0.010	< 0.010
Total Sulphur		U	2175	%	0.010	0.020
Sulphur (Elemental)		M	2180	mg/kg	1.0	
Chloride (Water Soluble)		M	2220	g/l	0.010	0.015
Nitrate (Water Soluble)		N	2220	g/l	0.010	0.012
Cyanide (Total)		M	2300	mg/kg	0.50	
Sulphide (Easily Liberatable)		N	2325	mg/kg	0.50	
Ammonium (Water Soluble)		M	2220	g/l	0.01	< 0.01
Sulphate (Total)		U	2430	%	0.010	
Sulphate (Acid Soluble)		U	2430	%	0.010	0.020
Arsenic		M	2455	mg/kg	0.5	
Barium		M	2455	mg/kg	0.5	
Cadmium		M	2455	mg/kg	0.10	
Chromium		M	2455	mg/kg	0.5	
Molybdenum		M	2455	mg/kg	0.5	
Antimony		N	2455	mg/kg	2.0	
Copper		M	2455	mg/kg	0.50	
Mercury		M	2455	mg/kg	0.05	
Nickel		M	2455	mg/kg	0.50	
Lead		M	2455	mg/kg	0.50	
Selenium		M	2455	mg/kg	0.25	
Zinc		M	2455	mg/kg	0.50	
Chromium (Trivalent)		N	2490	mg/kg	1.0	
Chromium (Hexavalent)		N	2490	mg/kg	0.50	
Aliphatic VPH >C5-C6	HS_2D_AL	U	2780	mg/kg	0.05	
Aliphatic VPH >C6-C7	HS_2D_AL	U	2780	mg/kg	0.05	
Aliphatic VPH >C7-C8	HS_2D_AL	U	2780	mg/kg	0.05	
Aliphatic VPH >C8-C10	HS_2D_AL	U	2780	mg/kg	0.05	

Results - Soil

Project: 25517 Lisheen Tipperary (DOBA)

Client: IGSL				**Chemtest Job No.:**		24-25300
Quotation No.:				**Chemtest Sample ID.:**		1847668
Order No.:				Client Sample Ref.:		BH4
				Sample Type:		SOIL
				Top Depth (m):		2.00
				Date Sampled:		07-Aug-2024
				Asbestos Lab:		
Determinand	**HWOL Code**	**Accred.**	**SOP**	**Units**	**LOD**	
Total Aliphatic VPH >C5-C10	HS_2D_AL	U	2780	mg/kg	0.25	
Aliphatic EPH >C10-C12 MC	EH_2D_AL_#1	M	2690	mg/kg	2.00	
Aliphatic EPH >C12-C16 MC	EH_2D_AL_#1	M	2690	mg/kg	1.00	
Aliphatic EPH >C16-C21 MC	EH_2D_AL_#1	M	2690	mg/kg	2.00	
Aliphatic EPH >C21-C35 MC	EH_2D_AL_#1	M	2690	mg/kg	3.00	
Aliphatic EPH >C35-C40 MC	EH_2D_AL_#1	N	2690	mg/kg	10.00	
Total Aliphatic EPH >C10-C35 MC	EH_2D_AL_#1	M	2690	mg/kg	5.00	
Aromatic VPH >C5-C7	HS_2D_AR	U	2780	mg/kg	0.05	
Aromatic VPH >C7-C8	HS_2D_AR	U	2780	mg/kg	0.05	
Aromatic VPH >C8-C10	HS_2D_AR	U	2780	mg/kg	0.05	
Total Aromatic VPH >C5-C10	HS_2D_AR	U	2780	mg/kg	0.25	
Aromatic EPH >C10-C12 MC	EH_2D_AR_#1	U	2690	mg/kg	1.00	
Aromatic EPH >C12-C16 MC	EH_2D_AR_#1	U	2690	mg/kg	1.00	
Aromatic EPH >C16-C21 MC	EH_2D_AR_#1	U	2690	mg/kg	2.00	
Aromatic EPH >C21-C35 MC	EH_2D_AR_#1	U	2690	mg/kg	2.00	
Aromatic EPH >C35-C40 MC	EH_2D_AR_#1	N	2690	mg/kg	1.00	
Total Aromatic EPH >C10-C35 MC	EH_2D_AR_#1	U	2690	mg/kg	5.00	
Total VPH >C5-C10	HS_2D_Total	U	2780	mg/kg	0.50	
Total EPH >C10-C35 MC	EH_2D_Total_#1	U	2690	mg/kg	10.00	
Mineral Oil EPH		N	2670	mg/kg	10	
Benzene		M	2760	µg/kg	1.0	
Toluene		M	2760	µg/kg	1.0	
Ethylbenzene		M	2760	µg/kg	1.0	
m & p-Xylene		M	2760	µg/kg	1.0	
o-Xylene		M	2760	µg/kg	1.0	
Methyl Tert-Butyl Ether		M	2760	µg/kg	1.0	
Naphthalene		M	2800	mg/kg	0.10	
Acenaphthylene		N	2800	mg/kg	0.10	
Acenaphthene		M	2800	mg/kg	0.10	
Fluorene		M	2800	mg/kg	0.10	
Phenanthrene		M	2800	mg/kg	0.10	
Anthracene		M	2800	mg/kg	0.10	
Fluoranthene		M	2800	mg/kg	0.10	
Pyrene		M	2800	mg/kg	0.10	
Benzo[a]anthracene		M	2800	mg/kg	0.10	
Chrysene		M	2800	mg/kg	0.10	
Benzo[b]fluoranthene		M	2800	mg/kg	0.10	
Benzo[k]fluoranthene		M	2800	mg/kg	0.10	
Benzo[a]pyrene		M	2800	mg/kg	0.10	

Results - Soil

Project: 25517 Lisheen Tipperary (DOBA)

Client: IGSL				**Chemtest Job No.:**		24-25300
Quotation No.:				**Chemtest Sample ID.:**		1847668
Order No.:				Client Sample Ref.:		BH4
				Sample Type:		SOIL
				Top Depth (m):		2.00
				Date Sampled:		07-Aug-2024
				Asbestos Lab:		
Determinand	**HWOL Code**	**Accred.**	**SOP**	**Units**	**LOD**	
Indeno(1,2,3-c,d)Pyrene		M	2800	mg/kg	0.10	
Dibenz(a,h)Anthracene		N	2800	mg/kg	0.10	
Benzo[g,h,i]perylene		M	2800	mg/kg	0.10	
Coronene		N	2800	mg/kg	0.10	
PCB 28		U	2815	mg/kg	0.010	
PCB 52		U	2815	mg/kg	0.010	
PCB 101		U	2815	mg/kg	0.010	
PCB 118		U	2815	mg/kg	0.010	
PCB 153		U	2815	mg/kg	0.010	
PCB 138		U	2815	mg/kg	0.010	
PCB 180		U	2815	mg/kg	0.010	
Tot PCBs Low (7 Congeners)		N	2815	mg/kg	0.05	
Total Phenols		M	2920	mg/kg	0.10	

Results - Single Stage WAC

Project: 25517 Lisheen Tipperary (DOBA)

						Landfill Waste Acceptance Criteria Limits		
Chemtest Job No:	24-25300							
Chemtest Sample ID:	1847654							
Sample Ref:	TP01							
Sample ID:								
Sample Location:								
Top Depth(m):	0.6							
Bottom Depth(m):								
Sampling Date:	07-Aug-2024							
Determinand	**SOP**	**HWOL Code**	**Accred.**	**Units**		**Inert Waste Landfill**	**Stable, Non-reactive hazardous waste in non-hazardous Landfill**	**Hazardous Waste Landfill**
Total Organic Carbon	2625		M	%	0.40	3	5	6
Loss On Ignition	2610		M	%	1.8	--	--	10
Total BTEX	2760		M	mg/kg	< 0.010	6	--	--
Total PCBs (7 Congeners)	2815		M	mg/kg	< 0.10	1	--	--
TPH Total WAC	2670	EH_CU_1D_Total	M	mg/kg	< 10	500	--	--
Total Of 17 PAHs Lower	2800		N	mg/kg	< 1.0	100	--	--
pH at 20C	2010		M		8.4	--	>6	--
Acid Neutralisation Capacity	2015		N	mol/kg	0.011	--	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	< 0.0002	< 0.0020	0.5	2	25
Barium	1455		U	0.008	0.084	20	100	300
Cadmium	1455		U	< 0.00011	< 0.0011	0.04	1	5
Chromium	1455		U	< 0.0005	< 0.0050	0.5	10	70
Copper	1455		U	0.0007	0.0068	2	50	100
Mercury	1455		U	< 0.00005	< 0.00050	0.01	0.2	2
Molybdenum	1455		U	0.0008	0.0076	0.5	10	30
Nickel	1455		U	0.0006	0.0058	0.4	10	40
Lead	1455		U	< 0.0005	< 0.0050	0.5	10	50
Antimony	1455		U	< 0.0005	< 0.0050	0.06	0.7	5
Selenium	1455		U	< 0.0005	< 0.0050	0.1	0.5	7
Zinc	1455		U	0.004	0.042	4	50	200
Chloride	1220		U	< 1.0	< 10	800	15000	25000
Fluoride	1220		U	0.68	6.8	10	150	500
Sulphate	1220		U	< 1.0	< 10	1000	20000	50000
Total Dissolved Solids	1020		N	57	570	4000	60000	100000
Phenol Index	1920		U	< 0.030	< 0.30	1	-	-
Dissolved Organic Carbon	1610		U	7.9	79	500	800	1000

Solid Information	
Dry mass of test portion/kg	0.090
Moisture (%)	15

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: 25517 Lisheen Tipperary (DOBA)

						Landfill Waste Acceptance Criteria Limits		
Chemtest Job No:	24-25300							
Chemtest Sample ID:	1847655							
Sample Ref:	TP02							
Sample ID:								
Sample Location:								
Top Depth(m):	0.4							
Bottom Depth(m):								
Sampling Date:	07-Aug-2024							
Determinand	**SOP**	**HWOL Code**	**Accred.**	**Units**		**Inert Waste Landfill**	**Stable, Non-reactive hazardous waste in non-hazardous Landfill**	**Hazardous Waste Landfill**
Total Organic Carbon	2625		M	%	6.9	3	5	6
Loss On Ignition	2610		M	%	2.2	--	--	10
Total BTEX	2760		M	mg/kg	< 0.010	6	--	--
Total PCBs (7 Congeners)	2815		M	mg/kg	< 0.10	1	--	--
TPH Total WAC	2670	EH_CU_1D_Total	M	mg/kg	< 10	500	--	--
Total Of 17 PAHs Lower	2800		N	mg/kg	< 1.0	100	--	--
pH at 20C	2010		M		8.3	--	>6	--
Acid Neutralisation Capacity	2015		N	mol/kg	0.010	--	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	0.0009	0.0093	0.5	2	25
Barium	1455		U	0.008	0.081	20	100	300
Cadmium	1455		U	0.00027	0.0027	0.04	1	5
Chromium	1455		U	< 0.0005	< 0.0050	0.5	10	70
Copper	1455		U	0.0020	0.020	2	50	100
Mercury	1455		U	< 0.00005	< 0.00050	0.01	0.2	2
Molybdenum	1455		U	0.0027	0.027	0.5	10	30
Nickel	1455		U	0.0006	0.0058	0.4	10	40
Lead	1455		U	0.0010	0.010	0.5	10	50
Antimony	1455		U	0.0006	0.0060	0.06	0.7	5
Selenium	1455		U	0.0009	0.0090	0.1	0.5	7
Zinc	1455		U	0.011	0.11	4	50	200
Chloride	1220		U	1.6	16	800	15000	25000
Fluoride	1220		U	0.57	5.7	10	150	500
Sulphate	1220		U	4.4	44	1000	20000	50000
Total Dissolved Solids	1020		N	62	620	4000	60000	100000
Phenol Index	1920		U	< 0.030	< 0.30	1	-	-
Dissolved Organic Carbon	1610		U	6.8	68	500	800	1000

Solid Information	
Dry mass of test portion/kg	0.090
Moisture (%)	15

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: 25517 Lisheen Tipperary (DOBA)

						Landfill Waste Acceptance Criteria Limits		
Chemtest Job No:	24-25300							
Chemtest Sample ID:	1847657							
Sample Ref:	TP04							
Sample ID:								
Sample Location:								
Top Depth(m):	0.7							
Bottom Depth(m):								
Sampling Date:	07-Aug-2024							
Determinand	**SOP**	**HWOL Code**	**Accred.**	**Units**		**Inert Waste Landfill**	**Stable, Non-reactive hazardous waste in non-hazardous Landfill**	**Hazardous Waste Landfill**
Total Organic Carbon	2625		M	%	0.85	3	5	6
Loss On Ignition	2610		M	%	1.4	--	--	10
Total BTEX	2760		M	mg/kg	< 0.010	6	--	--
Total PCBs (7 Congeners)	2815		M	mg/kg	< 0.10	1	--	--
TPH Total WAC	2670	EH_CU_1D_Total	M	mg/kg	< 10	500	--	--
Total Of 17 PAHs Lower	2800		N	mg/kg	< 1.0	100	--	--
pH at 20C	2010		M		8.4	--	>6	--
Acid Neutralisation Capacity	2015		N	mol/kg	0.0080	--	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	0.0005	0.0055	0.5	2	25
Barium	1455		U	0.012	0.12	20	100	300
Cadmium	1455		U	< 0.00011	< 0.0011	0.04	1	5
Chromium	1455		U	< 0.0005	< 0.0050	0.5	10	70
Copper	1455		U	0.0011	0.011	2	50	100
Mercury	1455		U	< 0.00005	< 0.00050	0.01	0.2	2
Molybdenum	1455		U	0.0013	0.013	0.5	10	30
Nickel	1455		U	0.0006	0.0056	0.4	10	40
Lead	1455		U	< 0.0005	< 0.0050	0.5	10	50
Antimony	1455		U	< 0.0005	< 0.0050	0.06	0.7	5
Selenium	1455		U	0.0006	0.0057	0.1	0.5	7
Zinc	1455		U	0.003	0.032	4	50	200
Chloride	1220		U	< 1.0	< 10	800	15000	25000
Fluoride	1220		U	0.25	2.5	10	150	500
Sulphate	1220		U	1.8	18	1000	20000	50000
Total Dissolved Solids	1020		N	62	620	4000	60000	100000
Phenol Index	1920		U	< 0.030	< 0.30	1	-	-
Dissolved Organic Carbon	1610		U	5.3	53	500	800	1000

