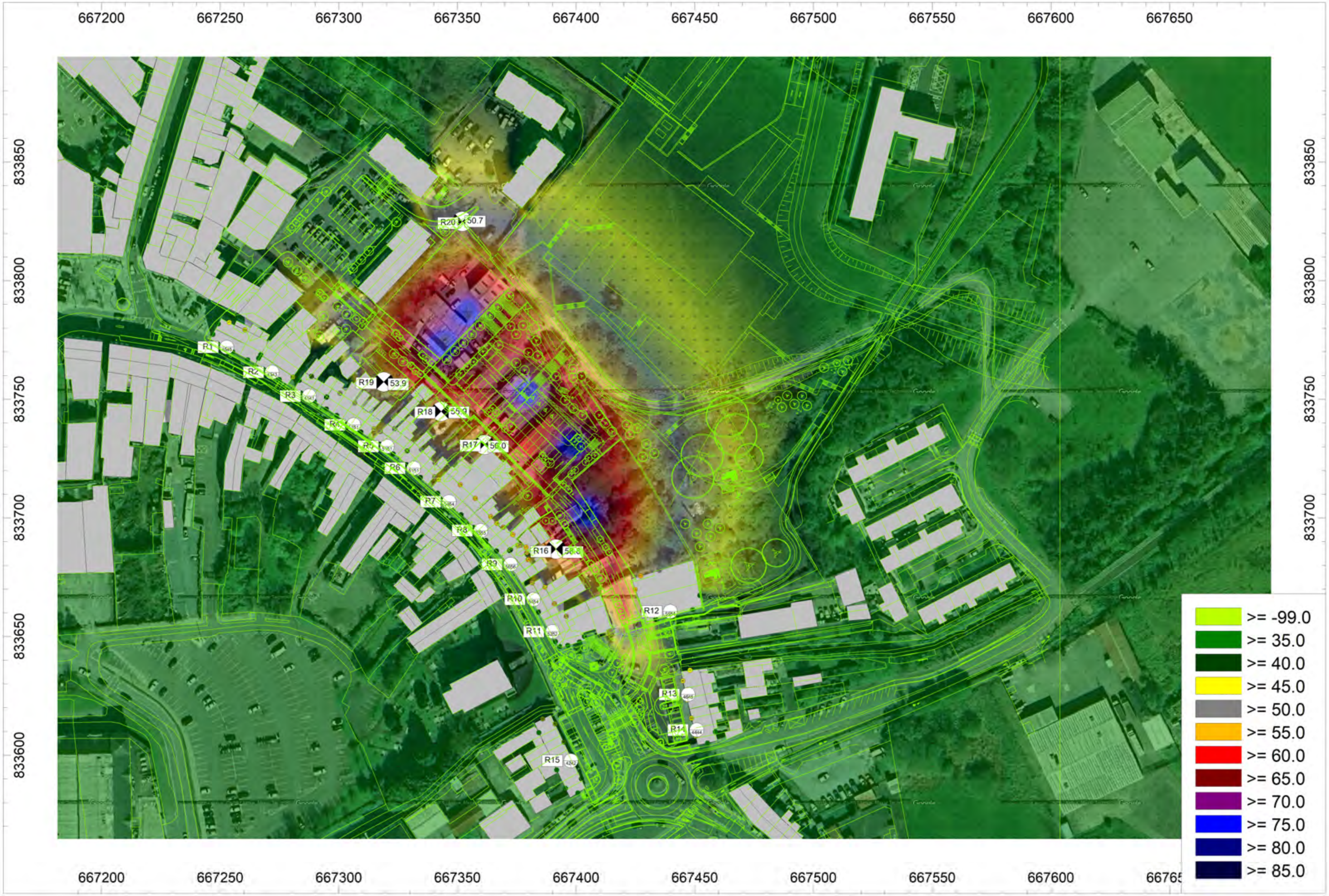
Noise Delineation Map (dBA) Scenario C1 - Earthworks



7 Soils, Geology & Hydrogeology

7.1 Preliminary Risk Assessment

7.2 Ground Investigation Report

Dublin Street North Preliminary Geoenvironmental Risk Assessment

Client	**McAdam Design Limited**
Document Ref.	23165-PRA-001-00
Project Title	Dublin Street North PRA
Date	13/10/2023

Project Title:	Dublin Street North PRA
Report Title:	Dublin Street North Preliminary Geoenvironmental Risk Assessment
Document Reference:	23165-PRA-001-00

Client:	McAdam Design Limited
Confidentiality	Client Confidential

REVISION HISTORY

Rev	Date	Reason for Issue	Originator	Reviewer	Approver
00	13/10/2023	For Information	J McGrath/ L Braga	R Harrison/ S Curtis	R Harrison

REVISION SUMMARY

Rev	Date	Section(s)	Detail of Change

DISCLAIMER

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1 INTRODUCTION

1.1 GENERAL

Gavin and Doherty Geosolutions (UK) Ltd (GDG) were commissioned by McAdam Design Ltd. to complete a Preliminary Geoenvironmental Risk Assessment (Desk Study) Report of environmental ground conditions for a proposed development site on Land North of Dublin Street, Monaghan. The site location and site boundary are outlined in Figure 1-2 and the indicative site layout, provided by the client as the Public Consultation Design - Illustrative Plan, is outlined in Figure 1-1.

Figure 1-1 Indicative Site Plan

The desktop study review is intended to inform the construction of the development which consists of:

- Semi-private public open space; and,
- Associated infrastructure.

The site is located at Irish Transverse Mercator (ITM) reference 667400 Easting, 833700 Northing. It is situated in the town and county of Monaghan in the Republic of Ireland. Access from Dublin is via the M1 and N2, approximately 130 km northbound; and access from Belfast is via M1 and N2, approximately 91 km to the southwest. Dublin Street is a one-way road heading southeast and accesses Old Cross Square. In the vicinity of the project area are several commercial businesses, including Monaghan Shopping Centre Mall, Fleming's SuperValu Monaghan, Go Petrol Station and Monaghan Harps GAA Club.

The indicative site plan is proved as Figure 1-1. This report aims to assess potential contamination constraints on the site as it currently stands, and concerning the potential development, and to provide outline recommendations for additional works required to address areas of uncertainty.

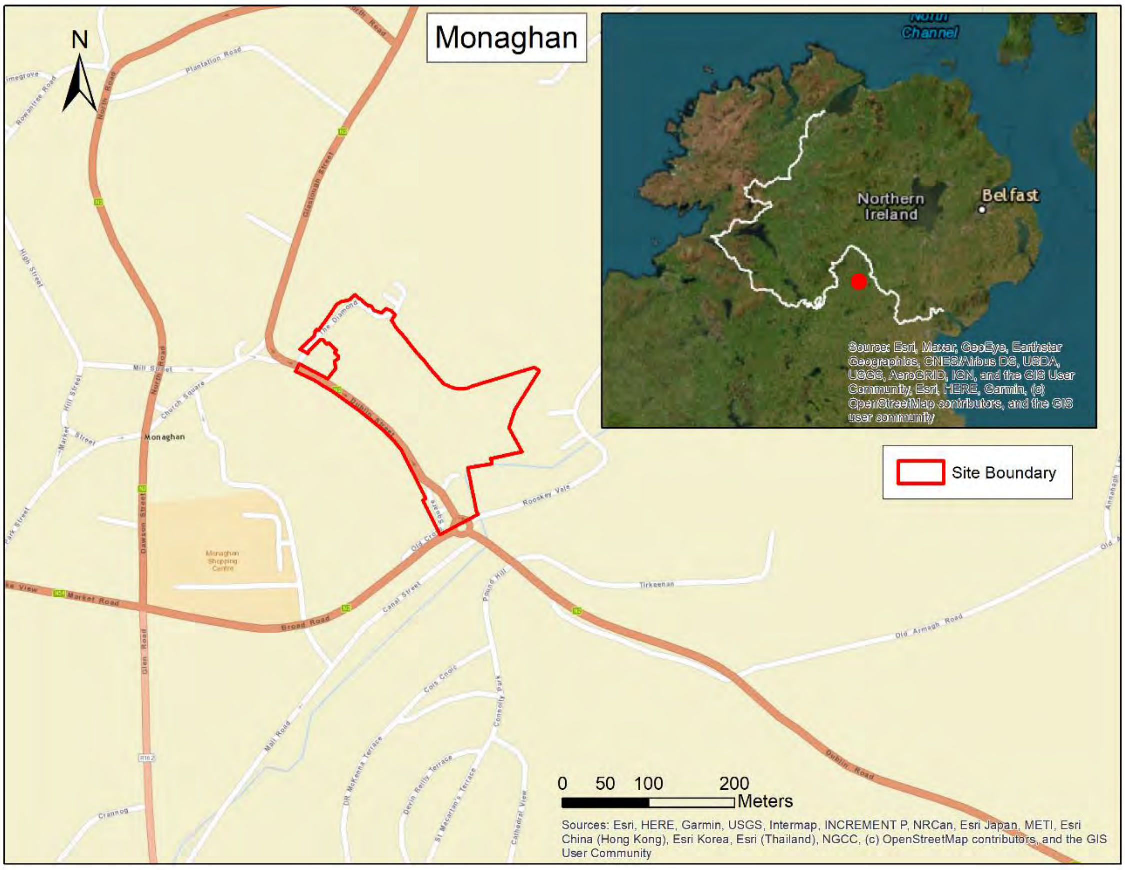


Figure 1-2 Site Location Plan

1.2 SCOPE OF WORKS

Desk-based information contained within this report has been compiled through a review of environmental data and available mapping (historical, geological, and hydrogeological). The preparation of this report included the following specific tasks:

- Review the relevant development history of the site from available historical maps to identify previous uses that may have resulted in contamination issues or constraints.
- Review the local geology, surface water, and hydrogeology classifications from the available geological plans and memoirs.
- Undertake a qualitative risk assessment of potential contamination issues at the site. The qualitative risk assessment includes the development of an Initial Conceptual Site Model for the site and the identification of any Significant Pollutant Linkages.
- Determine whether additional investigation is necessary to provide further information on the contamination and geotechnical status of the site.

A site walkover was undertaken by a GDG Engineer on 16th August 2023, with photographs included in Appendix A.

1.3 DESK STUDY RESOURCES

The following information sources have been used to assist in making a preliminary assessment of potential constraints posed by the site concerning the proposed development.

- Historic Ordnance Survey Ireland (OSI) maps ranging between 1829-1841, 1897-1913 & 1913.
    - ○ https://osi.ie/products/professional-mapping/historical-mapping/
- Internet-based aerial photography between 1985 and 2022. Google Earth.
- Geological Survey Ireland Spatial Resources Map Viewer – Department of Communications, Climate Action and Environment. Which addresses geological & geotechnical records, geological heritage, soil geochemistry, aggregate potential etc:
    - ○ http://dcenr.maps.arcgis.com/apps/MapSeries/index.html?appid=a30af518e87a4c0ab2fbde2aaac3c228
- Radon Potential, via the Environmental Protection Agency Radon Map:
    - ○ http://www.epa.ie/radiation/radonmap/
- Environmental Protection Agency Radon Map Viewer
    - ○ https://gis.epa.ie/EPAMaps/
- Land and Soil EPA maps
    - ○ https://webapps.geohive.ie/mapviewer/index.html
- Industrial and Sensitive land use records obtained from EPA.
    - ○ https://gis.epa.ie/EPAMaps/

Information was obtained from the site walkover conducted by GDG on 16th August 2023.

1.4 GUIDANCE

The following guidance documents have been used in the production of this report:

- Land contamination risk management (LCRM) - How to assess and manage the risks from land contamination. Environment Agency (EA, UK October 2020, last updated July 2023)
- Guidance on the management of contaminated land and groundwater at EPA Licensed Sites (EPA Ireland, 2013)
- Environmental Risk Assessment for Unregulated Waste Disposal Sites (EPA Ireland, 2007)

1.5 RISK ASSESSMENT

The primary objective when addressing concerns regarding contaminated land and groundwater is to ensure the protection of human health, water sources (including groundwater), and the broader environment.

Adopting a Risk-based assessment of recognized or suspected problems regarding contaminated land and groundwater is considered the optimal approach and is obligatory according to the regulations for Environmental Liability. The utilization of a 'risk-based' procedure should be consistently applied to comprehend contamination matters of land and groundwater at various sites to a satisfactory extent. This comprehension enables informed decision-making and regulatory approval for proposed actions or remedies.

The methodology for conducting risk assessment aligns closely with the guidelines outlined in the EPA's CODE OF PRACTICE: Environmental Risk Assessment for Unregulated Waste Disposal Sites (2007) (referred to as “COP” hereafter) and the UK Environment Agency’s (UKEA) publication Land contamination risk management (LCRM) October 2020 & updated April 2021.

For the assessment procedure to be effective, there is a need for the collection of reliable data based on a good-quality Conceptual Site Model (CSM) - Table 1 2. The CSM describes the potential sources of contamination at a site, the migration pathways it may follow and the receptors it could impact upon. Potential receptors to land and groundwater contamination might include (but are not exclusive to) humans, water resources, groundwater/surface water-dependent ecosystems and living organisms. If complete source–pathway–receptor scenarios exist then there is a potential pollutant linkage that needs to be characterised and assessed (via formal risk assessment).

To identify a risk of contamination, there is the need to identify not only a potential source of contamination and a receptor but also a pathway or mechanism by which the contamination can be transported between the source and the receptor. A combination of a source, a pathway and a receptor is known as a ‘pollutant linkage’. Definitions of each element are provided in Table 1-1.

Table 1-1 Definitions of Source, Pathway and Receptor

Source	**Contaminated materials and/or gases/ vapours**
Pathway	The route via which the receptor can be or is being exposed to the source of contamination
Receptor	Human health, property, ecosystem and/or water environment that may be affected by the source of contamination through ingestion, inhalation, touch, or other mechanism

For a risk to exist, a complete Source – Pathway – Receptor linkage must be present. Should one or more of the components be missing, then the linkage is not complete and there is no associated risk.

2 DESK STUDY

2.1 SITE DESCRIPTION

The 21,168 m^2 site is located in the town of Monaghan, which is the county town of County Monaghan, Republic of Ireland. The ITM Reference for the approximate centre of the site is 667400 Easting, 833700 Northing and the location is shown in Figure 1-2 and Figure 2-1.

The site is located to the northeast of the town centre, extending from The Diamond to the northwest, south-eastwards along Dublin Street, and is defined to the southeast by Old Cross Square.

The plan area is defined by the residential terraces on Dublin Street to the southwest and their long rear gardens that extend to the north. Historically the rear gardens extended to the wall that formerly enclosed St. Davnet's. 20th-century development resulted in the introduction of an informal access road to the rear and various backland developments including commercial premises.

This assessment is focused on the development areas provided in Figure 2-1, which comprise areas of semi-private public open space and associated infrastructure. Residential and commercial development which will take place in the hatched areas does not form part of this assessment.

Figure 2-1 Site boundary

2.1.1 CURRENT SITE USE

The site comprises mixed commercial and residential land. This consists of professional services including solicitors offices, commercial uses including retail units; laundry, clothing, footwear, salon, public house, restaurant, PVC windows supplier, auto repair shop and Guest House. Commercial premises have also developed to the rear, including a furniture factory. A number of the shops extended the retail use to the full width of the property which does not allow separate access to the upper levels and which has led to vacancy at upper levels. There are also several vacant shops along the street. The backland areas are substantial but underutilised.

2.1.2 CURRENT SURROUNDING AREA USE

The surrounding area is best described as the town centre, comprising a mix of uses, including residential and a mix of small to medium-scale retail uses based on the traditional narrow plot street pattern on Glaslough Street, the Diamond, Dublin Street and Market Square. A cemetery is present in the immediate vicinity of Old Cross Square. A petrol station and an alcoholic beverage wholesaler (Monaghan Bottlers Ltd) are also in the surrounding area. Agricultural land is present to the north of the site.

The map in Figure 2-2 is a cropping of the Corine Land Cover 2018 (EPA) which shows the land use classifications for the site and its surroundings. The dataset is based on the interpretation of satellite imagery and national in-situ vector data. The project boundaries fall into two classes "Continuous urban fabric" (purple hatching) for the largest area and a smaller area classified as "Pastures" (green hatching).

Figure 2-2 Land use (Corine 2018, EPA 2023)

2.2 SITE WALKOVER

A site walkover was undertaken by a GDG Engineer on the 16th of August 2023. Some access constraints/ restrictions have been identified on the site, see constraints drawing within Appendix B. Access to the site is limited and some difficulties are foreseen for the entry of machinery and undertaking investigation works, as summarised below:

- At Dublin Street, there are several possible access routes to the site, which range from narrow footpaths to 2.1-2.4m in width. Some (including the one beside the laundry) are covered with a height of ~3m. Access to the central portion of the site would require clearance of vegetation, with Japanese Knotweed having been identified within the vegetation.
- This central area is accessible from the track to the northeast of the site via two main entrances. Both of these are on private land, with one featuring a locked gate. Access would need to be agreed upon with the keyholder/landowner.
- A large sealed shipping container and shed were present in this central area, however, the owners were not available to provide access/ a description of the contents.
- Construction and demolition materials have been utilised to form a ramp access egress route in several locations across the central portion of the site.

- Access to the heavily vegetated area in the eastern part of the site, to the west of a former infirmary (section 2.3), was not possible from the northeast due to the presence of a large wall. The dense vegetation in this area also prevents access.
- The ruins of the former Infirmary are visible in a densely forested thicket. Vegetation clearance including tree felling would be required to access the area.
- The Eastern corner of the site is accessible via a 1.2 m wide footpath, but there is a significant amount of vegetation which will make access difficult.
- In the southern part of the site, near Old Cross Square, the buildings have a large retaining wall behind them and it is difficult to access the back of the Shambles bar. Additionally, much of the land in the southern portion of the site is private residential land, with no vehicular access from the street.
- The southern portion of the site to the North of Old Cross Square, is accessible via one route with two key constraints:
    - From the 'Let Us Launder' laundry side, the gates are locked, (2.1m wide and 3m high at Dublin Street), liaison with the land owner/ key holder will be necessary.
    - Access from here into the land behind the laundry is via a tight bend, with a gate (~2.3m width), which is also not ideal for ground investigation plant selection. This land is owned separately from the laundry and will also require landowner liaison.
- Access was not possible to:
    - The Northwestern portion of the site to the southwest of the Diamond Carpark
    - The southern portion of the site to the North of Old Cross Square, this area was heavily vegetated with a significant amount of waste such as broken glass bottles/cans observed in the wooded area.
- The majority of the buildings present in the vicinity of the site had oil storage tanks to the rear, understood to form part of the central heating systems.

2.2.1 INVASIVE PLANT OBSERVATIONS

Although the walkover survey conducted on the 16th of August 2023 was not undertaken by an ecologist, GDG noted the presence of probable Japanese Knotweed at the following locations presented in Figure 2-3.

Figure 2-3 Japanese Knotweed Locations

A photograph log is presented in Appendix A, noting the presence of Japanese Knotweed in five distinct areas:

- Plates 4, 5 & 6: On the access road to the North of the site.
- Plate 60 & 61: Within the wooded area close to the Former Infirmary.
- Plate 45 & 192: On the site access road.
- Plate 251, 252 & 253: To the East of the Site.
- Plate 254 & 255: At the entrance to Monaghan Harps GAA Club.

As part of any site investigation or other intrusive works, we would recommend prohibiting access to these areas and establishing a no-dig zone of min. 7m offset in the vicinity of these knotweed stands, based on the following: *It is an offence under Article 49 (2) of the European Communities (Birds and Natural Habitats) Regulations 2011 for any person to plant, disperse, allow to grow or cause to disperse, spread or otherwise cause to grow throughout the state any plant included in Part 1 of the Third Schedule. Japanese knotweed is included in the Third Schedule of the Regulations.*

A full Invasive Species Survey and Management Plan will be managed and directed by others, and the suitability of the proposals above will be confirmed by those responsible for this aspect.

No evidence of Himalayan Balsam or Giant Hogweed was observed onsite.

2.3 SITE HISTORY

The history of the site has been reviewed using historical Ordnance Survey Ireland (OSI) maps dating:

- 6 Inch First Edition Colour/ B&W (1829-1841)
- 25 Inch B&W (1897-1913)

- 6 Inch Last Edition B&W (1913)

Google Earth has been used to cover the period 1985 – 2023. A summary is provided in

Table 2-1

Table 2-1 Site History

Date	Site History	Surrounding Land Use
1829 - 1841	• The buildings are present in a similar locality to the present day. • The northeastern portion of the site has no buildings of note and is covered in pastures. • Shambles Bridge and Old Cross Square are identified in the south of the site. • The present-day street network exists at this time with Dublin Street, Dawson Street and Male Road. • Monaghan was a well-established townland in this period.	• An old infirmary and quarry can be seen near the south-eastern edge of the site. • The canal bridge is located to the south of the site. • The "Diamond" area to the north of the site is also present, as is Monaghan Lake (later called Peter's Lake). • Gaol (West of Monaghan Lake) - 400-500m NW of the Diamond Carpark.
1897-1913	• As above the site remains partly covered by buildings and partly by pastureland.	• The location where the infirmary used to be is now called the "Lodge". • There is a symbology of a landform break in the area where the quarry used to be, apparently, the quarry no longer operated at this time. • The area where there used to be a Gaol is now identified as Monaghan County Infirmary. • Smithy/ Blacksmith – 20m east of the site's southern boundary. • Gasworks - about 300m NEE of our southern boundary. • A graveyard is identified to the east of Old Cross Square at the rear of the Presbyterian Church.
1913	• In a similar way as before, the site is still partly covered by buildings and partly by pastureland.	• There is an area of pasture in the region where the quarry used to be. • The area where there used to be a Monaghan County Infirmary is now identified as a County Hospital. Laundry is also located to the north of the hospital. • Gasworks are mentioned in the same area. • The graveyard and church are identified on the map. A pump station is located 90m to the southwest of the site.

Date	Site History	Surrounding Land Use
		• A Sawmill/ Creamery are present - 80m South of Dublin Street on the banks of the Shambles.
Google Earth 1985 - 2023	• The site does not experience any significant changes during this period.	• The surrounding area experiences minor alternation and new builds.

2.4 ANTICIPATED GROUND CONDITIONS

Anticipated geological and hydrogeological conditions across the site were determined from available Geological Survey of Ireland (GSI) 1:100,000 and 50,000 and – "Report on ground investigation for proposed Monaghan Town Collection Network" (IGSL, 2007).

2.4.1 REGIONAL GEOLOGY AND LANDSCAPE

In general, Monaghan's landscape is low and gently undulating. The northern third of the county, where the study area is located, is underlain by Carboniferous rocks, some 360 to 330 million years old. Monaghan's geology is partly evident in the physical features we see in the county today. These main physical features include the Drumlin Hills and the lakes. The drumlins were formed during the last ice age (the Midland cold stage, 75 - 10,000 years ago). The ice sheets that covered Co Monaghan during the last Ice Age had a profound influence on its current landscape. In much of the county, it has been shaped by the moving ice sheet in the countless drumlins that have given the landscape its "egg basket" appearance (Swartz & Daly 2002; Simms 2003).

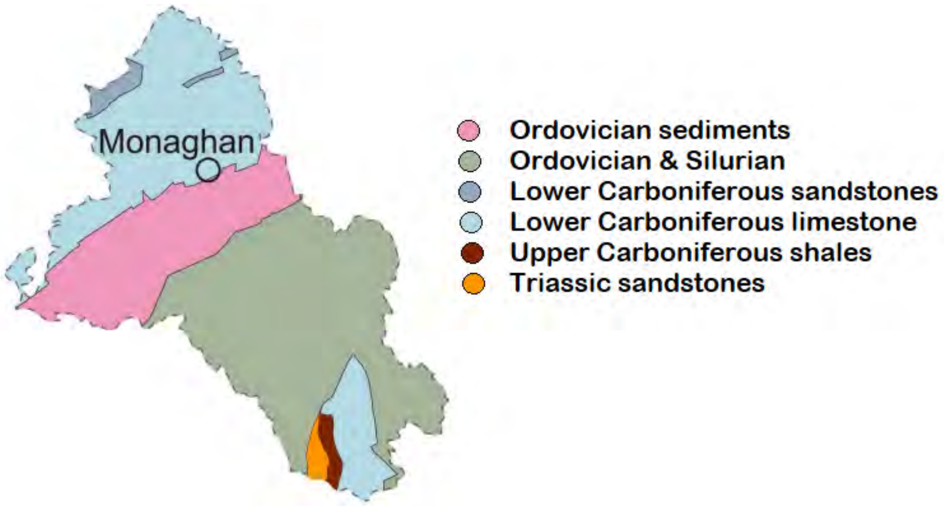


Figure 2-4 Regional Geology

2.4.2 BEDROCK GEOLOGY

The bedrock geology underlying the site is mapped on the GSI 1:100,000 bedrock formations map. This data shows that there are three different formations underlying and adjacent to the proposed site:

- Ballysteen Formation (Limestone) - Dark muddy limestone, shale. Irregularly bedded and nodular bedded argillaceous bioclastic limestones (wackestones and packstones), interbedded with fossiliferous calcareous shales. It represents a widespread development throughout Westmeath and Longford.
- Ulster Canal Formation (Sandstone) - It is composed of a marine sandstone unit and 'shaly pales and pale beds', that is silty and sandy limestones that are variably fossiliferous with occasional parallel and cross-laminations and some fine-grained limestones.
- Cooldaragh Formation (Mudstone) - It consists of pale brown-grey siltstones and mudstones, algal, evaporitic and argillaceous micrites and muddy siltstones.

The bedrock geology map (GSI, 2023) is shown in

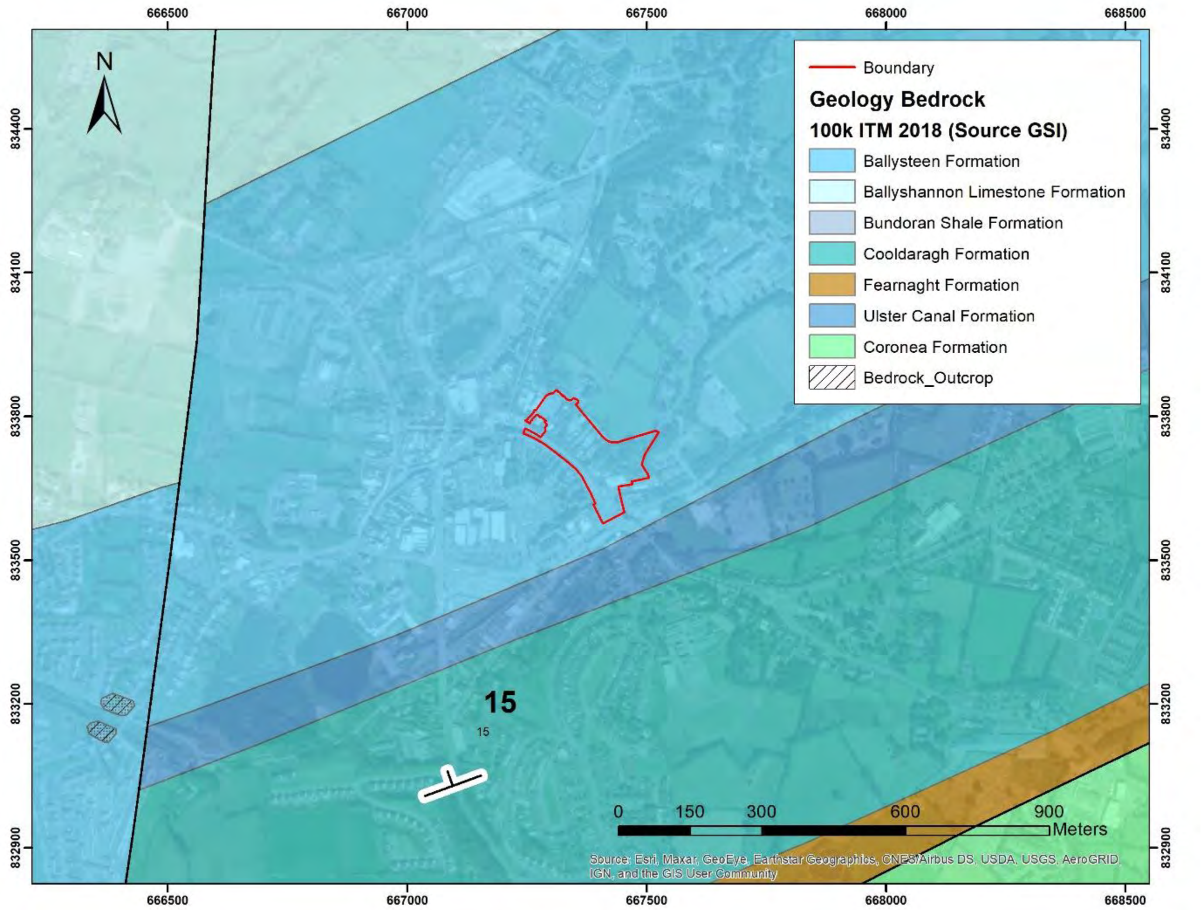


Figure 2-5. From the mapped information, the site is entirely within the **Ballysteen Formation (Limestone).**

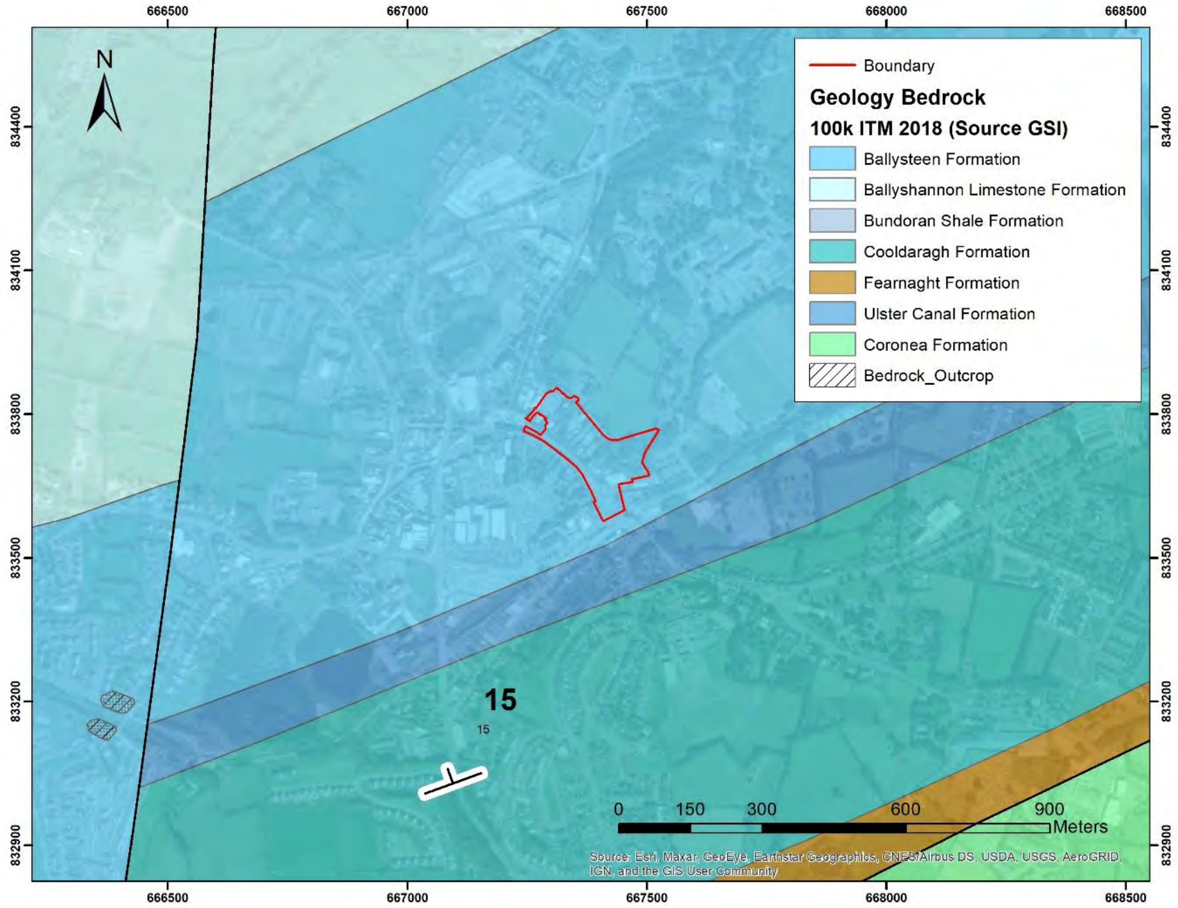


Figure 2-5 Bedrock Geology (GSI, 2023)

2.4.3 QUATERNARY SEDIMENTS

According to the 'Quaternary geology of Ireland – Sediments Map' scale 1:50,000 (GSI, 2023), the site consists of glacial till deposits derived from limestones (TLs), as well as the made ground (A) as shown in Figure 2-6. In the areas immediately around the edges of the site, alluvium and peat are also mapped, as can be seen on the map.

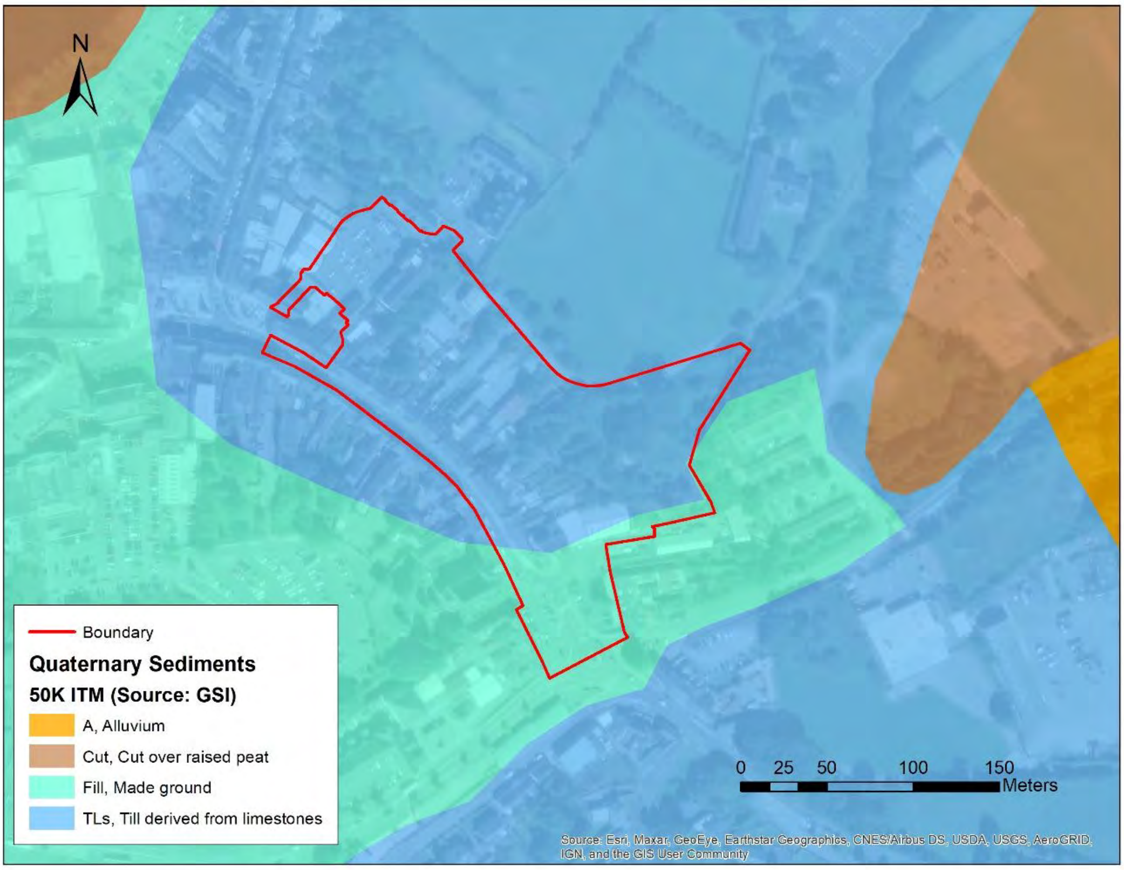


Figure 2-6 Quaternary Geology (GSI, 2023)

Using the GSI Geotechnical Boreholes data, it is possible to check at what depth the bedrock was found in the vicinity and area of the site, Figure 2-7. There is a wide variation of information, but it is possible to verify that the rock was found between 5 and 10 meters in the vicinity of the Ulster Canal. Continuing north along Dublin Street 2 boreholes report reaching the bedrock between 0-5 meters and another that reached the bedrock between 5-10 meters. There are no further details about these boreholes - Figure 2-7.