Solid Information	
Dry mass of test portion/kg	0.090
Moisture (%)	9.8

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: 25517 Lisheen Tipperary (DOBA)

						Landfill Waste Acceptance Criteria Limits		
Chemtest Job No:	24-25300							
Chemtest Sample ID:	1847659							
Sample Ref:	TP05							
Sample ID:								
Sample Location:								
Top Depth(m):	1.00							
Bottom Depth(m):								
Sampling Date:	07-Aug-2024							
Determinand	**SOP**	**HWOL Code**	**Accred.**	**Units**		**Inert Waste Landfill**	**Stable, Non-reactive hazardous waste in non-hazardous Landfill**	**Hazardous Waste Landfill**
Total Organic Carbon	2625		M	%	0.66	3	5	6
Loss On Ignition	2610		M	%	1.0	--	--	10
Total BTEX	2760		M	mg/kg	< 0.010	6	--	--
Total PCBs (7 Congeners)	2815		M	mg/kg	< 0.10	1	--	--
TPH Total WAC	2670	EH_CU_1D_Total	M	mg/kg	< 10	500	--	--
Total Of 17 PAHs Lower	2800		N	mg/kg	< 1.0	100	--	--
pH at 20C	2010		M		8.4	--	>6	--
Acid Neutralisation Capacity	2015		N	mol/kg	0.0060	--	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	0.0014	0.015	0.5	2	25
Barium	1455		U	0.007	0.067	20	100	300
Cadmium	1455		U	0.00011	0.0011	0.04	1	5
Chromium	1455		U	0.0005	0.0055	0.5	10	70
Copper	1455		U	0.0010	0.0099	2	50	100
Mercury	1455		U	< 0.00005	< 0.00050	0.01	0.2	2
Molybdenum	1455		U	0.0033	0.033	0.5	10	30
Nickel	1455		U	0.0005	0.0053	0.4	10	40
Lead	1455		U	< 0.0005	< 0.0050	0.5	10	50
Antimony	1455		U	< 0.0005	< 0.0050	0.06	0.7	5
Selenium	1455		U	0.0006	0.0060	0.1	0.5	7
Zinc	1455		U	0.003	0.026	4	50	200
Chloride	1220		U	< 1.0	< 10	800	15000	25000
Fluoride	1220		U	0.17	1.7	10	150	500
Sulphate	1220		U	< 1.0	< 10	1000	20000	50000
Total Dissolved Solids	1020		N	54	540	4000	60000	100000
Phenol Index	1920		U	< 0.030	< 0.30	1	-	-
Dissolved Organic Carbon	1610		U	4.8	< 50	500	800	1000

Solid Information	
Dry mass of test portion/kg	0.090
Moisture (%)	10

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: 25517 Lisheen Tipperary (DOBA)

						Landfill Waste Acceptance Criteria Limits		
Chemtest Job No:	24-25300							
Chemtest Sample ID:	1847661							
Sample Ref:	TP-SA03							
Sample ID:								
Sample Location:								
Top Depth(m):	0.7							
Bottom Depth(m):								
Sampling Date:	07-Aug-2024							
Determinand	**SOP**	**HWOL Code**	**Accred.**	**Units**		**Inert Waste Landfill**	**Stable, Non-reactive hazardous waste in non-hazardous Landfill**	**Hazardous Waste Landfill**
Total Organic Carbon	2625		M	%	0.99	3	5	6
Loss On Ignition	2610		M	%	1.6	--	--	10
Total BTEX	2760		M	mg/kg	< 0.010	6	--	--
Total PCBs (7 Congeners)	2815		M	mg/kg	< 0.10	1	--	--
TPH Total WAC	2670	EH_CU_1D_Total	M	mg/kg	< 10	500	--	--
Total Of 17 PAHs Lower	2800		N	mg/kg	< 1.0	100	--	--
pH at 20C	2010		M		8.6	--	>6	--
Acid Neutralisation Capacity	2015		N	mol/kg	0.011	--	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	< 0.0002	< 0.0020	0.5	2	25
Barium	1455		U	0.008	0.082	20	100	300
Cadmium	1455		U	< 0.00011	< 0.0011	0.04	1	5
Chromium	1455		U	< 0.0005	< 0.0050	0.5	10	70
Copper	1455		U	0.0010	0.010	2	50	100
Mercury	1455		U	< 0.00005	< 0.00050	0.01	0.2	2
Molybdenum	1455		U	0.0013	0.013	0.5	10	30
Nickel	1455		U	< 0.0005	< 0.0050	0.4	10	40
Lead	1455		U	< 0.0005	< 0.0050	0.5	10	50
Antimony	1455		U	< 0.0005	< 0.0050	0.06	0.7	5
Selenium	1455		U	< 0.0005	< 0.0050	0.1	0.5	7
Zinc	1455		U	0.006	0.059	4	50	200
Chloride	1220		U	< 1.0	< 10	800	15000	25000
Fluoride	1220		U	0.36	3.6	10	150	500
Sulphate	1220		U	< 1.0	< 10	1000	20000	50000
Total Dissolved Solids	1020		N	46	460	4000	60000	100000
Phenol Index	1920		U	< 0.030	< 0.30	1	-	-
Dissolved Organic Carbon	1610		U	5.6	56	500	800	1000

Solid Information	
Dry mass of test portion/kg	0.090
Moisture (%)	13

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: 25517 Lisheen Tipperary (DOBA)

						Landfill Waste Acceptance Criteria Limits		
Chemtest Job No:	24-25300							
Chemtest Sample ID:	1847663							
Sample Ref:	BH1							
Sample ID:								
Sample Location:								
Top Depth(m):	1.00							
Bottom Depth(m):								
Sampling Date:	07-Aug-2024							
Determinand	**SOP**	**HWOL Code**	**Accred.**	**Units**		**Inert Waste Landfill**	**Stable, Non-reactive hazardous waste in non-hazardous Landfill**	**Hazardous Waste Landfill**
Total Organic Carbon	2625		M	%	7.4	3	5	6
Loss On Ignition	2610		M	%	2.2	--	--	10
Total BTEX	2760		M	mg/kg	< 0.010	6	--	--
Total PCBs (7 Congeners)	2815		M	mg/kg	< 0.10	1	--	--
TPH Total WAC	2670	EH_CU_1D_Total	M	mg/kg	< 10	500	--	--
Total Of 17 PAHs Lower	2800		N	mg/kg	< 1.0	100	--	--
pH at 20C	2010		M		8.3	--	>6	--
Acid Neutralisation Capacity	2015		N	mol/kg	0.017	--	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	0.0010	0.0097	0.5	2	25
Barium	1455		U	< 0.005	< 0.050	20	100	300
Cadmium	1455		U	< 0.00011	< 0.0011	0.04	1	5
Chromium	1455		U	< 0.0005	< 0.0050	0.5	10	70
Copper	1455		U	0.0010	0.010	2	50	100
Mercury	1455		U	< 0.00005	< 0.00050	0.01	0.2	2
Molybdenum	1455		U	0.0069	0.069	0.5	10	30
Nickel	1455		U	< 0.0005	< 0.0050	0.4	10	40
Lead	1455		U	< 0.0005	< 0.0050	0.5	10	50
Antimony	1455		U	< 0.0005	< 0.0050	0.06	0.7	5
Selenium	1455		U	< 0.0005	< 0.0050	0.1	0.5	7
Zinc	1455		U	0.006	0.065	4	50	200
Chloride	1220		U	4.6	46	800	15000	25000
Fluoride	1220		U	0.15	1.5	10	150	500
Sulphate	1220		U	3.6	36	1000	20000	50000
Total Dissolved Solids	1020		N	58	580	4000	60000	100000
Phenol Index	1920		U	< 0.030	< 0.30	1	-	-
Dissolved Organic Carbon	1610		U	3.1	< 50	500	800	1000

Solid Information	
Dry mass of test portion/kg	0.090
Moisture (%)	13

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: 25517 Lisheen Tipperary (DOBA)

						Landfill Waste Acceptance Criteria Limits		
Chemtest Job No:	24-25300							
Chemtest Sample ID:	1847664							
Sample Ref:	BH2							
Sample ID:								
Sample Location:								
Top Depth(m):	1.00							
Bottom Depth(m):								
Sampling Date:	07-Aug-2024							
Determinand	**SOP**	**HWOL Code**	**Accred.**	**Units**		**Inert Waste Landfill**	**Stable, Non-reactive hazardous waste in non-hazardous Landfill**	**Hazardous Waste Landfill**
Total Organic Carbon	2625		M	%	0.67	3	5	6
Loss On Ignition	2610		M	%	2.9	--	--	10
Total BTEX	2760		M	mg/kg	< 0.010	6	--	--
Total PCBs (7 Congeners)	2815		M	mg/kg	< 0.10	1	--	--
TPH Total WAC	2670	EH_CU_1D_Total	M	mg/kg	< 10	500	--	--
Total Of 17 PAHs Lower	2800		N	mg/kg	< 1.0	100	--	--
pH at 20C	2010		M		8.6	--	>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	0.0002	0.0024	0.5	2	25
Barium	1455		U	0.006	0.060	20	100	300
Cadmium	1455		U	< 0.00011	< 0.0011	0.04	1	5
Chromium	1455		U	< 0.0005	< 0.0050	0.5	10	70
Copper	1455		U	0.0008	0.0079	2	50	100
Mercury	1455		U	< 0.00005	< 0.00050	0.01	0.2	2
Molybdenum	1455		U	0.0008	0.0077	0.5	10	30
Nickel	1455		U	< 0.0005	< 0.0050	0.4	10	40
Lead	1455		U	< 0.0005	< 0.0050	0.5	10	50
Antimony	1455		U	< 0.0005	< 0.0050	0.06	0.7	5
Selenium	1455		U	< 0.0005	< 0.0050	0.1	0.5	7
Zinc	1455		U	0.006	0.061	4	50	200
Chloride	1220		U	1.3	13	800	15000	25000
Fluoride	1220		U	0.61	6.1	10	150	500
Sulphate	1220		U	< 1.0	< 10	1000	20000	50000
Total Dissolved Solids	1020		N	65	650	4000	60000	100000
Phenol Index	1920		U	< 0.030	< 0.30	1	-	-
Dissolved Organic Carbon	1610		U	6.0	60	500	800	1000

Solid Information	
Dry mass of test portion/kg	0.090
Moisture (%)	2.9

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: 25517 Lisheen Tipperary (DOBA)

						Landfill Waste Acceptance Criteria Limits		
Chemtest Job No:	24-25300							
Chemtest Sample ID:	1847666							
Sample Ref:	BH3							
Sample ID:								
Sample Location:								
Top Depth(m):	1.00							
Bottom Depth(m):								
Sampling Date:	07-Aug-2024							
Determinand	**SOP**	**HWOL Code**	**Accred.**	**Units**		**Inert Waste Landfill**	**Stable, Non-reactive hazardous waste in non-hazardous Landfill**	**Hazardous Waste Landfill**
Total Organic Carbon	2625		M	%	5.4	3	5	6
Loss On Ignition	2610		M	%	2.8	--	--	10
Total BTEX	2760		M	mg/kg	< 0.010	6	--	--
Total PCBs (7 Congeners)	2815		M	mg/kg	< 0.10	1	--	--
TPH Total WAC	2670	EH_CU_1D_Total	M	mg/kg	< 10	500	--	--
Total Of 17 PAHs Lower	2800		N	mg/kg	< 1.0	100	--	--
pH at 20C	2010		M		8.7	--	>6	--
Acid Neutralisation Capacity	2015		N	mol/kg	0.0060	--	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	0.0003	0.0033	0.5	2	25
Barium	1455		U	0.009	0.086	20	100	300
Cadmium	1455		U	< 0.00011	< 0.0011	0.04	1	5
Chromium	1455		U	< 0.0005	< 0.0050	0.5	10	70
Copper	1455		U	0.0017	0.017	2	50	100
Mercury	1455		U	< 0.00005	< 0.00050	0.01	0.2	2
Molybdenum	1455		U	0.0031	0.031	0.5	10	30
Nickel	1455		U	0.0007	0.0068	0.4	10	40
Lead	1455		U	< 0.0005	< 0.0050	0.5	10	50
Antimony	1455		U	< 0.0005	< 0.0050	0.06	0.7	5
Selenium	1455		U	< 0.0005	< 0.0050	0.1	0.5	7
Zinc	1455		U	0.007	0.075	4	50	200
Chloride	1220		U	3.4	34	800	15000	25000
Fluoride	1220		U	0.40	4.0	10	150	500
Sulphate	1220		U	1.5	15	1000	20000	50000
Total Dissolved Solids	1020		N	67	670	4000	60000	100000
Phenol Index	1920		U	< 0.030	< 0.30	1	-	-
Dissolved Organic Carbon	1610		U	5.0	< 50	500	800	1000