One existing ground investigation report was available on the GSI geotechnical archive for an adjacent site – “Report on ground investigation for proposed Monaghan Town Collection Network” (IGSL, 2007). The reported site is located approximately 500m to the west of the project.

The investigation is composed of nine cable percussive boreholes extending to depths of up to 12mbgl and associated in-situ testing and laboratory testing reports.

The boreholes identify a varied ground profile consisting of:

- Made ground – Stiff and dense granular and cohesive fill material,
- Organic material – Very soft to Soft PEAT and soft organic SILT and sandy SILT,
- Granular Glacial till – Medium dense to very dense glacial sandy GRAVEL with cobbles and boulders reported,

- Cohesive Glacial Till – Firm to stiff gravelly CLAY with cobbles and boulders.

Bedrock was not confirmed during the investigation. Although this investigation identified peat deposits, it is not envisaged that peat will be present within the site boundary as presented in Figure 2-6.

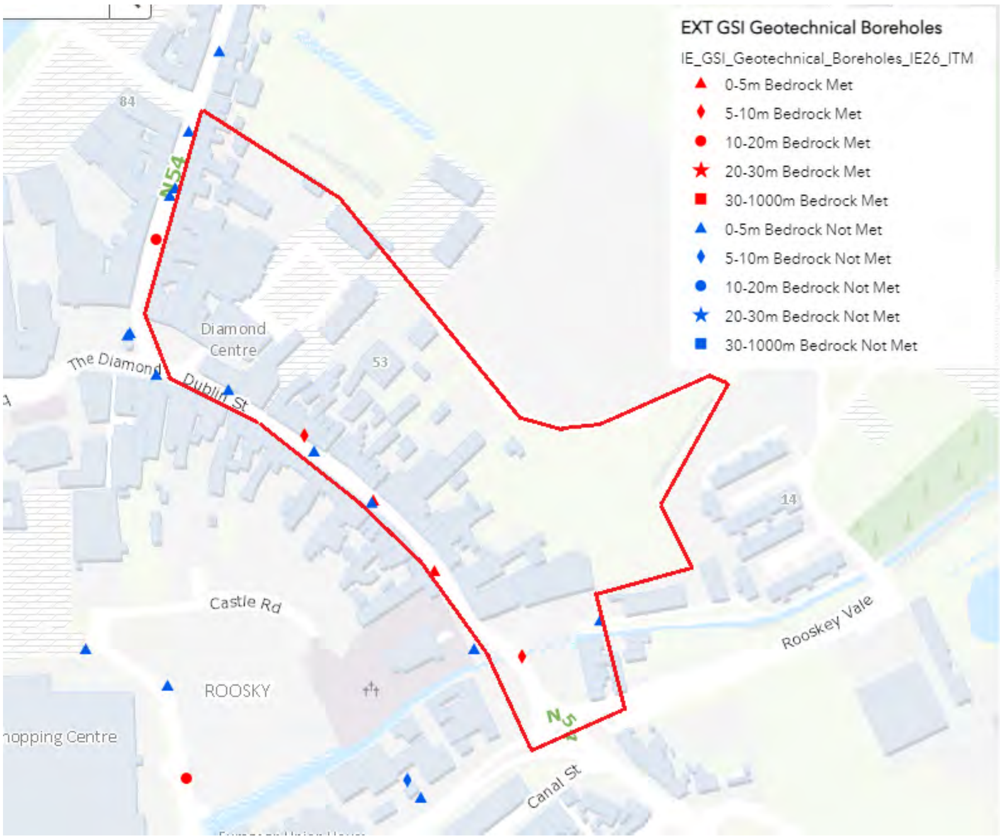
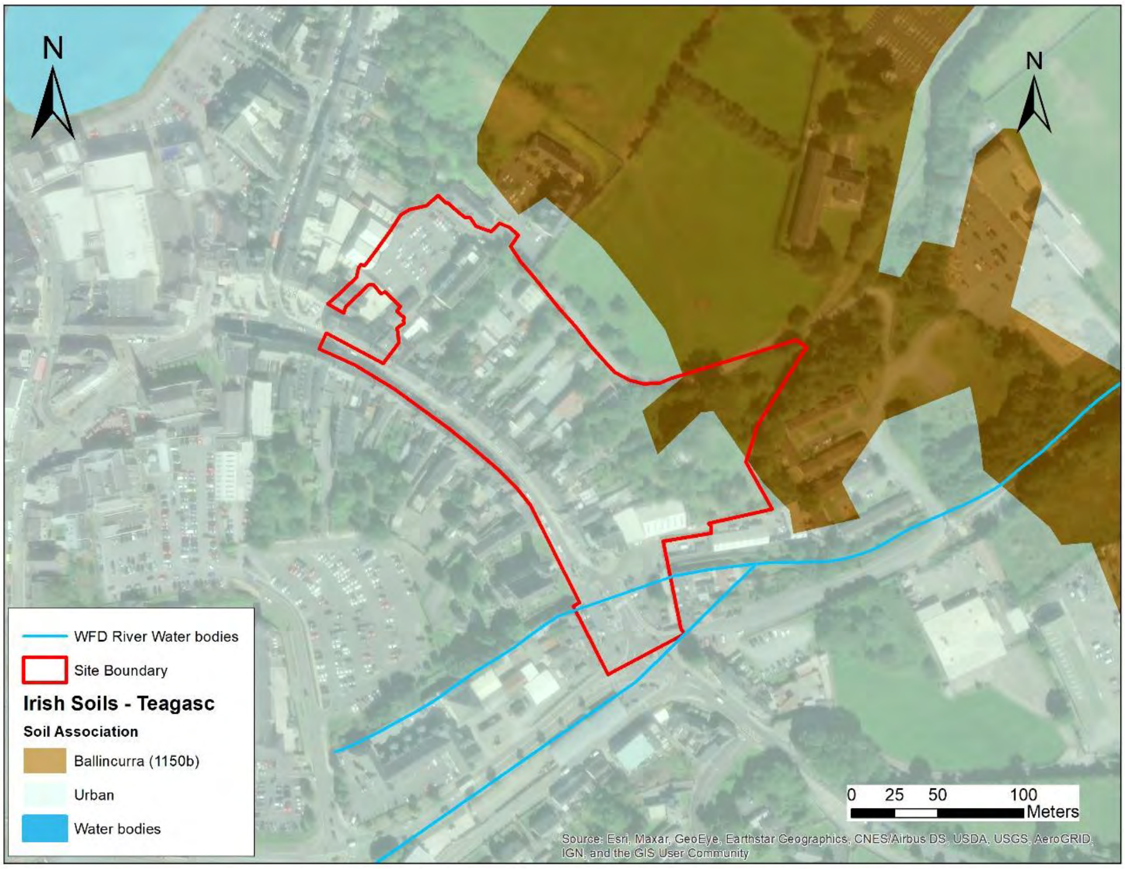


Figure 2-7 GSI Geotechnical Boreholes data

2.4.4 SOILS

The soil mapped by Teagasc for the site area is shown in Figure 2-8. The map shows that within the boundaries of the site, two soil classes are present. One is the Urban soil which covers most of the site. The other soil present, of natural origin, is Ballincurra (1150b) characterized as fine loamy over limestone bedrock, Subgroup: Typical Calcareous Brown Earths.



Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Figure 2-8 Irish soils at the site (Teagasc, 2023)

2.5 TOPOGRAPHY

The landform of the region is presented in Figure 2-9, with elevations on the site varying between 68m Above Ordnance Datum (AOD) (in the east) and 59mAOD (in the south). The base level of the region and the site are the Ulster Canal and the River Shambles, which on the site are at elevations of around 59mAOD.

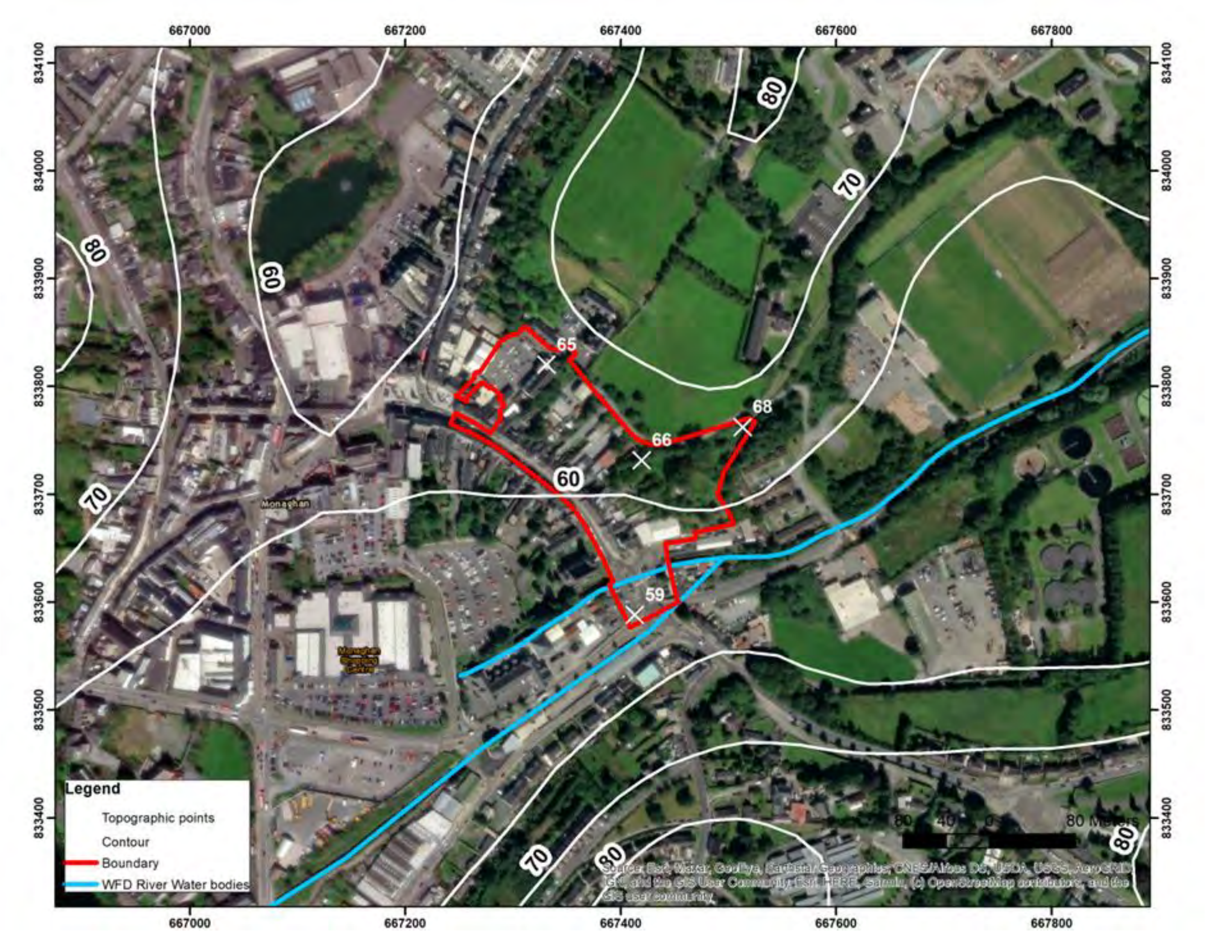


Figure 2-9 Topography

2.6 HYDROLOGY

The site is located upstream in the watershed named Blackwater. The Blackwater catchment lies in the Neagh Bann International River Basin District and is part of the larger Lough Neagh-Lower Bann catchment. The Blackwater is a cross-border catchment with a surface area of 1,491km², of which 1,097 km² (74%) lies in NI (County Armagh and County Tyrone) and 393.8km² (26%) is located in ROI (County Monaghan).

Locally, the Ulster Canal runs south of the project area and the River Shambles cuts through the site. Ulster Canal and the Shambles River separate just upstream of the site and the Ulster Canal, diverting south of the River Shambles, has been culverted under several areas through the town (Canal Street), including the square. The river flows locally in a north-easterly direction, Figure 2-11. Two bodies of water are also in the vicinity of Dublin Street North Regeneration Project: Patena Lake (or Peter's Lake) 175 m to the northwest and Convent Lake 550 km to the west.

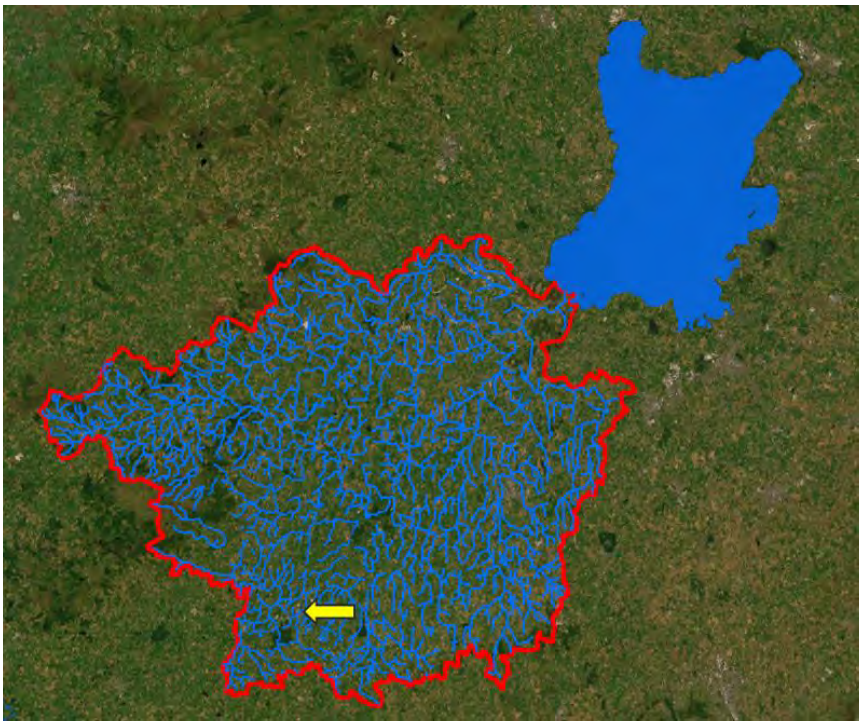


Figure 2-10 Blackwater Catchment

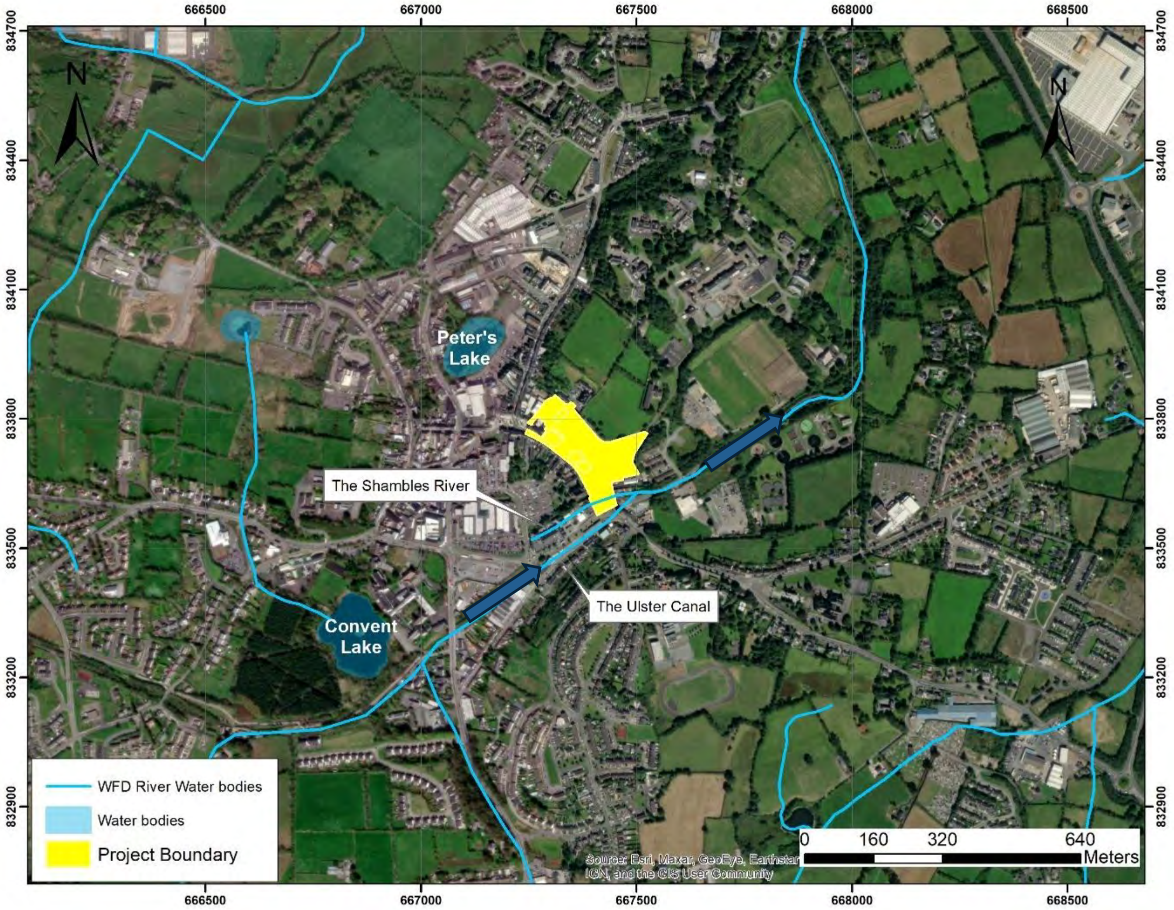


Figure 2-11 Site hydrography

Concerning surface water quality, the information from the EPA (2023) is shown in Table 2-2 River water quality.

Table 2-2 River water quality

Parameter	Status
River Waterbodies Risk for Shambles locally	at Risk
River Waterbody WFD Status 2016-2021	Poor

In the vicinity of the site boundary (marked with a red x) there is flood risk – medium probability on the banks of the Shambles River, as can be seen on the map in Figure 2-12. This layer shows the modelled extent of land that might be flooded by rivers in a severe flood event. Medium Probability flood events have approximately a 1-in-a-100 chance of occurring or being exceeded in any given year. This is also referred to as an Annual Exceedance Probability (AEP) of 1%.

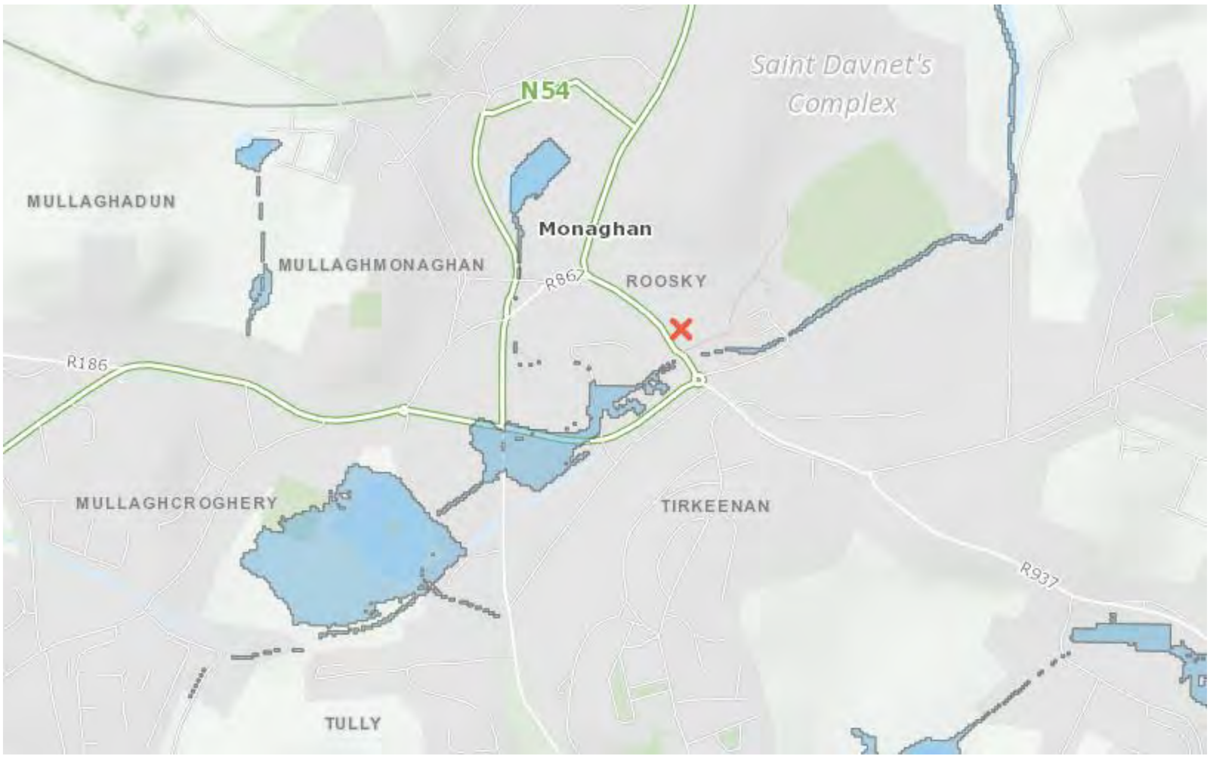


Figure 2-12 Flood Risk (EPA, 2023)

The Historic Flood Maps produced by GSI in collaboration with Trinity College Dublin and the Institute of Technology Carlow (Figure 2-13) don't show any flood areas within 750 m of the site. However, the requirement for a flood risk assessment should be undertaken by a suitably qualified hydrologist.

Figure 2-13 Historic Flood Maps produced (GSI, 2023)

2.7 HYDROGEOLOGY

Monaghan is characterized by a mild and moderate climate (Cfb) - Köppen and Geiger. The average annual temperature in Monaghan is 9.3 °C and the rainfall here is around 1001 mm per year.

According to information provided by GSI Groundwater Resources (Aquifer), the groundwater Rock Unit beneath the site is the Dinantian Lower Impure Limestone, and the aquifer is defined as Regionally Important Aquifer-Fissured bedrock (Rf). The Average Recharge Range for the site is in two different classes, with most of the site being in the 101-150mm/yr class and a smaller area being in the 51-100mm/yr class as shown on the map in Figure 2-14 The Subsoil Permeability is considered Low for the site and surrounding Figure 2-15. However, in terms of groundwater vulnerability, the site is in the High and Moderate classes as is shown in Figure 2-16.

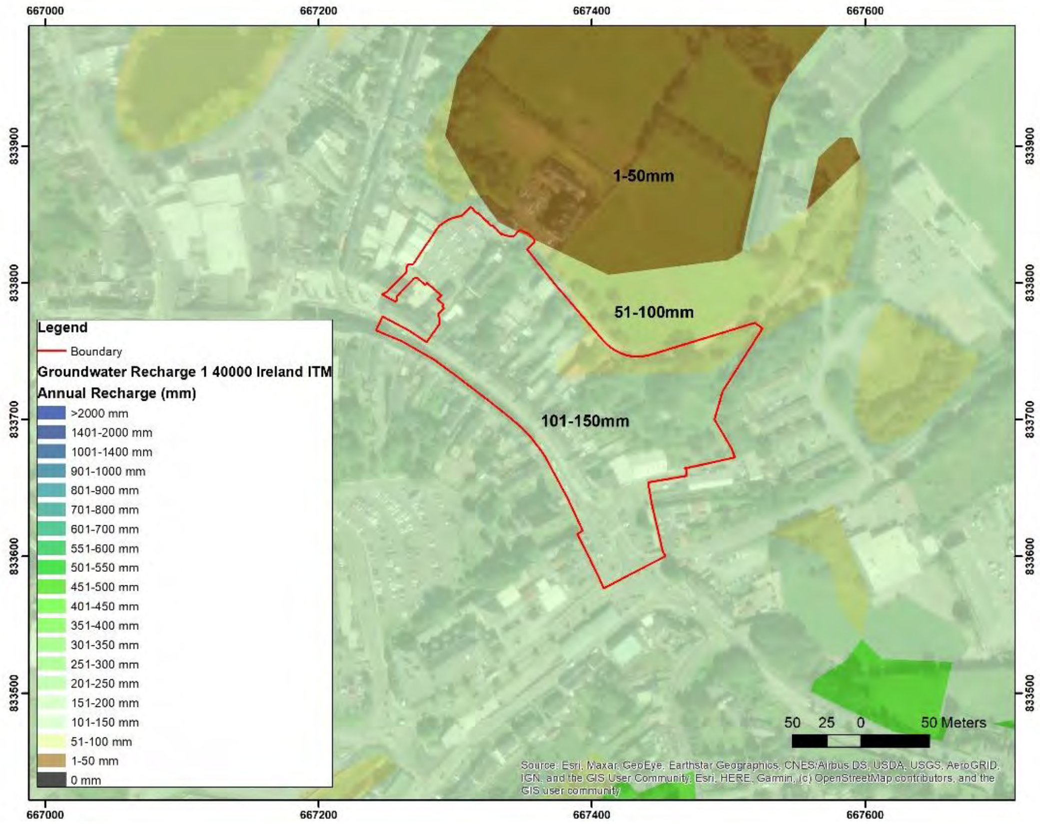
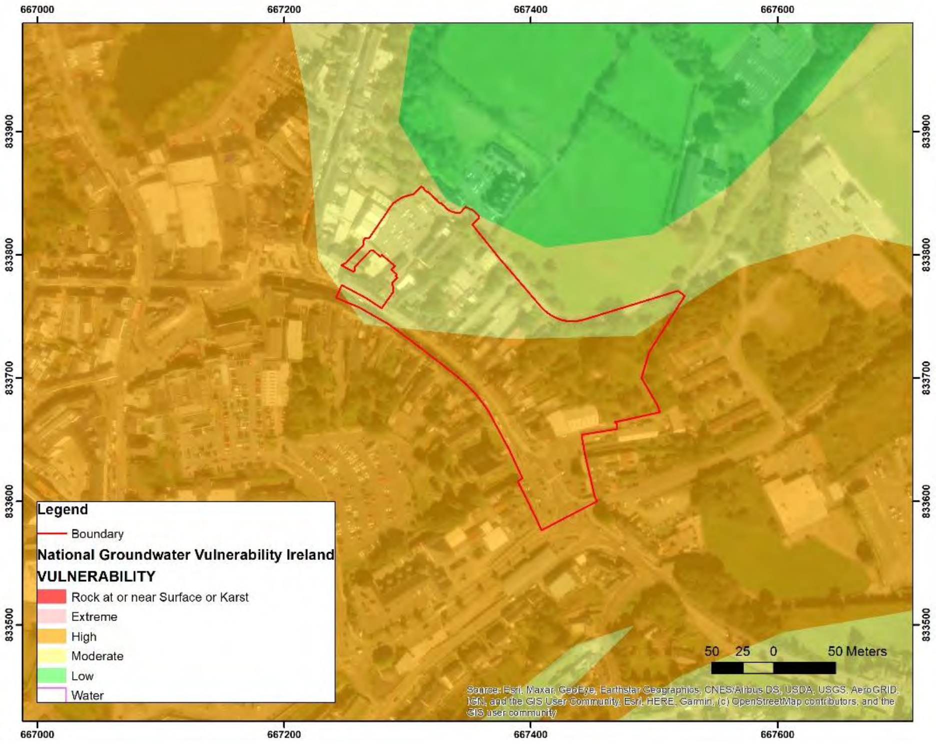


Figure 2-14 Groundwater Recharge (GSI, 2023)

Figure 2-15 Subsoil Permeability (GSI, 2023)



Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community, Esri, HERE, Garmin, (c) OpenStreetMap contributors, and the GIS user community

Figure 2-16 National Groundwater Vulnerability Ireland (GSI, 2023)

Groundwater direction: The groundwater probably follows the local topography which directs the water to the northwest (Figure 2-17), with the base being the River Shambles.

Figure 2-17 Groundwater direction

Groundwater quality: Concerning groundwater quality, the information from the EPA (2023) is shown in Table 2-3 Groundwater quality.

Table 2-3 Groundwater quality

Parameter	Status
Ground Waterbodies Risk: Not at Risk	Not at Risk
Ground Waterbody WFD Status 2016-2021	Good

The dataset known as Public Supply Source Protection Areas consists of designated zones called Source Protection Areas (SPAs) which are situated around points where groundwater is extracted. These extraction points are managed by Irish Water and serve as sources for supplying Public Water Supply Schemes throughout Ireland. The primary purpose of these SPAs is to enhance protection by imposing stricter regulations on activities carried out within some or all parts of the area from which water flows into the well or spring, known as the Zone of Contribution (ZOC). There are two distinct Source Protection Areas (SPAs) that have been identified. The first is the Inner Protection Area (SI), which is established to safeguard against immediate negative impacts stemming from human actions, particularly those causing microbial pollution. The second is the Outer Protection Area (SO), encompassing the remaining portion of the zone of contribution (ZOC) to the specific groundwater extraction point, such as a borehole or spring.

The map in Figure 2-18 shows that the site lies within the Monaghan PWS SO - Outer Protection Area. This area is identified as having a potential impact on the quality and safety of the water source. The goal of these measures is to minimize potential contamination or pollution of the groundwater source that could affect the quality of the water supplied to the public. The controls aim to ensure that activities within this zone do not compromise the integrity of the water source and maintain its suitability for use as a public water supply.

There is no Natural Heritage Area (NHA) or Geological Heritage Area (GHA) in the immediate vicinity of the site.

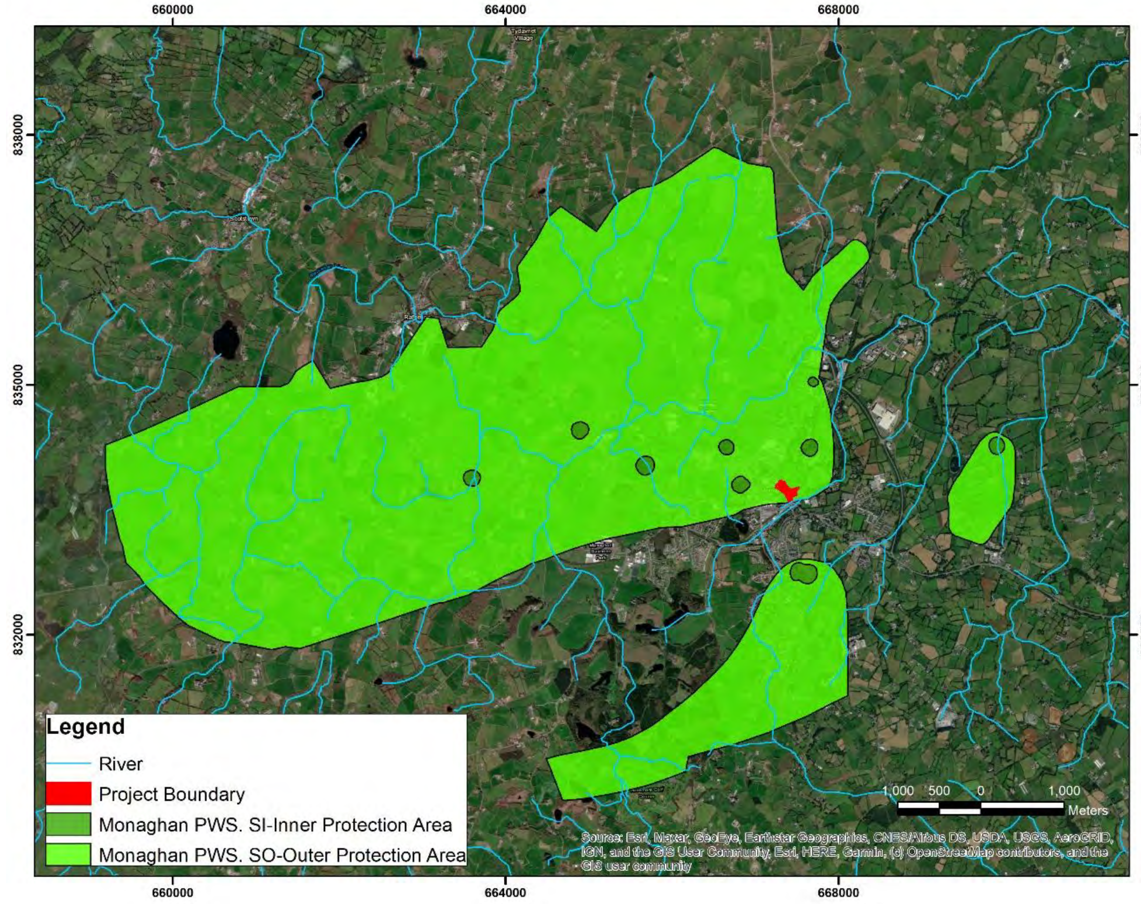


Figure 2-18 Public Supply Source Protection Areas (GSI, 2023)

2.8 MINING

According to Geological Survey Ireland Spatial Resources records, there is currently no mining activity in the vicinity of the site. The nearest Mineral Locality is to the south of the area approximately 4 km away, identified as Gabbro Mining.

2.9 INDUSTRIAL LAND USE

With the records available at the Environmental Protection Agency map viewer, there are no potentially contaminated industrial sites within 250m of the site boundary. Although there is potential that the infilled quarry (at the SE limit of the site) and the description/ type of infill is unknown.

2.10 RADON

As detailed on the Radon Risk Map in Figure 2-19 by the EPA. This map shows a prediction of the number of houses in any one area that are likely to have high radon levels. Those areas in red are most at risk from radon and are called High Radon Areas. The map is based on an analysis of indoor radon measurements plus geological information including, bedrock type, quaternary geology, soil permeability and aquifer type. The areas of the map in orange and yellow are areas of medium and low risk respectively. The map shows that the site is located in a region of medium risk.

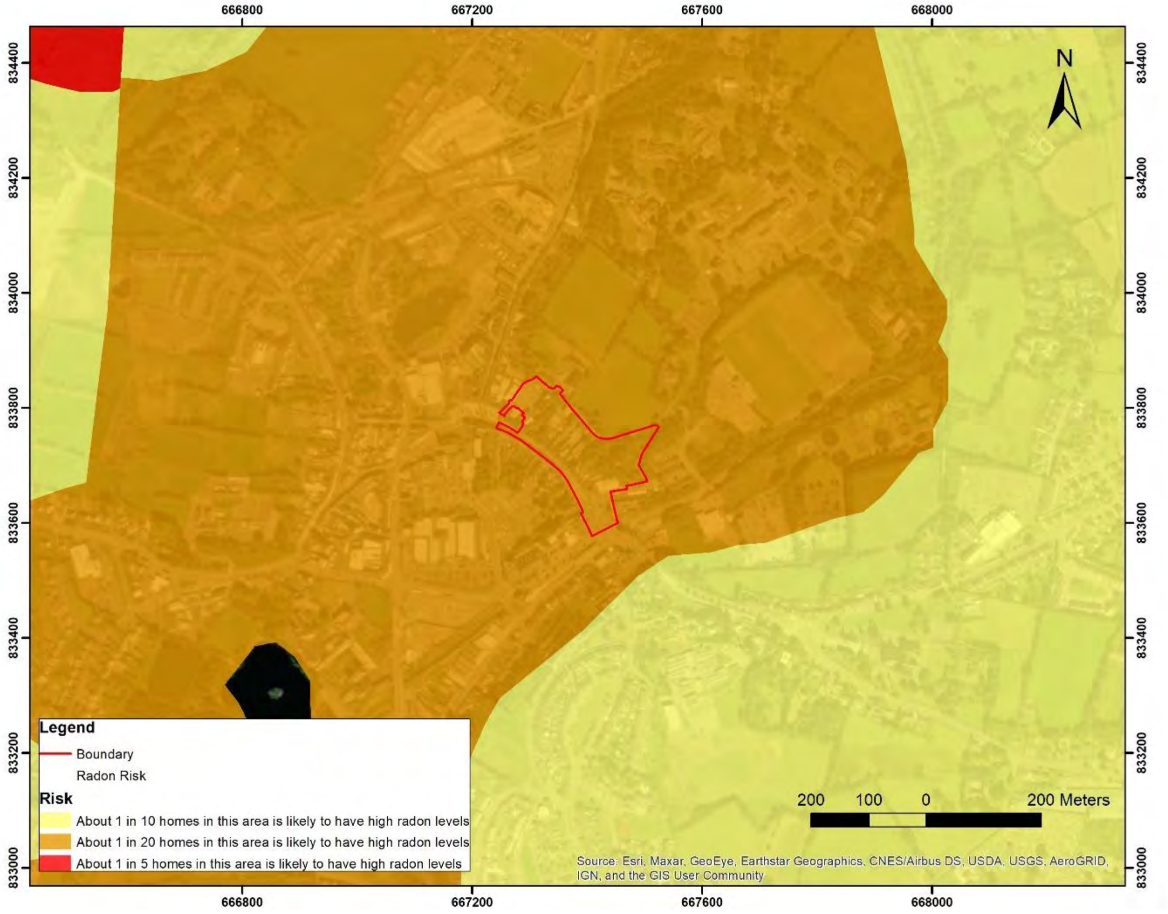


Figure 2-19 Radon Risk (EPA, 2023)

3 INITIAL CONCEPTUAL SITE MODEL

3.1 GENERAL

In line with current Environmental Protection Agency guidance, plausible source, pathway and receptor linkages have been identified for the site. The plausible linkages are indicated in the conceptual site model outlined and discussed in Section 3 of this document.

The project in question, Urban Renewal and Regeneration of Dublin Street and Dublin Street North Backlands is an urban revitalization that will involve earthmoving, levelling, cutting and filling, asphalting, and landscaping. The components of the Conceptual Site Model (CSM) are presented as follows.

3.2 SOURCES

3.2.1 ON-SITE

- **Current Land Use**
  - **1) Unknown Nature-Made Ground** – The made ground beneath the site is unknown in quality and quantity. These materials can contain a high organic content which, if degraded, can produce gases such as methane, carbon dioxide and oxygen-depleted gases. The unknown Made Ground material also has a risk of containing other contaminants, including heavy metals.
  - **2) Auto repair shop** – Oil and fuel leaks from vehicles being repaired or serviced can seep into the ground, introducing hydrocarbons and other harmful chemicals into the soil and groundwater. They often use solvents, degreasers, and various chemicals for cleaning and maintenance. Improper handling or disposal of waste fluids such as coolant, brake fluid, transmission fluid, and antifreeze can lead to the release of hazardous chemicals into the environment. The dismantling and maintenance of vehicle parts can release heavy metals like lead, cadmium, and mercury. Inadequate handling of used batteries can lead to leaks of battery acid, which contains sulfuric acid that can severely contaminate soil and groundwater. Aerosol sprays for painting or cleaning can release volatile organic compounds (VOCs) into the air, some of which can settle onto the ground and potentially infiltrate. Considering that the auto repair shop must follow regulations and best practices, but also considering the occurrence of accidents, contamination from this source should be unlikely, however, further intrusive ground investigation, sampling and testing is recommended to confirm this.
  - **3) Laundry** – Commercial laundries have the potential to cause contamination in soil and groundwater due to the chemicals and pollutants associated with the laundering process. While modern regulations and practices have improved the situation, there are still some concerns to be aware of. Detergents and cleaning agents can contain phosphates, surfactants, solvents like perchloroethylene (PCE is a volatile organic compound – VOC), microplastics and heavy metals (such as cadmium, lead, or mercury) and other compounds that, if not managed properly, might find their way into soil and groundwater. Considering that the laundry must follow regulations and best practices, but also considering the occurrence of accidents, contamination from this source should be unlikely, however, further intrusive ground investigation, sampling and testing is recommended to confirm this.
  - **4) Oil tanks from existing buildings** – Oil tanks from residential and commercial buildings can result in soil and groundwater contamination if they are not properly installed,

maintained, and managed. Corrosion, cracks, or improper installation can lead to leaks or spills of oil from the tanks. Petroleum products contain volatile organic compounds that can dissolve in groundwater. Contamination from this source is possible given the age and installation of the tank presented in Appendix A, therefore, further intrusive ground investigation, sampling and testing are recommended to confirm the presence/ absence of hydrocarbon contamination. The location of the fuel storage tanks is also presented in the constraints drawing included in Appendix B.

- **Previous / Historical Development**
  - **5) Previous urban infrastructure** – Dublin Street and Dublin Street North Backlands have been occupied by infrastructure developments such as commercial properties. These activities historically occurring within the site area are not strongly linked to severe contamination. Consequently, the likelihood of this contamination affecting the current application site is minimal.
  - **6) Old infirmary** – An infirmary is mentioned on the OSI map of 1829-1841, which later no longer appears on the maps of 1897-1913, and the site is referred to as "Lodge". From the maps, the area seems to be located partially within the boundaries of the site. Waste management practices in the 19th century were often less regulated and environmentally conscious than they are today. Waste might have been disposed of in ways that are now recognized as harmful to the environment. Some possibilities of contamination are raised, such as medical/chemical/pharmaceutical waste. It might have involved the use of chemicals like mercury-based compounds, arsenic, and other medicinal substances which could be improper disposal in the soil. Construction materials used in the infirmary, such as lead-based paints, could have deteriorated over time and leached into the soil. Groundwater and ground gas sampling in the vicinity of the old infirmary will be recommended as part of the investigations to provide further confirmation of this.

3.2.2 SURROUNDING

- **Current Land Use**
  - **7) Petrol station –** A petrol station has a considerable potential to contaminate soil, water and groundwater. Some potential sources of contamination include accidental spills and leaks of gasoline (hydrocarbons) during refuelling, maintenance, or due to faulty equipment. Many petrol stations use USTs to store gasoline. Corrosion or damage to these tanks can lead to leaks, allowing fuel to seep into the surrounding environment. Improper storage of various chemicals for maintenance and cleaning purposes. These spills can result in the direct release of contaminants into the soil, which can migrate into groundwater. "Go Petrol Station" is 200m from the site but downstream from the site and consequently the risk to the site associated with contamination from the petrol station is considered to be low.
  - **8) Cemetery –** The graveyard has been located in the vicinity of the site since at least 1897. This cemetery is located on the border of the Ulster Canal. Cemeteries have the potential to cause soil and groundwater contamination due to the activities and materials associated with burial practices. While modern cemetery management practices and regulations aim to minimize these risks, there are still some concerns to be aware of, such as embalming fluids which can contain formaldehyde and other chemicals and heavy metals from the coffins. Some grave maintenance products, such as fertilizers, pesticides, and herbicides, can introduce chemicals into the soil that might eventually migrate to groundwater. Burial of organic matter can lead to microbial activity in the soil. While decomposition is a natural

process, it can release substances like nitrogen and pathogens that might affect groundwater quality if not managed properly. The cemetery is also downstream from the site, and consequently, the risk to the site associated with contamination from this source is considered to be low.

- **9) Monaghan Bottlers** – An alcoholic beverage wholesaler, if not managed properly, has the potential to cause soil and groundwater contamination through chemical storage and spills of cleaning agents, solvents, and additives. Wastewater generated from cleaning processes and cooling systems used for storing beverages also can potentially be a source of contaminants. This structure is also a considerable distance from the site, and the risk to the site is considered to be low.

- **Previous / Historical Development**

  - **10) Old quarry** – A quarry appears on the OSI maps of 1829-1841 on the SE edges of the site and is no longer mentioned on later maps. A deactivated quarry, if not properly managed, can potentially cause soil and groundwater contamination due to various factors related to its history, activities, and the materials involved. It might have stockpiled materials such as mined rocks, soils, and aggregates. These materials can contain trace amounts of minerals or metals that, if not properly managed, might leach into the soil, watercourse and groundwater. Quarry walls, floors and waste piles can contain mineral deposits that release trace elements, metals, or minerals into the environment. Chemicals, such as explosives or solvents also might have been used during their active phase. When the quarry is deactivated and refilled, this may have potentially contaminated infill potential contaminated infill (e.g. Coal, clinker, dust ash, foul lime, spent oxide, acid tar, coal tar etc.). Possible pollutants linked to fill materials of uncertain origin could encompass metals, inorganic substances, hydrocarbons, asbestos, and subsurface gases. Because the quarry area is not directly in the study area, and because it had already ceased its activities before 1897-1913, the possible sources of contamination from this former activity are considered unlikely, groundwater and ground gas sampling in the vicinity of the old quarry will be recommended as part of the investigations to provide further confirmation of this.
  - **11) Gas Works** – Gas Works are mentioned on the OSI maps of 1829-1841 and 1897-1913 about 300m NEE of our southern boundary and are no longer mentioned on later maps. Historical gas works, which were facilities that produced gas from coal or other carbon-rich materials for lighting and heating before the widespread use of natural gas, have the potential to cause significant soil and groundwater contamination due to the nature of their operations. These facilities often involved the production and distribution of coal gas, which contained various pollutants. While many gas works have been decommissioned or repurposed, their legacy can still pose contamination risks, such as coal tar residues, filling material as such ash, slag, and other waste products. Leaks or spills from underground tanks and piping. The production and use of coal gas involved benzene and other volatile organic compounds (VOCs) and Heavy metals. The historical Gasworks is located a relatively long distance away and on the other side of the River Shambles, which is why the risk associated with contamination from this source to the site is considered to be low.

Potential sources are listed in Table 3-1.

Table 3-1 Conceptual Site Model – Sources

Source	Description	Current or previous land use	Distance
1	Unknown Nature-Made Ground	Current land use	On-site
2	Auto repair shop	Current land use	On-site
3	Laundry	Current land use	On-site
4	Oil tanks from existing buildings	Current land use	On-site
5	Previous urban infrastructure	Previous	On-site
6	Old Infirmary	Previous	On-site
7	Petrol station	Current land use	Surrounding area
8	Cemetery	Current land use	Surrounding area
9	Monaghan Bottlers	Current land use	Surrounding area
10	Old Quarry	Previous	Surrounding area
11	Gas Works	Previous	Surrounding area

3.3 PATHWAYS

The key pathways and receptors considered for the remainder of this section have been identified on the basis that no remedial measures are to be carried out (to determine the likely risks without remediation). The principal exposure pathways pertinent to the site are considered to be:

- Exposure to site users by near-surface contamination from soil and groundwater (through ingestion, inhalation, and skin contact (dermal) routes).
- Migration of contamination/ground gas through permeable granular superficial deposits.
- Migration of the contamination in the superficial and/or bedrock groundwater.
- Accumulation of vapours/ground gases in buildings and structures.
- Direct contact of soils with buried concrete / materials
- Uptake of contamination by plant roots.

3.4 RECEPTORS

"Receptors" are defined in EPA (2013) as "Something that could be adversely affected by a contaminant, e.g. people, a water body (groundwater or surface water), living organism, property or an ecological system. A groundwater receptor could include existing and potential future drinking water supplies, surface water bodies into which groundwater discharges (e.g. streams) and groundwater dependent terrestrial ecosystems (GWDTEs)." Potential receptors at the site are as follows:

3.4.1 HUMANS

The project site currently comprises predominantly continuous urban fabric and a smaller portion of land considered agricultural (pasture). The intended future use of the site is for public gardens, open spaces, access roads and parking. Members of the public, construction workers and future residents are therefore considered potential receptors.

3.4.2 FAUNA AND VEGETATION (ECOLOGY)

There are no specifically identified sensitive ecological receptors on site or within 250m of the site boundary. However, a disturbance is expected in the areas covered by vegetation and their possible ecological population such as small rodents, birds, insects and microbiota. The proposed landscaping will likely consist of a combination of new planting and retention of existing vegetation, which are considered potential receptors.

3.4.3 SURFACE WATER

In the area surrounding the site, there are surface water resources, the River Shambles which crosses the site and the Ulster Canal (50m south of the site), which are considered potential receptors.

3.4.4 GROUNDWATER

The aquifer unit present beneath the site is the Dinantian Lower Impure Limestone and is defined as being Regionally Important Aquifer-Fissured bedrock (Rf). Local groundwater flow is likely to follow the topography in a south-westerly direction, towards the River Shambles. Despite the low permeability, the local aquifer vulnerability is High and Moderate with an average annual recharge ranging from 51-150mm. In addition, the area is considered a Public Supply Source Protection Area. The groundwater is a potential receptor.

3.5 RISK ASSESSMENT

This evaluation is qualitative, as it involves professional expert opinions being employed to evaluate the available data concerning the site's conditions for risk assessment purposes. The structure for conducting these evaluations is detailed in CIRIA C552, titled "Contaminated Land Risk Assessment, a Guide to Good Practice." This guideline stipulates that the evaluation of risk should consider both the probability of an incident occurring and the seriousness of its potential outcomes.

For each identified possible connection to pollutants, one of six risk levels has been assigned. These levels are: Very Low, Low, Low/Moderate, Moderate, High, and Very High. If the risk level is determined to be **Low/Moderate or higher, it signifies that additional assessment**, investigation, or potential remediation steps will be necessary. The subsequent table (Table 3-2) provides a concise overview of the potential connections to pollutants and the corresponding qualitative assessments of risk related to the site.

Considering the analyses carried out and summarized in Table 3-2, the most relevant sources of this risk analysis are Unknown Nature-Made Ground, Auto repair shop, Laundry and Oil tanks from existing buildings.

Table 3-2 Risk Assessment

Source	Receptors (with receptive pathway)	Risk
1) Unknown Nature-Made Ground	Humans	Low/Moderate
	Fauna And Vegetation (Ecology)	Low
	Surface Water	Low/Moderate
	Groundwater	Low/Moderate
2) Auto repair shop	Humans	Low
	Fauna And Vegetation (Ecology)	Low/Moderate
	Surface Water	Low/Moderate
	Groundwater	Moderate
3) Laundry	Humans	Low
	Fauna And Vegetation (Ecology)	Low/Moderate
	Surface Water	Low/Moderate
	Groundwater	Moderate
4) Oil tanks from existing buildings	Humans	Low
	Fauna And Vegetation (Ecology)	Low/Moderate
	Surface Water	Low/Moderate
	Groundwater	Moderate
5) Previous urban infrastructure	Humans	Low
	Fauna And Vegetation (Ecology)	Low
	Surface Water	Low
	Groundwater	Low
6) Old Infirmary	Humans	Low
	Fauna And Vegetation (Ecology)	Low
	Surface Water	Low
	Groundwater	Low
7) Petrol station	Humans	Low
	Fauna And Vegetation (Ecology)	Low
	Surface Water	Low
	Groundwater	Low
8) Cemetery	Humans	Low
	Fauna And Vegetation (Ecology)	Low
	Surface Water	Low
	Groundwater	Low
9) Monaghan Bottlers	Humans	Low
	Fauna And Vegetation (Ecology)	Low
	Surface Water	Low
	Groundwater	Low
10) Old Quarry	Humans	Low
	Fauna And Vegetation (Ecology)	Low
	Surface Water	Low
	Groundwater	Low
11) Gas Works	Humans	Low
	Fauna And Vegetation (Ecology)	Low
	Surface Water	Low
	Groundwater	Low

4 POTENTIAL GEOTECHNICAL ISSUES

Based on the available information at the site, the site is expected to be predominantly representative of residential, commercial, greenfield and pasture land - covered by a mixture of natural soils and made ground. The available borehole information from the Geological Survey of Ireland (GSI) is outlined in Section 2.4 and indicates the ground conditions at the site are expected to comprise variable-made ground, overlying cohesive and granular glacial tills and a bedrock formation thought to be muddy limestones and shales. The available site investigation report (IGSL, 2007) is from a neighbouring site and indicates the presence of high-strength glacial tills with a high cobble and boulder content and fails to adequately identify the bedrock lithologies with borehole extending to between 4 and 13mbgl. Regionally the available GSI desk study information would indicate that the bedrock level is variable locally but is expected to be deeper than 5m at the site location.

Project-specific site investigations will be necessary to confirm the information from the desk study, to characterise the ground conditions at the site, collect samples for appropriate contamination testing, and carry out in situ testing and laboratory geotechnical testing of the soils to determine their engineering parameters. The site investigation campaign will be a vital tool for the civils design and optioneering enabling the most cost-effective and appropriate engineering solution.

Several of the borehole logs indicate the presence of peat material between the made ground and glacial till material. It will be essential to try to identify if this material is present at the proposed site location as the presence of peat material could have an influence on the settlement and bearing strengths of any proposed pavements and structures. A suitable engineering solution will need to be employed in areas where peat has been identified such as excavate and replace, surcharging, ground improvement or piled foundation solutions.

The identified presence of both granular and cohesive glacial till materials locally within the available site investigation information would indicate that a site-specific ground model needs to be developed for the project site. The differentiation between a cohesive and granular sub-formation material for spread foundations and pavements will be important in the estimation of settlements and the behaviours of groundwater within any excavations as part of the design.

Large granular material identified within the overburden such as cobbles and boulders could present a risk for any proposed driven piling at the site such as sheet piles. Large grades of granular materials could cause the refusal of a sheet pile at an insufficient depth for the design. This would be assessed following the site investigations and an appropriate piling solution would be designed should this be required as part of the design.

The use of geotechnical in situ and laboratory testing in the proposed site investigation locations will aid in determining the engineering strength parameters for the overburden soils. These will be used in the stability, bearing or settlement assessments for any of the proposed pavements, buildings, retaining structures or cut-and-fill slopes in the earthworks design.

Groundwater monitoring is recommended to determine groundwater conditions and enable effective future design of foundations and other infrastructure.

Investigations will also be required to determine whether there are aggressive soil conditions on site, thus enabling the selection of the appropriate concrete class.

5 CONCLUSIONS AND RECOMMENDATIONS

5.1 CONCLUSIONS

The purpose of this Geoenvironmental Desk Study is to assess potential contamination and geotechnical constraints to the site and provide outline recommendations for additional investigative works required to address any areas of uncertainty.

Reviews of the data set detailed within this report have identified the potential presence of contamination associated with historical uses of the site and the surrounding area. This is primarily associated with the Unknown Nature-Made Ground, Auto repair shop, Laundry and Oil tanks from existing buildings

Considering the current use of the site and the historic use of the site, the risk associated with the site is considered to be Low/Moderate, associated with potential risks to the human, fauna and vegetation, surface water and groundwater.

The information about Radon Gas from EPA in section 2.10 (Figure 2-19 Radon Risk (EPA, 2023) shows that the site is located in a region of medium risk.

5.1.1 GEOTECHNICAL

The following general potential geotechnical constraints to this development have been identified.

- Unconfirmed thickness, characteristics and geotechnical properties of the likely localised Made Ground, and variable natural soils (superficial deposits) within the proposed project area,
- Unconfirmed bedrock depths which have been identified as locally variable during the desktop study,
- Soft pat material has been identified in neighbouring sites. It will be important to identify the presence or absence of this material at the proposed site. If peat material is present on the site, an appropriate engineering solution will be required.
- Highly variable lithologies identified in past site investigations in the area would suggest that the overburden soils are of high strength with a high cobble and boulder content. It is important to assess these soils further to ensure an adequate earthworks design, particularly in the design of any cut slopes and retaining structures.
- The potential for the natural or Made Ground soils to be chemically aggressive towards buried concrete or pipework.

5.2 RECOMMENDATIONS

Before the development of the site it is recommended that intrusive investigation works are undertaken to characterise the ground conditions for the following key purposes:

- To characterise the chemical nature of the soils and groundwater across the site, concerning potential human health and water environment risks.

- To investigate the depth, nature and extent of the Made Ground and the underlying till and solid deposits.
- To establish the depth of competent foundation stratum across the site.
- To assess the groundwater conditions beneath the site.
- To assess the potential risk from ground gases.

There is a potential for radon generation on the site, reference should be made to BRE 211 (2015) for details of basic radon protection measures required for new dwellings.

Subject to the design of the detailed site investigation, it is considered that the following minimum works will be required:

- ***Trial pitting*** across the site to characterise any Made Ground and underlying till deposits and permit recovery of soil samples for subsequent chemical and geotechnical analysis.
- Drilling of ***boreholes*** to characterise the underlying deposits and depth to a suitable founding stratum, permit recovery of soil samples for geotechnical analysis and allow installation of combined gas/groundwater monitoring wells.
- ***Chemical analysis*** of the soils and groundwater to assess the potential risk to human health, the water environment and buildings/structures.
- ***Geotechnical testing*** of the soils and rock, including Standard Penetration Testing (SPT) and laboratory testing to obtain geotechnical design parameters including characteristic testing, assessment of undrained shear strength and friction angle. This may also include the assessment of any made ground for aggressivity toward buried concrete. The findings of the geotechnical assessment will be used for foundation and road design. Given the undulating nature of the site, it is likely earthworks will be required to facilitate drainage design, therefore earthworks testing of the soils is recommended.
- ***Ground gas and groundwater level monitoring*** of borehole installations and collection of groundwater samples, for subsequent chemical analysis.
- ***Surface water monitoring*** ideally along both the Shambles and Ulster Canal. As a minimum (where accessible) samples should be obtained on both water bodies, hydraulically up-gradient and down-gradient and directly adjacent to the site.

As part of the recommended site investigations, access should be prohibited areas of Japanese Knotweed growth. A no-dig zone min. 7m offset should be implemented in the vicinity of identified knotweed stands, this is in light of the following: *It is an offence under Article 49 (2) of the European Communities (Birds and Natural Habitats) Regulations 2011 for any person to plant, disperse, allow to grow or cause to disperse, spread or otherwise cause to grow throughout the state any plant included in Part 1 of the Third Schedule. Japanese knotweed is included in the Third Schedule of the Regulations.*

A full Invasive Species Survey and Management Plan will be managed and directed by others, and the suitability of the proposals above will be confirmed by those responsible for this aspect.

5.3 LIMITATIONS

The following limitations for the execution of the project are anticipated:

- Problems accessing the area due to dense vegetation.
- The presence of Japanese knotweed on the site and in the immediate vicinity. In Appendix A there are details of the invasive plant observations.
- Retaining walls, narrow entrances and closed gates also make accessing the area difficult with readily available mechanical ground investigation plant.

This assessment is focused on the development areas provided in Figure 2-1, which comprise areas of semi-private public open space and associated infrastructure. Residential and commercial development which is understood to be undertaken in the hatched areas does not form part of this assessment.

To understand the previous conditions of land use, Ordnance Survey Ireland (OSI) historical maps were analysed, however, due to the lack of historical sequencing (mapping being unavailable for a significant portion of the 20th Century), this assessment also has limitations.

This report has been prepared based on the available information received during the study period. Although every reasonable effort has been made to obtain all relevant information, all potential contaminants, environmental constraints or liabilities associated with the site may not necessarily have been revealed.

Appendix A SITE WALKOVER 16TH AUGUST 2023

Site Diary

Project	23165 Monaghan Dublin Street
Location	Monaghan, Co. Monaghan
Date	16/08/2023
Engineer	Chris Engleman

Weather: Describe the temperature, cloud cover, rainfall etc.

21°, sunny intervals.

Activities on site: Describe all activities that you have witnessed on-site including their location and progress. List any samples that you are aware have been taken.

Chris Engleman (CE) from GDG drove to site from Dublin and parked on Dublin Street initially.

CE walks up access track from Dublin Street towards TP05, TP07, BH02 and TP08. At the Dublin street entrance this road is 2.4m wide. Access to BH02 and TP08 will require clearance of vegetation and may be limited to areas close to yard.

Japanese knotweed is sighted just outside the site boundary to the north of TP07. CE walked east along the access track which borders the northeast boundary of the site. Access into TP05 and TP07 would be best achieved from this road, where a large, locked gate currently prevents access. Vegetation clearance may be required at these locations.

Further along this road to the SE, access into TP06/BH01 is observed. This location would be best accessed from this track. A large container is observed at this location. The contents of this are unclear. The ramp down from the access track to the driveway appears to be constructed from building debris.

Access into the BH01 and TP04 location is not possible from the northeast due to a large wall.

At the bend in the track NE from BH01, heavy vegetation prevents access. Japense knotweed is spotted within the dense vegetation. Roughly 520m SE from here, the ruins of the former infirmary are visible in a densely forested thicket.

CE continues along the track to the East and turns right onto the footpath leading Southwest towards Old cross square. Footpath is 1.2m wide, with roughly 1m either side of grass verge. The location of TP01 is heavily vegetated. TP02 is on a grassy area close to the footpath.

CE walks to Old Cross Square, noting that the buildings have a large retaining wall behind them. CE then accesses the back of the Shambles bar and notes that no access is possible from here into the proposed locations. Two oil tanks are visible behind the shambles bar. One is metal and slightly rusted, and the other is plastic. Both appear to be sightly raised off the ground.

CE walks to original TP03 location. Location is inaccessible for SI as it is located in a private garden behind a house on Dublin Street, with only a small set of steps allowing access. A plastic oil tank sitting directly on the ground is observed here.

CE walks up access route beside ‘Let Us Launder’ laundry. Access at this location is 2.1m and 3m high. Gates into TP04 location are locked. Locations require access around a tight bend (~2.3m width).

Access was not possible into former Tp09 location, along with former BH01, TP04, TP03 and TP02 due to vegetation/locked gates.

Most buildings had oil tanks situated behind them. No asbestos was noted.

CE exits site.

Instructions to Contractor

All instructions must be signed off by the Client first. Provide evidence how this approval was obtained.

	Detail of instruction	Evidence of approval from Client
1		
2		
3		

Clarifications required from Client

1	

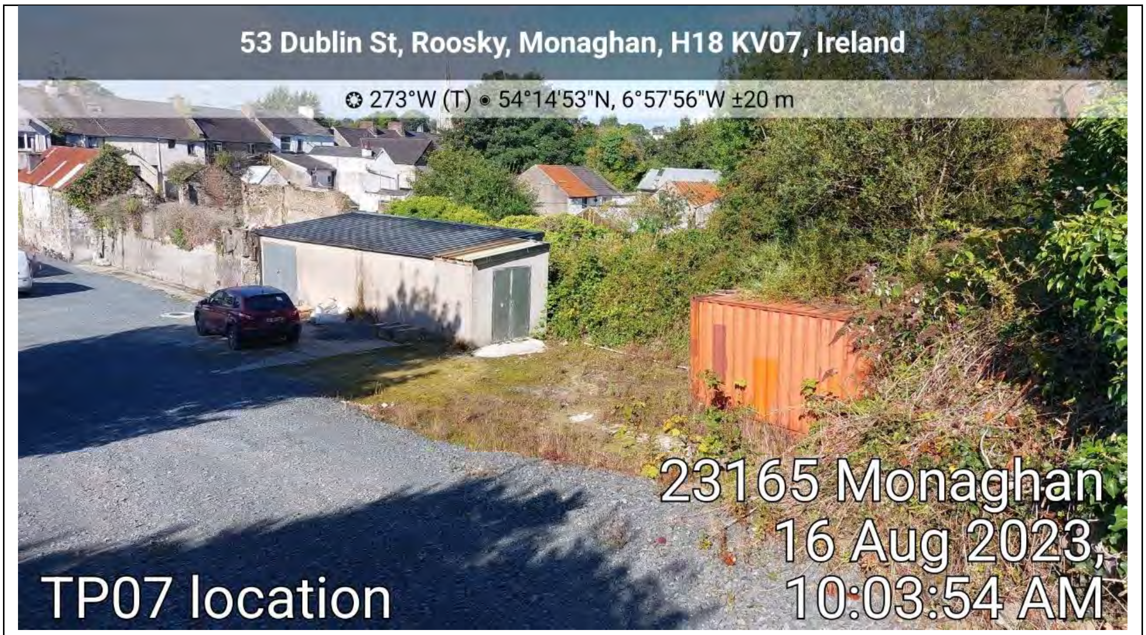
Safety Observations				
Card No.	Description	Mitigation	Submitted by	Closed /Open

Site Photos

Japanese knotweed close to TP07.

Access to BH02 and TP08 (formerly TP10).

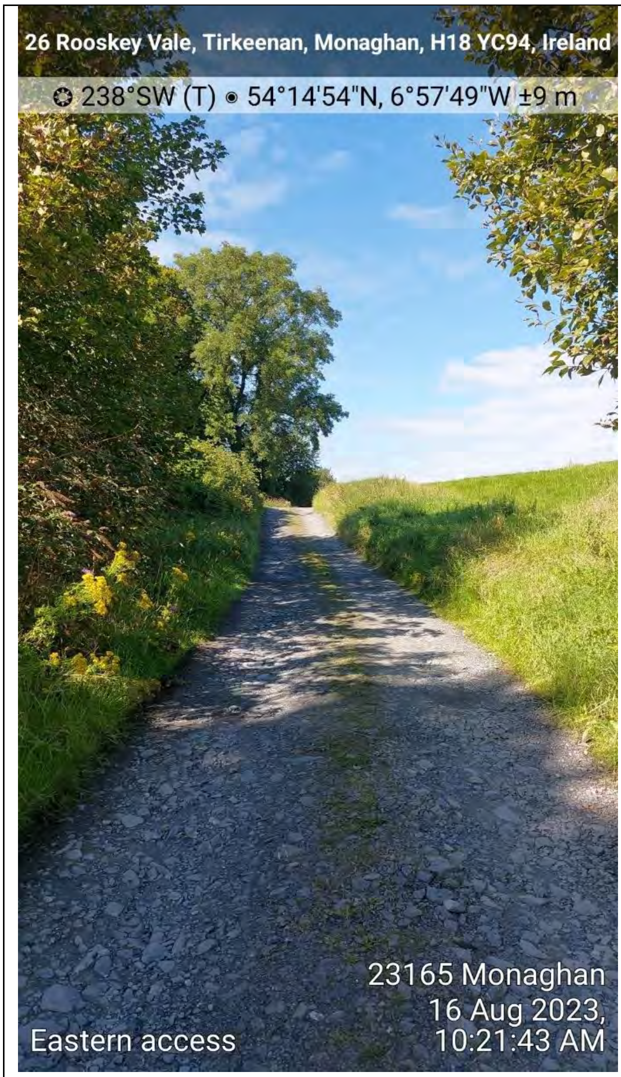
Access to TP07 and TP05 (formerly TP06 and TP08).



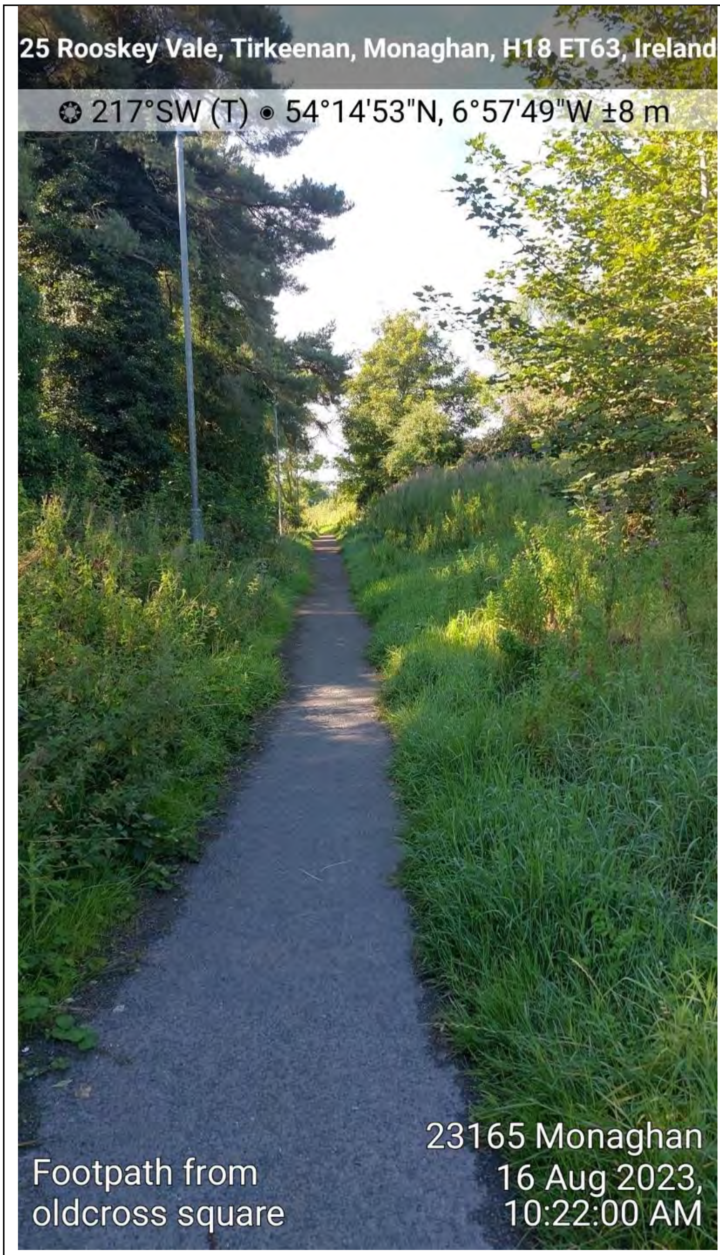
TP06 (formerly TP07) and BH01 location.

Dense vegetation including Japanese knotweed, looking towards the former BH01 location.

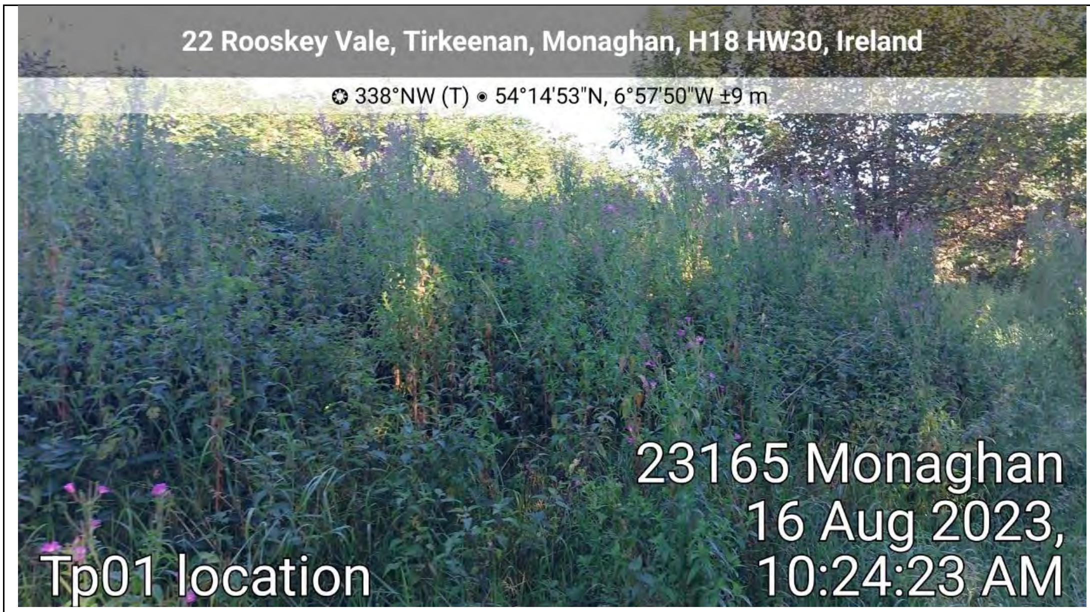
Ruins of old infirmary.



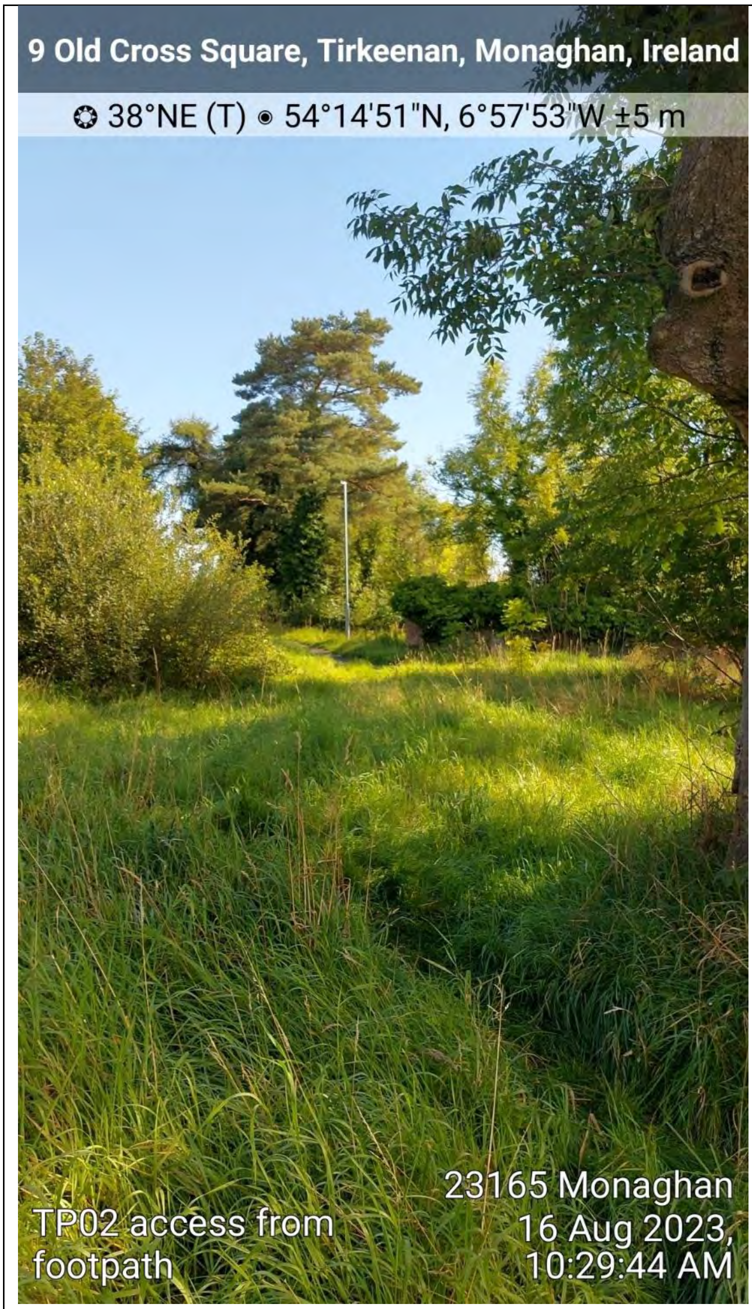
Access road from the east.