Solid Information	
Dry mass of test portion/kg	0.090
Moisture (%)	17

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: 25517 Lisheen Tipperary (DOBA)

						Landfill Waste Acceptance Criteria Limits		
Chemtest Job No:	24-25300							
Chemtest Sample ID:	1847667							
Sample Ref:	BH4							
Sample ID:								
Sample Location:								
Top Depth(m):	1.00							
Bottom Depth(m):								
Sampling Date:	07-Aug-2024							
Determinand	**SOP**	**HWOL Code**	**Accred.**	**Units**		**Inert Waste Landfill**	**Stable, Non-reactive hazardous waste in non-hazardous Landfill**	**Hazardous Waste Landfill**
Total Organic Carbon	2625		M	%	4.7	3	5	6
Loss On Ignition	2610		M	%	2.6	--	--	10
Total BTEX	2760		M	mg/kg	< 0.010	6	--	--
Total PCBs (7 Congeners)	2815		M	mg/kg	< 0.10	1	--	--
TPH Total WAC	2670	EH_CU_1D_Total	M	mg/kg	< 10	500	--	--
Total Of 17 PAHs Lower	2800		N	mg/kg	< 1.0	100	--	--
pH at 20C	2010		M		8.8	--	>6	--
Acid Neutralisation Capacity	2015		N	mol/kg	0.0080	--	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	0.0042	0.5	2	25
Barium	1455		U	0.008	0.082	20	100	300
Cadmium	1455		U	< 0.00011	< 0.0011	0.04	1	5
Chromium	1455		U	< 0.0005	< 0.0050	0.5	10	70
Copper	1455		U	0.0012	0.012	2	50	100
Mercury	1455		U	< 0.00005	< 0.00050	0.01	0.2	2
Molybdenum	1455		U	0.0022	0.022	0.5	10	30
Nickel	1455		U	0.0006	0.0058	0.4	10	40
Lead	1455		U	< 0.0005	< 0.0050	0.5	10	50
Antimony	1455		U	< 0.0005	< 0.0050	0.06	0.7	5
Selenium	1455		U	< 0.0005	< 0.0050	0.1	0.5	7
Zinc	1455		U	0.003	0.030	4	50	200
Chloride	1220		U	2.3	23	800	15000	25000
Fluoride	1220		U	0.32	3.2	10	150	500
Sulphate	1220		U	< 1.0	< 10	1000	20000	50000
Total Dissolved Solids	1020		N	88	880	4000	60000	100000
Phenol Index	1920		U	< 0.030	< 0.30	1	-	-
Dissolved Organic Carbon	1610		U	6.5	65	500	800	1000

Solid Information	
Dry mass of test portion/kg	0.090
Moisture (%)	14

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.

Test Methods

SOP	Title	Parameters included	Method summary	Water Accred.
1010	pH Value of Waters	pH at 20°C	pH Meter	
1020	Electrical Conductivity and Total Dissolved Solids (TDS) in Waters	Electrical Conductivity at 25°C 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.	
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	
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 at 20°C	pH Meter	
2015	Acid Neutralisation Capacity	Acid Reserve	Titration	
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 <30°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	
2175	Total Sulphur in Soils	Total Sulphur	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.	
2180	Sulphur (Elemental) in Soils by HPLC	Sulphur	Dichloromethane extraction / HPLC with UV detection	
2192	Asbestos	Asbestos	Polarised light microscopy / Gravimetry	
2220	Water soluble Chloride in Soils	Chloride	Aqueous extraction and measurememt by 'Aquakem 600' Discrete Analyser using ferric nitrate / mercuric thiocyanate.	
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.	
2325	Sulphide in Soils	Sulphide	Steam distillation with sulphuric acid / analysis by 'Aquakem 600' Discrete Analyser, using N,N–dimethyl-p-phenylenediamine.	
2430	Total Sulphate in soils	Total Sulphate	Acid digestion followed by determination of sulphate in extract by ICP-OES.	
2455	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.	
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	

Test Methods

SOP	Title	Parameters included	Method summary	Water Accred.
2690	EPH A/A Split	Aliphatics: >C10–C12, >C12–C16, >C16–C21, >C21– C35, >C35– C40 Aromatics: >C10–C12, >C12–C16, >C16–C21, >C21– C35, >C35– C40	Acetone/Heptane extraction / GCxGC FID detection	
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.	
2780	VPH A/A Split	Aliphatics: >C5–C6, >C6–C7,>C7–C8,>C8-C10 Aromatics: >C5–C7,>C7-C8,>C8–C10	Water extraction / Headspace GCxGC FID detection	
2800	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Soil by GC-MS	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-MS	
2815	Polychlorinated Biphenyls (PCB) ICES7Congeners in Soils by GC-MS	ICES7 PCB congeners	Acetone/Hexane extraction / GC-MS. Reported PCB 101 results may contain contributions from PCB 90 due to inseparable chromatography.	
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

This report shall not be reproduced except in full, and only with the prior approval of the laboratory.
Any comments or interpretations are outside the scope of UKAS accreditation.
The Laboratory is not accredited for any sampling activities and reported results relate to the samples 'as received' at the laboratory.
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 EPH, VPH, TPH, BTEX, VOCs, SVOCs, PCBs, Phenols.

For all other tests the samples were dried at ≤ 30°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 30 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.

Water Sample Category Key for Accreditation

DW - Drinking Water
GW - Ground Water
LE - Land Leachate
NA - Not Applicable

Report Information

PL - Prepared Leachate
PW - Processed Water
RE - Recreational Water
SA - Saline Water
SW - Surface Water
TE - Treated Effluent
TS - Treated Sewage
UL - Unspecified Liquid

Clean Up Codes

NC - No Clean Up
MC - Mathematical Clean Up
FC - Florisil Clean Up

HWOL Acronym System

HS - Headspace analysis
EH - Extractable hydrocarbons – i.e. everything extracted by the solvent
CU - Clean-up – e.g. by Florisil, silica gel
1D - GC – Single coil gas chromatography
Total - Aliphatics & Aromatics
AL - Aliphatics only
AR - Aromatic only
2D - GC-GC – Double coil gas chromatography
#1 - EH_2D_Total but with humics mathematically subtracted
#2 - EH_2D_Total but with fatty acids mathematically subtracted
+ - Operator to indicate cumulative e.g. EH+EH_Total or EH_CU+HS_Total

If you require extended retention of samples, please email your requirements to:
customerservices@chemtest.com

eurofins | Chemtest
Eurofins Chemtest Ltd
Depot Road
Newmarket
CB8 0AL
Tel: 01638 606070
Email: info@chemtest.com

Final Report

Report No.:	24-29760-1
Initial Date of Issue:	26-Sep-2024
Re-Issue Details:	
Client	IGSL
Client Address:	M7 Business Park Naas County Kildare Ireland
Contact(s):	Darren Keogh
Project	25517 Lisheen Tipperary

Quotation No.:	Q24-34387	**Date Received:**	17-Sep-2024
Order No.:		**Date Instructed:**	17-Sep-2024
No. of Samples:	5		
Turnaround (Wkdays):	7	**Results Due:**	25-Sep-2024
Date Approved:	26-Sep-2024		

Approved By:

Details: David Smith, Technical Director

For details about application of accreditation to specific matrix types, please refer to the Table at the back of this report

Results - Leachate

Project: 25517 Lisheen Tipperary

Client: IGSL				**Chemtest Job No.:**		24-29760	24-29760	24-29760
Quotation No.: Q24-34387				**Chemtest Sample ID.:**		1867007	1867009	1867010
Order No.:				Client Sample Ref.:		BH6	BH7	BH7
				Sample Type:		SOIL	SOIL	SOIL
				Top Depth (m):		1.0	1.0	3.0
				Date Sampled:		11-Sep-2024	11-Sep-2024	11-Sep-2024
Determinand	**Accred.**	**SOP**	**Type**	**Units**	**LOD**			
Ammonium	U	1220	10:1	mg/l	0.050	< 0.050	0.067	0.19
Ammonium	N	1220	10:1	mg/kg	0.10	1.4	0.93	2.4

Results - Soil

Project: 25517 Lisheen Tipperary

Client: IGSL				**Chemtest Job No.:**		24-29760	24-29760	24-29760	24-29760	24-29760
Quotation No.: Q24-34387				**Chemtest Sample ID.:**		1867007	1867008	1867009	1867010	1867011
Order No.:				Client Sample Ref.:		BH6	BH6	BH7	BH7	BH7
				Sample Type:		SOIL	SOIL	SOIL	SOIL	SOIL
				Top Depth (m):		1.0	2.0	1.0	3.0	3.50
				Date Sampled:		11-Sep-2024	11-Sep-2024	11-Sep-2024	11-Sep-2024	11-Sep-2024
				Asbestos Lab:		DURHAM		DURHAM	DURHAM	
Determinand	**HWOL Code**	**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	
Moisture		N	2030	%	0.020	15	12	11	13	17
Soil Colour		N	2040		N/A	Brown	Brown	Brown	Brown	Brown
Other Material		N	2040		N/A	Stones	Roots and Stones	Stones and Roots	Stones	Stones and Roots
Soil Texture		N	2040		N/A	Clay	Clay	Clay	Clay	Clay
pH (2.5:1) at 20C		N	2010		4.0		8.8			8.3
Boron (Hot Water Soluble)		M	2120	mg/kg	0.40	< 0.40		< 0.40	< 0.40	
Magnesium (Water Soluble)		N	2120	g/l	0.010		< 0.010			< 0.010
Sulphate (2:1 Water Soluble) as SO4		M	2120	g/l	0.010		< 0.010			0.044
Total Sulphur		U	2175	%	0.010		0.020			0.090
Sulphur (Elemental)		M	2180	mg/kg	1.0	< 1.0		3.0	6.4	
Chloride (Water Soluble)		M	2220	g/l	0.010		< 0.010			< 0.010
Nitrate (Water Soluble)		N	2220	g/l	0.010		< 0.010			0.012
Cyanide (Total)		M	2300	mg/kg	0.50	< 0.50		< 0.50	< 0.50	
Sulphide (Easily Liberatable)		N	2325	mg/kg	0.50	3.5		4.7	5.9	
Ammonium (Water Soluble)		M	2220	g/l	0.01		< 0.01			< 0.01
Sulphate (Total)		U	2430	%	0.010	0.019		0.069	0.12	
Sulphate (Acid Soluble)		U	2430	%	0.010		0.073			0.063
Arsenic		M	2455	mg/kg	0.5	10		11	5.8	
Barium		M	2455	mg/kg	0.5	97		110	78	
Cadmium		M	2455	mg/kg	0.10	1.4		1.3	1.1	
Chromium		M	2455	mg/kg	0.5	15		15	7.5	
Molybdenum		M	2455	mg/kg	0.5	0.8		0.7	< 0.5	
Antimony		N	2455	mg/kg	2.0	< 2.0		< 2.0	< 2.0	
Copper		M	2455	mg/kg	0.50	12		19	7.2	
Mercury		M	2455	mg/kg	0.05	0.14		0.09	0.05	
Nickel		M	2455	mg/kg	0.50	34		54	15	
Lead		M	2455	mg/kg	0.50	30		32	48	
Selenium		M	2455	mg/kg	0.25	1.7		2.3	0.86	
Zinc		M	2455	mg/kg	0.50	55		170	170	
Chromium (Trivalent)		N	2490	mg/kg	1.0	15		15	7.5	
Chromium (Hexavalent)		N	2490	mg/kg	0.50	< 0.50		< 0.50	< 0.50	
Aliphatic VPH >C5-C6	HS_2D_AL	U	2780	mg/kg	0.05	< 0.05		< 0.05	< 0.05	
Aliphatic VPH >C6-C7	HS_2D_AL	U	2780	mg/kg	0.05	< 0.05		< 0.05	< 0.05	
Aliphatic VPH >C7-C8	HS_2D_AL	U	2780	mg/kg	0.05	< 0.05		< 0.05	< 0.05	
Aliphatic VPH >C8-C10	HS_2D_AL	U	2780	mg/kg	0.05	< 0.05		< 0.05	< 0.05	

Results - Soil

Project: 25517 Lisheen Tipperary

Client: IGSL				**Chemtest Job No.:**		24-29760	24-29760	24-29760	24-29760	24-29760
Quotation No.: Q24-34387				**Chemtest Sample ID.:**		1867007	1867008	1867009	1867010	1867011
Order No.:				Client Sample Ref.:		BH6	BH6	BH7	BH7	BH7
				Sample Type:		SOIL	SOIL	SOIL	SOIL	SOIL
				Top Depth (m):		1.0	2.0	1.0	3.0	3.50
				Date Sampled:		11-Sep-2024	11-Sep-2024	11-Sep-2024	11-Sep-2024	11-Sep-2024
				Asbestos Lab:		DURHAM		DURHAM	DURHAM	
Determinand	**HWOL Code**	**Accred.**	**SOP**	**Units**	**LOD**					
Total Aliphatic VPH >C5-C10	HS_2D_AL	U	2780	mg/kg	0.25	< 0.25		< 0.25	< 0.25	
Aliphatic EPH >C10-C12 MC	EH_2D_AL_#1	M	2690	mg/kg	2.00	< 2.0		< 2.0	< 2.0	
Aliphatic EPH >C12-C16 MC	EH_2D_AL_#1	M	2690	mg/kg	1.00	< 1.0		< 1.0	< 1.0	
Aliphatic EPH >C16-C21 MC	EH_2D_AL_#1	M	2690	mg/kg	2.00	< 2.0		< 2.0	< 2.0	
Aliphatic EPH >C21-C35 MC	EH_2D_AL_#1	M	2690	mg/kg	3.00	< 3.0		< 3.0	< 3.0	
Aliphatic EPH >C35-C40 MC	EH_2D_AL_#1	N	2690	mg/kg	10.00	< 10		< 10	< 10	
Total Aliphatic EPH >C10-C35 MC	EH_2D_AL_#1	M	2690	mg/kg	5.00	< 5.0		< 5.0	< 5.0	
Aromatic VPH >C5-C7	HS_2D_AR	U	2780	mg/kg	0.05	< 0.05		< 0.05	< 0.05	
Aromatic VPH >C7-C8	HS_2D_AR	U	2780	mg/kg	0.05	< 0.05		< 0.05	< 0.05	
Aromatic VPH >C8-C10	HS_2D_AR	U	2780	mg/kg	0.05	< 0.05		< 0.05	< 0.05	
Total Aromatic VPH >C5-C10	HS_2D_AR	U	2780	mg/kg	0.25	< 0.25		< 0.25	< 0.25	
Aromatic EPH >C10-C12 MC	EH_2D_AR_#1	U	2690	mg/kg	1.00	< 1.0		< 1.0	< 1.0	
Aromatic EPH >C12-C16 MC	EH_2D_AR_#1	U	2690	mg/kg	1.00	< 1.0		< 1.0	< 1.0	
Aromatic EPH >C16-C21 MC	EH_2D_AR_#1	U	2690	mg/kg	2.00	3.5		2.4	3.2	
Aromatic EPH >C21-C35 MC	EH_2D_AR_#1	U	2690	mg/kg	2.00	< 2.0		< 2.0	< 2.0	
Aromatic EPH >C35-C40 MC	EH_2D_AR_#1	N	2690	mg/kg	1.00	< 1.0		< 1.0	< 1.0	
Total Aromatic EPH >C10-C35 MC	EH_2D_AR_#1	U	2690	mg/kg	5.00	< 5.0		< 5.0	< 5.0	
Total VPH >C5-C10	HS_2D_Total	U	2780	mg/kg	0.50	< 0.50		< 0.50	< 0.50	
Total EPH >C10-C35 MC	EH_2D_Total_#1	U	2690	mg/kg	10.00	< 10		< 10	< 10	
Mineral Oil EPH		N	2670	mg/kg	10	< 10		< 10	< 10	
Benzene		M	2760	µg/kg	1.0	< 1.0		< 1.0	< 1.0	
Toluene		M	2760	µg/kg	1.0	< 1.0		< 1.0	< 1.0	
Ethylbenzene		M	2760	µg/kg	1.0	< 1.0		< 1.0	< 1.0	
m & p-Xylene		M	2760	µg/kg	1.0	< 1.0		< 1.0	< 1.0	
o-Xylene		M	2760	µg/kg	1.0	< 1.0		< 1.0	< 1.0	
Methyl Tert-Butyl Ether		M	2760	µg/kg	1.0	< 1.0		< 1.0	< 1.0	
Naphthalene		M	2800	mg/kg	0.10	< 0.10		< 0.10	< 0.10	
Acenaphthylene		N	2800	mg/kg	0.10	< 0.10		< 0.10	< 0.10	
Acenaphthene		M	2800	mg/kg	0.10	< 0.10		< 0.10	< 0.10	
Fluorene		M	2800	mg/kg	0.10	< 0.10		< 0.10	< 0.10	
Phenanthrene		M	2800	mg/kg	0.10	< 0.10		< 0.10	< 0.10	
Anthracene		M	2800	mg/kg	0.10	< 0.10		< 0.10	< 0.10	
Fluoranthene		M	2800	mg/kg	0.10	< 0.10		< 0.10	< 0.10	
Pyrene		M	2800	mg/kg	0.10	< 0.10		< 0.10	< 0.10	
Benzo[a]anthracene		M	2800	mg/kg	0.10	< 0.10		< 0.10	< 0.10	
Chrysene		M	2800	mg/kg	0.10	< 0.10		< 0.10	< 0.10	
Benzo[b]fluoranthene		M	2800	mg/kg	0.10	< 0.10		< 0.10	< 0.10	
Benzo[k]fluoranthene		M	2800	mg/kg	0.10	< 0.10		< 0.10	< 0.10	
Benzo[a]pyrene		M	2800	mg/kg	0.10	< 0.10		< 0.10	< 0.10	

Results - Soil

Project: 25517 Lisheen Tipperary

Client: IGSL				**Chemtest Job No.:**		24-29760	24-29760	24-29760	24-29760	24-29760
Quotation No.: Q24-34387				**Chemtest Sample ID.:**		1867007	1867008	1867009	1867010	1867011
Order No.:				Client Sample Ref.:		BH6	BH6	BH7	BH7	BH7
				Sample Type:		SOIL	SOIL	SOIL	SOIL	SOIL
				Top Depth (m):		1.0	2.0	1.0	3.0	3.50
				Date Sampled:		11-Sep-2024	11-Sep-2024	11-Sep-2024	11-Sep-2024	11-Sep-2024
				Asbestos Lab:		DURHAM		DURHAM	DURHAM	
Determinand	**HWOL Code**	**Accred.**	**SOP**	**Units**	**LOD**					
Indeno(1,2,3-c,d)Pyrene		M	2800	mg/kg	0.10	< 0.10		< 0.10	< 0.10	
Dibenz(a,h)Anthracene		N	2800	mg/kg	0.10	< 0.10		< 0.10	< 0.10	
Benzo[g,h,i]perylene		M	2800	mg/kg	0.10	< 0.10		< 0.10	< 0.10	
Coronene		N	2800	mg/kg	0.10	< 0.10		< 0.10	< 0.10	
PCB 28		U	2815	mg/kg	0.010	< 0.010		< 0.010	< 0.010	
PCB 52		U	2815	mg/kg	0.010	< 0.010		< 0.010	< 0.010	
PCB 101		U	2815	mg/kg	0.010	< 0.010		< 0.010	< 0.010	
PCB 118		U	2815	mg/kg	0.010	< 0.010		< 0.010	< 0.010	
PCB 153		U	2815	mg/kg	0.010	< 0.010		< 0.010	< 0.010	
PCB 138		U	2815	mg/kg	0.010	< 0.010		< 0.010	< 0.010	
PCB 180		U	2815	mg/kg	0.010	< 0.010		< 0.010	< 0.010	
Tot PCBs Low (7 Congeners)		N	2815	mg/kg	0.05	< 0.05		< 0.05	< 0.05	
Total Phenols		M	2920	mg/kg	0.10	< 0.10		< 0.10	< 0.10	

Results - Single Stage WAC

Project: 25517 Lisheen Tipperary

						Landfill Waste Acceptance Criteria Limits		
Chemtest Job No:	24-29760							
Chemtest Sample ID:	1867007							
Sample Ref:	BH6							
Sample ID:								
Sample Location:								
Top Depth(m):	1.0							
Bottom Depth(m):								
Sampling Date:	11-Sep-2024					Inert Waste Landfill	Stable, Non-reactive hazardous waste in non-hazardous Landfill	Hazardous Waste Landfill
Determinand	**SOP**	**HWOL Code**	**Accred.**	**Units**				
Total Organic Carbon	2625		M	%	0.31	3	5	6
Loss On Ignition	2610		M	%	1.5	--	--	10
Total BTEX	2760		M	mg/kg	< 0.010	6	--	--
Total PCBs (7 Congeners)	2815		M	mg/kg	< 0.10	1	--	--
TPH Total WAC	2670	EH_CU_1D_Total	M	mg/kg	< 10	500	--	--
Total Of 17 PAHs Lower	2800		N	mg/kg	< 1.0	100	--	--
pH at 20C	2010		M		8.0	--	>6	--
Acid Neutralisation Capacity	2015		N	mol/kg	0.0060	--	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	0.0039	0.5	2	25
Barium	1455		U	0.007	0.072	20	100	300
Cadmium	1455		U	< 0.00011	< 0.0011	0.04	1	5
Chromium	1455		U	0.0006	0.0055	0.5	10	70
Copper	1455		U	0.0012	0.012	2	50	100
Mercury	1455		U	< 0.00005	< 0.00050	0.01	0.2	2
Molybdenum	1455		U	0.0008	0.0083	0.5	10	30
Nickel	1455		U	0.0006	0.0062	0.4	10	40
Lead	1455		U	< 0.0005	< 0.0050	0.5	10	50
Antimony	1455		U	< 0.0005	< 0.0050	0.06	0.7	5
Selenium	1455		U	< 0.0005	< 0.0050	0.1	0.5	7
Zinc	1455		U	0.005	0.050	4	50	200
Chloride	1220		U	< 1.0	< 10	800	15000	25000
Fluoride	1220		U	0.25	2.5	10	150	500
Sulphate	1220		U	< 1.0	< 10	1000	20000	50000
Total Dissolved Solids	1020		N	44	440	4000	60000	100000
Phenol Index	1920		U	< 0.030	< 0.30	1	-	-
Dissolved Organic Carbon	1610		U	3.6	< 50	500	800	1000

Solid Information	
Dry mass of test portion/kg	0.090
Moisture (%)	15

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: 25517 Lisheen Tipperary

						Landfill Waste Acceptance Criteria Limits		
Chemtest Job No:	24-29760							
Chemtest Sample ID:	1867009							
Sample Ref:	BH7							
Sample ID:								
Sample Location:								
Top Depth(m):	1.0							
Bottom Depth(m):								
Sampling Date:	11-Sep-2024					Inert Waste Landfill	Stable, Non-reactive hazardous waste in non-hazardous Landfill	Hazardous Waste Landfill
Determinand	**SOP**	**HWOL Code**	**Accred.**	**Units**				
Total Organic Carbon	2625		M	%	1.9	3	5	6
Loss On Ignition	2610		M	%	1.4	--	--	10
Total BTEX	2760		M	mg/kg	< 0.010	6	--	--
Total PCBs (7 Congeners)	2815		M	mg/kg	< 0.10	1	--	--
TPH Total WAC	2670	EH_CU_1D_Total	M	mg/kg	< 10	500	--	--
Total Of 17 PAHs Lower	2800		N	mg/kg	< 1.0	100	--	--
pH at 20C	2010		M		8.4	--	>6	--
Acid Neutralisation Capacity	2015		N	mol/kg	0.0060	--	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	0.0010	0.010	0.5	2	25
Barium	1455		U	0.079	0.79	20	100	300
Cadmium	1455		U	< 0.00011	< 0.0011	0.04	1	5
Chromium	1455		U	0.0008	0.0077	0.5	10	70
Copper	1455		U	0.0021	0.021	2	50	100
Mercury	1455		U	< 0.00005	< 0.00050	0.01	0.2	2
Molybdenum	1455		U	0.0021	0.021	0.5	10	30
Nickel	1455		U	0.0022	0.022	0.4	10	40
Lead	1455		U	0.0019	0.019	0.5	10	50
Antimony	1455		U	0.0013	0.013	0.06	0.7	5
Selenium	1455		U	< 0.0005	< 0.0050	0.1	0.5	7
Zinc	1455		U	0.009	0.089	4	50	200
Chloride	1220		U	< 1.0	< 10	800	15000	25000
Fluoride	1220		U	0.20	2.0	10	150	500
Sulphate	1220		U	5.1	51	1000	20000	50000
Total Dissolved Solids	1020		N	91	910	4000	60000	100000
Phenol Index	1920		U	< 0.030	< 0.30	1	-	-
Dissolved Organic Carbon	1610		U	4.1	< 50	500	800	1000

Solid Information	
Dry mass of test portion/kg	0.090
Moisture (%)	11

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: 25517 Lisheen Tipperary

						Landfill Waste Acceptance Criteria Limits		
Chemtest Job No:	24-29760							
Chemtest Sample ID:	1867010							
Sample Ref:	BH7							
Sample ID:								
Sample Location:								
Top Depth(m):	3.0							
Bottom Depth(m):								
Sampling Date:	11-Sep-2024							
Determinand	**SOP**	**HWOL Code**	**Accred.**	**Units**		**Inert Waste Landfill**	**Stable, Non-reactive hazardous waste in non-hazardous Landfill**	**Hazardous Waste Landfill**
Total Organic Carbon	2625		M	%	3.2	3	5	6
Loss On Ignition	2610		M	%	2.7	--	--	10
Total BTEX	2760		M	mg/kg	< 0.010	6	--	--
Total PCBs (7 Congeners)	2815		M	mg/kg	< 0.10	1	--	--
TPH Total WAC	2670	EH_CU_1D_Total	M	mg/kg	< 10	500	--	--
Total Of 17 PAHs Lower	2800		N	mg/kg	< 1.0	100	--	--
pH at 20C	2010		M		8.2	--	>6	--
Acid Neutralisation Capacity	2015		N	mol/kg	0.0030	--	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	0.0008	0.0079	0.5	2	25
Barium	1455		U	0.054	0.54	20	100	300
Cadmium	1455		U	< 0.00011	< 0.0011	0.04	1	5
Chromium	1455		U	0.0005	0.0051	0.5	10	70
Copper	1455		U	0.0012	0.012	2	50	100
Mercury	1455		U	< 0.00005	< 0.00050	0.01	0.2	2
Molybdenum	1455		U	0.0014	0.014	0.5	10	30
Nickel	1455		U	0.0010	0.010	0.4	10	40
Lead	1455		U	0.0005	0.0050	0.5	10	50
Antimony	1455		U	0.0012	0.012	0.06	0.7	5
Selenium	1455		U	< 0.0005	< 0.0050	0.1	0.5	7
Zinc	1455		U	0.005	0.051	4	50	200
Chloride	1220		U	< 1.0	< 10	800	15000	25000
Fluoride	1220		U	0.14	1.4	10	150	500
Sulphate	1220		U	3.2	32	1000	20000	50000
Total Dissolved Solids	1020		N	48	480	4000	60000	100000
Phenol Index	1920		U	< 0.030	< 0.30	1	-	-
Dissolved Organic Carbon	1610		U	4.3	< 50	500	800	1000

Solid Information	
Dry mass of test portion/kg	0.090
Moisture (%)	13

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.