Footpath leading to TP01 and TP02.

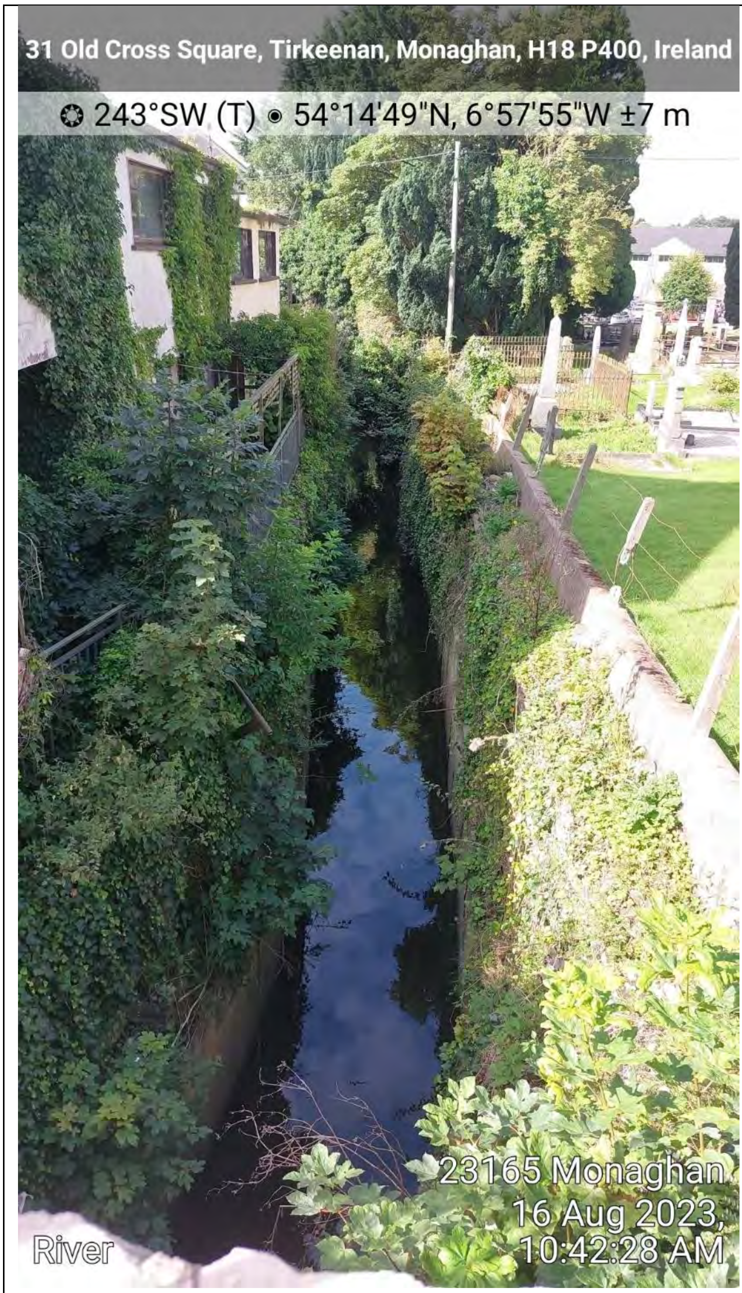


TP01 location.

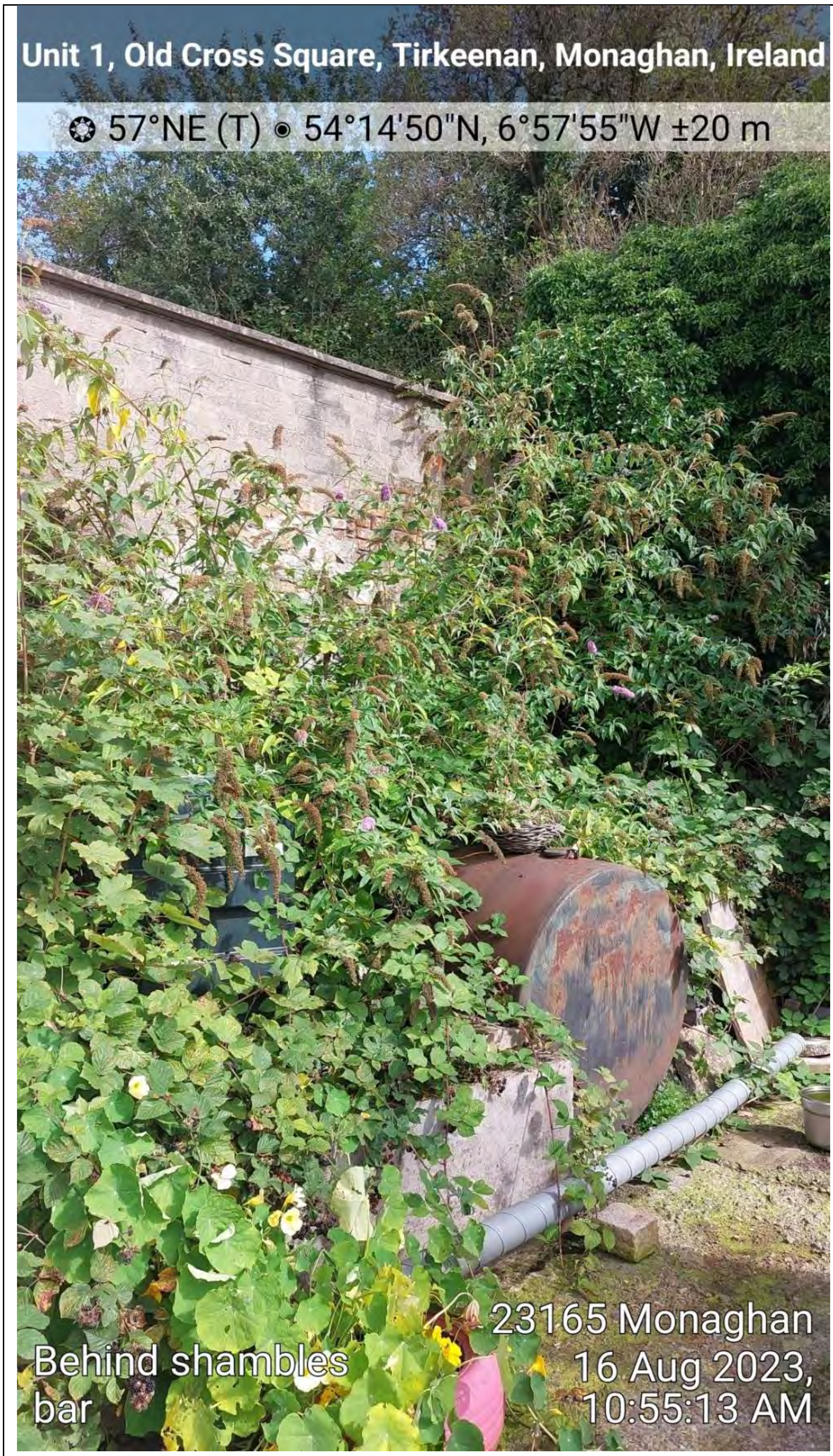


TP02 location.

Possible pumping station.



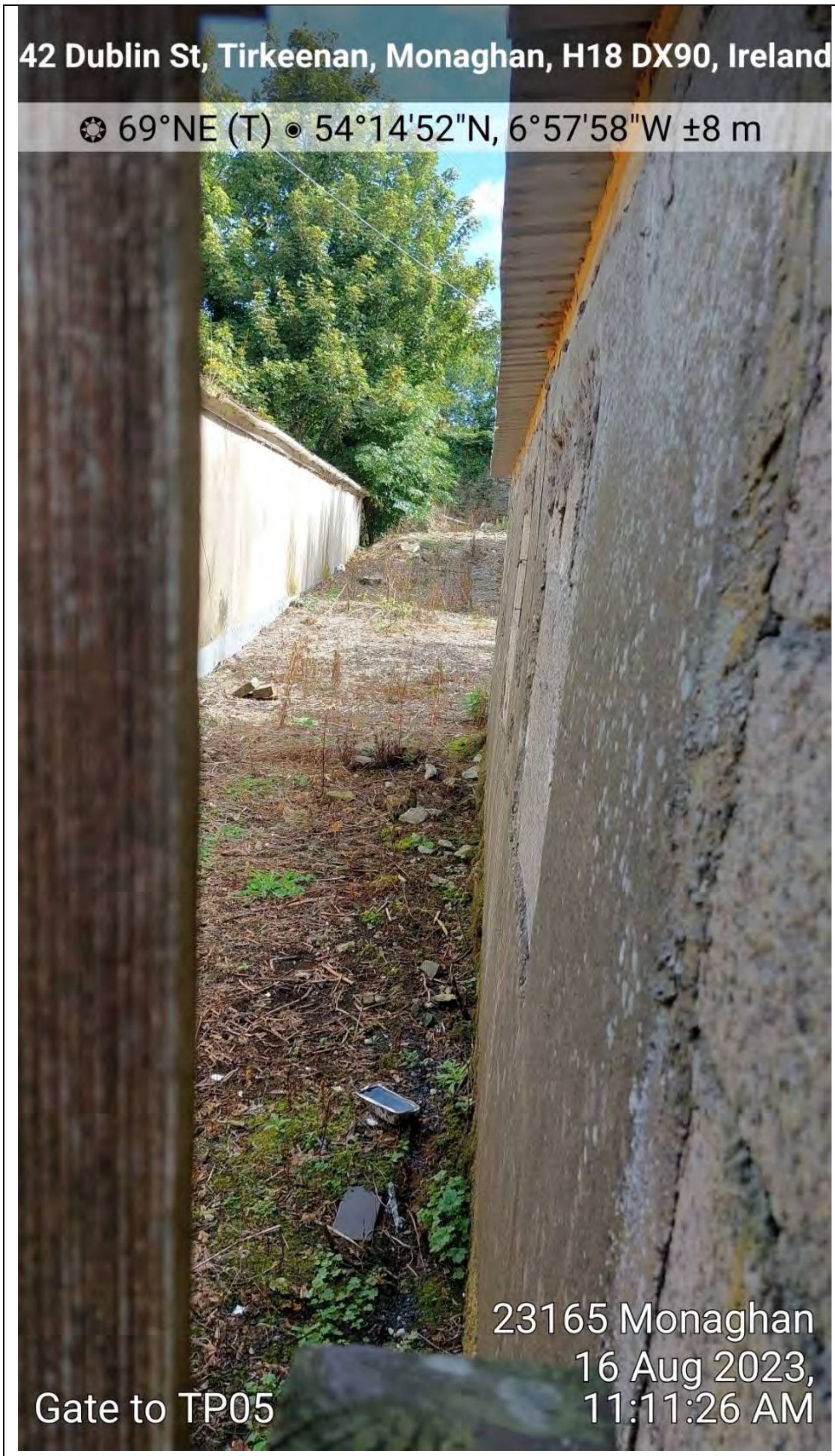
River Shambles close to church.



Oil tanks behind the Shambles bar on Dublin street.

Oil tank behind private house on Dublin Street at former TP03 location.

Access to TP04 by laundry.



TP04 location.

Name:	**Signed:**
Chris Engleman	

Plate 4: Japanese Knotweed

Plate 5: Japanese Knotweed

Plate 3: Japanese Knotweed

Plate 45: Japanese Knotweed

Plate 60: Japanese Knotweed

Plate 61: Japanese Knotweed

Plate 192: Japanese Knotweed

Plate 251: Japanese Knotweed

Plate 252: Japanese Knotweed

Plate 253: Japanese Knotweed

Plate 254: Japanese Knotweed

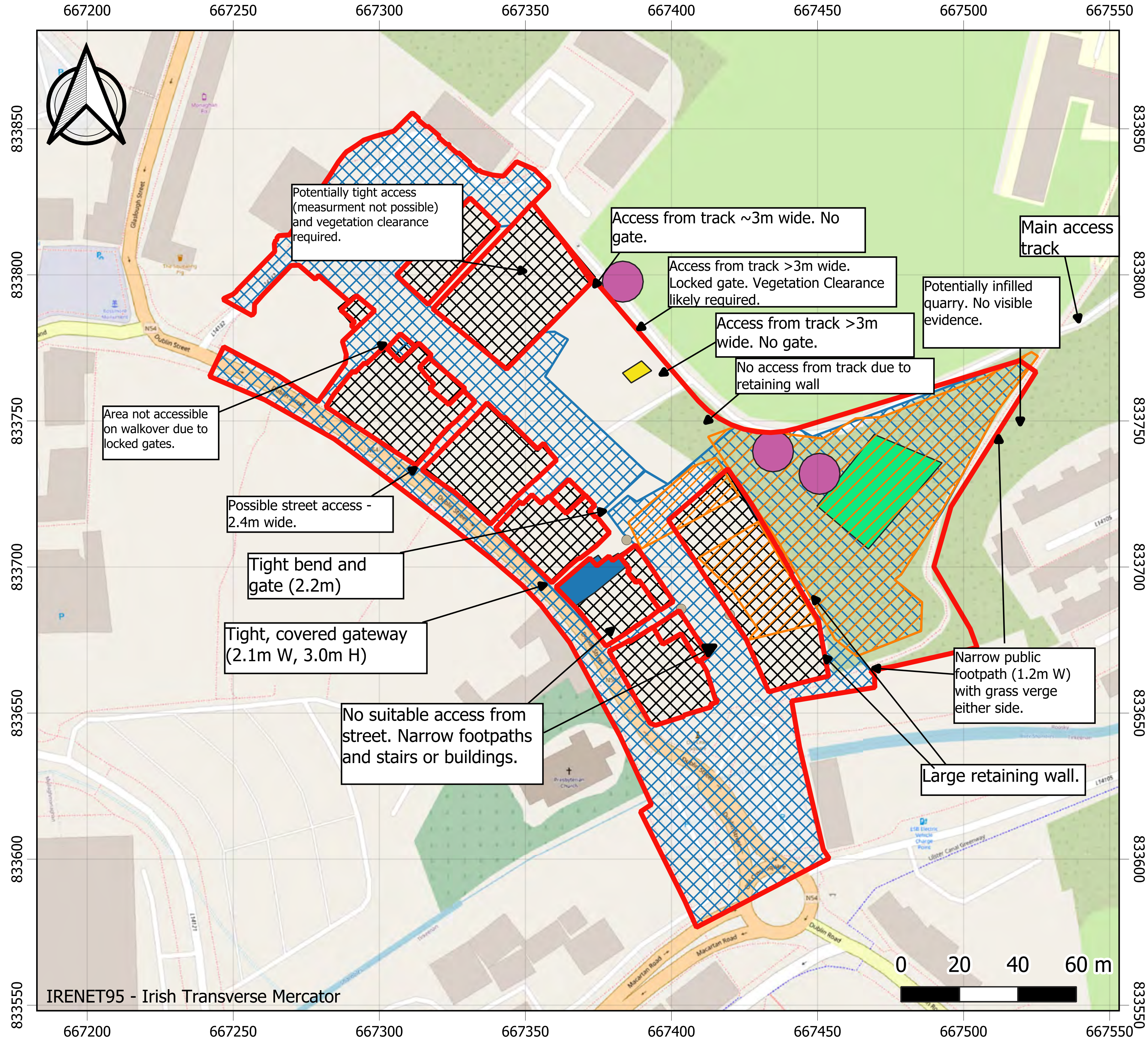
Plate 255: Japanese Knotweed

Plate 127: Tanks

Plate 128: Tanks

Plate 151: Tanks

Appendix B SITE CONSTRAINTS DRAWING



Dublin Street North

Constraints Plan DRAFT

Legend

Draft Red Line Boundary	—
Constraints	
Dense Vegetation/Trees	▨
Infirmary Ruin	🟩
Japanese Knotweed (7m Buffer)	🟪
Laundry	🟦
Unknown Container	🟨
Outside Site Boundary	▨
Access Constraints	▨
Oil Tanks	●

REV:	DATE:	DRAWN	CHECKED
00	29.08.2023	CE	JmG

DRAWING No: 23165-GDG-XX-CON-DR-G-0002

DRAFT

SCALE: 1:1700

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Monaghan Dublin Street – Interpretative Ground Investigation Report

Client	**McAdam Design Ltd.**
Document Ref.	23165-GIR-001-00
Project Title	Monaghan Dublin Street
Date	24/10/2024

Project Title:	Monaghan Dublin Street
Report Title:	Ground Investigation Report
Document Reference:	23165-GIR-001-00

Client:	McAdam Design Ltd.
Ultimate Client:	Monaghan County Council
Confidentiality	Client Confidential

REVISION HISTORY

Rev	Date	Reason for Issue	Originator	Checker	Reviewer	Approver
00	24/10/2024	For Client comments	JK/RH	AB	PQ	EO

DISCLAIMER

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REVISION SUMMARY

Rev	Date	Section(s)	Detail of Change
-	-	-	-

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EXECUTIVE SUMMARY

Gavin and Doherty Geosolutions (UK) Ltd. (GDG) was requested by McAdam Design Ltd. to complete a Ground Investigation Report (GIR) for the geotechnical design of Dublin Street North Regeneration in Monaghan Town.

This GIR discusses the ground investigations and geoenvironmental assessment associated with the proposed Dublin Street North redevelopment, Co. Monaghan. The GIR includes the development of an engineering geological model of the study area and defines geotechnical parameters for the geotechnical design of the civil infrastructure associated with the development. This assessment is based on the following:

1. A desk study of high-level data from various online mapping databases,
2. Scheme-specific ground investigations consisting of
    - cable percussive boreholes
    - trial pitting
    - a suite of geotechnical and chemical laboratory tests and
3. Published and unpublished case histories.

It is highlighted that the geotechnical information detailed within this document is limited to the soil information made available at the time of writing. The latest information used in this revision of the report was taken from Dublin St.North, Monaghan, report no.24-0640 (September 2024) factual report prepared by Causeway Geotech Ltd. Any additional information which may become available following the issue of this GIR shall be reviewed and incorporated into a later revision of this GIR which may result in alterations to the proposed geotechnical parameters.

In general, the subsurface geology includes Topsoil, overlying Made Ground, overlying Cohesive and Granular Glacial Till, overlying limestone. Bedrock was encountered only in 2 rotary cores during the historic GI works and as a result, the lithology of the bedrock could not be confirmed in the Site area, nor could its geotechnical parameters be assessed. The anticipated depths and thickness of the underlying soil and rock stratigraphy have been summarised for the proposed development area.

The results of in-situ tests (Standard Penetration Tests, geotechnical laboratory tests have been reviewed in this GIR. The anticipated geotechnical parameters associated with each stratum have been presented based on the factual GI information received to date. The groundwater levels recorded during the GI were also studied to determine the most probable groundwater level.

Geoenvironmental assessment of the investigation data concerning human health and the wider environment, including water environment, and buildings & structures was carried out. The results indicated the presence of asbestos fibres, lead and metal in Made Ground within a localised area to the rear of the existing residential properties, north of the site. It is recommended that If any unforeseen contamination be identified during earthworks or construction (e.g. hydrocarbon impacted soils, asbestos, etc.), then work in such areas should be halted until a suitably qualified professional has been consulted to assess the situation and provide advice. Moreover, the desk study ascsciated with radon levels shows that the site is in a region of Medium risk, where approximately 1 in 20 properties may have elevated indoor radon measurements, and consequently any future residential development should consider the possible requirement for radon mitigation measures.

The Dublin Street North redevelopment will require geotechnical designs which have been discussed from a high level in this GIR. A summary of geotechnical parameters is provided in Table 1-1.

Table 1-1: Summary of Engineering Ground Model and Interpreted Design Parameters

Interpreted Geological Stratum		**Made Ground**	**Glacial Till (Cohesive)$^{a, b}$**
Classification	Soil Classification	Variable	CL, CI
	w_N (%)	16 – 20% (18%)	12 – 42% (19%)
	w_L (%)	39 – 55% (47%)	28 – 45% (35%)
	w_P (%)	16	13 – 25% (18%)
	Plasticity Index (%)	23	10 – 27% (17%)
	Liquidity Index	0.09	-0.42 – 1.0 (0.1)
	γ (kN/m^3)	20	20
	m_v (m^2/MN)	0.17	0.42 for z≤2m BGL Min (0.035,$\frac{1}{7.8z-10.8}$) for z >2m BGL
Strength	Effective Peak Friction Angle ϕ' (°)	30	30
	Effective Cohesion c' (kN/m^2)	0	0
	Undrained Shear Strength c_u (kN/m^2)	60	44 for z ≤ 2m BGL Min (258.5, 71.5z-99) for z >2m BGL
Deformation	Drained Young's Modulus E' (MPa)	24	17.6 for z ≤ 2m BGL Min (103, 28.6z-39.6) for z >2m BGL
	Undrained Young's Modulus E_u (MPa)	30	22 for z≤2m BGL Min (129, 35.8z-49.5) for z >2m BGL
Geohazard		Potential for oversized particles such as concrete, brick, stones, ceramics, roots, timber and plastic. Made Ground may vary in composition and engineering behaviour over short distances. High organic odour to be encountered in the material.	Potential for gravels and oversized particles (Glacial Till – Granular) to be encountered in the material and could affect temporary works due to its high permeability. Potential for settlement of any ground bearing structures

Interpreted Geological Stratum		Made Ground	Glacial Till (Cohesive)[a, b]
		Groundwater is influenced by the tidal range and any excavations should consider the most onerous tidal range. Sand and gravel content in the material may result in quicker than anticipated transition to drained strength characteristics. Asbestos, lead and metals were identified in Made Ground located to the rear of the existing residential properties, north of the site.	during either temporary or permanent works. High organic odour to be encountered in the material. Groundwater is influenced by the tidal range and any excavations should consider the most onerous tidal range.

Notes

* Values in () indicates average value

[a] z is the depth (m) from 0.0m BGL

[b] Glacial Till (Granular) was confirmed by Particle Size Distribution (PSD) results carried out in samples retrieved from historic holes located outside the examined Site boundary. Also, in the absence of sufficient site-specific data (limited no. of SPT N data and with low reliability as SPT N values are ‘refusals’), the characteristic parameters for Glacial Till (Granular) were not defined in this GIR.

1 INTRODUCTION

Gavin and Doherty Geosolutions (UK) Ltd. (GDG) was engaged by McAdam Design Ltd. to complete a Ground Investigation Report (GIR) for a proposed redevelopment on the Land North of Dublin Street, Monaghan. The proposed works are part of the Monaghan County Council Regeneration Scheme for Dublin Street and its backlands in Monaghan Town.

This GIR provides an interpretation and summary of the relevant desk study information, ground investigation (GI) information, in-situ, geotechnical and geoenvironmental laboratory soil testing. This report outlines summary design parameters for use in the preliminary design of the proposed development infrastructure.

The principal parties of the project are:

- Monaghan County Council in the main contract,
- McAdam Design Ltd is the Consulting Engineer and Employer's Representative in the main contract,
- GDG is the geotechnical sub-consultant to McAdam Design UK Ltd, and
- Causeway Geotech Ltd. (Causeway) is the ground investigation contractor.

1.1 DESCRIPTION OF THE PROJECT

The proposed development is part of the Regeneration plan prepared on behalf of Monaghan County Council, which envisages the redevelopment of an area located on Dublin Street North. As stated in Regeneration Plan *'The plan area benefits from an existing Dublin Street Local Area Action Plan, 2011 (LAAP 2011) [13] . The LAAP 2011 proposes a new street to the rear of Dublin Street, with infill and new mixed-use development, and a new interim surface car parking area of 0.5ha, with amenity and recreational area. There are also proposed improved pedestrian links, and local access from the new street to The Diamond and Old Cross Square."*)[13] The site is located across a mixed use of land types some residential and some of past industrial use. The indicative site layout, provided by the client as the Public Consultation Design - Illustrative Plan, is outlined in Figure 1-1.

1.2 GEOTECHNICAL CATEGORY

The scheme has been identified as Geotechnical Category 2 according to I.S. EN 1997-1:2005+A1: 2013 in that it includes only conventional types of structure with no exceptional risk or difficult ground or loading.

Figure 1-1: Illustrative Plan (Drawing number: DBL-OPE-00-XX-DR-L-901306)

1.3 SCOPE OF REPORT

This GIR is prepared in accordance with I.S. EN 1997-1:2005 and the 2015 AGS Guide to Good Practice in Writing Ground Reports. The scope of this GIR is summarised as follows:

- Carry out a desk study for the Site to include:
    - A review of the historical maps from the GeoHive,
    - A review of the Geological Survey Ireland (GSI) and online geological mapping data,
    - A review of the Google Earth Imagery.
- Summarise details of the ground investigations undertaken as part of this report and previous Ground Investigations (GIs),
- Present the interpreted ground conditions and material properties for the main geological units encountered across the scheme, and
- Develop a ground model and discuss the ground conditions highlighting any variability and uncertainties.

2 DESK STUDY

2.1 SITE DESCRIPTION

The Site is in the town of Monaghan, which is the county town of County Monaghan, Republic of Ireland. The ITM Reference for the approximate centre of the site is 667400 Easting, 833700 Northing and the location is shown Table 2-1. The Site is located to the northeast of the town centre, extending from the Diamond Centre to the northwest, south-eastwards along Dublin Street, and is defined to the southeast by Old Cross Square. The surrounding area is characterised by a mix of retail, commercial, community, residential and ecclesiastical building as well as surface car parking.

The plan area is defined by the residential terraces on Dublin Street to the southwest and their long rear gardens that extend to the north. Historically, the rear gardens extended to the wall that formerly enclosed St. Davnet's 20th-century development, resulting in the introduction of an informal access road to the rear and various backland developments, including commercial premises.

This assessment is focused on the development areas shown in Figure 2-1, which comprise areas of semi-private public open space and associated infrastructure. Residential and commercial development which will take place in the hatched areas does not form part of this assessment.

Figure 2-1: Site boundary

The proposed redevelopment scheme would comprise:

- New shared surface 'Russel Row' to the rear of properties fronting Dublin Street,
- Resurfacing of Dublin Street, new pedestrian pavements, relocation of car parking spaces
- Temporary car park/ event space,
- Urban civic spaces,
- New public park,
- Future development plots,
- Landscaping, lighting, upgrading of services.

2.2 LAND USE AND HISTORICAL RECORDS

2.2.1 CURRENT SITE USE

The site comprises mixed commercial and residential land. This consists of professional services, including solicitor's offices, commercial uses including retail units, laundry, clothing, footwear, salons, a public house, a restaurant, a PVC windows supplier, an auto repair shop and a guest house. Commercial premises have also developed to the rear, including a furniture factory. A number of the shops extended the retail use to the full width of the property. There are also several vacant shops along the street and the backland areas are substantial but underutilised.

2.2.2 CURRENT SURROUNDING AREA USE

The surrounding area is best described as the town centre, comprising a mix of uses, including residential and a mix of small to medium-scale retail uses based on the traditional narrow plot street pattern on Glaslough Street, the Diamond Centre, Dublin Street and Market Square. Agricultural land is present to the north of the site.

The map in Figure 2-2 extracted from the Corine Land Cover 2018 (EPA) which shows the land use classifications for the site and its surroundings. The dataset is based on the interpretation of satellite imagery and national in-situ vector data. The project boundaries fall into two classes 'Continuous urban fabric' (purple hatching) for the largest area and a smaller area classified as 'Pastures' (green hatching).

Figure 2-2: Land use (Corine 2018, EPA 2023)

2.3 HISTORICAL LAND USES

The history of the site has been reviewed using historical Ordnance Survey Ireland (OSI) maps dating:

- 6 Inch First Edition Colour/ B&W (1829-1841)
- 25 Inch B&W (1897-1913)
- 6 Inch Last Edition B&W (1913)

Google Earth viewer has been used to cover the period 1985 – 2023. A summary of the historical land use is provided in Table 2-1.

Table 2-1: Site History

Date	On-site land use	Surrounding environs
1829 - 1841	The buildings are present in a similar locality to the present day. The northeastern portion of the site has no buildings of note and is covered in pastures. Shambles Bridge and Old Cross Square are identified in the south of the site.	An old infirmary and quarry can be seen near the south-eastern edge of the site. The canal bridge is located to the south of the site. The 'Diamond Centre' area to the north of the site is also present, as is Monaghan Lake (later called Peter's Lake).

Date	On-site land use	Surrounding environs
	The present-day street network exists at this time with Dublin Street, Dawson Street and Male Road. Monaghan was a well-established townland in this period.	Gaol (West of Monaghan Lake) - 400-500m NW of the Diamond Carpark.
1897-1913	As above the site remains partly covered by buildings and partly by pastureland.	The location where the infirmary used to be is now called the 'Lodge'. There is a symbology of a landform break in the area where the quarry used to be, apparently, the quarry no longer operated at this time. The area where there used to be a Gaol is now identified as Monaghan County Infirmary. Smithy/ Blacksmith – 20m east of the site's southern boundary. Gasworks - about 300m NEE of our southern boundary. A graveyard is identified to the east of Old Cross Square at the rear of the Presbyterian Church.
1913	In a similar way as before, the site is still partly covered by buildings and partly by pastureland.	There is an area of pasture in the region where the quarry used to be. The area where there used to be a Monaghan County Infirmary is now identified as a County Hospital. Laundry is also located to the north of the hospital. Gasworks are mentioned in the same area. The graveyard and church are identified on the map. A pump station is located 90m to the southwest of the site. A Sawmill/ Creamery are present - 80m South of Dublin Street on the banks of the Shambles.
Google Earth 1985 - 2023	The site does not experience any significant changes during this period.	The surrounding area experiences minor alternation and new builds.

2.4 TOPOGRAPHY

The landform of the region is presented in Figure 2-3, with elevations on the site varying between 70.0m Above Ordnance Datum (AOD) (in the east) and 60.0 m AOD (in the south), approximately. The base level of the region and the site are the Ulster Canal and the River Shambles, which on the site are at elevations of around 59.0m AOD.

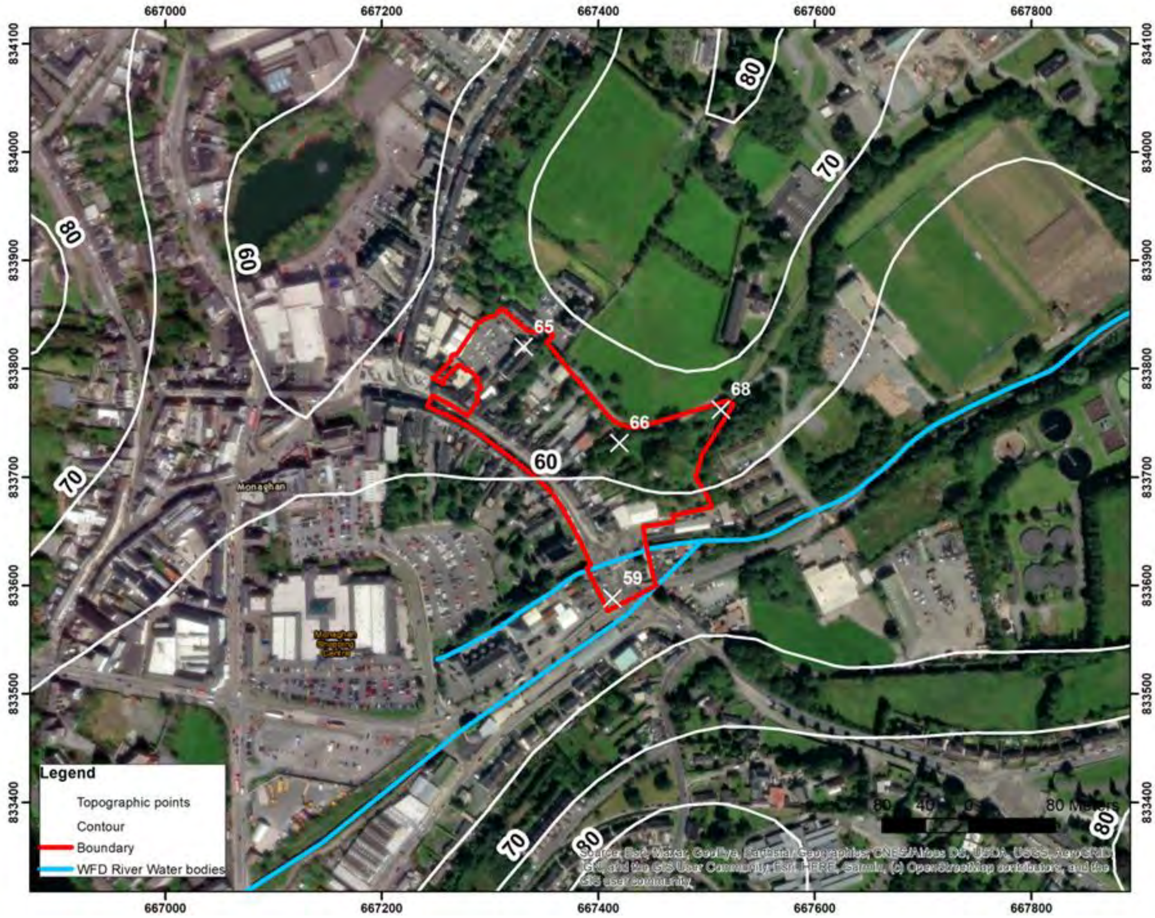


Figure 2-3: Topography

2.5 GEOLOGY

2.5.1 BEDROCK GEOLOGY

The bedrock geology underlying the site is mapped on the GSI 1:100,000 bedrock formations map. This data shows that there are three different formations underlying and adjacent to the proposed site:

- Ballysteen Formation (Limestone) - Dark muddy limestone, shale. Irregularly bedded and nodular bedded argillaceous bioclastic limestones (wackestones and packstones), interbedded with fossiliferous calcareous shales. It represents a widespread development throughout Westmeath and Longford.
- Ulster Canal Formation (Sandstone) - It is composed of a marine sandstone unit and 'shaly pales and pale beds', that is silty and sandy limestones that are variably fossiliferous with occasional parallel and cross-laminations and some fine-grained limestones.
- Cooldaragh Formation (Mudstone) - It consists of pale brown-grey siltstones and mudstones, algal, evaporitic and argillaceous micrites and muddy siltstones.

The bedrock geology map (GSI, 2024) is shown in Figure 2-4. From the mapped information, the site is entirely within the Ballysteen Formation (Limestone).

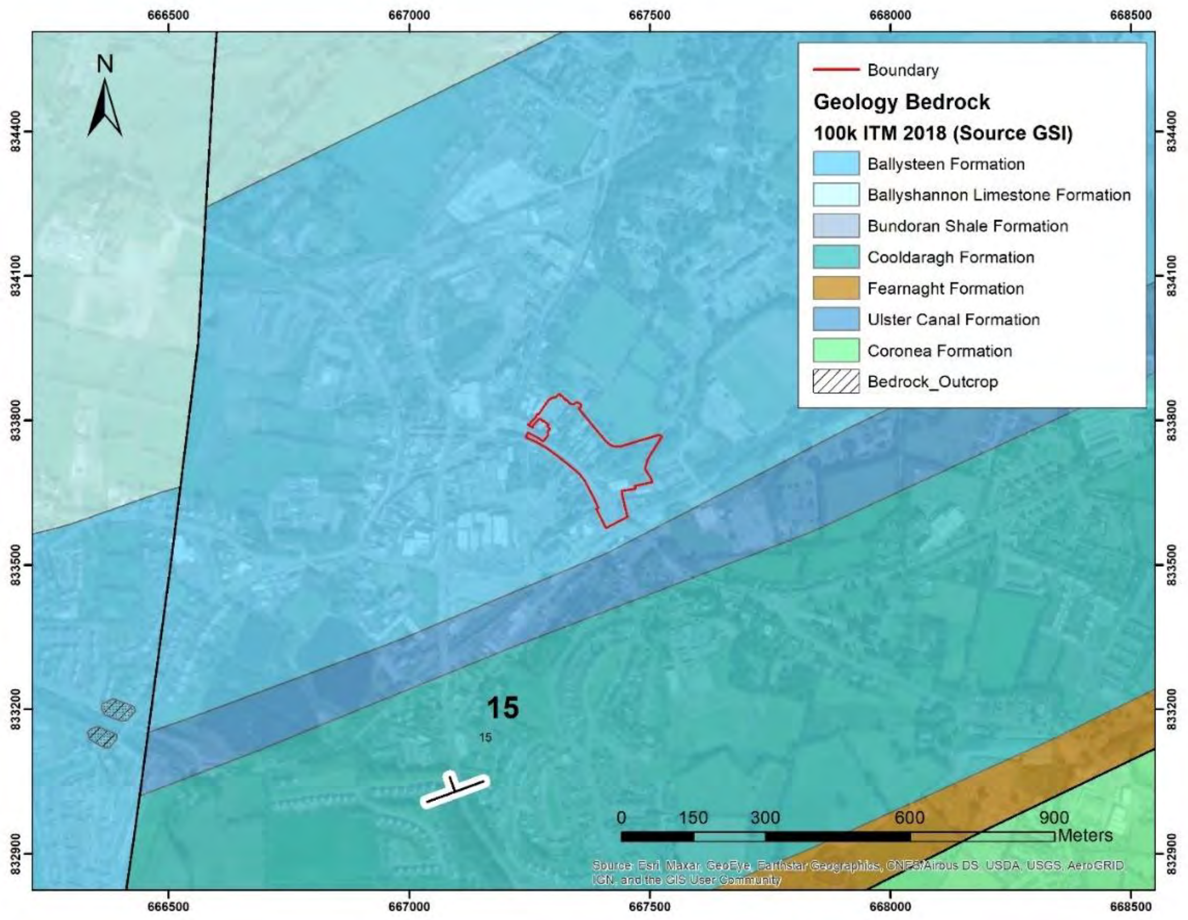


Figure 2-4: Bedrock Geology (GSI, 2024)

2.5.2 QUATERNARY SEDIMENTS

According to the 'Quaternary Geology of Ireland – Sediments Map, scale 1:50,000 (GSI, 2024), the site consists of Glacial Till deposits derived from limestones (TLs) and the Made Ground (fill), as shown in Figure 2-5. In the areas immediately around the edges of the site, alluvium and peat are also mapped, as can be seen on the map. It is important to note that the GSI mapping only considers the first layer of greater than 1m thickness and is mapped at a scale which may not resolve small-scale local features.

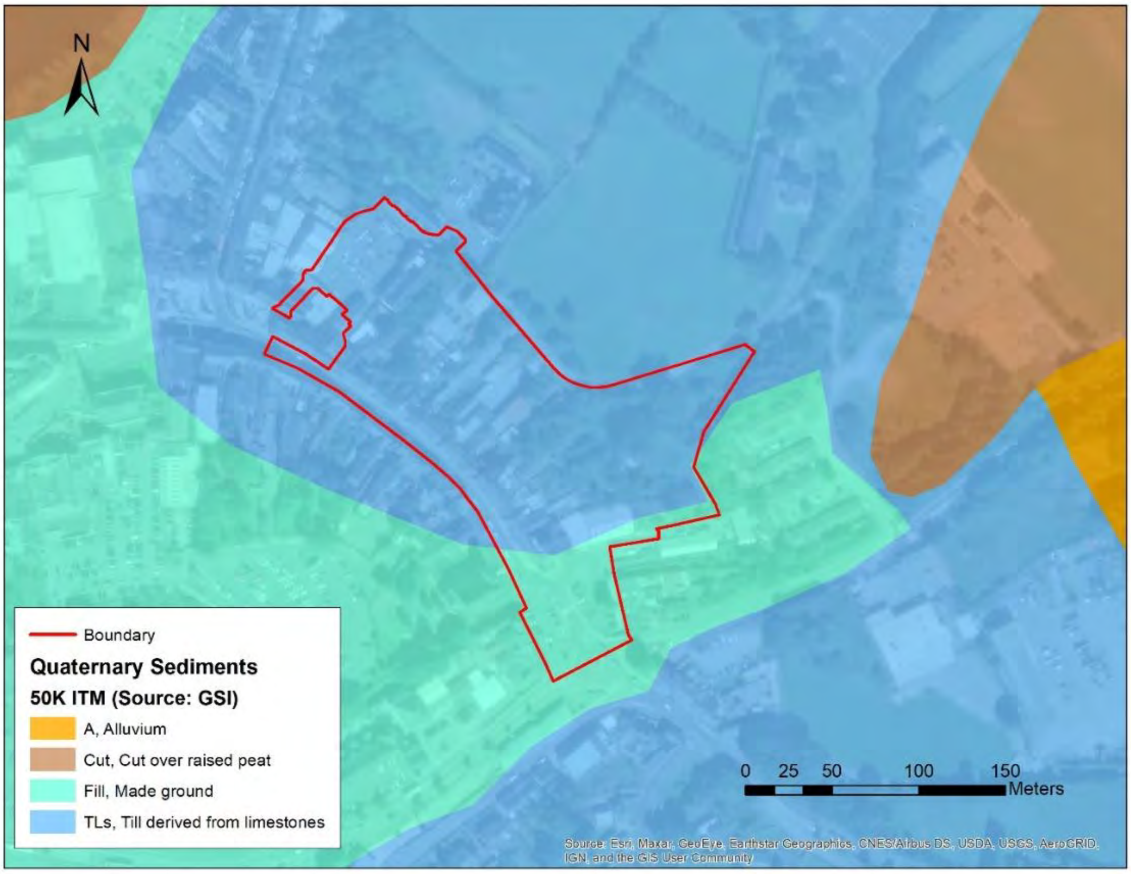


Figure 2-5: Quaternary Geology (GSI, 2024)

2.5.3 SOILS

The soil mapped by the Teagasc dataset presented in the Teagasc website [24] for the site area is shown in Figure 2-6. The map shows that within the boundaries of the site, two soil classes are present. One is the Made Ground which covers most of the site. The other soil present, of natural origin, is Till derived from mixed Devonian and Carboniferous rocks, category - Mineral poorly drained (Mainly acidic).

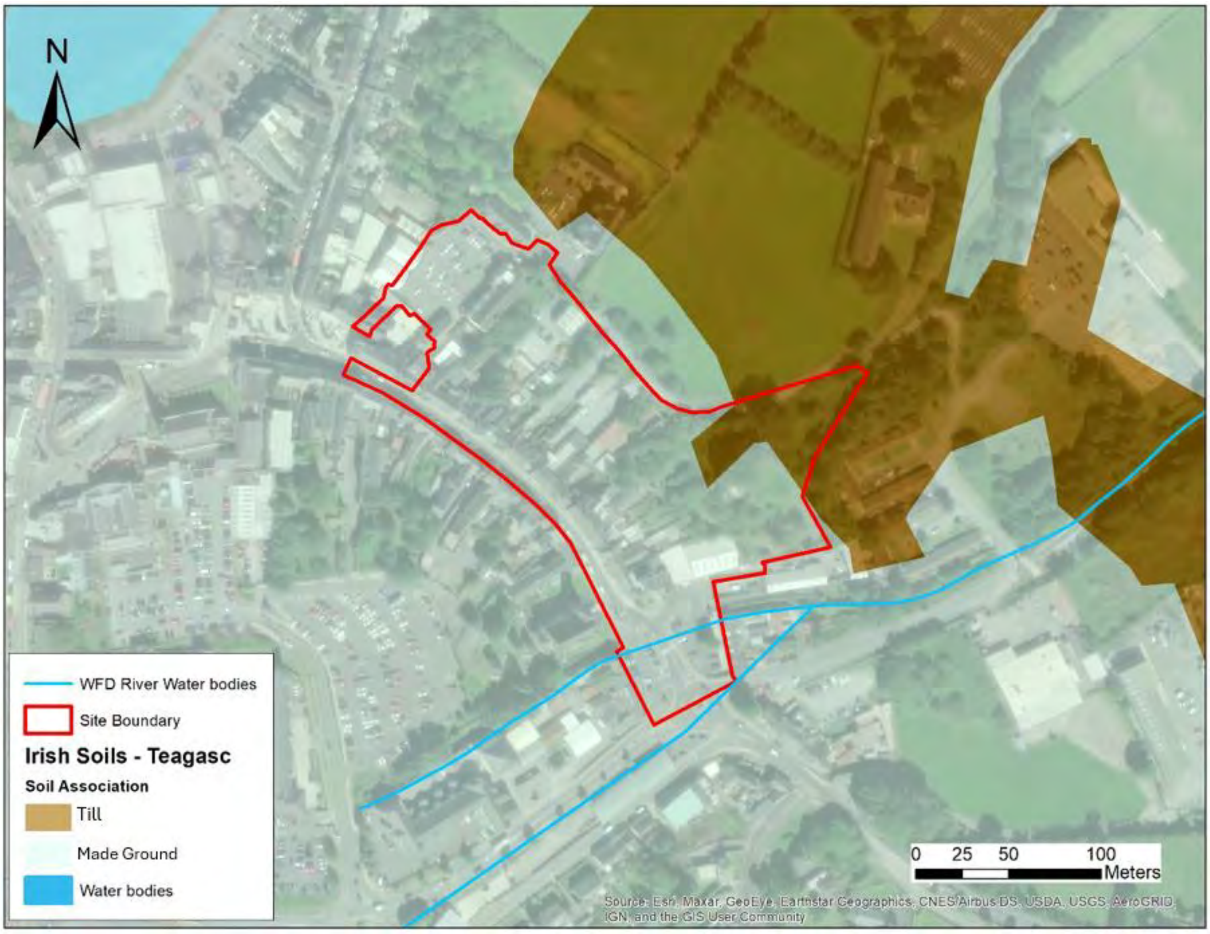


Figure 2-6: Irish soils at the Site (Teagasc, 2024)

2.6 HYDROLOGY

The site is part of the larger Lough Neagh-Lower Bann catchment (Figure 2-7). Locally, the Ulster Canal runs south of the project area and the River Shambles cuts through the site. Ulster Canal and the Shambles River separate just upstream of the site and the Ulster Canal, diverting south of the River Shambles, has been culverted under several areas through the town (Canal Street), including the square. The river flows locally in a north-easterly direction, Figure 2-8. Two bodies of water are also in the vicinity of Dublin Street North Regeneration Project: Patena Lake (or Peter's Lake), 175 m to the northwest and Convent Lake, 550 m to the west.

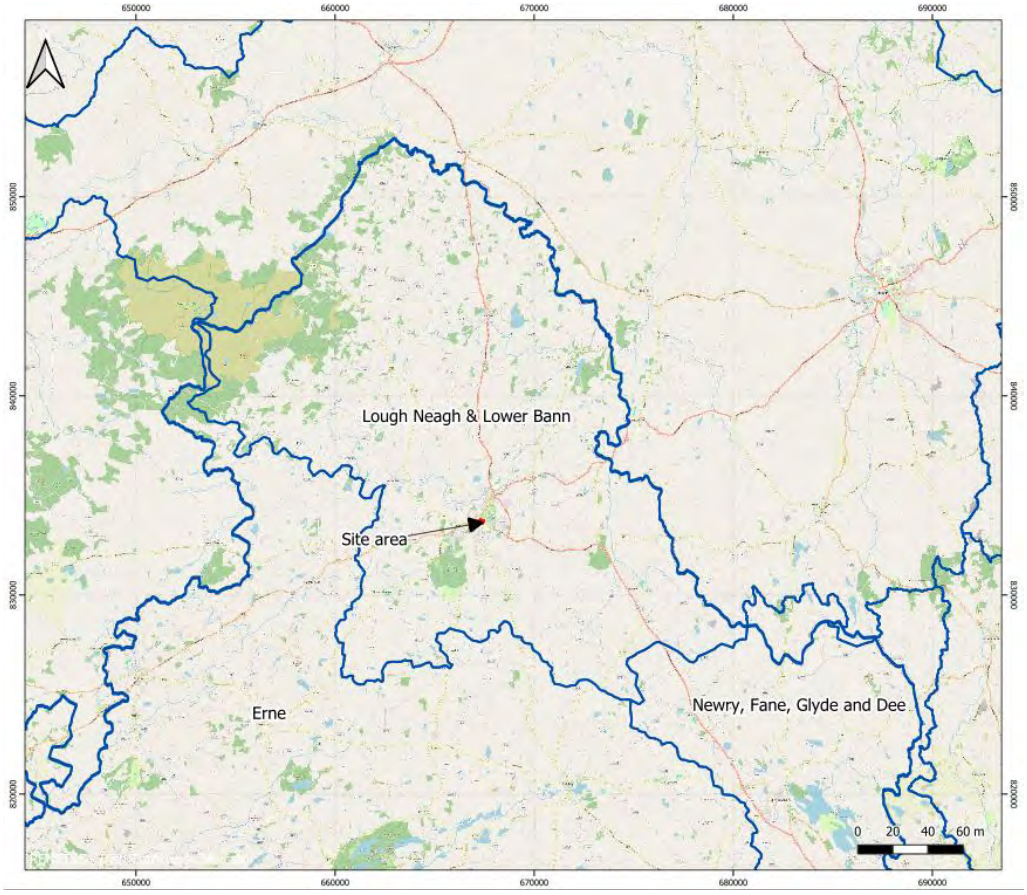


Figure 2-7: Blackwater Catchment

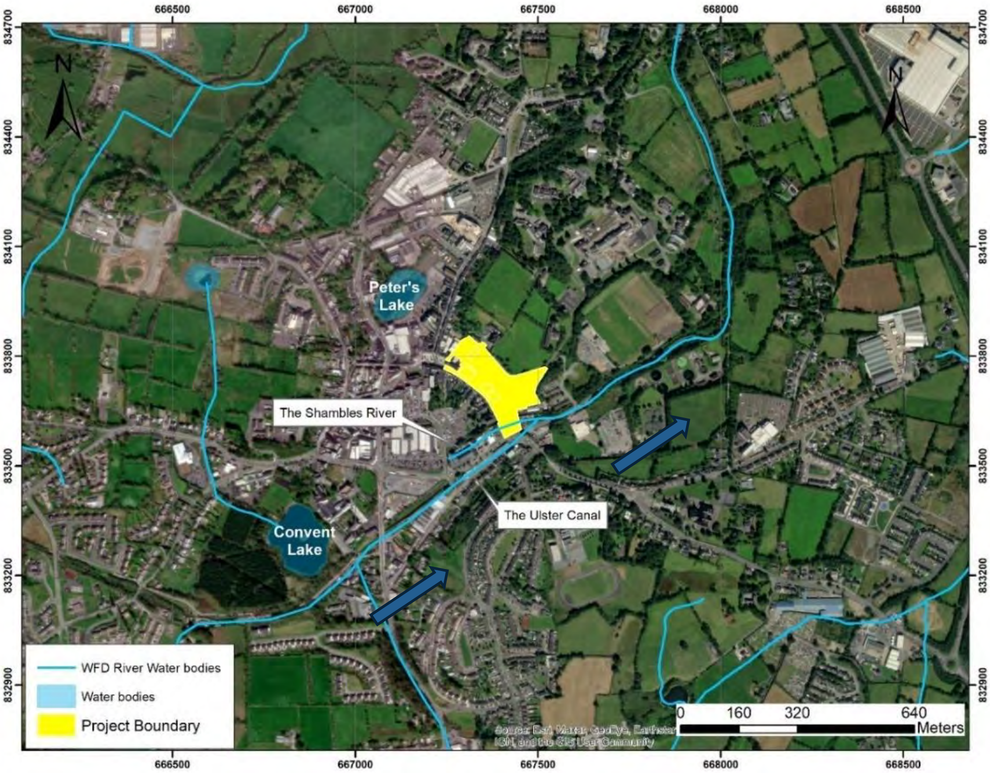


Figure 2-8: Site hydrography

Concerning surface water quality, the information from the EPA (2023) is shown in Table 2-2: River water quality.

Table 2-2: River water quality

Parameter	Status
River Waterbodies Risk for Shambles locally	at Risk
River Waterbody WFD Status 2016-2021	Poor

In the vicinity of the site boundary (marked with a red 'x') there is flood risk – medium probability on the banks of the Shambles River, as can be seen on the map in Figure 2-9. This layer shows the modelled extent of land that might be flooded by rivers in a severe flood event. Medium Probability flood events have approximately a 1-in-a-100 chance of occurring or being exceeded in any given year. This is also referred to as an Annual Exceedance Probability (AEP) of 1%.

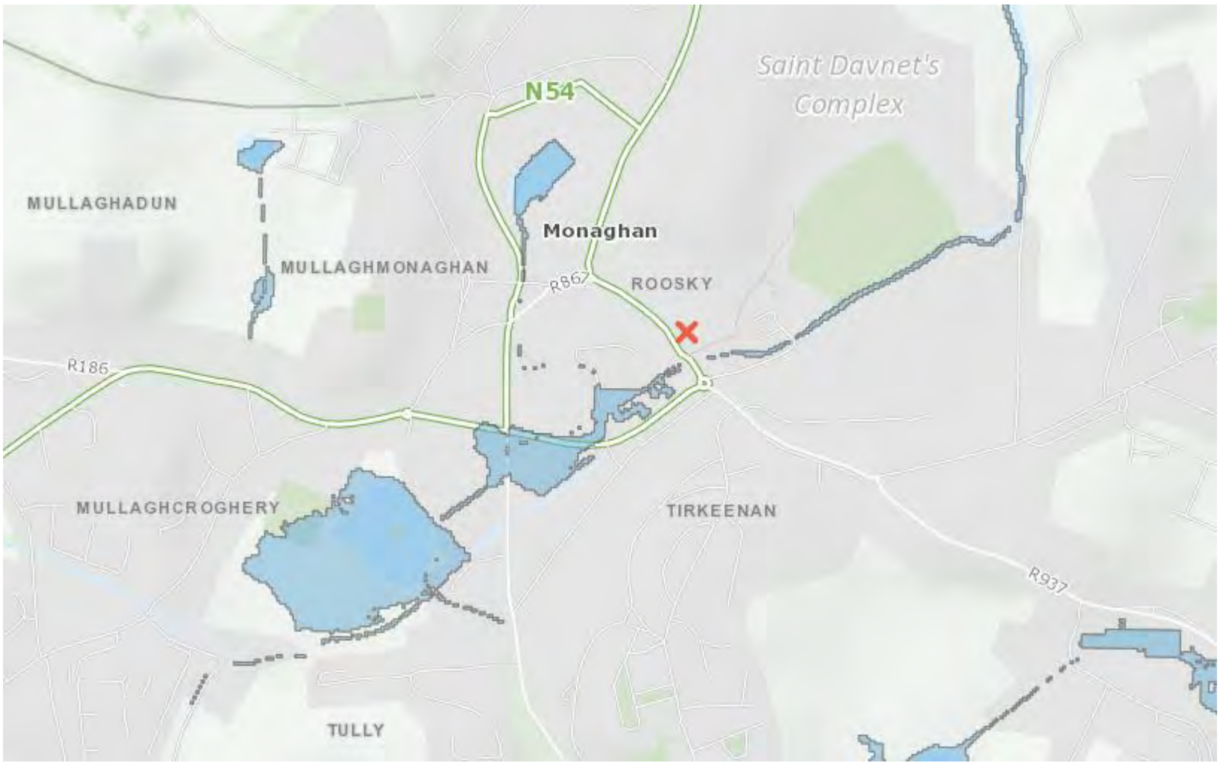


Figure 2-9 Flood Risk (EPA, 2024)

The Historic Flood Maps produced by GSI in collaboration with Trinity College Dublin and the Institute of Technology Carlow (Figure 2-10) don't show any flood areas within 750 m of the site.

Figure 2-10: Historic Flood Maps produced (GSI, 2024)

2.7 HYDROGEOLOGY

According to information provided by GSI Groundwater Resources (Aquifer), the groundwater Rock Unit beneath the site is the Dinantian Lower Impure Limestone, and the aquifer is defined as Regionally Important Aquifer-Fissured bedrock (Rf). The Subsoil Permeability is considered Low for the site and surrounding Figure 2-11. However, in terms of groundwater vulnerability, the site is in the High and Moderate classes as shown in Figure 2-12.

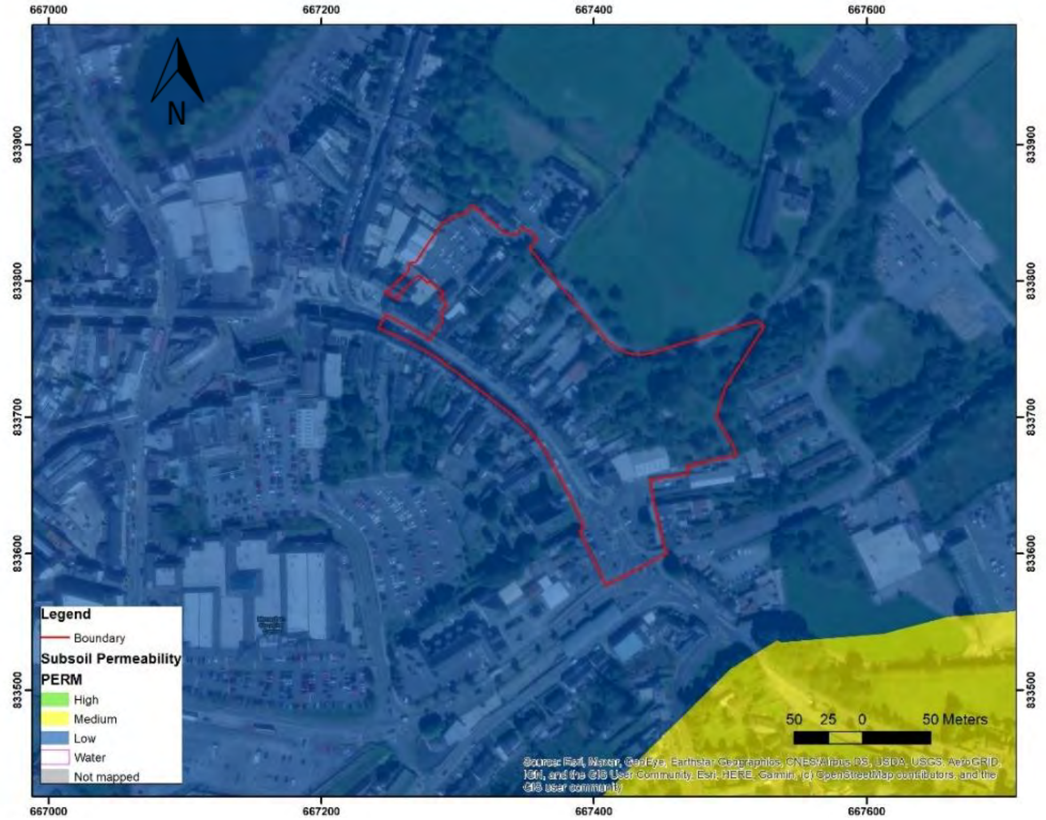


Figure 2-11: Subsoil Permeability (GSI, 2024)

Figure 2-12: National Groundwater Vulnerability Ireland (GSI, 2024)

2.8 MINING

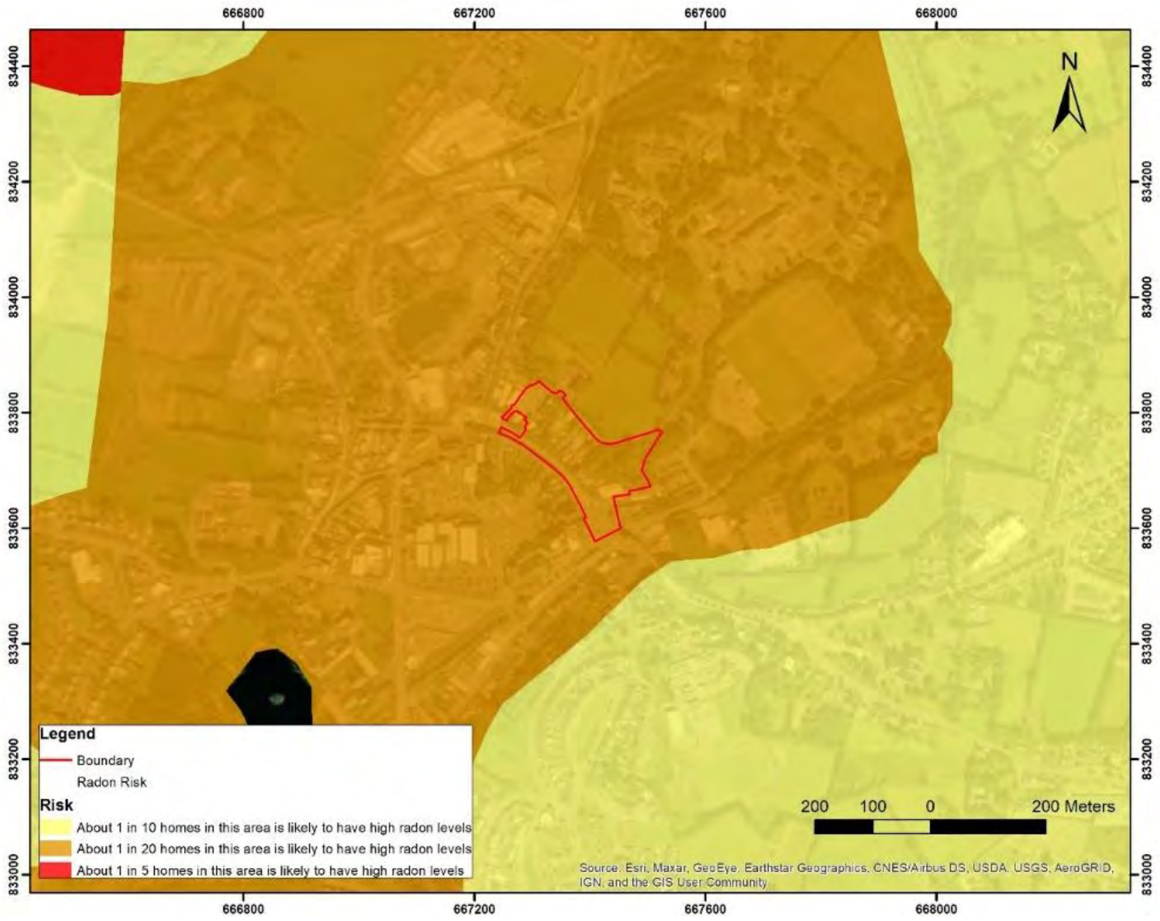
According to Geological Survey Ireland Spatial Resources records, there is currently no mining activity in the vicinity of the site. The nearest Mineral Locality is to the south of the area approximately 4 km away, identified as Gabbro Mining.

2.9 INDUSTRIAL LAND USE

With the records available at the Environmental Protection Agency map viewer, there are no potentially contaminated industrial sites within 250m of the site boundary. However, there is potential that the infilled quarry (at the SE limit of the site) and the description/ type of infill is unknown.

2.10 RADON

Radon Risk Map by the EPA is shown in Figure 2-13. This map shows a prediction of the number of houses in any one area that are likely to have high radon levels. Those areas in red are most at risk from radon and are called High Radon Areas. The map is based on an analysis of indoor radon measurements plus geological information including, bedrock type, quaternary geology, soil permeability and aquifer type. The areas of the map in orange and yellow are areas of medium and low risk respectively. The map shows that the site is located in a region of medium risk.



Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Figure 2-13: Radon Risk (EPA, 2023)

3 GROUND INVESTIGATION

3.1 HISTORIC GI

Two factual reports detailing the ground investigation regimes completed historically in the surrounding area were provided by the McAdam Design.
The historical GI included:

- Report on Site Investigation, Active Travel Project for CORA on behalf Monaghan County Council - Report No. 24665, July 2023 (IGSL -Site 1) – Completed by IGSL [12] and included:
    - 8 no. cable percussion boreholes
    - Three rotary cores holes,
    - 14 no. trial pits,
    - One standpipe installation,
    - Geotechnical Soil and Rock Laboratory Tests,
    - Chemical and Environmental Laboratory Tests.
- Report on Site Investigation, Active Travel Project for DBFL on behalf Monaghan County Council - Report No. 24665/1, July 2023 (IGSL-Site 2) – Completed by IGSL [11] and included:
    - Two no. cable percussion boreholes
    - Two no. rotary cores holes,
    - 9 no. trial pits,
    - Two standpipe installations,
    - 9 no. CBR by Plate Test,
    - Four BRE Digest 365 Infiltration tests,
    - Three slit trenches,
    - Three vane shear tests,
    - Geotechnical Soil and Rock Laboratory Tests,
    - Chemical and Environmental Laboratory Tests.

A layout plan showing the approximate location of each historical and 2024 GI is illustrated in Figure 3-1. The stratigraphy encountered by the historical GI is summarised in the following paragraphs along the 2024 GI. These historical GIs typically confirm the ground conditions encountered by the information described in the GI conducted by Causeway Geotech (Causeway, 2024).

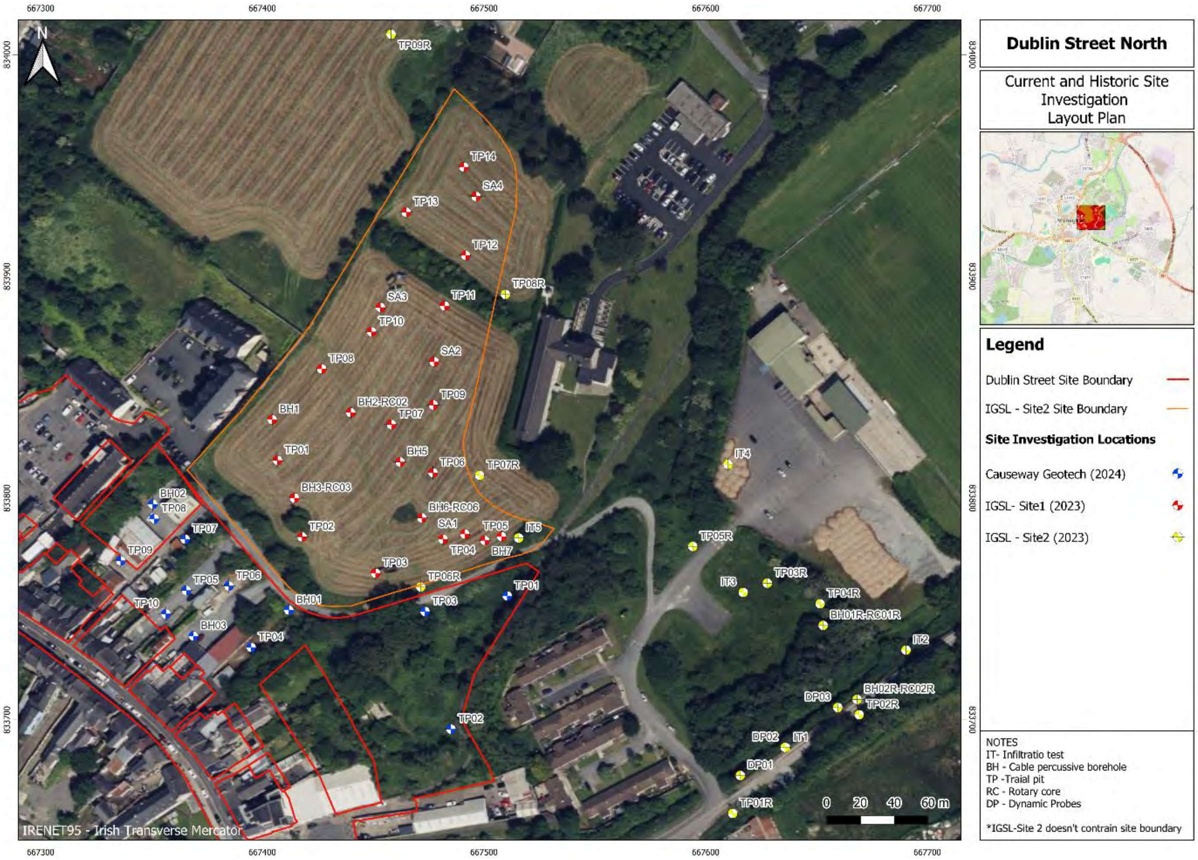


Figure 3-1: 2024 GI and Historic Site Investigation Layout Plan

3.2 GROUND INVESTIGATION (SEPTEMBER 2024)

The GI for the main contract of the Dublin Street Monaghan project was specified by GDG and was undertaken by Causeway in 2024 [1] in accordance with I.S. EN 1997-2:2007 and associated standards. Full details of the results of the field and laboratory are detailed in the Causeway (2024) factual GI report. The GI works comprised:

- Three cable percussion boreholes,
- Ten trial pits,
- Two archaeological trenches,
- One infiltration/soakaway test,
- Four indirect CBR tests,
- Standard Penetration Tests,
- Three Plate Load tests,
- Geotechnical Laboratory Testing:
  - 10 no. Atterberg Limits,
  - 10 no. Particle Size Distribution test,

- Environmental laboratory testing of soil & water.

The plan of the Causeway (2024) ground investigation showing the locations of exploratory holes is presented in Figure 3-2.

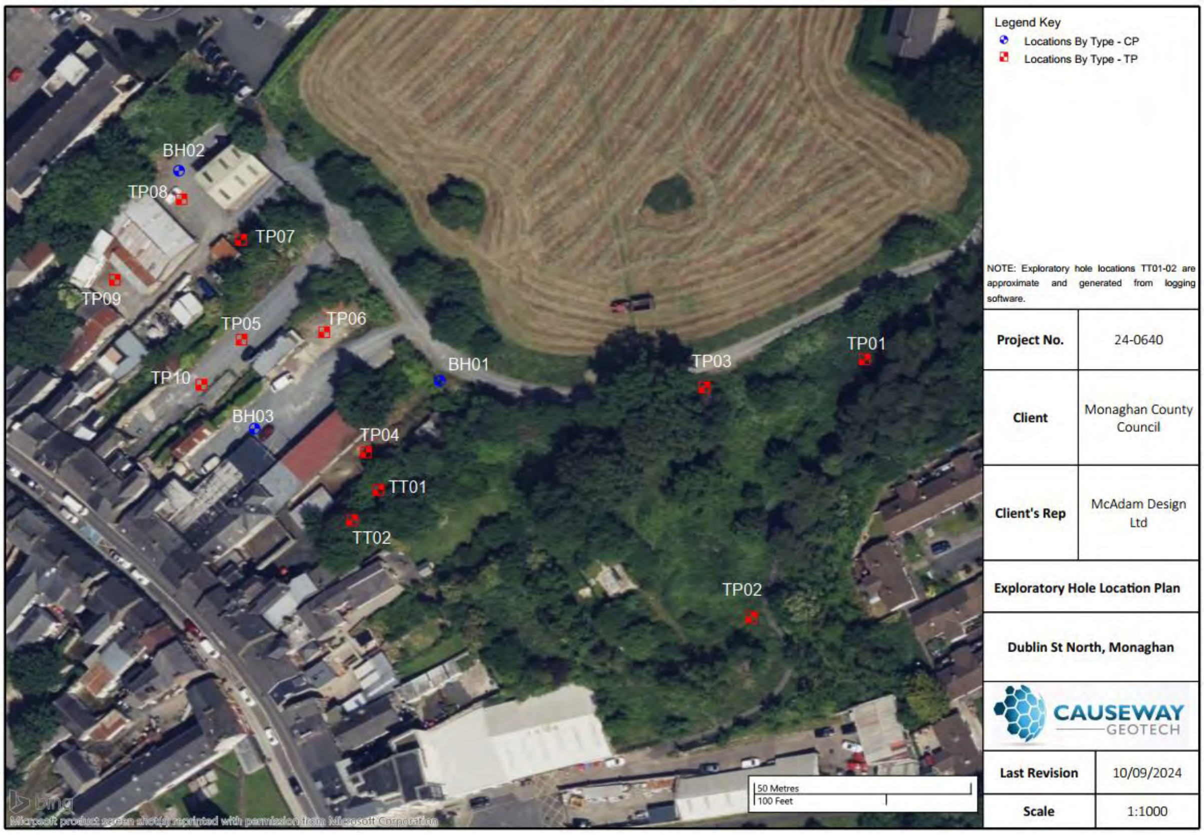


Figure 3-2: Ground investigation plan (Causeway Geotech, 2024)

3.3 GEOENVIRONMENTAL LABORATORY TESTING

The geoenvironmental testing carried out is presented in Table 3-1.