Test Methods

SOP	Title	Parameters included	Method summary	Water Accred.
1010	pH Value of Waters	pH at 20°C	pH Meter	
1020	Electrical Conductivity and Total Dissolved Solids (TDS) in Waters	Electrical Conductivity at 25°C 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.	
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	
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 at 20°C	pH Meter	
2015	Acid Neutralisation Capacity	Acid Reserve	Titration	
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 <30°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	
2175	Total Sulphur in Soils	Total Sulphur	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.	
2180	Sulphur (Elemental) in Soils by HPLC	Sulphur	Dichloromethane extraction / HPLC with UV detection	
2192	Asbestos	Asbestos	Polarised light microscopy / Gravimetry	
2220	Water soluble Chloride in Soils	Chloride	Aqueous extraction and measurememt by 'Aquakem 600' Discrete Analyser using ferric nitrate / mercuric thiocyanate.	
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.	
2325	Sulphide in Soils	Sulphide	Steam distillation with sulphuric acid / analysis by 'Aquakem 600' Discrete Analyser, using N,N–dimethyl-p-phenylenediamine.	
2430	Total Sulphate in soils	Total Sulphate	Acid digestion followed by determination of sulphate in extract by ICP-OES.	
2455	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.	
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	

Test Methods

SOP	Title	Parameters included	Method summary	Water Accred.
2690	EPH A/A Split	Aliphatics: >C10–C12, >C12–C16, >C16–C21, >C21– C35, >C35– C40 Aromatics: >C10–C12, >C12–C16, >C16–C21, >C21– C35, >C35– C40	Acetone/Heptane extraction / GCxGC FID detection	
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.	
2780	VPH A/A Split	Aliphatics: >C5–C6, >C6–C7,>C7–C8,>C8-C10 Aromatics: >C5–C7,>C7-C8,>C8–C10	Water extraction / Headspace GCxGC FID detection	
2800	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Soil by GC-MS	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-MS	
2815	Polychlorinated Biphenyls (PCB) ICES7Congeners in Soils by GC-MS	ICES7 PCB congeners	Acetone/Hexane extraction / GC-MS. Reported PCB 101 results may contain contributions from PCB 90 due to inseparable chromatography.	
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

This report shall not be reproduced except in full, and only with the prior approval of the laboratory.
Any comments or interpretations are outside the scope of UKAS accreditation.
The Laboratory is not accredited for any sampling activities and reported results relate to the samples 'as received' at the laboratory.
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 EPH, VPH, TPH, BTEX, VOCs, SVOCs, PCBs, Phenols.

For all other tests the samples were dried at ≤ 30°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 30 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.

Water Sample Category Key for Accreditation

DW - Drinking Water
GW - Ground Water
LE - Land Leachate
NA - Not Applicable

Report Information

PL - Prepared Leachate
PW - Processed Water
RE - Recreational Water
SA - Saline Water
SW - Surface Water
TE - Treated Effluent
TS - Treated Sewage
UL - Unspecified Liquid

Clean Up Codes

NC - No Clean Up
MC - Mathematical Clean Up
FC - Florisil Clean Up

HWOL Acronym System

HS - Headspace analysis
EH - Extractable hydrocarbons – i.e. everything extracted by the solvent
CU - Clean-up – e.g. by Florisil, silica gel
1D - GC – Single coil gas chromatography
Total - Aliphatics & Aromatics
AL - Aliphatics only
AR - Aromatic only
2D - GC-GC – Double coil gas chromatography
#1 - EH_2D_Total but with humics mathematically subtracted
#2 - EH_2D_Total but with fatty acids mathematically subtracted
+ - Operator to indicate cumulative e.g. EH+EH_Total or EH_CU+HS_Total

If you require extended retention of samples, please email your requirements to:
customerservices@chemtest.com

eurofins | Chemtest
Eurofins Chemtest Ltd
Depot Road
Newmarket
CB8 0AL
Tel: 01638 606070
Email: info@chemtest.com

Final Report

Report No.:	24-31051-1
Initial Date of Issue:	08-Oct-2024
Re-Issue Details:	
Client	IGSL
Client Address:	M7 Business Park Naas County Kildare Ireland
Contact(s):	Darren Keogh
Project	25517 Lisheen Mine
Quotation No.:	Q23-33421
Order No.:	
No. of Samples:	9
Turnaround (Wkdays):	7
Date Approved:	08-Oct-2024
Approved By:	
Details:	David Smith, Technical Director

Date Received:	26-Sep-2024
Date Instructed:	26-Sep-2024
Results Due:	04-Oct-2024

For details about application of accreditation to specific matrix types, please refer to the Table at the back of this report

Results - Leachate

Project: 25517 Lisheen Mine

Client: IGSL				**Chemtest Job No.:**		24-31051	24-31051	24-31051	24-31051	24-31051	24-31051
Quotation No.: Q23-33421				**Chemtest Sample ID.:**		1872250	1872251	1872253	1872255	1872256	1872257
Order No.:				Client Sample Ref.:		TP6	TP7	TP8	TP9	TP10	TP11
				Sample Type:		SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
				Top Depth (m):		0.50	0.60	1.00	0.60	0.50	0.50
				Date Sampled:		20-Sep-2024	20-Sep-2024	20-Sep-2024	20-Sep-2024	20-Sep-2024	20-Sep-2024
Determinand	**Accred.**	**SOP**	**Type**	**Units**	**LOD**						
Ammonium	U	1220	10:1	mg/l	0.050	0.11	< 0.050	< 0.050	0.053	< 0.050	0.056
Ammonium	N	1220	10:1	mg/kg	0.10	1.3	0.53	0.33	0.67	0.45	0.77

Results - Soil

Project: 25517 Lisheen Mine

Client: IGSL				**Chemtest Job No.:**		24-31051	24-31051	24-31051	24-31051	24-31051	24-31051	24-31051
Quotation No.: Q23-33421				**Chemtest Sample ID.:**		1872250	1872251	1872252	1872253	1872254	1872255	1872256
Order No.:				Client Sample Ref.:		TP6	TP7	TP7	TP8	TP8	TP9	TP10
				Sample Type:		SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
				Top Depth (m):		0.50	0.60	1.40	1.00	2.00	0.60	0.50
				Date Sampled:		20-Sep-2024	20-Sep-2024	20-Sep-2024	20-Sep-2024	20-Sep-2024	20-Sep-2024	20-Sep-2024
				Asbestos Lab:		DURHAM	DURHAM		DURHAM		DURHAM	DURHAM
Determinand	**HWOL Code**	**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
Moisture		N	2030	%	0.020	7.3	7.1	7.4	7.4	7.8	8.6	10
Soil Colour		N	2040		N/A	Brown	Brown	Brown	Brown	Brown	Brown	Brown
Other Material		N	2040		N/A	Stones	Stones and Roots	Stones	Stones	Stones	Stones	Stones and Roots
Soil Texture		N	2040		N/A	Loam	Loam	Loam	Loam	Loam	Loam	Clay
pH (2.5:1) at 20C		N	2010		4.0			8.7		8.6		
Boron (Hot Water Soluble)		M	2120	mg/kg	0.40	< 0.40	< 0.40		< 0.40		< 0.40	< 0.40
Magnesium (Water Soluble)		N	2120	g/l	0.010			< 0.010		< 0.010		
Sulphate (2:1 Water Soluble) as SO4		M	2120	g/l	0.010			< 0.010		< 0.010		
Total Sulphur		U	2175	%	0.010			0.010		0.010		
Sulphur (Elemental)		M	2180	mg/kg	1.0	< 1.0	< 1.0		< 1.0		< 1.0	< 1.0
Chloride (Water Soluble)		M	2220	g/l	0.010			< 0.010		< 0.010		
Nitrate (Water Soluble)		N	2220	g/l	0.010			< 0.010		< 0.010		
Cyanide (Total)		M	2300	mg/kg	0.50	< 0.50	< 0.50		< 0.50		< 0.50	< 0.50
Sulphide (Easily Liberatable)		N	2325	mg/kg	0.50	4.0	4.7		7.3		< 0.50	4.9
Ammonium (Water Soluble)		M	2220	g/l	0.01			< 0.01		< 0.01		
Sulphate (Total)		U	2430	%	0.010	< 0.010	0.016		< 0.010		< 0.010	0.084
Sulphate (Acid Soluble)		U	2430	%	0.010			< 0.010		< 0.010		
Arsenic		M	2455	mg/kg	0.5	8.9	3.8		4.7		3.1	17
Barium		M	2455	mg/kg	0.5	28	25		45		54	93
Cadmium		M	2455	mg/kg	0.10	0.42	0.28		0.23		< 0.10	0.88
Chromium		M	2455	mg/kg	0.5	7.7	5.0		6.9		5.7	9.1
Molybdenum		M	2455	mg/kg	0.5	< 0.5	< 0.5		< 0.5		< 0.5	0.6
Antimony		N	2455	mg/kg	2.0	< 2.0	< 2.0		< 2.0		< 2.0	< 2.0
Copper		M	2455	mg/kg	0.50	8.7	4.7		6.5		6.2	13
Mercury		M	2455	mg/kg	0.05	< 0.05	< 0.05		< 0.05		< 0.05	0.05
Nickel		M	2455	mg/kg	0.50	16	13		14		14	36
Lead		M	2455	mg/kg	0.50	12	8.4		10		8.9	71
Selenium		M	2455	mg/kg	0.25	0.52	0.38		0.36		0.43	0.80
Zinc		M	2455	mg/kg	0.50	40	96		29		32	220
Chromium (Trivalent)		N	2490	mg/kg	1.0	7.7	5.0		6.9		5.7	9.1
Chromium (Hexavalent)		N	2490	mg/kg	0.50	< 0.50	< 0.50		< 0.50		< 0.50	< 0.50
Aliphatic VPH >C5-C6	HS_2D_AL	U	2780	mg/kg	0.05	< 0.05	< 0.05		< 0.05		< 0.05	< 0.05
Aliphatic VPH >C6-C7	HS_2D_AL	U	2780	mg/kg	0.05	< 0.05	< 0.05		< 0.05		< 0.05	< 0.05
Aliphatic VPH >C7-C8	HS_2D_AL	U	2780	mg/kg	0.05	< 0.05	< 0.05		< 0.05		< 0.05	< 0.05
Aliphatic VPH >C8-C10	HS_2D_AL	U	2780	mg/kg	0.05	< 0.05	< 0.05		< 0.05		< 0.05	< 0.05