Table 3-1: Summary of the geoenvironmental testing

Number of tests	Description	Notes
	SOIL	
22	Metals	(Sb, As, Ba, Be, B, Cd, Cr(III), Cr(VI), Cu, Pb, Hg, Ni, Se, V, Zn)
22	PAH (USEPA 16)	
22	TPH CWG C5-C44	
22	Asbestos presence screen	Identification was undertaken if/where asbestos fibres were detected.
22	Moisture Content	
22	Cyanide (Total & Free)	
22	Sulphate, Sulphide	
22	Phenol – Monohydric	

Number of tests	Description	Notes
22	pH & Acid neutralisation capacity (pH4) & Alkali Reserve	
22	Chloride, Nitrate	
22	Soil organic Matter	
22	Thiocyanate	
22	VOCs	Benzene, Toluene, Ethylbenzene, o-xylene, MTBE
LEACHATE (simulated leachates derived from soil samples)		
10	10:1 eluate preparation	
10	Leachable Metals	(As, B, Ca, Cd, Cr(III), Cr(VI), Cu, Pb, Hg, Ni, Se, V, Zn)
10	Leachable PAH (USEPA 16)	
10	Leachable TPH CWG C5-C44	
10	Leachable Phenol Monohydric Low Level	
10	Leachable Cyanide (Total & Free)	
10	Leachable ammoniacal nitrogen	
10	pH & electrical conductivity (leachate)	
10	Dissolved Organic Carbon	
10	Other Inorganics	Sulphur, Sulphide, Sulphate, Thiocyanate
10	VOCs	Benzene, Toluene, Ethylbenzene, p&m-xylene, o-xylene, MTBE
SURFACE WATER		
8	Leachable Metals	(As, B, Ca, Cd, Cr(III), Cr(VI), Cu, Pb, Hg, Ni, Se, V, Zn)
8	Leachable PAH (USEPA 16)	
8	Leachable TPH CWG C5-C44	
8	Leachable Phenol Monohydric Low Level	
8	Leachable Cyanide (Total & Free)	
8	Leachable ammoniacal nitrogen	
8	pH & electrical conductivity (leachate)	
8	Dissolved Organic Carbon	
8	Other Inorganics	Sulphur, Sulphide, Sulphate, Thiocyanate
8	VOCs	Benzene, Toluene, Ethylbenzene, p&m-xylene, o-xylene, MTBE

3.4 CONTAMINATION INVESTIGATION

3.4.1 CONTAMINATION OBSERVATIONS

No visual or olfactory evidence of contamination was encountered on Site and no visual evidence of potential asbestos-containing materials were recorded.

3.4.2 CHEMICAL ANALYSIS

Soil samples were selected for soil chemical analysis to assess potential contamination risks to human health, infrastructure, and the water environment. Testing comprised a suite of contaminants established from the desk-based assessment to potentially present within the Site. Surface water samples were also selected to assess potential contamination risks and to gauge any effect the site may have on the water environment.

The analysis suite and chemical analysis results are given in Appendix A.

3.4.3 GAS MONITORING

In the absence of a significant source of ground gas identified during the desk study or the intrusive investigation, and considering the absence of sensitive human receptors, gas and groundwater monitoring were not undertaken.

4 GROUND MODEL

4.1 STRATIGRAPHIC MODEL

The ground conditions are generally consistent across the Site based in both 2024 GI and historical GI results. The strata encountered by the GI included Topsoil overlying Made Ground overlying Glacial Till overlying Limestone. Limestone was encountered in two historic rotary cores RC01 and RC02R. A typical description of the soil materials encountered beneath the entire Site based on the 2024 GI is presented in Table 4-1, and the geotechnical cross-section of the exploratory holes is shown in Figure 4-1.

Moreover, Figure 4-2 and Figure 4-3 present cross sections based on the exploratory holes from IGSL-Site 1 and IGSL-Site 2. Due to the lack of ground-level information in some of the exploratory holes, the cross sections are presented as meters below ground level. These cross-sections demonstrate consistency in stratigraphy across 2024 GI and historic results. Consequently, the in-situ and laboratory tests from historic ground investigations were analysed alongside the 2024 GI campaign to establish accurate characteristic geotechnical parameters.

Table 4-1: Description of the soil material encountered across the Site

Soils	Description	Thickness (m)		Dept to top (mBGL)
		Max.	Min.	
Topsoil	-	0.20	0.05	0.00
Made Ground	Reworked soft to very stiff CLAY and GRAVEL with fragments of red brick, ceramics, roots and plastic. Gravel is subangular to coarse/ Angular fine to coarse GRAVEL of various lithologies.	2.40	0.20	0.00-0.20
Cohesive Glacial Till	Soft to very stiff dark brown slightly sandy slightly gravelly CLAY/SILT with low to medium cobble content. Sand is fine to coarse. Gravel is angular to coarse of sandstone and limestone. Cobbles are subangular.	15.00	0.20	0.20-1.10
Granular Glacial Till	Angular coarse GRAVEL and COBBLES with clay.	Unproven	0.10	2.60-3.00
Limestone	Strong to very strong, thickly to thinly bedded, light blue/grey fine-grained LIMESTONE, fresh to slightly weathered.	Unproven	3	7.50*

**RC01R, RC02R Historic GI - IGSL Site 2*

Figure 4-1: Stratigraphic model – 2024 GI with elevation (top) and depth (bottom)

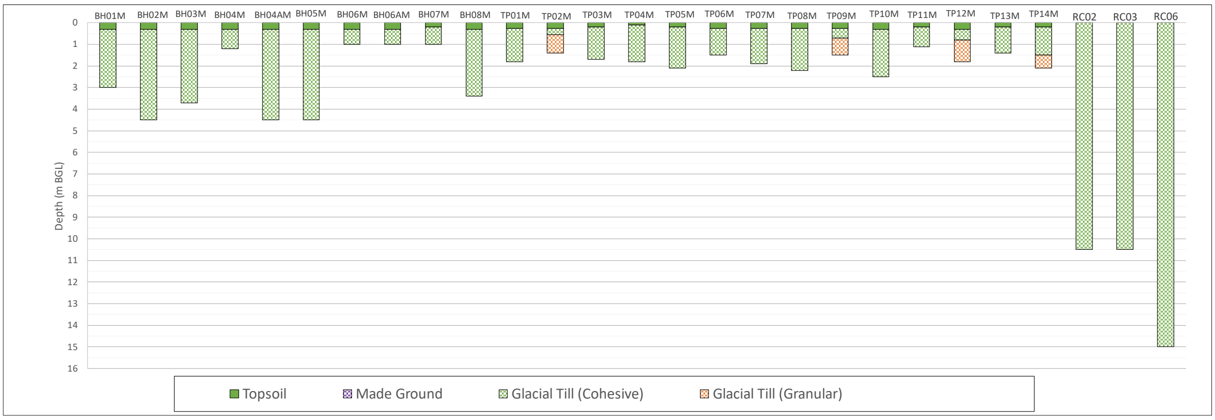


Figure 4-2: Stratigraphic model – IGSL Site 1

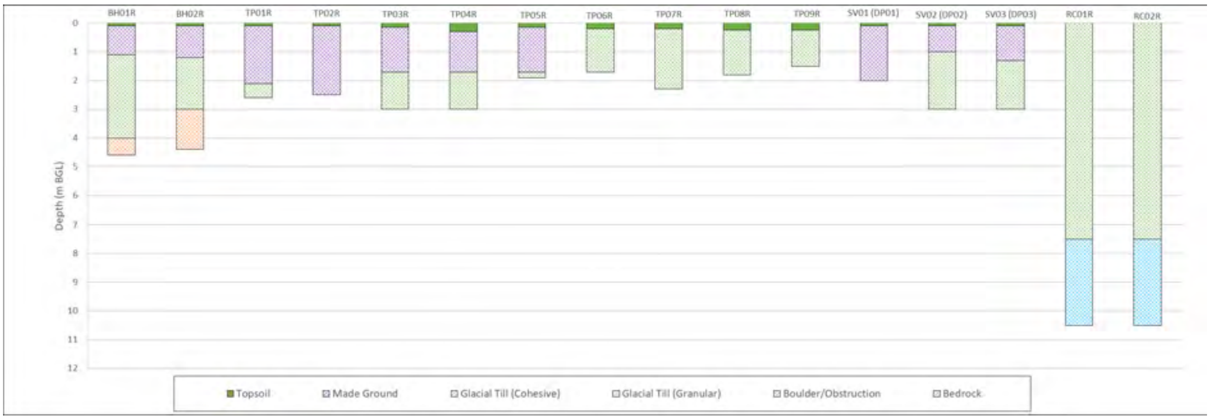


Figure 4-3: Stratigraphic model – IGSL Site 2

4.2 GROUND WATER CONDITIONS

During the Causeway site investigation, water strikes were observed in test pit TP10 at a depth of 2.70m, while test pit TP09 showed signs of moisture below 2.20m. The remaining exploratory holes did not yield any notable groundwater strikes during the drilling or excavation processes. It is important to note that the casing used to support borehole walls during drilling could potentially have sealed off any water-bearing layers. Therefore, the possibility of encountering groundwater during future excavation works should not be disregarded.

Groundwater conditions varied across the historic investigated sites. At IGSL - Site 1, water seepage was observed in only one trial pit, TP06, at a depth of 1.0m BGL. In contrast, IGSL - Site 2 exhibited more frequent water occurrences, with water recorded in multiple trial pits: TP01R, TP06R, TP08R, and TP09R. The water strikes at IGSL - Site 2 ranged from 0.5m BGL in TP09R to 2.1m BGL in TP01R.

Furthermore, two standpipes were installed in rotary core boreholes (RC01R and RC02R) at IGSL - Site 2 to facilitate groundwater monitoring. Standpipe water level measured 5 minutes after the completion of drilling operations was recorded at 6.55 m BGL and 4.85m BGL at RC01R and RC02R boreholes, respectively.

It should be noted that continuous groundwater monitoring has not been conducted at either site and groundwater levels usually vary due to seasonal and/or other effects and may at times differ to those recorded during the investigation. Therefore, a conservative groundwater level is recommended for design to mitigate against possible increases in porewater pressures or reductions in design resistances. As a minimum, the design groundwater levels should coincide with the upper-bound groundwater profile recorded near the proposed design element. For design purposes, a conservative groundwater level may be assumed to be at existing ground level, i.e. 0m BGL.

5 IN-SITU TESTS

5.1 STANDARD PENETRATION TESTING

Eight in-situ Standard Penetration Tests (SPT) were carried out within the boreholes completed by Causeway and 62 no completed by IGLS in two site investigation campaigns. The plots of the Causeway, IGSL- Site1&2 and combined data of uncorrected SPT-N values are presented in Figure 5-1 to Figure 5-3.

The summary of the statistics for uncorrected SPT N values recorded for soil strata is presented in Table 5-1. The SPT N value for the:

- Made Ground was encountered only in IGSL – Site 2 campaign. Made Ground across the Site varies from 2 blows to 50 blows for a 300mm penetration, where the value 50 is refusal. The SPT value of 50 was encountered in BH01R, suggesting that gravels (brick and flint) content is likely present within the stratum. Hence, the value of 50 is not considered to be representative of the stratum. The range of SPT-N values within the Made ground strata suggests the material is typically dense to medium dense.
- Glacial Till (Cohesive) layer across the Site is similar in all three datasets and varies from 4 blows to 48 blows for a 300mm penetration with an average of 19 in Causeway and 25, approximately, in IGSL- Site 1&2. Lower values were recorded at a shallow depth of 1.2m BGL suggesting the top of Glacial Till (Cohesive) is softer and increases with the depth. The range of SPT-N values within the layer suggests the material is stiff to very stiff.
- The SPT-N value for the Glacial Till (Granular) encountered in Causeway and IGSL – Site 2 dataset was refusals.
- The combined dataset shows agreement in Glacial Till (Cohesive) SPT N results. IGSL – Site1&2 follow the trend from 2024 Gi which proves that the stratum across the GI's is the same (Figure 5-3).

Table 5-1: Summary of SPT results

Stratum	Ground model	Count	Min	Average	Max	No. of refusals
Made Ground	Causeway (2024)	-	-	-	-	-
	IGSL- Site 1	-	-	-	-	-
	IGSL -Site 2	2	12	22	33	1
Glacial Till (Cohesive)	Causeway (2024)	6	4	19	45	1
	IGSL- Site 1	47	6	26	47	27
	IGSL -Site 2	10	5	25	47	2

Stratum	Ground model	Count	Min	Average	Max	No. of refusals
Glacial Till (Granular)	Causeway (2024)	2	50	50	50	2
	IGSL- Site 1	-	-	-	-	-
	IGSL -Site 2	3	50	50	50	3

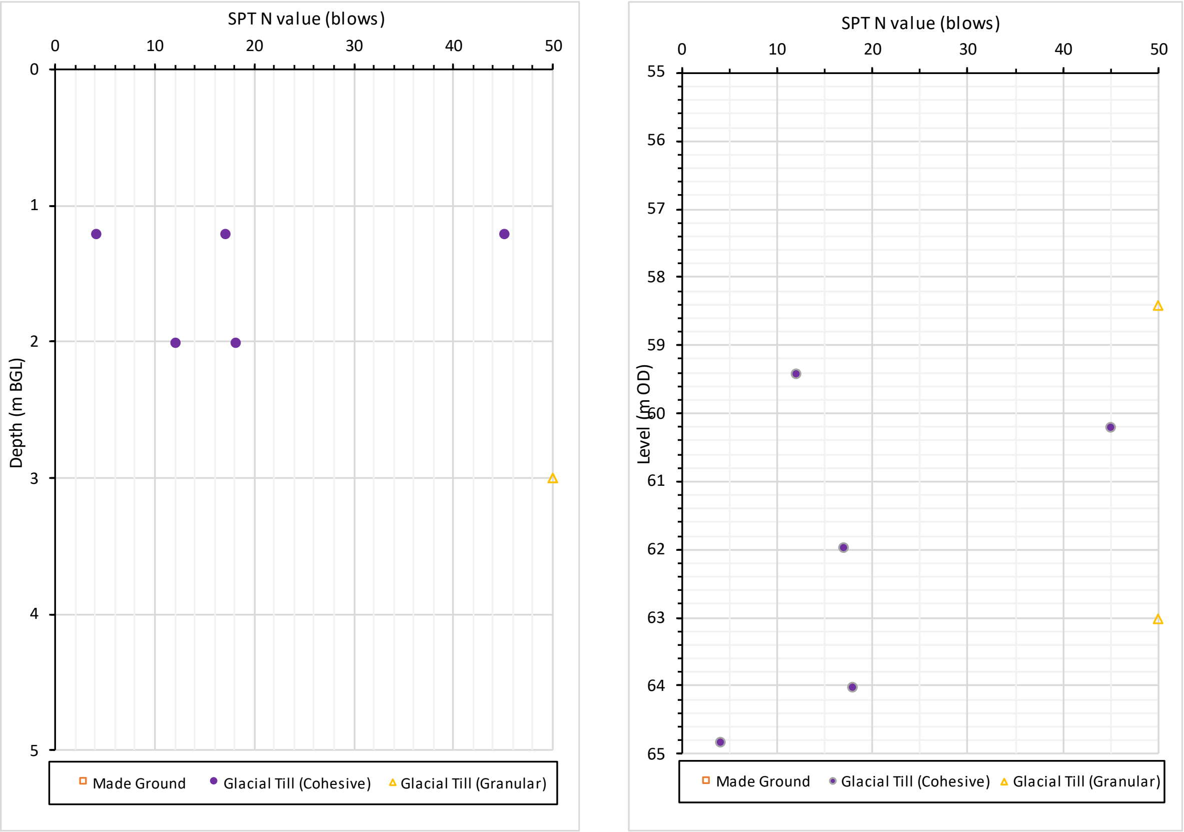


Figure 5-1: Uncorrected SPT N values – 2024 GI with depth (left) and elevation (right)

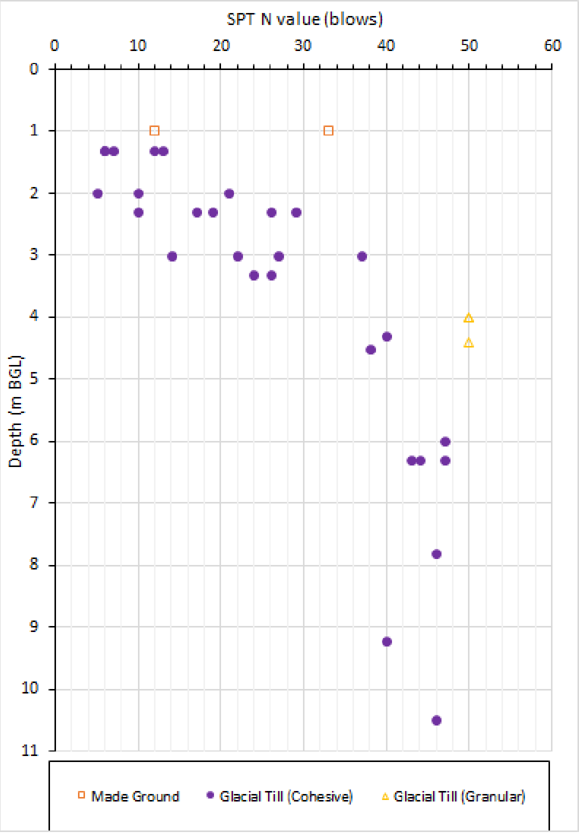


Figure 5-2: Uncorrected SPT N values – IGSL - Site1&2

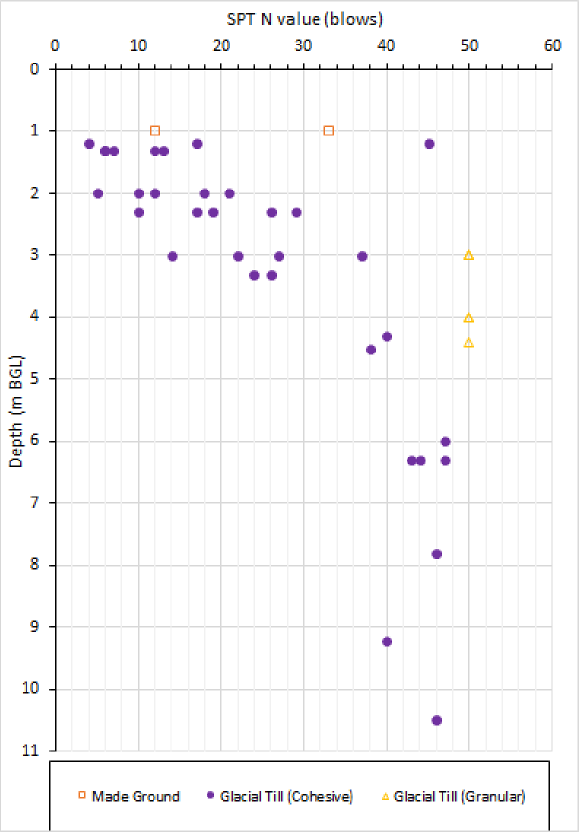


Figure 5-3: Uncorrected SPT N – all datasets

5.2 PLATE LOAD TESTS

Plate load tests (PLT) were performed at three locations across the Site using 450mm diameter plates at depths ranging from 0.5m BGL to 0.6m BGL with five equal loadings to a maximum pressure of approximately 280kPa followed by unloading in TP08, two loadings to a maximum of 86kPa followed by unloading in TP10 and four loading to a maximum of 203kPa followed by unloading in TP10A. The tests were performed to evaluate the subgrade reaction (K) modulus of the underlying strata and the equivalent California Bearing Ratio (CBR) value.

The results from plate load tests conducted across the Site are presented in Table 5-2. Subgrade reaction modulus (K) value is 29mPa/m for Made Ground and for Glacial Till (Cohesive) ranging between 12MPa/m and 13MPa/m.

Table 5-2: Plate bearing test results

Test ID	Ground elevation (mOD)	Test depth (m)	Underlying soil	Modulus of subgrade reaction (MPa/m)	Equivalent CBR
TP08	62.81	0.6	Made Ground – Firm slightly sandy gravelly CLAY with fragments of brick and tile	29.2	1.5%
TP10	61.31	0.5	Glacial Till (Cohesive)- Firm dark grey slightly sandy slightly gravelly CLAY with a few rootlets and high organic odour	12.1	0.3%
TP10A	61.31	0.6	Glacial Till (Cohesive)-Slightly sandy slightly gravelly CLAY	13.4	0.4%

5.2.1 SOAKAWAY TESTS

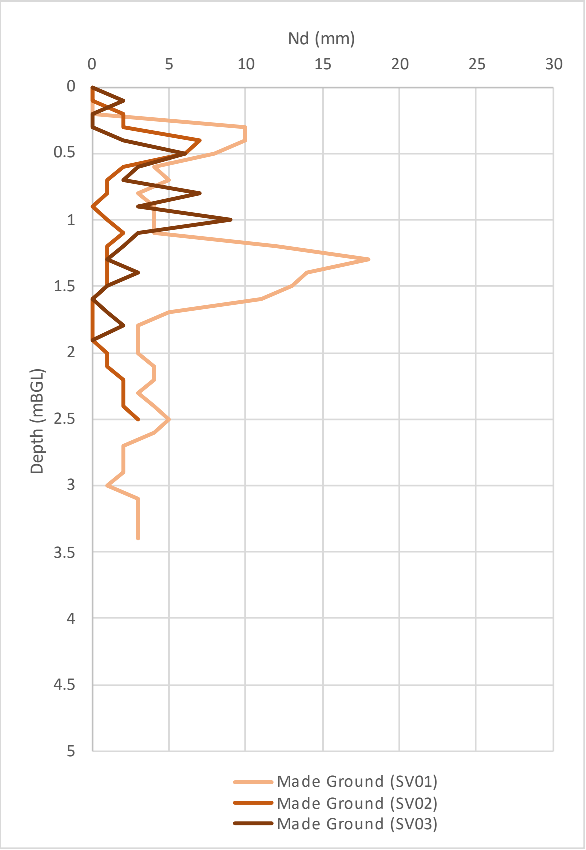
One infiltration test was performed following BRE Digest 365 ‘Soakaway Design’ in the Causeway SI, and fours tests in the IGSL – Site 1. The dataset from IGSL- Site 2 was omitted due to its considerable distance from the site, making it less relevant for our analysis. The infiltration rates obtained from soakaway tests across the Site are presented in Table 5-3. These results suggest that the shallow subsurface material is of low permeability.

Table 5-3: Soakaway test results

Test ID	Site Investigation	Ground elevation (mOD)	Pit dimensions (m)			Infiltration rate	
			Depth	Width	Length	(m/min)	(m/sec)
TP10	Causeway (2024)	61.3	1.5	0.7	1.6	Infiltration rate (q) is very low	
SA01	ISGL – Site 1	71.9	1.3	0.5	2.0	0.00173	2.89E-05
SA02	ISGL – Site 1	75.6	1.6	0.5	2.0	0.00023	3.83E-06
SA03	ISGL – Site 1	83.6	1.6	0.5	2.0	5.3E-05	8.85E-07
SA04	ISGL – Site 1	79.5	1.3	0.5	1.5	0	0
SA01R	IGSL – Site 2	55.7	1.7	0.5	1.7	0	0
SA02R	IGSL – Site 2	56.0	1.3	0.7	1.5	4E-05	6.67E-07
SA03R	IGSL – Site 2	57.1	1.7	0.5	1.5	0	0
SA04R	IGSL – Site 2	57.0	1.5	0.7	1.6	0.00102	1.69E-05

5.3 DYNAMIC PROBE RECORDS

As part of the IGSL-Site 2 campaign, three heavy dynamic probes (DPH) were conducted to a maximum depth of 3.8 meters using 50kg hammer with a fall height of 500mm and penetration increments of 100mm.The number of blows required to penetrate 100 mm (N_d) was recorded along the full depth of penetration by the DP. Ten dynamic probes were advanced using a window sampling at same as DPs, to provide supplementary coverage of the site between borehole locations. The N_d values for the Made Ground were recommended to be interpreted between 0 and 18 blows per 100mm penetration which is soft to very stiff material. For Glacial Till (Cohesive) N_d values ranging between 9 to 27 which corresponds to firm to very stiff material ([10] ,[22]). The results of the dynamic probes are presented in Figure 5-4.



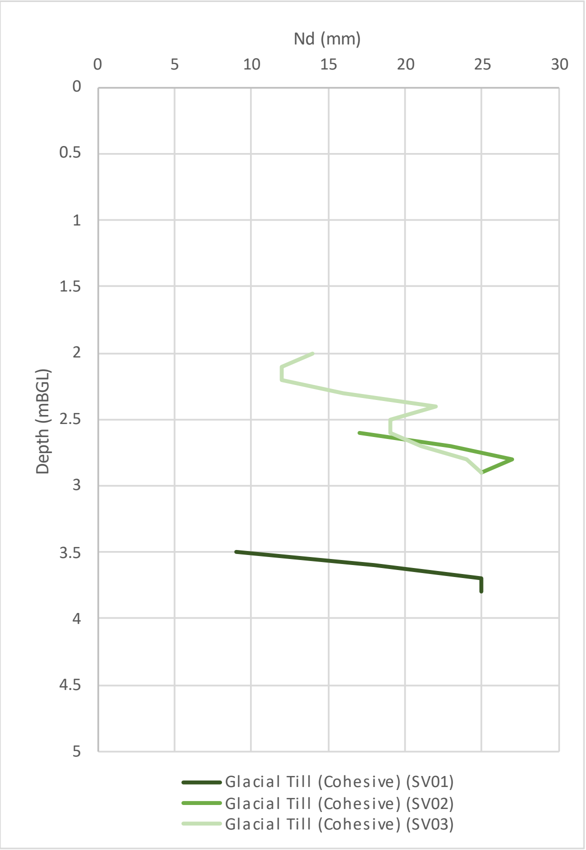


Figure 5-4: Dynamic Probes results for Made Ground (left) and Glacial Till (right) - IGSL Site 2

6 LABORATORY TESTS

6.1 CLASSIFICATION TESTS

6.1.1 PARTICLE SIZE DISTRIBUTION

Particle size distribution (PSD) classification testing was completed by Causeway on 9 no. soil samples recovered from the Made Ground and Glacial Till (Cohesive). Additional 9no. of tests were analysed from the IGSL- Site 1&2. The PSD plots for each of strata and combined datasets are presented in Figure 6-1, Figure 6-3, and Figure 6-5. In addition, the percentage of soil constituents obtained from the PSD results are illustrated in Figure 6-2, Figure 6-4, and Figure 6-6.

From the 2024 GI PSD results, the Made Ground stratum was determined to consist primarily of sand-sized particles, with silt being secondary and more than 20% percentages of gravel. Made ground is characterised as composite /mixed soil consists of 34% of fines with almost equal value of sand (42%) and gravel (24%) described as very silty SAND according to BS5930:2015. It is generally recognised that the properties of a composite soil containing a wide range of particle sizes are dictated by the finer particles, the coarser particles often simply acting as a filler in a finer matrix. Fine content is close to the boundary (i.e. 35%) between fine and coarse soil according to the British Soil Classification System (BSCS) [25] . Thus, for design purposes, Made Ground stratum is considered as cohesive soil.

Glacial Till (Cohesive) consist of similar content like Made Ground – primarily sand and silt content but with less than 20% value of gravel.

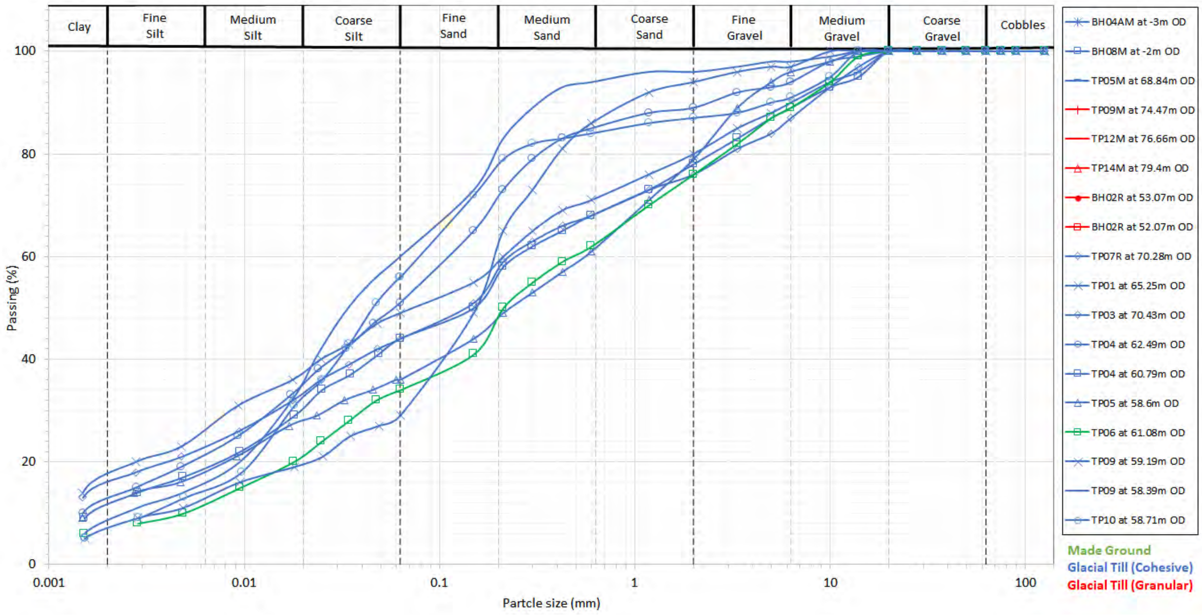


Figure 6-1:PSD results of Glacial Till (Cohesive) and Made Ground – 2024 GI

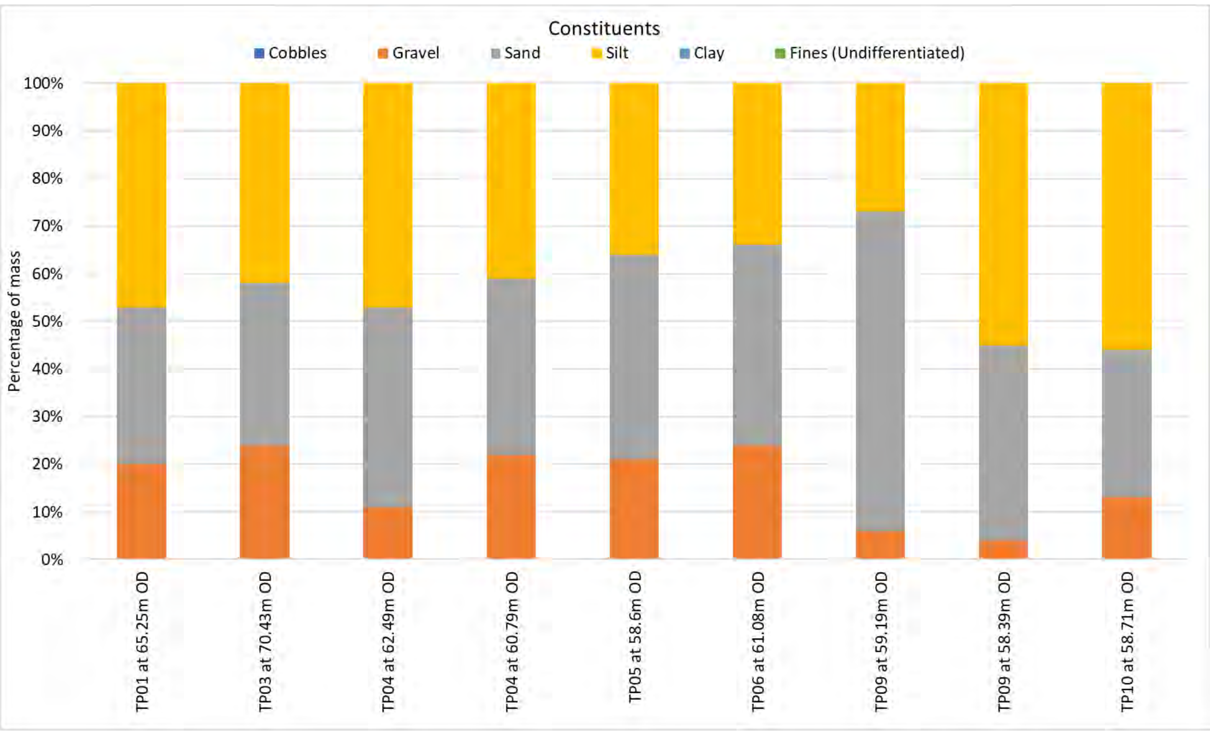


Figure 6-2: Percentage of soil constituents – 2024 GI

The PSD results from the IGSL – Site1&2 dataset, covers the characterisation of Glacial Till (Cohesive) and Glacial Till (Granular). Glacial Till (Cohesive) consists of 40% to 55% of fines with almost equal value of sand and gravel. The sample BH02R stands out as significantly different from other samples, containing an unusually high proportion of over 70% gravel and approximately 30% cobbles. This anomalous composition suggests that the logger may have encountered a localized lens of gravel or the top of the Glacial Till (Granular), or alternatively, there might have been an error in the sampling process.