Results - Soil

Project: 25517 Lisheen Mine

Client: IGSL				**Chemtest Job No.:**		24-31051	24-31051	24-31051	24-31051	24-31051	24-31051	24-31051
Quotation No.: Q23-33421				**Chemtest Sample ID.:**		1872250	1872251	1872252	1872253	1872254	1872255	1872256
Order No.:				Client Sample Ref.:		TP6	TP7	TP7	TP8	TP8	TP9	TP10
				Sample Type:		SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
				Top Depth (m):		0.50	0.60	1.40	1.00	2.00	0.60	0.50
				Date Sampled:		20-Sep-2024	20-Sep-2024	20-Sep-2024	20-Sep-2024	20-Sep-2024	20-Sep-2024	20-Sep-2024
				Asbestos Lab:		DURHAM	DURHAM		DURHAM		DURHAM	DURHAM
Determinand	**HWOL Code**	**Accred.**	**SOP**	**Units**	**LOD**							
Total Aliphatic VPH >C5-C10	HS_2D_AL	U	2780	mg/kg	0.25	< 0.25	< 0.25		< 0.25		< 0.25	< 0.25
Aliphatic EPH >C10-C12 MC	EH_2D_AL_#1	M	2690	mg/kg	2.00	< 2.0	< 2.0		< 2.0		< 2.0	< 2.0
Aliphatic EPH >C12-C16 MC	EH_2D_AL_#1	M	2690	mg/kg	1.00	< 1.0	< 1.0		< 1.0		< 1.0	< 1.0
Aliphatic EPH >C16-C21 MC	EH_2D_AL_#1	M	2690	mg/kg	2.00	< 2.0	< 2.0		< 2.0		< 2.0	< 2.0
Aliphatic EPH >C21-C35 MC	EH_2D_AL_#1	M	2690	mg/kg	3.00	< 3.0	< 3.0		< 3.0		< 3.0	< 3.0
Aliphatic EPH >C35-C40 MC	EH_2D_AL_#1	N	2690	mg/kg	10.00	< 10	< 10		< 10		< 10	< 10
Total Aliphatic EPH >C10-C35 MC	EH_2D_AL_#1	M	2690	mg/kg	5.00	< 5.0	< 5.0		< 5.0		< 5.0	< 5.0
Aromatic VPH >C5-C7	HS_2D_AR	U	2780	mg/kg	0.05	< 0.05	< 0.05		< 0.05		< 0.05	< 0.05
Aromatic VPH >C7-C8	HS_2D_AR	U	2780	mg/kg	0.05	< 0.05	< 0.05		< 0.05		< 0.05	< 0.05
Aromatic VPH >C8-C10	HS_2D_AR	U	2780	mg/kg	0.05	< 0.05	< 0.05		< 0.05		< 0.05	< 0.05
Total Aromatic VPH >C5-C10	HS_2D_AR	U	2780	mg/kg	0.25	< 0.25	< 0.25		< 0.25		< 0.25	< 0.25
Aromatic EPH >C10-C12 MC	EH_2D_AR_#1	U	2690	mg/kg	1.00	< 1.0	< 1.0		< 1.0		< 1.0	< 1.0
Aromatic EPH >C12-C16 MC	EH_2D_AR_#1	U	2690	mg/kg	1.00	< 1.0	< 1.0		< 1.0		< 1.0	< 1.0
Aromatic EPH >C16-C21 MC	EH_2D_AR_#1	U	2690	mg/kg	2.00	4.4	7.1		7.3		6.2	6.8
Aromatic EPH >C21-C35 MC	EH_2D_AR_#1	U	2690	mg/kg	2.00	< 2.0	< 2.0		< 2.0		< 2.0	< 2.0
Aromatic EPH >C35-C40 MC	EH_2D_AR_#1	N	2690	mg/kg	1.00	< 1.0	17		< 1.0		< 1.0	< 1.0
Total Aromatic EPH >C10-C35 MC	EH_2D_AR_#1	U	2690	mg/kg	5.00	< 5.0	7.2		7.4		6.3	7.4
Total VPH >C5-C10	HS_2D_Total	U	2780	mg/kg	0.50	< 0.50	< 0.50		< 0.50		< 0.50	< 0.50
Total EPH >C10-C35 MC	EH_2D_Total_#1	U	2690	mg/kg	10.00	< 10	< 10		< 10		< 10	< 10
Mineral Oil EPH		N	2670	mg/kg	10	< 10	< 10		< 10		< 10	< 10
Benzene		M	2760	µg/kg	1.0	< 1.0	< 1.0		< 1.0		< 1.0	< 1.0
Toluene		M	2760	µg/kg	1.0	< 1.0	< 1.0		< 1.0		< 1.0	< 1.0
Ethylbenzene		M	2760	µg/kg	1.0	< 1.0	< 1.0		< 1.0		< 1.0	< 1.0
m & p-Xylene		M	2760	µg/kg	1.0	< 1.0	< 1.0		< 1.0		< 1.0	< 1.0
o-Xylene		M	2760	µg/kg	1.0	< 1.0	< 1.0		< 1.0		< 1.0	< 1.0
Methyl Tert-Butyl Ether		M	2760	µg/kg	1.0	< 1.0	< 1.0		< 1.0		< 1.0	< 1.0
Naphthalene		M	2800	mg/kg	0.10	< 0.10	< 0.10		< 0.10		< 0.10	< 0.10
Acenaphthylene		N	2800	mg/kg	0.10	< 0.10	< 0.10		< 0.10		< 0.10	< 0.10
Acenaphthene		M	2800	mg/kg	0.10	< 0.10	< 0.10		< 0.10		< 0.10	< 0.10
Fluorene		M	2800	mg/kg	0.10	< 0.10	< 0.10		< 0.10		< 0.10	< 0.10
Phenanthrene		M	2800	mg/kg	0.10	< 0.10	< 0.10		< 0.10		< 0.10	< 0.10
Anthracene		M	2800	mg/kg	0.10	< 0.10	< 0.10		< 0.10		< 0.10	< 0.10
Fluoranthene		M	2800	mg/kg	0.10	< 0.10	< 0.10		< 0.10		< 0.10	< 0.10
Pyrene		M	2800	mg/kg	0.10	< 0.10	< 0.10		< 0.10		< 0.10	< 0.10
Benzo[a]anthracene		M	2800	mg/kg	0.10	< 0.10	< 0.10		< 0.10		< 0.10	< 0.10
Chrysene		M	2800	mg/kg	0.10	< 0.10	< 0.10		< 0.10		< 0.10	< 0.10
Benzo[b]fluoranthene		M	2800	mg/kg	0.10	< 0.10	< 0.10		< 0.10		< 0.10	< 0.10
Benzo[k]fluoranthene		M	2800	mg/kg	0.10	< 0.10	< 0.10		< 0.10		< 0.10	< 0.10
Benzo[a]pyrene		M	2800	mg/kg	0.10	< 0.10	< 0.10		< 0.10		< 0.10	< 0.10

Results - Soil

Project: 25517 Lisheen Mine

Client: IGSL				**Chemtest Job No.:**		24-31051	24-31051	24-31051	24-31051	24-31051	24-31051	24-31051
Quotation No.: Q23-33421				**Chemtest Sample ID.:**		1872250	1872251	1872252	1872253	1872254	1872255	1872256
Order No.:				Client Sample Ref.:		TP6	TP7	TP7	TP8	TP8	TP9	TP10
				Sample Type:		SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
				Top Depth (m):		0.50	0.60	1.40	1.00	2.00	0.60	0.50
				Date Sampled:		20-Sep-2024	20-Sep-2024	20-Sep-2024	20-Sep-2024	20-Sep-2024	20-Sep-2024	20-Sep-2024
				Asbestos Lab:		DURHAM	DURHAM		DURHAM		DURHAM	DURHAM
Determinand	**HWOL Code**	**Accred.**	**SOP**	**Units**	**LOD**							
Indeno(1,2,3-c,d)Pyrene		M	2800	mg/kg	0.10	< 0.10	< 0.10		< 0.10		< 0.10	< 0.10
Dibenz(a,h)Anthracene		N	2800	mg/kg	0.10	< 0.10	< 0.10		< 0.10		< 0.10	< 0.10
Benzo[g,h,i]perylene		M	2800	mg/kg	0.10	< 0.10	< 0.10		< 0.10		< 0.10	< 0.10
Coronene		N	2800	mg/kg	0.10	< 0.10	< 0.10		< 0.10		< 0.10	< 0.10
PCB 28		U	2815	mg/kg	0.010	< 0.010	< 0.010		< 0.010		< 0.010	< 0.010
PCB 52		U	2815	mg/kg	0.010	< 0.010	< 0.010		< 0.010		< 0.010	< 0.010
PCB 101		U	2815	mg/kg	0.010	< 0.010	< 0.010		< 0.010		< 0.010	< 0.010
PCB 118		U	2815	mg/kg	0.010	< 0.010	< 0.010		< 0.010		< 0.010	< 0.010
PCB 153		U	2815	mg/kg	0.010	< 0.010	< 0.010		< 0.010		< 0.010	< 0.010
PCB 138		U	2815	mg/kg	0.010	< 0.010	< 0.010		< 0.010		< 0.010	< 0.010
PCB 180		U	2815	mg/kg	0.010	< 0.010	< 0.010		< 0.010		< 0.010	< 0.010
Tot PCBs Low (7 Congeners)		N	2815	mg/kg	0.05	< 0.05	< 0.05		< 0.05		< 0.05	< 0.05
Total Phenols		M	2920	mg/kg	0.10	< 0.10	< 0.10		< 0.10		< 0.10	< 0.10

Results - Soil

Project: 25517 Lisheen Mine

Client: IGSL				**Chemtest Job No.:**		24-31051	24-31051
Quotation No.: Q23-33421				**Chemtest Sample ID.:**		1872257	1872258
Order No.:				Client Sample Ref.:		TP11	TP11
				Sample Type:		SOIL	SOIL
				Top Depth (m):		0.50	1.10
				Date Sampled:		20-Sep-2024	20-Sep-2024
				Asbestos Lab:		DURHAM	
Determinand	**HWOL Code**	**Accred.**	**SOP**	**Units**	**LOD**		
ACM Type		U	2192		N/A	-	
Asbestos Identification		U	2192		N/A	No Asbestos Detected	
Moisture		N	2030	%	0.020	6.7	7.3
Soil Colour		N	2040		N/A	Brown	Brown
Other Material		N	2040		N/A	Stones	Stones
Soil Texture		N	2040		N/A	Loam	Loam
pH (2.5:1) at 20C		N	2010		4.0		8.7
Boron (Hot Water Soluble)		M	2120	mg/kg	0.40	< 0.40	
Magnesium (Water Soluble)		N	2120	g/l	0.010		< 0.010
Sulphate (2:1 Water Soluble) as SO4		M	2120	g/l	0.010		< 0.010
Total Sulphur		U	2175	%	0.010		0.010
Sulphur (Elemental)		M	2180	mg/kg	1.0	< 1.0	
Chloride (Water Soluble)		M	2220	g/l	0.010		0.33
Nitrate (Water Soluble)		N	2220	g/l	0.010		< 0.010
Cyanide (Total)		M	2300	mg/kg	0.50	< 0.50	
Sulphide (Easily Liberatable)		N	2325	mg/kg	0.50	3.8	
Ammonium (Water Soluble)		M	2220	g/l	0.01		< 0.01
Sulphate (Total)		U	2430	%	0.010	< 0.010	
Sulphate (Acid Soluble)		U	2430	%	0.010		< 0.010
Arsenic		M	2455	mg/kg	0.5	2.3	
Barium		M	2455	mg/kg	0.5	21	
Cadmium		M	2455	mg/kg	0.10	< 0.10	
Chromium		M	2455	mg/kg	0.5	3.6	
Molybdenum		M	2455	mg/kg	0.5	< 0.5	
Antimony		N	2455	mg/kg	2.0	< 2.0	
Copper		M	2455	mg/kg	0.50	2.8	
Mercury		M	2455	mg/kg	0.05	0.33	
Nickel		M	2455	mg/kg	0.50	6.9	
Lead		M	2455	mg/kg	0.50	5.6	
Selenium		M	2455	mg/kg	0.25	< 0.25	
Zinc		M	2455	mg/kg	0.50	14	
Chromium (Trivalent)		N	2490	mg/kg	1.0	3.6	
Chromium (Hexavalent)		N	2490	mg/kg	0.50	< 0.50	
Aliphatic VPH >C5-C6	HS_2D_AL	U	2780	mg/kg	0.05	< 0.05	
Aliphatic VPH >C6-C7	HS_2D_AL	U	2780	mg/kg	0.05	< 0.05	
Aliphatic VPH >C7-C8	HS_2D_AL	U	2780	mg/kg	0.05	< 0.05	
Aliphatic VPH >C8-C10	HS_2D_AL	U	2780	mg/kg	0.05	< 0.05	