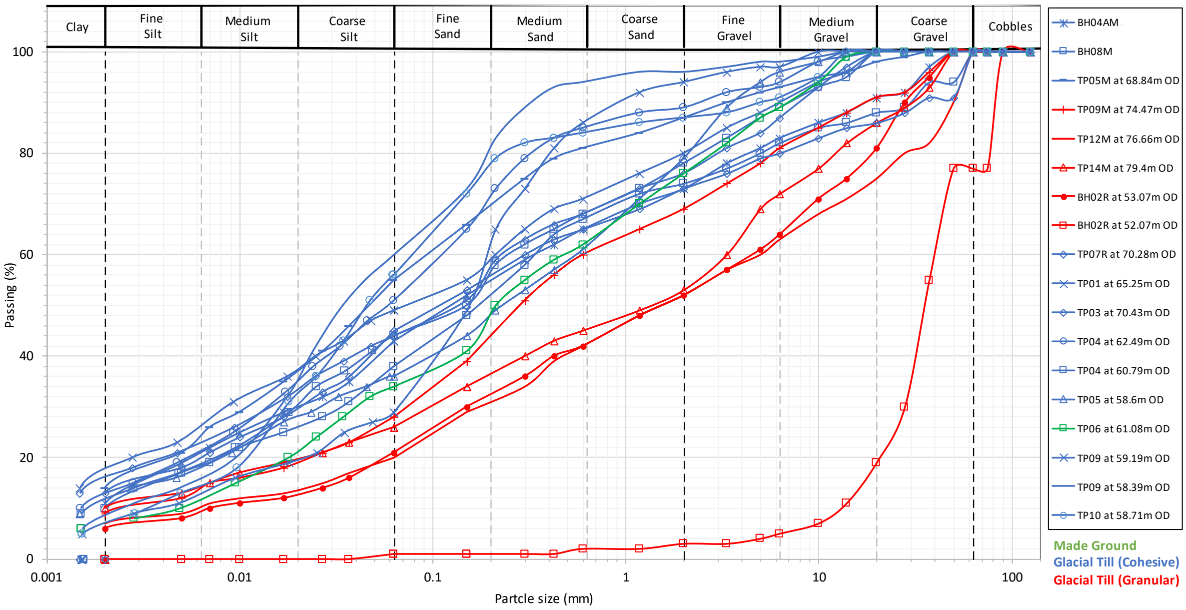


Figure 6-3: PSD results of Glacial Till (Cohesive) and Glacial Till (Granular) – IGSL - Site 1&2

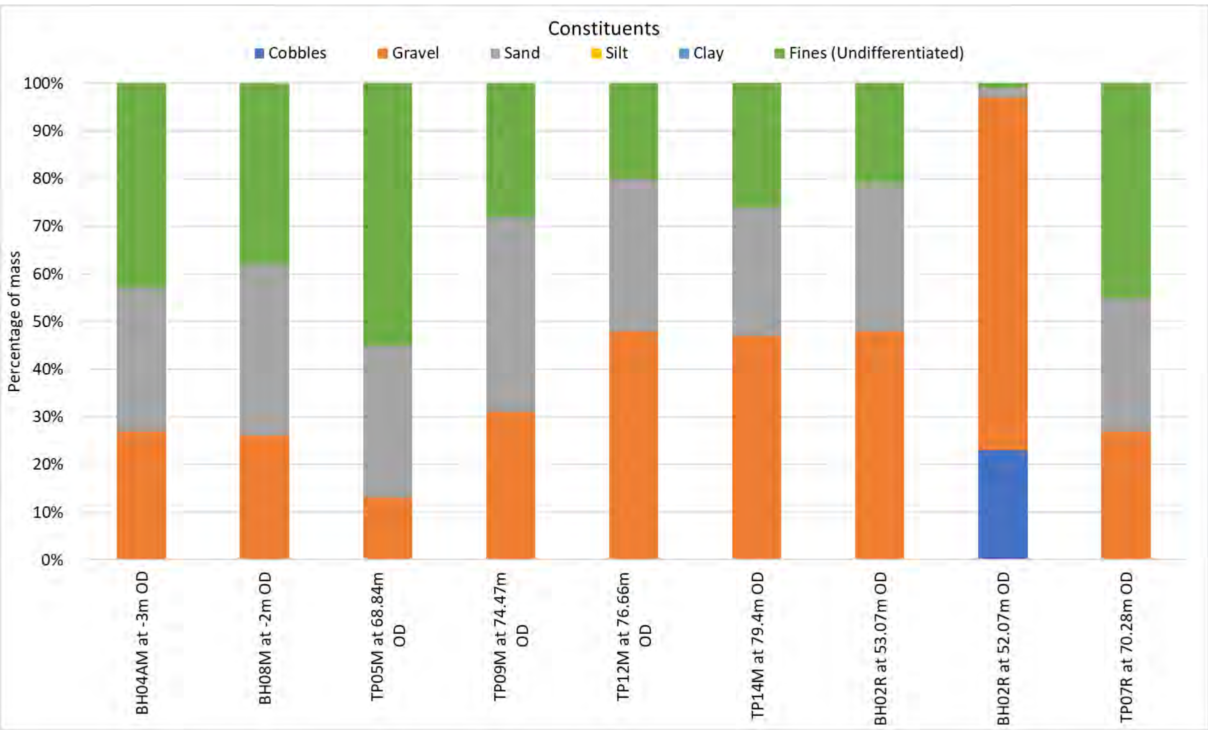


Figure 6-4: Percentage of soil constituents – IGSL – Site1&2

The recent and historic datasets show general agreement in soil composition, with the notable exception that in the IGSL results indicate a higher proportion of silt particles compared to the recent findings.

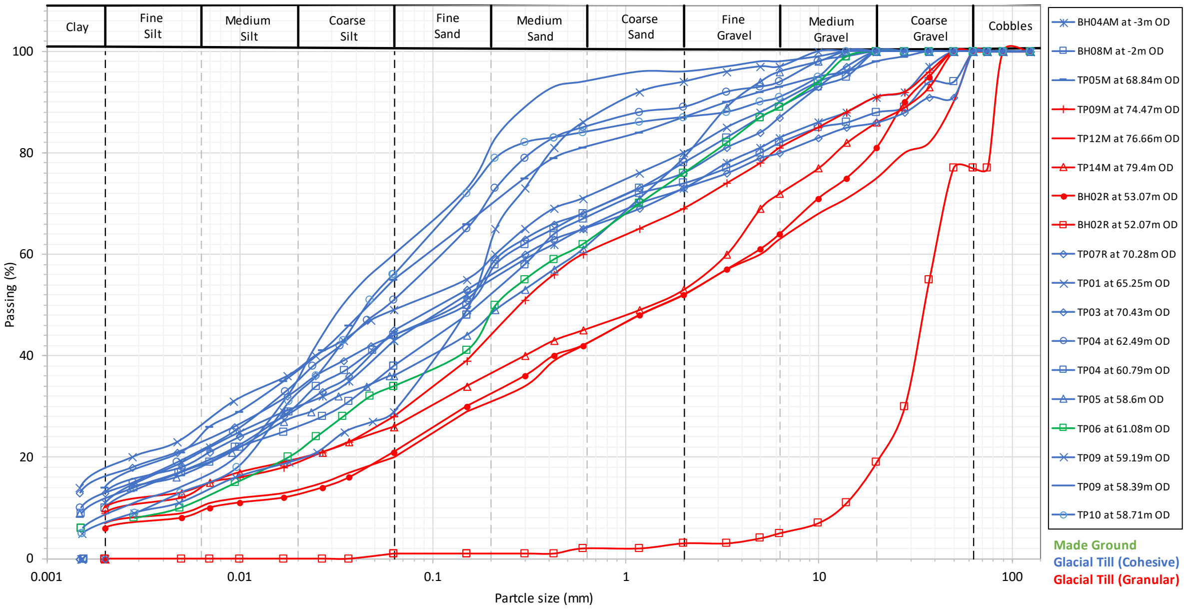


Figure 6-5: PSD results of Made Ground, Glacial Till (Cohesive), and Glacial Till (Granular) – all datasets

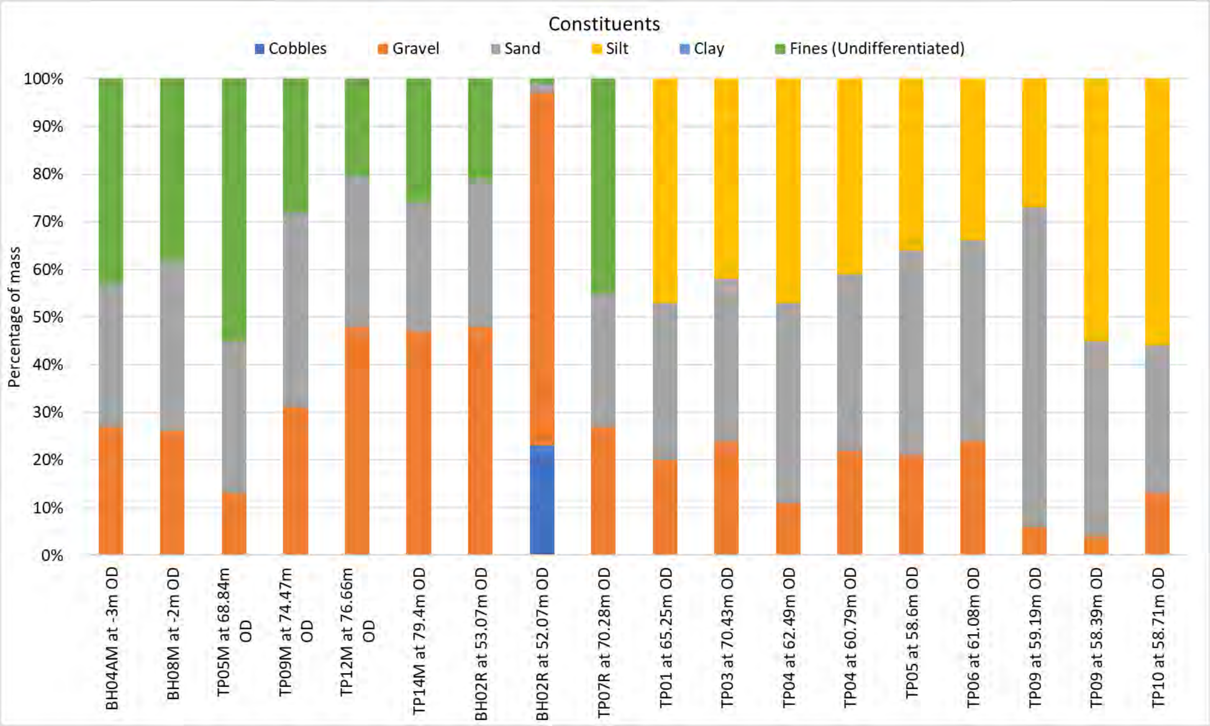


Figure 6-6: Percentage of soil constituents – all dataset

6.2 ORGANIC CONTENT

Organic content testing was completed on five samples recovered from Glacial Till (Cohesive) strata encountered across the Site during the 2024 GI. Organic material results were found in two samples and are summarised in Table 6-1 and illustrated in Figure 6-7. The results suggest that the sample from TP04 contains very low percentages of organic matter and is thus designated as inorganic (i.e. <2%) in accordance with BS 5930:2015, and sample from TP10 can be described as soil with medium organic content. The elevated percentage of organic content observed in some samples may be attributed to their proximity to the topsoil layer. Topsoil typically contains a higher concentration of organic matter due to the presence of decomposed plant and animal materials, as well as microbial activity. As sampling locations approach the surface or interface with the topsoil, it's not uncommon to encounter increased levels of organic content.

Additionally, organic tests were conducted in the historic GI. Eleven samples were checked from Made ground and Glacial Till (cohesive). Organic content in these samples ranged from 2.8% to 7.8%, with one high value of 10% encountered at 0.8m BGL within the Glacial Till (cohesive).

Table 6-1: Summary of organic content results

BH ID	GI campaign	Depth	Description	Organic content (%)
TP04	2024 GI	0.5	Gravely sandy SILT with low cobble content.	1.2
TP10	2024 GI	0.5	Slightly sand slightly gravelly CLAY with a few rootles and high organic odour.	9.0
BH01	IGSL – Site 1	0.5	Firm brown SILT/CLAY with occasional gravel	5.0
BH03	IGSL – Site 1	0.5	Soft to firm brown sandy SILT/CLAY with occasional gravel	1.5
BH07	IGSL – Site 1	0.8	Very stiff brown sandy SILT/CLAY with some gravels and cobbles	10
TP04	IGSL – Site 1	0.5	Sandy very gravelly CLAY with high cobbles and low boulders content.	3.1
TP08	IGSL – Site 1	0.8	Firm to stiff sandy very gravelly CLAY with high cobbles and boulders content.	2.8
TP13	IGSL – Site 1	0.6	Firm to stiff sandy very gravelly CLAY with high cobbles and boulders content.	4.7
BH01R	IGSL – Site 2	0.5	Made Ground - Soft brown SILT/CLAY with occasional fine gravel	7.8
BH02R	IGSL – Site 2	1.0	Made Ground- brown gravelly Clay fill	3.5
TP01R	IGSL – Site 2	0.6	Made Ground – gravelly Clay, angular stones, red bricks, roots, timber, plastic, concrete	5.3
TP02R	IGSL – Site 2	2.0		4.0
TP05R	IGSL – Site 2	0.5		3.1

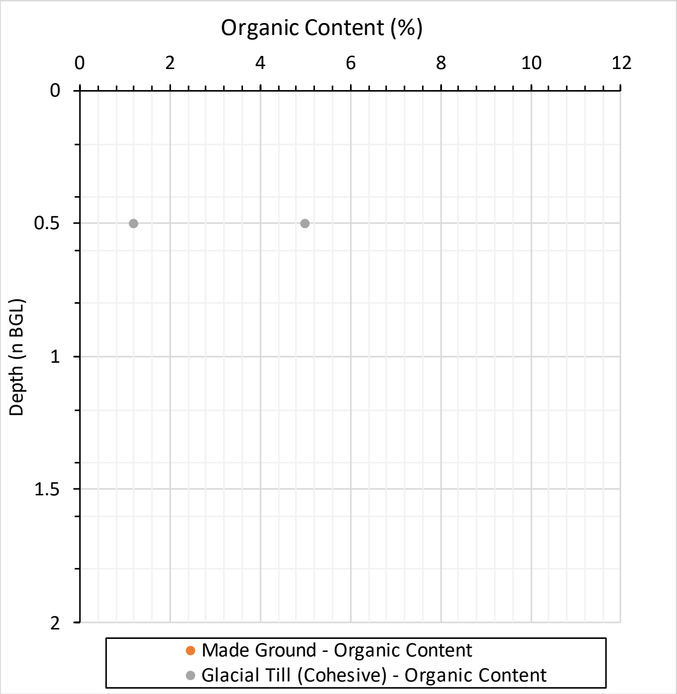


Figure 6-7: Organic content- 2024 GI

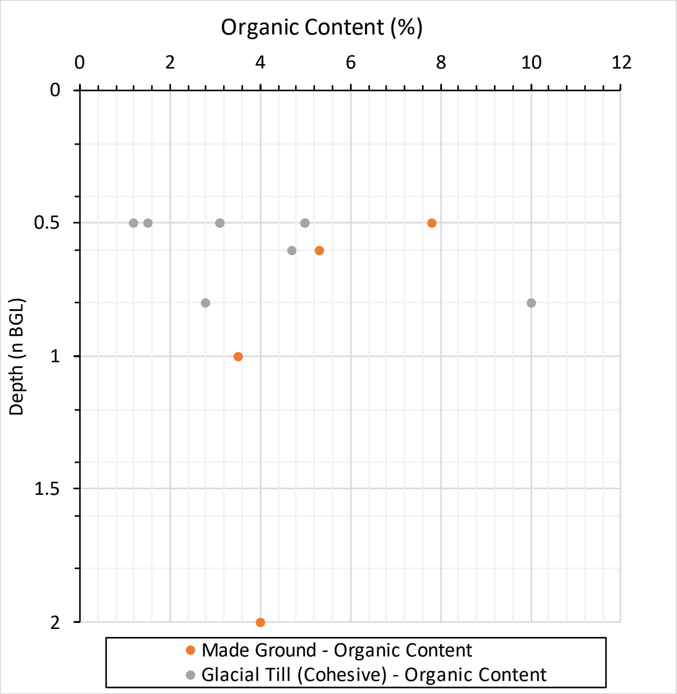


Figure 6-8: Organic content - all datasets

6.3 MOISTURE CONTENT

Causeway completed moisture content (MC) testing on 10 no. soil samples recovered from the Made Ground and Granular Till (Cohesive & Granular) overburden strata encountered across the Site. The MC values measured during the geotechnical laboratory testing are illustrated in Figure 6-9 and the results are summarised in Table 6-2. The MC of the Glacial Till (Cohesive) (6 No. samples) was measured between 15% and 42%, while in the historic GI the moisture content was raging from 12%-26%. The low MC measurement (i.e. 12%) could be due to sample recovery/storage and thus excluded from the average MC value. High MC (33%, 42%) was measured in samples encountered from TP9 and TP10 where water strikes occurred (2024 GI). Moisture content (MC) for Made Ground is consistent across GIs and raging from 16%-18%. Only one record of 13% MC was reported for Glacial Till (Granular). Figure 6-9 presents the MC values for 2024 GI and all datasets together.

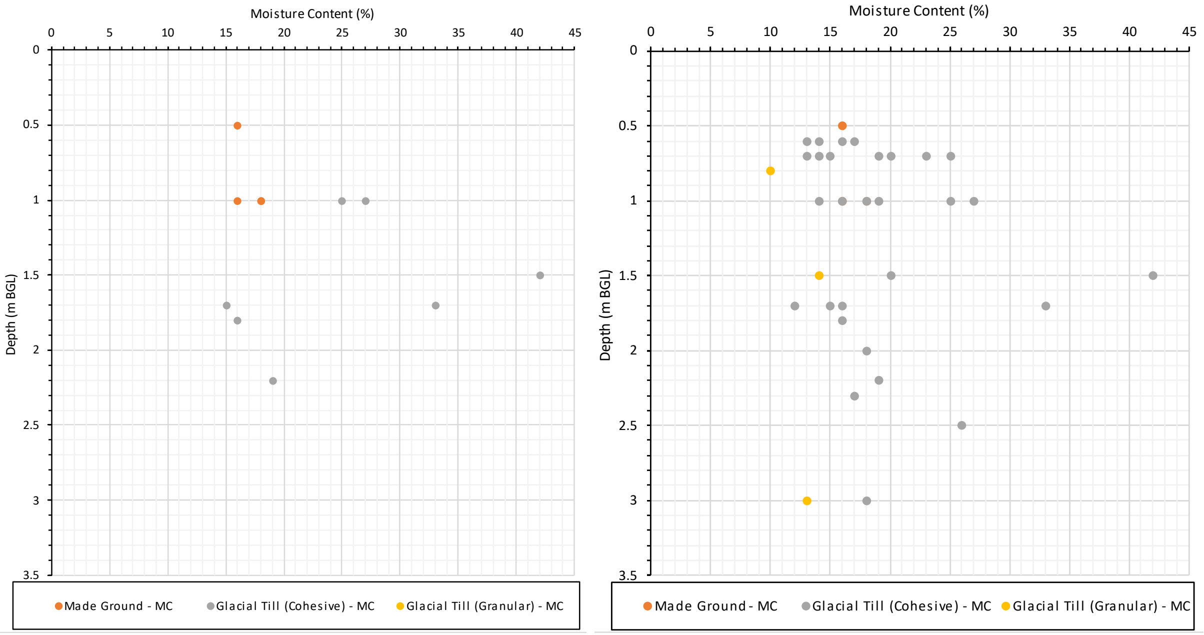


Figure 6-9: Moisture Content – 2024 GI (left) and all dataset (right)

Table 6-2: Moisture content summary

Stratum	Moisture content (%)			
	Count	Min	Average	Max
Made Ground	5	16	18	20
Glacial Till (Cohesive)	27	12	19	42
Glacial Till (Granular)	4	10	12	14

6.4 ATTERBERG LIMITS

Atterberg limit testing was carried out on 7 No. soil samples recovered from exploratory holes spread across the Site and 16 no. samples from the historic GI. The Atterberg limit testing was completed to determine the Liquid Limit (LL) and Plastic Limit (PL) values for each cohesive soil type, with MC measured on the same samples. The MC, LL and PL plot was produced for each stratum encountered in the 2024 GI and combined datasets in Figure 6-10 and Figure 6-11. A summary of the statistics for the Atterberg limits test results, including the minimum, average and maximum values, are presented in Table 6-3.

Table 6-3: Summary of Liquid limit, Plastic limit and Plasticity Index test results

Stratum	Liquid Limit (%)			Plastic Limit (%)			Plasticity index (%)			Moisture content (%)		
	Min	Ave	Max	Min	Ave	Max	Min	Ave	Max	Min	Ave	Max
Made Ground	39	47	55	16	16	16	23	23	23	16	18	20
Glacial Till (Cohesive)	28	35	45	13	18	25	10	17	27	12	19	42
Glacial Till (Granular)	32	32	32	NP	NP	NP	NP	NP	NP	10	12	14

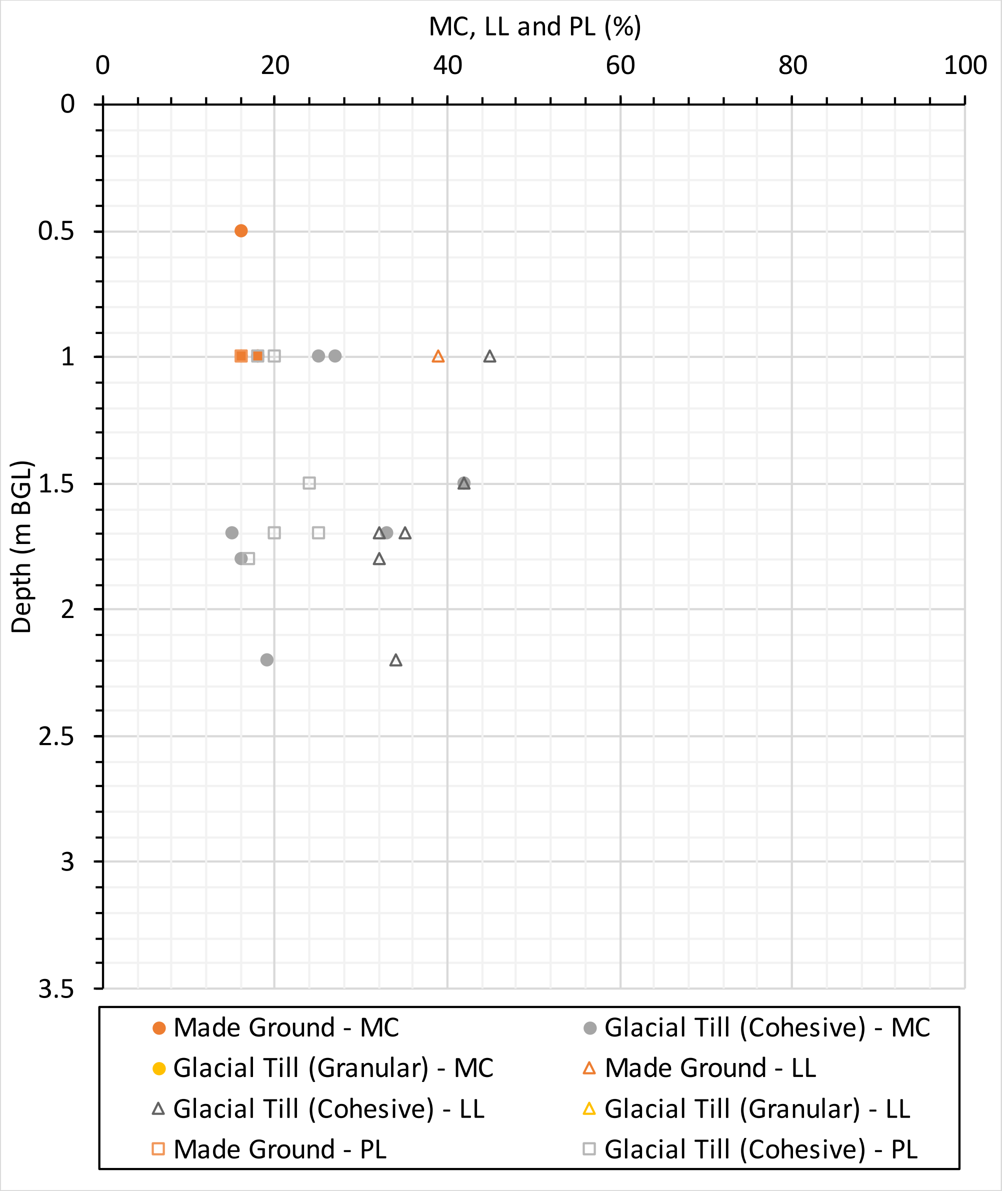


Figure 6-10: Atterberg Limits results – 2024 GI

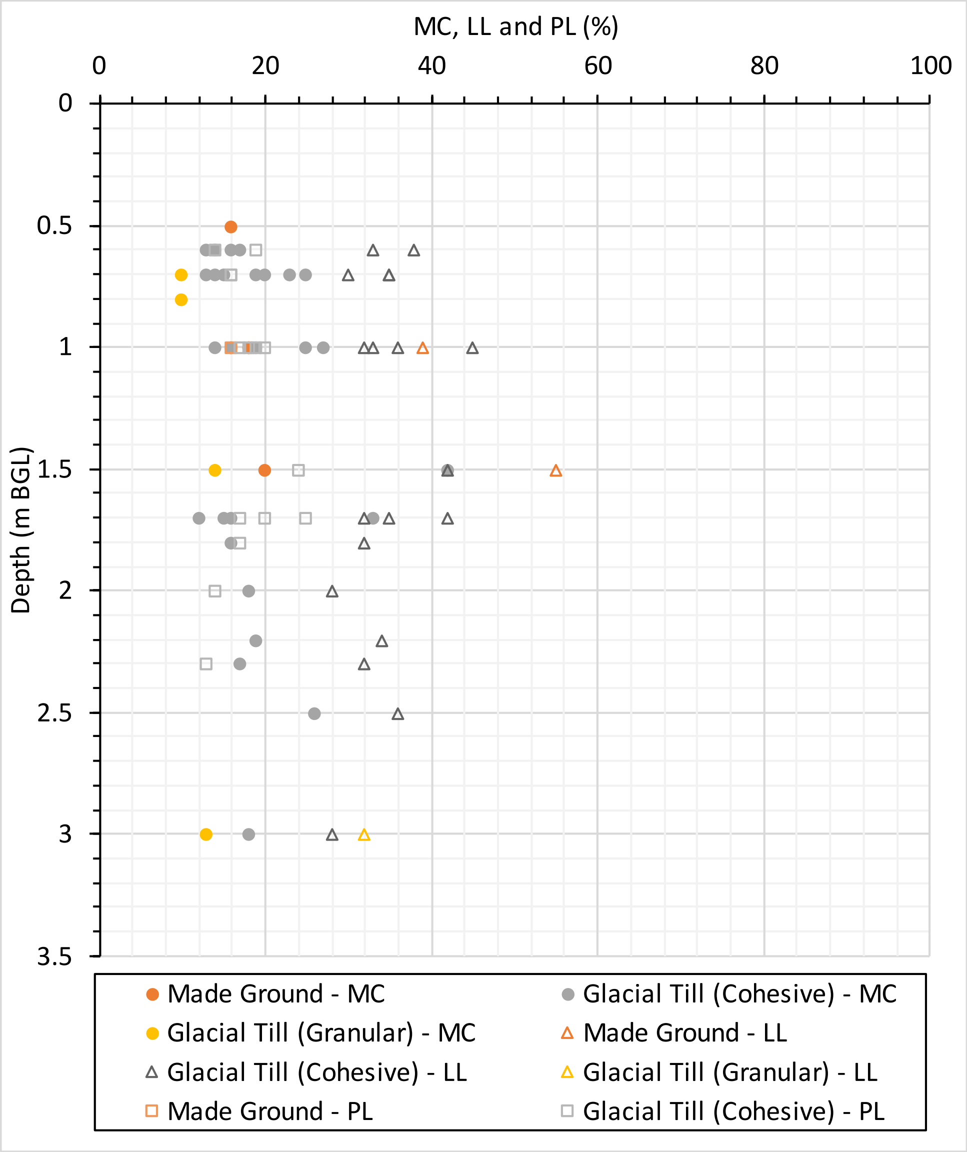


Figure 6-11: Atterberg Limits results - all data datasets

The BS 5930:2015 plasticity chart, which assesses the material behaviour by plotting the LL of each material against the Plasticity Index (Ip) of the same soil sample, is shown in Figure 6-12. The Ip of a soil sample equals the difference between the LL and PL. Each data point is then compared to the A-Line, which distinguishes between clays and silts.

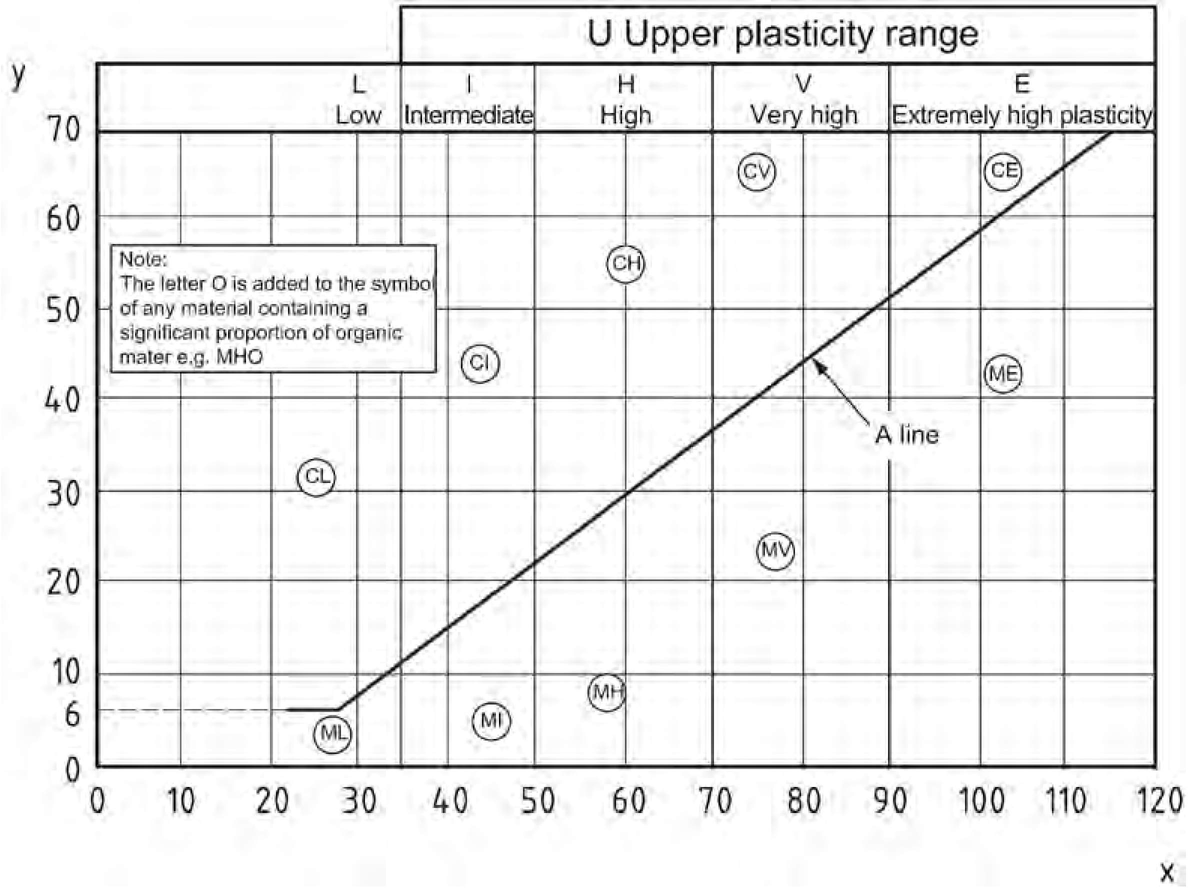


Figure 6-12: BS5930:2015 plasticity chart

For the Made Ground stratum, the moisture contents (MC) of the samples were typically closer to the PL value than the LL material. This indicates that this material is likely of medium or high strength at its natural moisture content with low compressibility. The I_p value of the Made Ground was calculated to be 15%, as shown in the plasticity charts Figure 6-13 for 2024 GI and Figure 6-14 for all datasets. The LL and I_p combinations of the Made Ground suggest the cohesive part within the material is low plasticity clay.

For the Glacial Till (Cohesive) stratum, the moisture content values were typically between the measured LL and PL values but closer to the PL than the LL. This indicates that the material is likely high strength with low compressibility, which agrees with the SPT results. The I_p values of the Glacial Till (Cohesive) were calculated to range between 10% and 27%, as shown in the plasticity charts. The LL and I_p combinations suggest the cohesive material is low to intermediate plasticity clay.

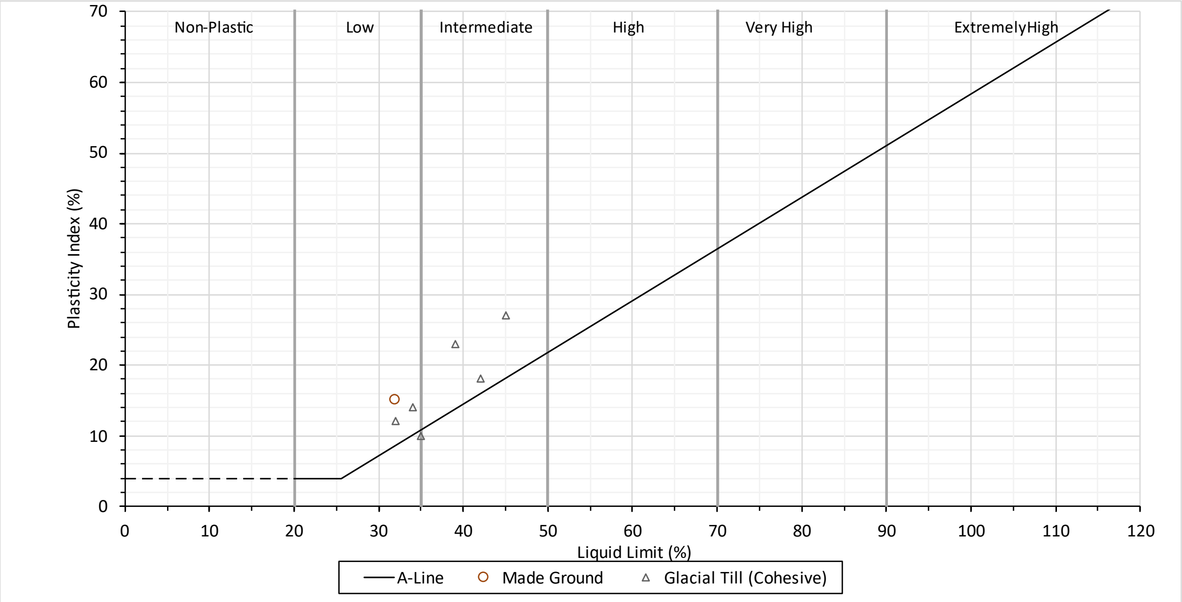


Figure 6-13: BS 5930:2015 plasticity chart – 2024 GI

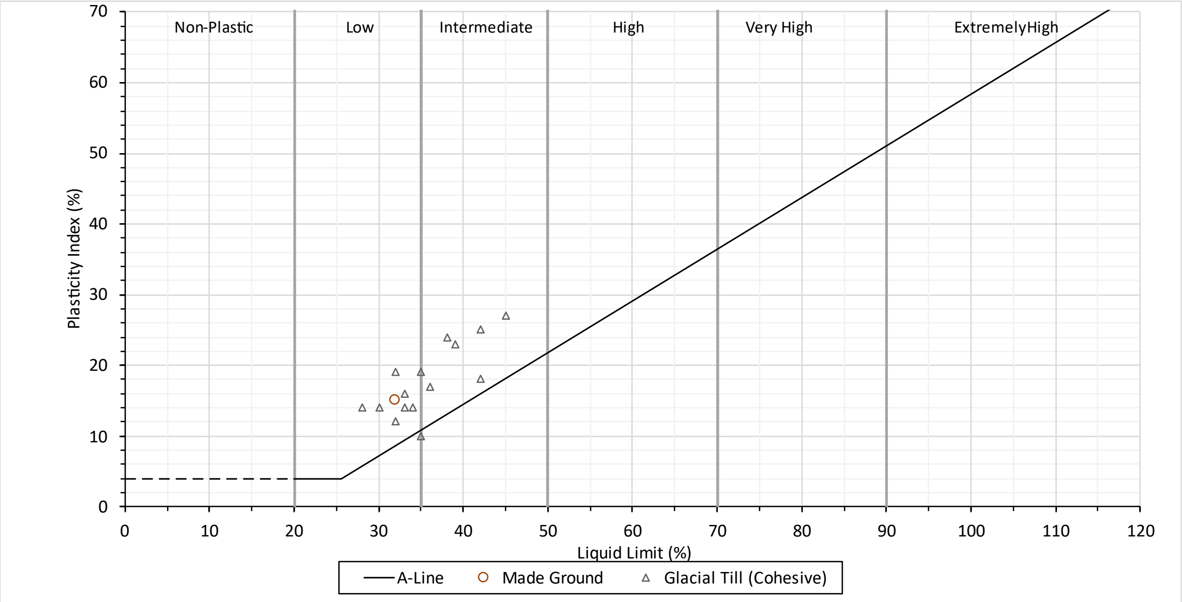


Figure 6-14: BS 5930:2015 plasticity chart –-all datasets

6.5 COMPACTION TESTING

6.5.1 OPTIMUM MOISTURE CONTENT VERSUS MAXIMUM DRY DENSITY

10 no. Dry Denisty/Moisture Content Relationship test have been carried out by IGSL. The test results show the correlation between the water content in a soil sample and its corresponding dry density after compaction. The summary of results is presented Table 6-4.

Table 6-4: OMC vs. maximum dry density results

Location ID	Depth (m)	GI	Stratum description	Optimum Moisture Content (%)	Maximum Dry Density (Mg/m^3)
TP01	0.7	IGSL-Site 1	Glacial Till (Cohesive)	11.0	1.90
TP03	0.7	IGSL-Site 1	Glacial Till (Cohesive)	12.0	1.86
TP05	0.7	IGSL-Site 1	Glacial Till (Cohesive)	12.0	1.86
TP09	0.7	IGSL-Site 1	Glacial Till (Granular)	12.0	1.88
TP12	0.8	IGSL-Site 1	Glacial Till (Granular)	12.0	1.89
TP14	1.5	IGSL-Site 1	Glacial Till (Granular)	14.0	1.85
TP04R	1.7	IGSL- Site2	Glacial Till (Cohesive)	8.1	2.01
TP06R	0.7	IGSL- Site2	Glacial Till (Cohesive)	11.0	1.89
TP08R	0.7	IGSL- Site2	Glacial Till (Cohesive)	11.0	1.80
TP09R	0.6	IGSL- Site2	Glacial Till (Cohesive)	11	1.84

6.5.2 MOISTURE CONDITION VALUE

A series of determination of Moisture Condition Value (MCV) and Natural Moisture Content tests (MC) were conducted during the IGSL-Site 1&2 campaign. These two parameters are inversely proportional, with an increase in moisture content resulting in a reduction in the MCV.