Results - Soil

Project: 25517 Lisheen Mine

Client: IGSL				**Chemtest Job No.:**		24-31051	24-31051
Quotation No.: Q23-33421				**Chemtest Sample ID.:**		1872257	1872258
Order No.:				Client Sample Ref.:		TP11	TP11
				Sample Type:		SOIL	SOIL
				Top Depth (m):		0.50	1.10
				Date Sampled:		20-Sep-2024	20-Sep-2024
				Asbestos Lab:		DURHAM	
Determinand	**HWOL Code**	**Accred.**	**SOP**	**Units**	**LOD**		
Total Aliphatic VPH >C5-C10	HS_2D_AL	U	2780	mg/kg	0.25	< 0.25	
Aliphatic EPH >C10-C12 MC	EH_2D_AL_#1	M	2690	mg/kg	2.00	< 2.0	
Aliphatic EPH >C12-C16 MC	EH_2D_AL_#1	M	2690	mg/kg	1.00	< 1.0	
Aliphatic EPH >C16-C21 MC	EH_2D_AL_#1	M	2690	mg/kg	2.00	2.4	
Aliphatic EPH >C21-C35 MC	EH_2D_AL_#1	M	2690	mg/kg	3.00	3.8	
Aliphatic EPH >C35-C40 MC	EH_2D_AL_#1	N	2690	mg/kg	10.00	< 10	
Total Aliphatic EPH >C10-C35 MC	EH_2D_AL_#1	M	2690	mg/kg	5.00	6.2	
Aromatic VPH >C5-C7	HS_2D_AR	U	2780	mg/kg	0.05	< 0.05	
Aromatic VPH >C7-C8	HS_2D_AR	U	2780	mg/kg	0.05	< 0.05	
Aromatic VPH >C8-C10	HS_2D_AR	U	2780	mg/kg	0.05	< 0.05	
Total Aromatic VPH >C5-C10	HS_2D_AR	U	2780	mg/kg	0.25	< 0.25	
Aromatic EPH >C10-C12 MC	EH_2D_AR_#1	U	2690	mg/kg	1.00	< 1.0	
Aromatic EPH >C12-C16 MC	EH_2D_AR_#1	U	2690	mg/kg	1.00	< 1.0	
Aromatic EPH >C16-C21 MC	EH_2D_AR_#1	U	2690	mg/kg	2.00	6.8	
Aromatic EPH >C21-C35 MC	EH_2D_AR_#1	U	2690	mg/kg	2.00	< 2.0	
Aromatic EPH >C35-C40 MC	EH_2D_AR_#1	N	2690	mg/kg	1.00	< 1.0	
Total Aromatic EPH >C10-C35 MC	EH_2D_AR_#1	U	2690	mg/kg	5.00	7.4	
Total VPH >C5-C10	HS_2D_Total	U	2780	mg/kg	0.50	< 0.50	
Total EPH >C10-C35 MC	EH_2D_Total_#1	U	2690	mg/kg	10.00	14	
Mineral Oil EPH		N	2670	mg/kg	10	< 10	
Benzene		M	2760	µg/kg	1.0	< 1.0	
Toluene		M	2760	µg/kg	1.0	< 1.0	
Ethylbenzene		M	2760	µg/kg	1.0	< 1.0	
m & p-Xylene		M	2760	µg/kg	1.0	< 1.0	
o-Xylene		M	2760	µg/kg	1.0	< 1.0	
Methyl Tert-Butyl Ether		M	2760	µg/kg	1.0	< 1.0	
Naphthalene		M	2800	mg/kg	0.10	< 0.10	
Acenaphthylene		N	2800	mg/kg	0.10	< 0.10	
Acenaphthene		M	2800	mg/kg	0.10	< 0.10	
Fluorene		M	2800	mg/kg	0.10	< 0.10	
Phenanthrene		M	2800	mg/kg	0.10	< 0.10	
Anthracene		M	2800	mg/kg	0.10	< 0.10	
Fluoranthene		M	2800	mg/kg	0.10	< 0.10	
Pyrene		M	2800	mg/kg	0.10	< 0.10	
Benzo[a]anthracene		M	2800	mg/kg	0.10	< 0.10	
Chrysene		M	2800	mg/kg	0.10	< 0.10	
Benzo[b]fluoranthene		M	2800	mg/kg	0.10	< 0.10	
Benzo[k]fluoranthene		M	2800	mg/kg	0.10	< 0.10	
Benzo[a]pyrene		M	2800	mg/kg	0.10	< 0.10	

Results - Soil

Project: 25517 Lisheen Mine

Client: IGSL		**Chemtest Job No.:**				24-31051	24-31051
Quotation No.: Q23-33421		**Chemtest Sample ID.:**				1872257	1872258
Order No.:		Client Sample Ref.:				TP11	TP11
		Sample Type:				SOIL	SOIL
		Top Depth (m):				0.50	1.10
		Date Sampled:				20-Sep-2024	20-Sep-2024
		Asbestos Lab:				DURHAM	
Determinand	**HWOL Code**	**Accred.**	**SOP**	**Units**	**LOD**		
Indeno(1,2,3-c,d)Pyrene		M	2800	mg/kg	0.10	< 0.10	
Dibenz(a,h)Anthracene		N	2800	mg/kg	0.10	< 0.10	
Benzo[g,h,i]perylene		M	2800	mg/kg	0.10	< 0.10	
Coronene		N	2800	mg/kg	0.10	< 0.10	
PCB 28		U	2815	mg/kg	0.010	< 0.010	
PCB 52		U	2815	mg/kg	0.010	< 0.010	
PCB 101		U	2815	mg/kg	0.010	< 0.010	
PCB 118		U	2815	mg/kg	0.010	< 0.010	
PCB 153		U	2815	mg/kg	0.010	< 0.010	
PCB 138		U	2815	mg/kg	0.010	< 0.010	
PCB 180		U	2815	mg/kg	0.010	< 0.010	
Tot PCBs Low (7 Congeners)		N	2815	mg/kg	0.05	< 0.05	
Total Phenols		M	2920	mg/kg	0.10	< 0.10	

Results - Single Stage WAC

Project: 25517 Lisheen Mine

						Landfill Waste Acceptance Criteria Limits		
Chemtest Job No:	24-31051							
Chemtest Sample ID:	1872250							
Sample Ref:	TP6							
Sample ID:								
Sample Location:								
Top Depth(m):	0.50							
Bottom Depth(m):								
Sampling Date:	20-Sep-2024					**Inert Waste Landfill**	**Stable, Non-reactive hazardous waste in non-hazardous Landfill**	**Hazardous Waste Landfill**
Determinand	**SOP**	**HWOL Code**	**Accred.**	**Units**				
Total Organic Carbon	2625		M	%	2.1	3	5	6
Loss On Ignition	2610		M	%	1.3	--	--	10
Total BTEX	2760		M	mg/kg	< 0.010	6	--	--
Total PCBs (7 Congeners)	2815		M	mg/kg	< 0.10	1	--	--
TPH Total WAC	2670	EH_CU_1D_Total	M	mg/kg	< 10	500	--	--
Total Of 17 PAHs Lower	2800		N	mg/kg	< 1.0	100	--	--
pH at 20C	2010		M		8.5	--	>6	--
Acid Neutralisation Capacity	2015		N	mol/kg	0.074	--	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	0.0039	0.5	2	25
Barium	1455		U	< 0.005	< 0.050	20	100	300
Cadmium	1455		U	< 0.00011	< 0.0011	0.04	1	5
Chromium	1455		U	0.16	1.6	0.5	10	70
Copper	1455		U	0.0015	0.015	2	50	100
Mercury	1455		U	< 0.00005	< 0.00050	0.01	0.2	2
Molybdenum	1455		U	0.0022	0.022	0.5	10	30
Nickel	1455		U	< 0.0005	< 0.0050	0.4	10	40
Lead	1455		U	< 0.0005	< 0.0050	0.5	10	50
Antimony	1455		U	< 0.0005	< 0.0050	0.06	0.7	5
Selenium	1455		U	< 0.0005	< 0.0050	0.1	0.5	7
Zinc	1455		U	0.004	0.043	4	50	200
Chloride	1220		U	< 1.0	< 10	800	15000	25000
Fluoride	1220		U	0.22	2.2	10	150	500
Sulphate	1220		U	< 1.0	< 10	1000	20000	50000
Total Dissolved Solids	1020		N	40	400	4000	60000	100000
Phenol Index	1920		U	< 0.030	< 0.30	1	-	-
Dissolved Organic Carbon	1610		U	3.1	< 50	500	800	1000

Solid Information	
Dry mass of test portion/kg	0.090
Moisture (%)	7.3

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: 25517 Lisheen Mine

						Landfill Waste Acceptance Criteria Limits		
Chemtest Job No:	24-31051							
Chemtest Sample ID:	1872251							
Sample Ref:	TP7							
Sample ID:								
Sample Location:								
Top Depth(m):	0.60							
Bottom Depth(m):								
Sampling Date:	20-Sep-2024							
Determinand	**SOP**	**HWOL Code**	**Accred.**	**Units**		**Inert Waste Landfill**	**Stable, Non-reactive hazardous waste in non-hazardous Landfill**	**Hazardous Waste Landfill**
Total Organic Carbon	2625		M	%	1.4	3	5	6
Loss On Ignition	2610		M	%	1.0	--	--	10
Total BTEX	2760		M	mg/kg	< 0.010	6	--	--
Total PCBs (7 Congeners)	2815		M	mg/kg	< 0.10	1	--	--
TPH Total WAC	2670	EH_CU_1D_Total	M	mg/kg	< 10	500	--	--
Total Of 17 PAHs Lower	2800		N	mg/kg	< 1.0	100	--	--
pH at 20C	2010		M		8.6	--	>6	--
Acid Neutralisation Capacity	2015		N	mol/kg	0.10	--	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	0.0002	0.0021	0.5	2	25
Barium	1455		U	< 0.005	< 0.050	20	100	300
Cadmium	1455		U	< 0.00011	< 0.0011	0.04	1	5
Chromium	1455		U	< 0.0005	< 0.0050	0.5	10	70
Copper	1455		U	0.0015	0.015	2	50	100
Mercury	1455		U	< 0.00005	< 0.00050	0.01	0.2	2
Molybdenum	1455		U	0.0007	0.0065	0.5	10	30
Nickel	1455		U	< 0.0005	< 0.0050	0.4	10	40
Lead	1455		U	< 0.0005	< 0.0050	0.5	10	50
Antimony	1455		U	< 0.0005	< 0.0050	0.06	0.7	5
Selenium	1455		U	< 0.0005	< 0.0050	0.1	0.5	7
Zinc	1455		U	0.005	0.049	4	50	200
Chloride	1220		U	< 1.0	< 10	800	15000	25000
Fluoride	1220		U	0.20	2.0	10	150	500
Sulphate	1220		U	< 1.0	< 10	1000	20000	50000
Total Dissolved Solids	1020		N	40	400	4000	60000	100000
Phenol Index	1920		U	< 0.030	< 0.30	1	-	-
Dissolved Organic Carbon	1610		U	2.7	< 50	500	800	1000

Solid Information	
Dry mass of test portion/kg	0.090
Moisture (%)	7.1

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: 25517 Lisheen Mine

						Landfill Waste Acceptance Criteria Limits		
Chemtest Job No:	24-31051							
Chemtest Sample ID:	1872253							
Sample Ref:	TP8							
Sample ID:								
Sample Location:								
Top Depth(m):	1.00							
Bottom Depth(m):								
Sampling Date:	20-Sep-2024							
Determinand	**SOP**	**HWOL Code**	**Accred.**	**Units**		**Inert Waste Landfill**	**Stable, Non-reactive hazardous waste in non-hazardous Landfill**	**Hazardous Waste Landfill**
Total Organic Carbon	2625		M	%	0.44	3	5	6
Loss On Ignition	2610		M	%	1.4	--	--	10
Total BTEX	2760		M	mg/kg	< 0.010	6	--	--
Total PCBs (7 Congeners)	2815		M	mg/kg	< 0.10	1	--	--
TPH Total WAC	2670	EH_CU_1D_Total	M	mg/kg	< 10	500	--	--
Total Of 17 PAHs Lower	2800		N	mg/kg	< 1.0	100	--	--
pH at 20C	2010		M		8.5	--	>6	--
Acid Neutralisation Capacity	2015		N	mol/kg	0.11	--	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	< 0.0002	< 0.0020	0.5	2	25
Barium	1455		U	0.006	0.061	20	100	300
Cadmium	1455		U	< 0.00011	< 0.0011	0.04	1	5
Chromium	1455		U	< 0.0005	< 0.0050	0.5	10	70
Copper	1455		U	0.0016	0.016	2	50	100
Mercury	1455		U	< 0.00005	< 0.00050	0.01	0.2	2
Molybdenum	1455		U	0.0010	0.010	0.5	10	30
Nickel	1455		U	< 0.0005	< 0.0050	0.4	10	40
Lead	1455		U	< 0.0005	< 0.0050	0.5	10	50
Antimony	1455		U	< 0.0005	< 0.0050	0.06	0.7	5
Selenium	1455		U	< 0.0005	< 0.0050	0.1	0.5	7
Zinc	1455		U	0.003	0.035	4	50	200
Chloride	1220		U	< 1.0	< 10	800	15000	25000
Fluoride	1220		U	0.28	2.8	10	150	500
Sulphate	1220		U	< 1.0	< 10	1000	20000	50000
Total Dissolved Solids	1020		N	36	360	4000	60000	100000
Phenol Index	1920		U	< 0.030	< 0.30	1	-	-
Dissolved Organic Carbon	1610		U	< 2.5	< 50	500	800	1000

Solid Information	
Dry mass of test portion/kg	0.090
Moisture (%)	7.4

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: 25517 Lisheen Mine

						Landfill Waste Acceptance Criteria Limits		
Chemtest Job No:	24-31051							
Chemtest Sample ID:	1872255							
Sample Ref:	TP9							
Sample ID:								
Sample Location:								
Top Depth(m):	0.60							
Bottom Depth(m):								
Sampling Date:	20-Sep-2024							
Determinand	**SOP**	**HWOL Code**	**Accred.**	**Units**		**Inert Waste Landfill**	**Stable, Non-reactive hazardous waste in non-hazardous Landfill**	**Hazardous Waste Landfill**
Total Organic Carbon	2625		M	%	0.88	3	5	6
Loss On Ignition	2610		M	%	1.3	--	--	10
Total BTEX	2760		M	mg/kg	< 0.010	6	--	--
Total PCBs (7 Congeners)	2815		M	mg/kg	< 0.10	1	--	--
TPH Total WAC	2670	EH_CU_1D_Total	M	mg/kg	< 10	500	--	--
Total Of 17 PAHs Lower	2800		N	mg/kg	< 1.0	100	--	--
pH at 20C	2010		M		8.4	--	>6	--
Acid Neutralisation Capacity	2015		N	mol/kg	0.12	--	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	< 0.0002	< 0.0020	0.5	2	25
Barium	1455		U	< 0.005	< 0.050	20	100	300
Cadmium	1455		U	< 0.00011	< 0.0011	0.04	1	5
Chromium	1455		U	< 0.0005	< 0.0050	0.5	10	70
Copper	1455		U	0.0015	0.015	2	50	100
Mercury	1455		U	< 0.00005	< 0.00050	0.01	0.2	2
Molybdenum	1455		U	0.0017	0.017	0.5	10	30
Nickel	1455		U	< 0.0005	< 0.0050	0.4	10	40
Lead	1455		U	< 0.0005	< 0.0050	0.5	10	50
Antimony	1455		U	< 0.0005	< 0.0050	0.06	0.7	5
Selenium	1455		U	< 0.0005	< 0.0050	0.1	0.5	7
Zinc	1455		U	0.004	0.043	4	50	200
Chloride	1220		U	< 1.0	< 10	800	15000	25000
Fluoride	1220		U	0.18	1.8	10	150	500
Sulphate	1220		U	2.5	25	1000	20000	50000
Total Dissolved Solids	1020		N	5.6	56	4000	60000	100000
Phenol Index	1920		U	< 0.030	< 0.30	1	-	-
Dissolved Organic Carbon	1610		U	< 2.5	< 50	500	800	1000

Solid Information	
Dry mass of test portion/kg	0.090
Moisture (%)	8.6

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: 25517 Lisheen Mine

						Landfill Waste Acceptance Criteria Limits		
Chemtest Job No:	24-31051							
Chemtest Sample ID:	1872256							
Sample Ref:	TP10							
Sample ID:								
Sample Location:								
Top Depth(m):	0.50							
Bottom Depth(m):								
Sampling Date:	20-Sep-2024							
Determinand	**SOP**	**HWOL Code**	**Accred.**	**Units**		**Inert Waste Landfill**	**Stable, Non-reactive hazardous waste in non-hazardous Landfill**	**Hazardous Waste Landfill**
Total Organic Carbon	2625		M	%	0.83	3	5	6
Loss On Ignition	2610		M	%	4.4	--	--	10
Total BTEX	2760		M	mg/kg	< 0.010	6	--	--
Total PCBs (7 Congeners)	2815		M	mg/kg	< 0.10	1	--	--
TPH Total WAC	2670	EH_CU_1D_Total	M	mg/kg	< 10	500	--	--
Total Of 17 PAHs Lower	2800		N	mg/kg	< 1.0	100	--	--
pH at 20C	2010		M		8.3	--	>6	--
Acid Neutralisation Capacity	2015		N	mol/kg	0.087	--	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	0.0022	0.022	0.5	2	25
Barium	1455		U	0.013	0.13	20	100	300
Cadmium	1455		U	< 0.00011	< 0.0011	0.04	1	5
Chromium	1455		U	0.0008	0.0075	0.5	10	70
Copper	1455		U	0.0028	0.028	2	50	100
Mercury	1455		U	< 0.00005	< 0.00050	0.01	0.2	2
Molybdenum	1455		U	0.0018	0.018	0.5	10	30
Nickel	1455		U	0.0031	0.032	0.4	10	40
Lead	1455		U	0.0037	0.037	0.5	10	50
Antimony	1455		U	< 0.0005	< 0.0050	0.06	0.7	5
Selenium	1455		U	< 0.0005	< 0.0050	0.1	0.5	7
Zinc	1455		U	0.027	0.28	4	50	200
Chloride	1220		U	< 1.0	< 10	800	15000	25000
Fluoride	1220		U	0.36	3.6	10	150	500
Sulphate	1220		U	2.6	26	1000	20000	50000
Total Dissolved Solids	1020		N	52	520	4000	60000	100000
Phenol Index	1920		U	< 0.030	< 0.30	1	-	-
Dissolved Organic Carbon	1610		U	3.3	< 50	500	800	1000

Solid Information	
Dry mass of test portion/kg	0.090
Moisture (%)	10

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: 25517 Lisheen Mine

						Landfill Waste Acceptance Criteria Limits		
Chemtest Job No:	24-31051							
Chemtest Sample ID:	1872257							
Sample Ref:	TP11							
Sample ID:								
Sample Location:								
Top Depth(m):	0.50							
Bottom Depth(m):								
Sampling Date:	20-Sep-2024							
Determinand	**SOP**	**HWOL Code**	**Accred.**	**Units**		**Inert Waste Landfill**	**Stable, Non-reactive hazardous waste in non-hazardous Landfill**	**Hazardous Waste Landfill**
Total Organic Carbon	2625		M	%	0.54	3	5	6
Loss On Ignition	2610		M	%	0.92	--	--	10
Total BTEX	2760		M	mg/kg	< 0.010	6	--	--
Total PCBs (7 Congeners)	2815		M	mg/kg	< 0.10	1	--	--
TPH Total WAC	2670	EH_CU_1D_Total	M	mg/kg	< 10	500	--	--
Total Of 17 PAHs Lower	2800		N	mg/kg	< 1.0	100	--	--
pH at 20C	2010		M		8.3	--	>6	--
Acid Neutralisation Capacity	2015		N	mol/kg	0.097	--	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	0.0038	0.5	2	25
Barium	1455		U	0.008	0.077	20	100	300
Cadmium	1455		U	< 0.00011	< 0.0011	0.04	1	5
Chromium	1455		U	0.0005	0.0053	0.5	10	70
Copper	1455		U	0.0016	0.017	2	50	100
Mercury	1455		U	< 0.00005	< 0.00050	0.01	0.2	2
Molybdenum	1455		U	0.0007	0.0068	0.5	10	30
Nickel	1455		U	0.0007	0.0068	0.4	10	40
Lead	1455		U	< 0.0005	< 0.0050	0.5	10	50
Antimony	1455		U	< 0.0005	< 0.0050	0.06	0.7	5
Selenium	1455		U	< 0.0005	< 0.0050	0.1	0.5	7
Zinc	1455		U	0.005	0.045	4	50	200
Chloride	1220		U	< 1.0	< 10	800	15000	25000
Fluoride	1220		U	0.25	2.5	10	150	500
Sulphate	1220		U	1.6	16	1000	20000	50000
Total Dissolved Solids	1020		N	41	410	4000	60000	100000
Phenol Index	1920		U	< 0.030	< 0.30	1	-	-
Dissolved Organic Carbon	1610		U	3.6	< 50	500	800	1000

Solid Information	
Dry mass of test portion/kg	0.090
Moisture (%)	6.7

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.

Test Methods

SOP	Title	Parameters included	Method summary	Water Accred.
1010	pH Value of Waters	pH at 20°C	pH Meter	
1020	Electrical Conductivity and Total Dissolved Solids (TDS) in Waters	Electrical Conductivity at 25°C 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.	
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	
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 at 20°C	pH Meter	
2015	Acid Neutralisation Capacity	Acid Reserve	Titration	
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 <30°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	
2175	Total Sulphur in Soils	Total Sulphur	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.	
2180	Sulphur (Elemental) in Soils by HPLC	Sulphur	Dichloromethane extraction / HPLC with UV detection	
2192	Asbestos	Asbestos	Polarised light microscopy / Gravimetry	
2220	Water soluble Chloride in Soils	Chloride	Aqueous extraction and measuremernt by 'Aquakem 600' Discrete Analyser using ferric nitrate / mercuric thiocyanate.	
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.	
2325	Sulphide in Soils	Sulphide	Steam distillation with sulphuric acid / analysis by 'Aquakem 600' Discrete Analyser, using N,N–dimethyl-p-phenylenediamine.	
2430	Total Sulphate in soils	Total Sulphate	Acid digestion followed by determination of sulphate in extract by ICP-OES.	
2455	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.	
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	

Test Methods

SOP	Title	Parameters included	Method summary	Water Accred.
2690	EPH A/A Split	Aliphatics: >C10–C12, >C12–C16, >C16–C21, >C21– C35, >C35– C40 Aromatics: >C10–C12, >C12–C16, >C16–C21, >C21– C35, >C35– C40	Acetone/Heptane extraction / GCxGC FID detection	
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.	
2780	VPH A/A Split	Aliphatics: >C5–C6, >C6–C7,>C7–C8,>C8-C10 Aromatics: >C5–C7,>C7-C8,>C8–C10	Water extraction / Headspace GCxGC FID detection	
2800	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Soil by GC-MS	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-MS	
2815	Polychlorinated Biphenyls (PCB) ICES7Congeners in Soils by GC-MS	ICES7 PCB congeners	Acetone/Hexane extraction / GC-MS. Reported PCB 101 results may contain contributions from PCB 90 due to inseparable chromatography.	
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

This report shall not be reproduced except in full, and only with the prior approval of the laboratory.
Any comments or interpretations are outside the scope of UKAS accreditation.
The Laboratory is not accredited for any sampling activities and reported results relate to the samples 'as received' at the laboratory.
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 EPH, VPH, TPH, BTEX, VOCs, SVOCs, PCBs, Phenols.

For all other tests the samples were dried at ≤ 30°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 30 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.

Water Sample Category Key for Accreditation

DW - Drinking Water
GW - Ground Water
LE - Land Leachate
NA - Not Applicable

Report Information

PL - Prepared Leachate
PW - Processed Water
RE - Recreational Water
SA - Saline Water
SW - Surface Water
TE - Treated Effluent
TS - Treated Sewage
UL - Unspecified Liquid

Clean Up Codes

NC - No Clean Up
MC - Mathematical Clean Up
FC - Florisil Clean Up

HWOL Acronym System

HS - Headspace analysis
EH - Extractable hydrocarbons – i.e. everything extracted by the solvent
CU - Clean-up – e.g. by Florisil, silica gel
1D - GC – Single coil gas chromatography
Total - Aliphatics & Aromatics
AL - Aliphatics only
AR - Aromatic only
2D - GC-GC – Double coil gas chromatography
#1 - EH_2D_Total but with humics mathematically subtracted
#2 - EH_2D_Total but with fatty acids mathematically subtracted
+ - Operator to indicate cumulative e.g. EH+EH_Total or EH_CU+HS_Total

If you require extended retention of samples, please email your requirements to:
customerservices@chemtest.com

Appendix 11

Waste Classification Report

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Waste Characterisation Assessment

Lisheen Mine

Co. Tipperary

Prepared For: -

IGSL Limited
Unit F
M7 Business Park
Naas
County Kildare

Prepared By: -

O'Callaghan Moran & Associates
Unit 15 Melbourne Business Park
Model Farm Road
Cork

October 2024

Project	Waste Characterisation: Lisheen Mine, Co. Tipperary			
Client	IGSL Limited			
Report No	Date	Status	Prepared By	Reviewed By
240016001	23/10/2024	Final	Austin Hynes PGeo MSc	Sean Moran B.Sc. MSc

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APPENDICES

1 INTRODUCTION

IGSL Limited requested O'Callaghan Moran & Associates (OCM) to undertake a waste characterisation assessment of eighteen (18 No.) samples of made and natural ground collected from eleven (11 No.) trial pits and six (6 No.) cable percussion boreholes from a site at Lisheen Mine, Co. Tipperary.

1.1 Methodology

IGSL provided a description of the ground conditions and collected samples of the soils from the borehole and trial pit locations. The samples were analysed at an accredited laboratory and the results formed the basis for a waste classification assessment, which was undertaken by OCM in accordance with the Environmental Protection Agency (EPA) Guidelines on the Classification of Waste (2015).

2 WASTE CLASSIFICATION ASSESSMENT

2.1 Soil Sampling and Laboratory Analysis

2.1.1 *Site Investigation*

The site investigation was undertaken in July and August 2024 and included the collection of eighteen (18 No.) samples of made and natural ground collected from eleven (11 No.) trial pits and six (6 No.) cable percussion boreholes. The location of the samples is shown on Figure 2.1 and 2.2. The logs are in Appendix 1.

There is topsoil at the surface of BH01-BH07, TP01, TP03, TP04 and TP07. There is Made Ground at the surface of TP02, TP05, TP06, TP08, TP10 and TP11. The Made Ground is composed of sandy gravelly CLAY/clayey sandy GRAVEL. The Made Ground ranges in thickness from 0.30-1.10 mbgl.

The Natural Ground is generally comprises firm to stiff sandy gravelly CLAY with cobble and boulder content to 2.00-3.50 mbgl which becomes very stiff below 2.50 mbgl. Some lenses of dense sandy GRAVEL/gravelly SAND were encountered across the site.

At BH07, dense sandy GRAVEL was encountered from 3.90-5.10 mbgl.

2.1.2 *Sample Collection*

IGSL collected the samples and placed them in laboratory prepared containers that were stored in coolers prior to shipment to Chemtest Ltd.

2.1.3 *Laboratory Analysis*

The samples were tested for, metals (arsenic, barium, cadmium, chromium, copper, mercury, molybdenum, nickel, lead, antimony, selenium and zinc, total organic carbon (TOC), BTEX (benzene, toluene, ethylbenzene and xylene) aliphatic and aromatic hydrocarbons, polychlorinated biphenyls (PCB), mineral oil, polyaromatic hydrocarbons (PAH) and asbestos. Leachate generated from the samples was tested for arsenic, barium, cadmium, chromium, copper, mercury, molybdenum, nickel, lead, antimony, selenium and zinc, chloride, fluoride, soluble sulphate, phenols, dissolved organic carbon (DOC), total dissolved solids (TDS).

This parameter range facilitates an assessment of the hazardous properties of the waste, and also allows a determination of appropriate off-site management options based on the Waste Acceptance Criteria (WAC) applied by landfill operators.

The analytical methods were all ISO/CEN approved and the method detection limits were below the relevant guidance/threshold values. The full laboratory report is in Appendix 2.

O'Callaghan Moran & Associates,
Unit 15 Melbourne Business Park,
Model Farm Road, Cork.
Tel. (021) 4345366
Email: info@ocallaghanmoran.com

Title:

Figure 2.1 Sample Location Plan

Legend

Client:

IGSL Limited