Particularly, the natural moisture content for Glacial Till (Cohesive) ranges between 13% and 23% with an average of 15%, while the MCV ranges between 4.6 and 7.3 with an average of 6.3. The MCV value for Glacial Till (Granular) is between 6.8 and 7.8, with MC of 10 to 14 and an average of 11. The summary of results is presented in Table 6-6 and Figure 6-15.

Table 6-5: Moisture Condition Value summary

Location ID	Depth (m)	GI	Stratum description	Moisture Content (%)	MCV
TP03	0.6	IGSL-Site 1	Glacial Till (Cohesive)	13	7.3
TP05	0.7	IGSL- Site 1	Glacial Till (Cohesive)	13	6.8
TP09	0.7	IGSL- Site 1	Glacial Till (Granular)	13	6.8
TP12	0.8	IGSL- Site1	Glacial Till (Granular)	10	5.7
TP14	1.5	IGSL- Site1	Glacial Till (Granular)	14	7.8

Location ID	Depth (m)	GI	Stratum description	Moisture Content (%)	MCV
TP04R	1.7	IGSL - Site 2	Glacial Till (Cohesive)	16	5.4
TP06R	0.7	IGSL - Site 2	Glacial Till (Cohesive)	20	4.6
TP08R	0.7	IGSL - Site 2	Glacial Till (Cohesive)	23	5.7
TP09R	0.6	IGSL – Site3	Glacial Till (Cohesive)	17	6.8

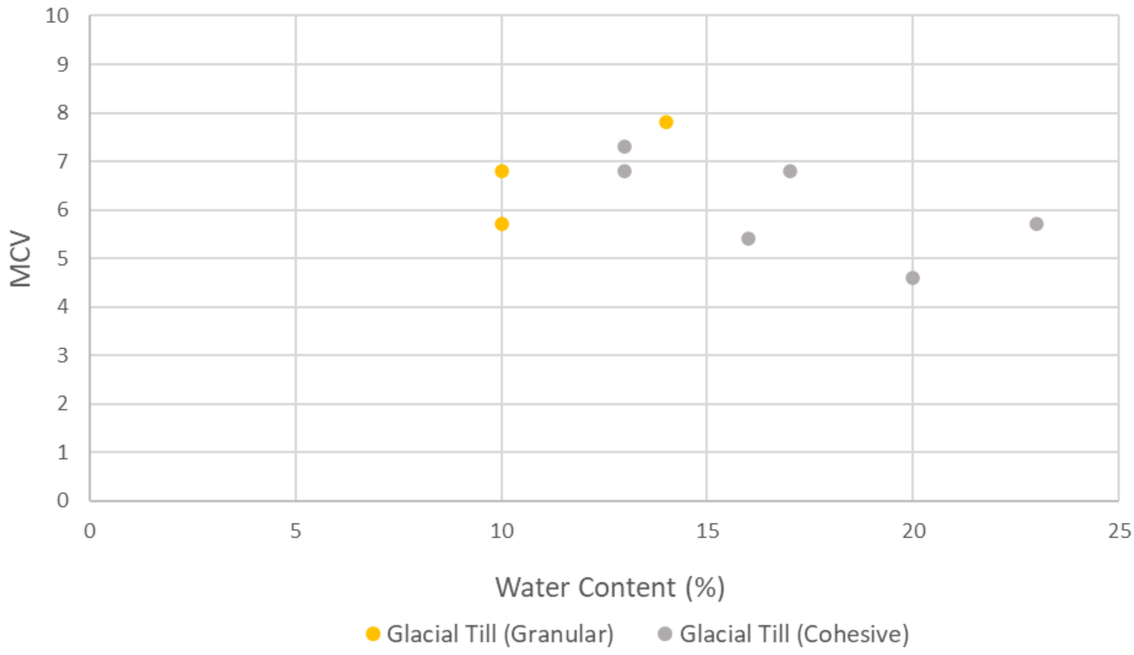


Figure 6-15: MCV vs. MC results

6.5.3 CALIFORNIA BEARING RATIO (CBR)

The California bearing ratio (CBRs) of four locations were measured using a Dynamic Cone Penetrometer (DCP) during 2024 GI. All samples were recovered from Made Ground layer. The results of the CBR test are summarised in Table 6-6. Moreover, CBR values were determined in 10 samples taken from Glacial Till (Cohesive) in the laboratory during the historic GI. A summary of the results is presented in Table 6-7.

Table 6-6: CBR results summary from DCP – 2024 GI

Borehole no.	Description	Top depth (m BGL)	Base depth (m BGL)	Min	Average	Max
TP02	Made Ground	0.20	1.18	9.30	26.86	66.00
BH03		0.50	1.45	25.0	67.75	>100
TP04		0.20	1.17	1.50	28.30	>100
TP07		0.25	1.23	9.30	55.82	>100

Table 6-6Table 6-7: CBR test results – historic GI

Borehole no.	Description	Depth	Bulk Density (Mg/m^3)	Dry Density (Mg/m^3)	Test Results			
					Moisture content (%)		CBR (%)	
					Top	Base	Top	Base
TP01*	Glacial Till (Cohesive)	0.70	2.01	1.76	14	14	5.7	5.6
TP03*	Glacial Till (Cohesive)	0.60	2.03	1.82	12	11	4.5	4.8
TP05*	Glacial Till (Cohesive)	0.70	2.06	1.83	14	13	3.7	4.5
TP09*	Glacial Till (Cohesive)	0.70	2.11	1.85	14	14	1.8	2.1
TP12*	Glacial Till (Cohesive)	0.80	2.15	1.95	10	10	8.2	7.1
TP14*	Glacial Till (Cohesive)	1.50	2.04	1.79	14	13	2.7	3.3
TP04R**	Glacial Till (Cohesive)	1.70	2.14	1.85	16	16	1.3	1.2
TP06R**	Glacial Till (Cohesive)	0.70	2.04	1.70	20	20	0.8	1.0
TP08R**	Glacial Till (Cohesive)	0.70	1.98	1.61	23	23	1.5	1.4
TP09R**	Glacial Till (Cohesive)	0.60	2.07	1.77	17	17	2.0	1.8
		min	**1.98**	**1.61**	**10.00**		**0.80**	
		max	**2.15**	**1.95**	**23.00**		**8.20**	
		average	**2.06**	**1.79**	**15.25**		**3.25**	

**IGSL -Site 1*

***IGSL-Site 2*

6.6 LABORATORY HAND VANE TEST

Shear vane tests were scheduled at three locations during IGSL-Site2 campaign. A GEONOR H-10 Vane was employed. In all instances refusals of apparatus were recorded on dense coarse subsoil/fill.

6.7 POINT LOAD TESTS

IGSL completed 6 no. point load tests on rock samples recovered from two of the rotary core boreholes completed across the site – RC01R and RC02R. The unconfined compressive strength (UCS) was estimated using the following equation:

$$UCS = k \times Is\ (50)$$

where factor k = 20 and Is(50) the Point load index value for a core diameter of 50 mm.

The UCS test results are illustrated in Figure 6-16. UCS values are in the range of 60 MPa to 136 MPa, with an average of 100 MPa.

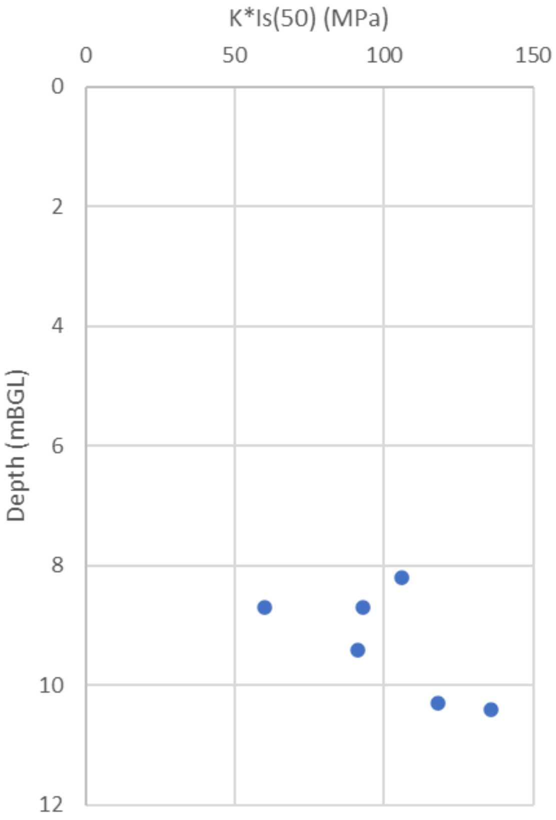


Figure 6-16: Limestone rock UCS profile

7 CHARACTERISTIC GEOTECHNICAL PARAMETERS

The characteristic geotechnical parameters are based on measured and derived values of ground properties along with relevant correlations or published values. A combination of in-situ tests such as SPT, available laboratory test results and empirical correlations from the literature were used to derive the site-wide soil parameters of each stratum encountered across the examined Site.

The characteristic values have been assessed to be cautious estimates of the value governing the limit state. The selected values may be the best estimate of the probable value (e.g. unit weight), the low estimate (e.g. strength and stiffness parameters) or the high estimate (e.g. strength parameters).

The best estimate values may be considered as characteristic values for engineering behaviour where 'average' properties are most relevant for the limit state under consideration. For independent parameters with sufficient data, the best estimate has been generally estimated as the mean of the measurements available for the specific soil layers. Some additional conservatism on either side of the unbiased 'best estimate' may be required in certain situations, such as where localised behaviour governs. Upper and lower estimate values have been derived using engineering judgment to provide a credible indication of the low and high distribution of the parameters, respectively. These parameters are not intended to represent absolute lower and upper bound lines, respectively, but somewhat indicative values that might be used for specific design purposes.

The rationale for deriving soil properties is summarised in the following sections.

7.1 SELECTION OF CHARACTERISTIC GEOTECHNICAL PARAMETERS

7.1.1 CHARACTERISTIC SPT N VALUE

The characteristic SPT N value has been assessed from the in-situ SPT measurements. The characteristic values for the SPT N values have been assessed to be closer to the low estimate as this parameter is used to derive soil strength and stiffness parameters.

The uncorrected SPT-N data was extracted from the GI data provided and has been corrected to N_{60} using the lower value of the following equations:

$$N_{60} = \frac{E_r N}{60}$$

Where:

- E_r is the energy ratio correction is 66%.
- N is the uncorrected SPT N value measured in the field.

In this case, the energy ratio is higher than 60%, therefore, the uncorrected SPT N values are more conservative and were taken as the characteristic values as presented below. The range of SPT N values from boreholes for each stratum and all datasets are summarised in Table 7-1.

The characteristic N_{SPT} value has also been assessed from the in-situ SPT and empirical correlations between heavyweight dynamic probes (DPSH) and SPT. However, conservative approach has been adopted to derive representative values. The dynamic probes data from IGSL-Site 2 were converted to equivalent SPT N values. In this study the following empirical correlation from Shahien and Farouk (2013) [22] was used:

$$N_{SPT} = 2.1 \times N_d(H)$$

where $N_d(H)$ is the Heavyweight dynamic probing blow count per 100mm interval.

The equivalent SPT N values were added to the plot presented in Figure 7-1. Made Ground, according to dynamic probe results, appears softer than indicated by the SPT N values. DP results encountered in Glacial Till (Cohesive) follows the increase in strength with depth as observed in the SPT N values. The discrepancies between the two datasets might be attributed to the distance of approximately 150m-200m between the 2024 ground investigation and the historic dynamic probe locations, suggesting potential variations in stratigraphy.

Table 7-1: Summary of characteristic SPT N values

Geological unit	**SPT N**				
	Count	Minimum	Maximum	Average	Characteristic
Made Ground	2	12	33	22	12
Glacial Till (Cohesive)	62	4	47	24	N=8 for z≤2m BGL N=Min(47, 13z-18) for z>2m BGL*
Glacial Till (Granular)	5	50	50	50	50**

**z is the depth (m) from 0.0m BGL*

*** The presence of Glacial Till (Granular) was confirmed by Particle Size Distribution (PSD) results carried out in samples retrieved from historic holes. Based on limited SPT N data for Granular Glacial deposits, the values obtained for Glacial Till (Granular) were refusals, thus are not considered to be representative of this stratum. However, in the absence of sufficient site-specific data, the characteristic parameters for Glacial Till (Granular) were not derived as part of this GIR.*

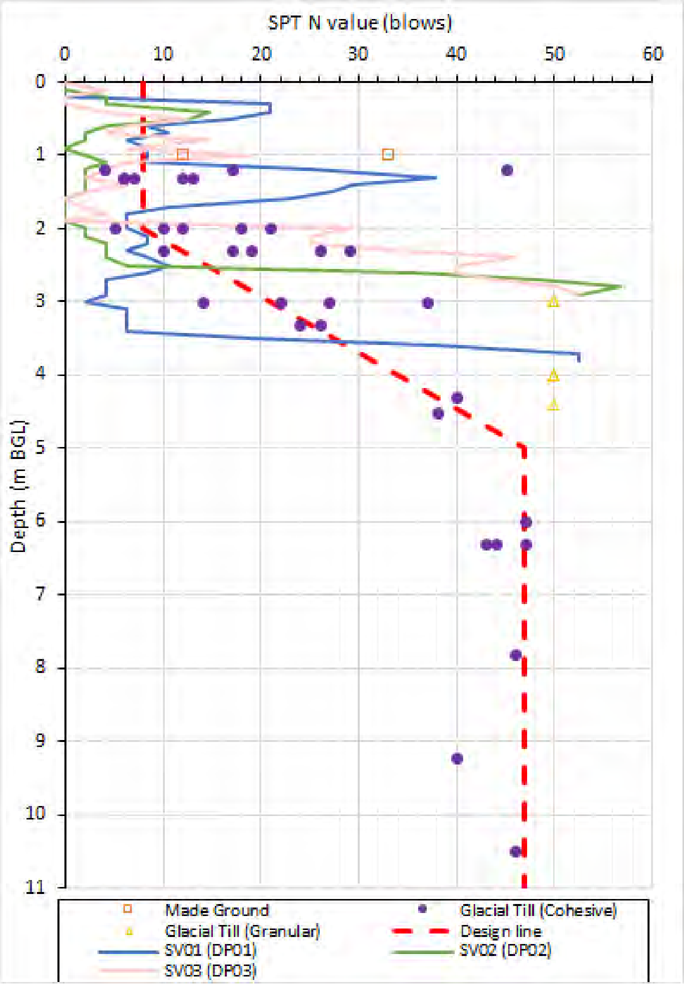


Figure 7-1:Uncorrected SPT N values with converted dynamic probes results for each soil layer with depth

7.1.2 UNIT WEIGHT

The dry and bulk densities of the soil samples subjected to the CBR test (10 no. samples) from historic GI were measured. Multiplying the measured density values by the acceleration due to gravity, taken as 9.81m/s^2, the unit weights were calculated as detailed in Table 7-2.

Table 7-2: Unit weight results from laboratory measurements

Stratum	Unit weight (kN/m^3)*	
	Dry	Bulk
Glacial Till (Cohesive)	16.0-19.5(18.0)*	19.5-21.5(20.0)

** Values in () indicate the average value*

The measured unit weights of the soils were reviewed against the empirical data presented in Figure 1 and Figure 2 of BS 8004:2015 (reproduced in Figure 7-2) to assess the reliability of the measured unit weights. The interpreted γ_{dry} and γ_{bulk} ranges based on the borehole descriptions for each of the strata encountered across the Site are presented in Table 7-3. It is noted that laboratory unit weight measurements were unavailable for Made Ground and Glacial Till (Granular) and thus the correlations from BS 8004:2015 were used to estimate the characteristic unit weight.

Table 7-3: Unit weight estimates from empirical data presented in BS 8004:2015

Stratum	Typical log description of density/strength	Unit weight (kN/m^3)			
		Dry		Bulk	
		Lower Bound	Upper Bound	Lower Bound	Upper Bound
Made Ground	Firm slightly sandy, slightly gravelly CLAY with fragments of bricks, ceramics, plastic and roots.	17	21	17	21
Glacial Till (Cohesive)	Soft to very stiff gravely sandy CLAY/SILT with cobble content.	15	22	15	22
Glacial Till (Granular)	Dense coarse GRAVEL with cobbles.	18	21	20	23

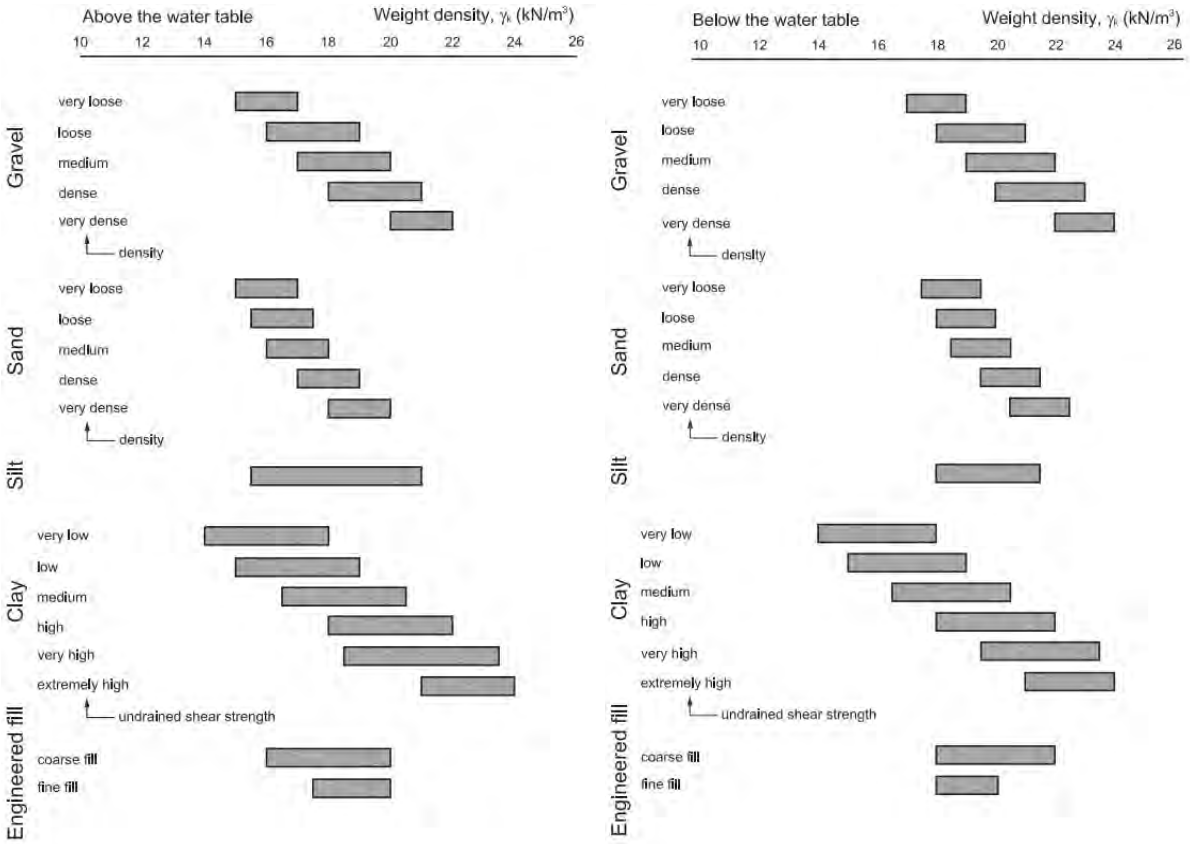


Figure 7-2: Figure 1 (left) and Figure 2 (right) of BS 8004:2015

Using all of the available information, the characteristic unit weights selected as representative of the soil mass and near the best estimate value are summarised in .

Table 7-4: Characteristic unit weight values

Stratum	Dry unit weight (kN/m³)	Bulk unit weight (kN/m³)
Made ground	18.0	20.0
Glacial Till (Cohesive)	18.0	20.0
Glacial Till (Granular)	18.0	20.0

7.1.3 UNDRAINED SHEAR STRENGTH

The undrained shear strength (c_u) of the cohesive deposits (Clay stratum) has been assessed from:

- The empirical correlation with CBR testing proposed by Black (1979), i.e. CBR=0.043 x c_u (kPa),
- The correlation with SPT N value after Stroud (1989) and

Based on the CBR values for Glacial Till (Cohesive), the c_u value ranges between 19.0 to 190.0 kPa.

SPTs were completed in the Made Ground and Glacial Till (Cohesive) layers encountered within the boreholes across the Site. For the estimation of the characteristic c_u values, the correlation with SPT N proposed by Stroud (1989) was used:

$$c_u = f_1 \times N$$

Where f_1 is a correlation factor determined using the plot produced by Stroud (1989) which has been reproduced in Table 7-3. Based on the I_p ranges - I_p is 23% for Made Ground, and between 10% and 27% with an average value of 17% for Glacial Till (Cohesive) - presented in Table 7-5, the correlation factor of f_1 was taken conservatively as 5 and 5.5, for Made Ground and Glacial Till (Cohesive), respectively. The c_u values derived using the correlation with the SPT data are presented in Table 7-5.

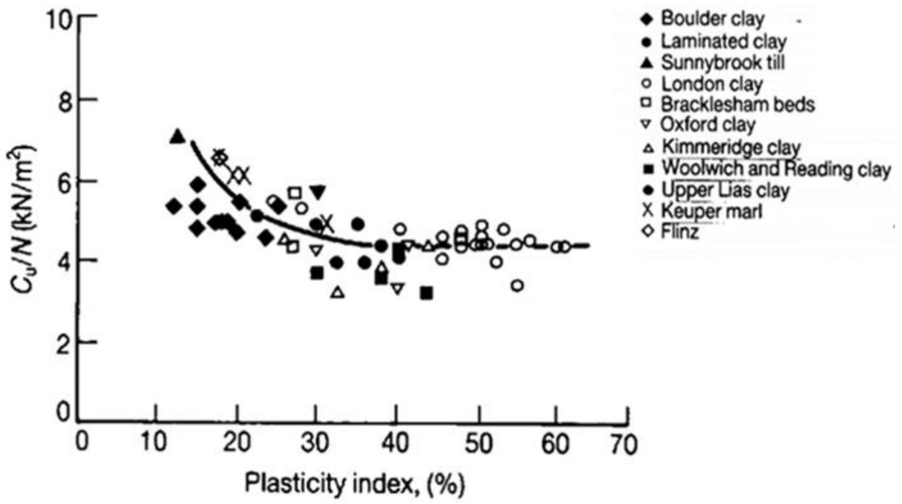


Figure 7-3: Correlation between SPT'N' and undrained shear strength (Stroud, 1989)

Table 7-5: Summary of undrained shear strength values from Stroud (1989)

Stratum	Min – max SPT N (blows)	Characteristic SPT N * (blows)	I_p (%)	f_1	c_u (kPa)
Made Ground	12-33	12	23	5	60-165
Glacial Till (Cohesive)	4-46	N=4 for z≤2m BGL N=Min(44, 10z-16) for z>2m BGL*	17	5.5	22*-258.5

**At shallow depths, max up to 1.0-1.5m*

The undrained shear strength c_u based on correlation with SPT N value after Stroud (1989) and the correlation with CBR testing proposed by Black (1979) is shown in Figure 7-4. Using all of the available information, the characteristic c_u values selected as being representative of the soil mass and near the low estimate value are summarised in Table 7-6.

Table 7-6: Characteristic undrained shear strength

Stratum	c_u (kPa)*
Made Ground	60
Glacial Till (Cohesive)	44kPa for z≤2m BGL Min (258.5, 71.5z-99) for z>2m BGL*

Note:

* z is the depth (m) from 0.0m BGL

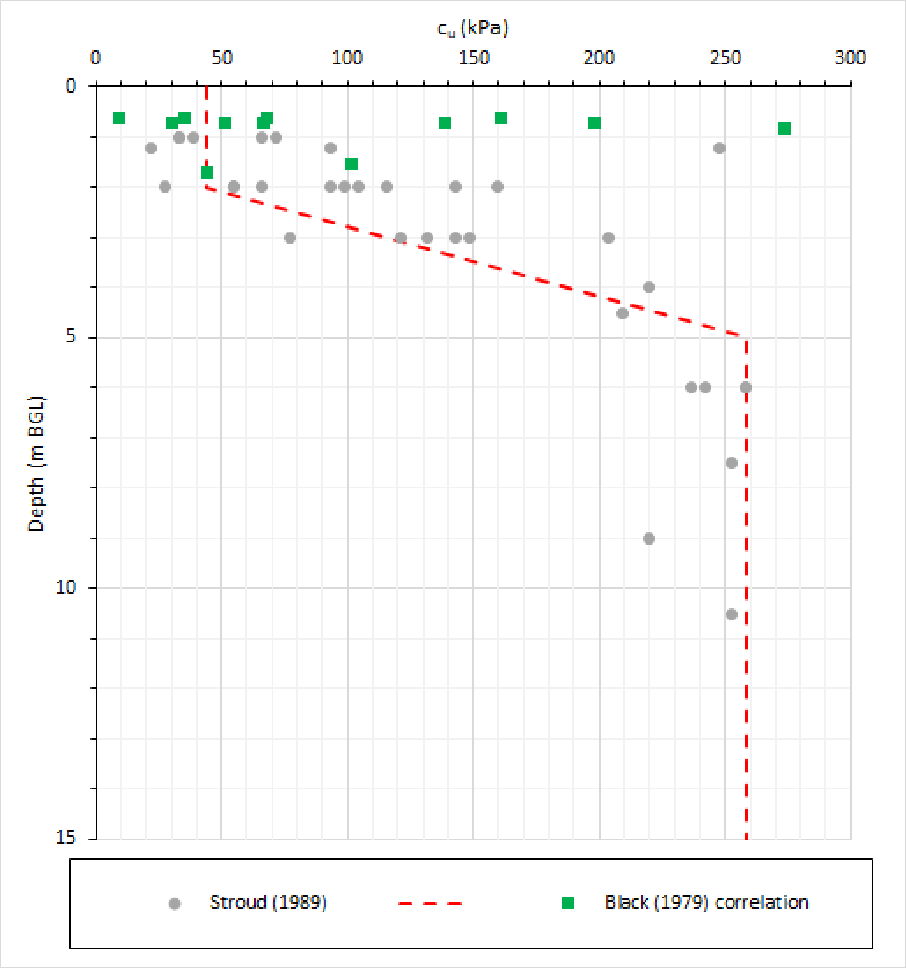


Figure 7-4: Undrained shear strength vs depth profile

7.1.4 ANGLE OF SHEARING RESISTANCE

The effective stress shear strength parameters of the overburden materials have been assessed using:

- The Santamarina and Diaz-Rodriguez (2003) correlation between Ip and ϕ' for cohesive materials,
- CIRIA report C504 Engineering in Glacial Till,
- Engineering experience of Irish Glacial and Peat Materials including Farrell et al. (1989), Donohue et al. (2003), Skipper et al. (2005), Long & Menkiti (2007), Long et al (2009), Long et al. (2012) and Farrell (2016)[8] .

7.1.4.1 COHESIVE / CLAY-LIKE MATERIAL

The $\phi'_{cv,k}$ for cohesive material with low percentages of coarse material can be estimated based on the expression proposed by Santamarina and Díaz-Rodriguez, 2003 (BS 8004 2015):

$$\phi'_{cv,k} = 42° – 12.5 \log_{10} I_p$$

Where I_p is the plasticity index (%) of the cohesive material.

It should be noted that the above formula is based on experience of UK silts and clays with very low granular content which are typically lower strength than Irish soils. Thus, the above correlation is deemed a conservative method for estimating the φ' of the cohesive materials encountered across the Site. For Made Ground one sample was recorded in regard of I_p; therefore, angle of shearing resistance of 25° was calculated. Based on characteristic I_p values presented in Table 6-3, $\phi'_{cv,k}$ for Glacial Till (Cohesive) material is between 24.0° and 29.5° with an average value of 27.0°. BS 8004:2015 also states that the peak effective angle for cohesive material is generally 2-4° greater than the critical volume effective angle. The peak effective angle will be taken as $\varphi'_{cv,k} + 2°$, which results in φ'_{pk} value of 29° and 27° for Made Ground and Glacial Till (Cohesive), respectively.

The CIRIA report C504 describes the relationship between ϕ’ and Plasticity index for CL and CI clays in drained triaxial shear. A correlation has been noted in which there is a reduction of φ with an increase in the plasticity index. Figure 6-3 presents the ϕ’ and Ip relationship based on which the angle of shearing resistance for Glacial Till is 32° for the characteristic Ip value of 17%.

In addition to the BS 8004:2015 and Sladen and Wrigley (1983) empirical correlations, guidance from the engineering experience of Irish Glacial Tills was also reviewed including Skipper et al. (2005), Long & Menkiti (2007), and Long et al. (2012). These peer-reviewed sources presented typical angle of shearing resistance values in the range of 34° to 38° for Irish Glacial Tills.

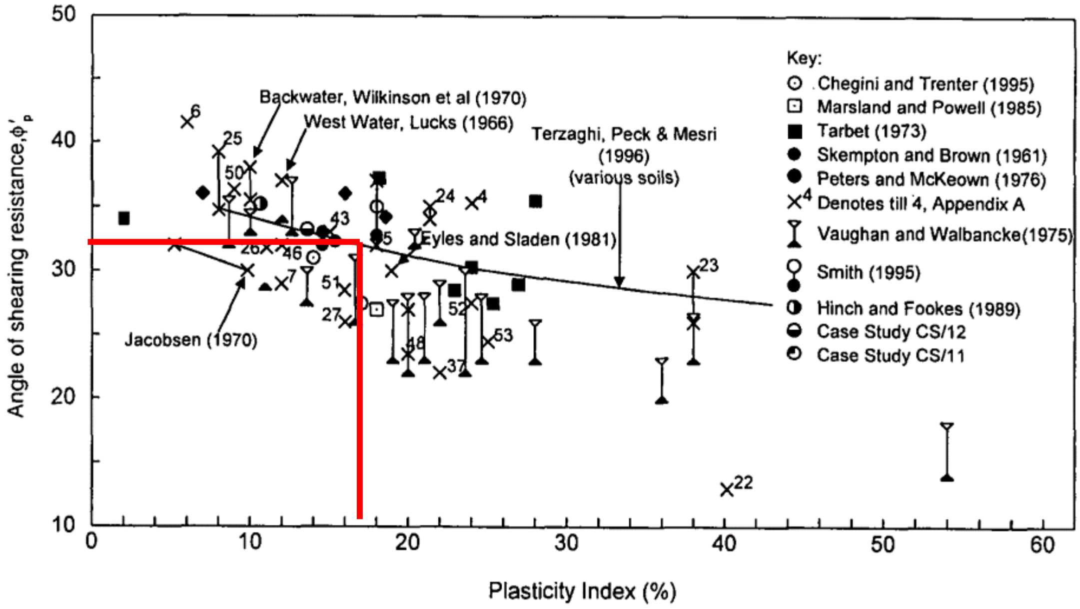


Figure 7-5: $I_{P.}$ vs angle of shearing resistance (Sladen and Wrigley, 1983) for cohesive material

Following a review of the empirical correlations and the available literature, the characteristic ϕ' of the Made Ground and Glacial Till (Cohesive) is recommended to be taken as 30°.

7.1.5 YOUNG'S MODULUS

7.1.5.1 COHESIVE AND MIXED MATERIAL

The Young's moduli (E) of the overburden materials have been assessed using:

- The Clarke (2017) correlation between undrained shear strength and undrained Young's modulus (E_u) for cohesive normally consolidated cohesive materials[2] ,
- The Clayton (2011) correlation between Poisson's ratio, undrained Young's modulus and drained Young's modulus (E') for cohesive materials[3]

The E_u value can be assumed to be in the range of 500 – 1500 x c_u, based on the recommendations by Clarke (2017). In this design, an E_u/c_u factor of 500 has been adopted as this range correlated well with GDG's experience of similar ground models. The E' of cohesive soils is based on the following relationship from Clayton (2011):

$$E' = \frac{1 + v}{1.5} E_u$$

Where υ is Poisson's ratio and is assumed to be in the range of 0.2 to 0.25. Taking υ to be 0.2 results in the above equation simplifying to:

$$E' = 0.8E_u$$

The range of Eu and E' is summarised in Table 7-7.

Table 7-7: Range of Eu and E' values

Stratum	E_u (MPa)	E'(MPa)
Made Ground	30-82.5 (56)	24-66 (45)
Glacial Till (Cohesive)	11-130 (68)*	8.8-104 (54)

**Average value*

***z is the depth (m) from 0.0m BGL*

Based on the above, a characteristic Young Modulus for drained and undrained conditions selected as summarised in Table 7-7.

Table 7-8: Characteristic Eu and E'

Stratum	E_u (MPa)	E'(MPa)
Made Ground	30	24
Glacial Till (Cohesive)	22MPa for z≤2m BGL Min (129, 35.8z-49.5) for z>2m BGL*	17.6 for z≤2m BGL Min (103, 28.6z-39.6) for z >2m BGL

Note:

** z is the depth (m) from 0.0m BGL*

7.1.6 COEFFICIENT OF VOLUME COMPRESSIBILITY

The coefficient of volume compressibility (m_v) was estimated for the fine-grained Cohesive Deposits using:

- The Stroud & Butler (1975) correlation between SPT N and m_v as shown in Figure 7-6.

The characteristic m_v values have been assessed to be near the high estimate of the value as this parameter is typically used as a multiplier to estimate ground movements during foundation design. Any designer should take cognisance that the design value of m_v is highly dependent on the stress level of interest.

Any designer should take cognisance that the design value of m_v is highly dependent on the stress level of interest.

The coefficient of volume compressibility can also be estimated using the equation proposed by Stroud and Butler (1975):

$$m_v = 1/(f_2*N)$$

Where f_2 is a correlation factor determined using the plot produced by Stroud & Butler (1975) which has been reproduced in Table 7-7. Following this plot, the f_2 factor was taken as 600 for the Glacial Till (Cohesive) stratum which has I_p values typically between 10% and 27%, and 500 for the Made ground which has a characteristic I_p value of 23%. The characteristic coefficient of volume compressibility values determined using this correlation and the SPT N values from Figure 5-3 are shown inFigure 7-7 and results are presented in Table 7-9.

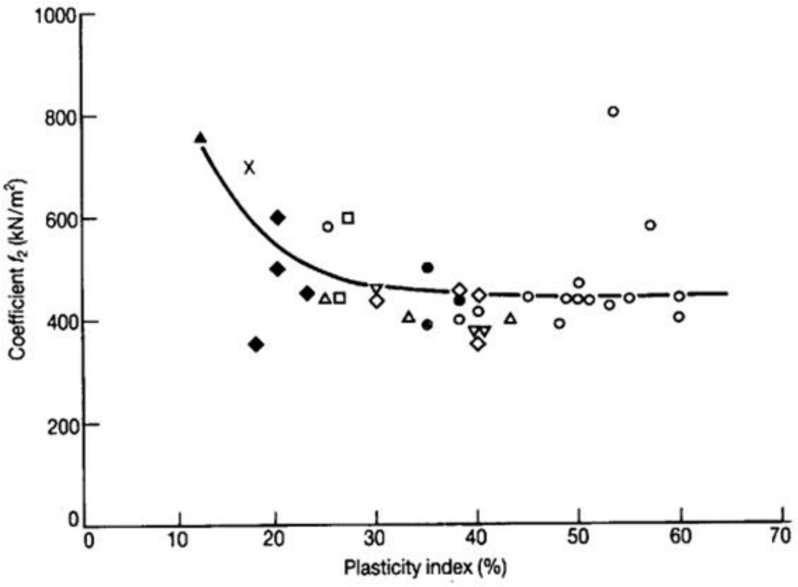


Figure 7-6: Correlation between SPT'N' and the coefficient of volume compressibility (Stroud and Butler, 1975)

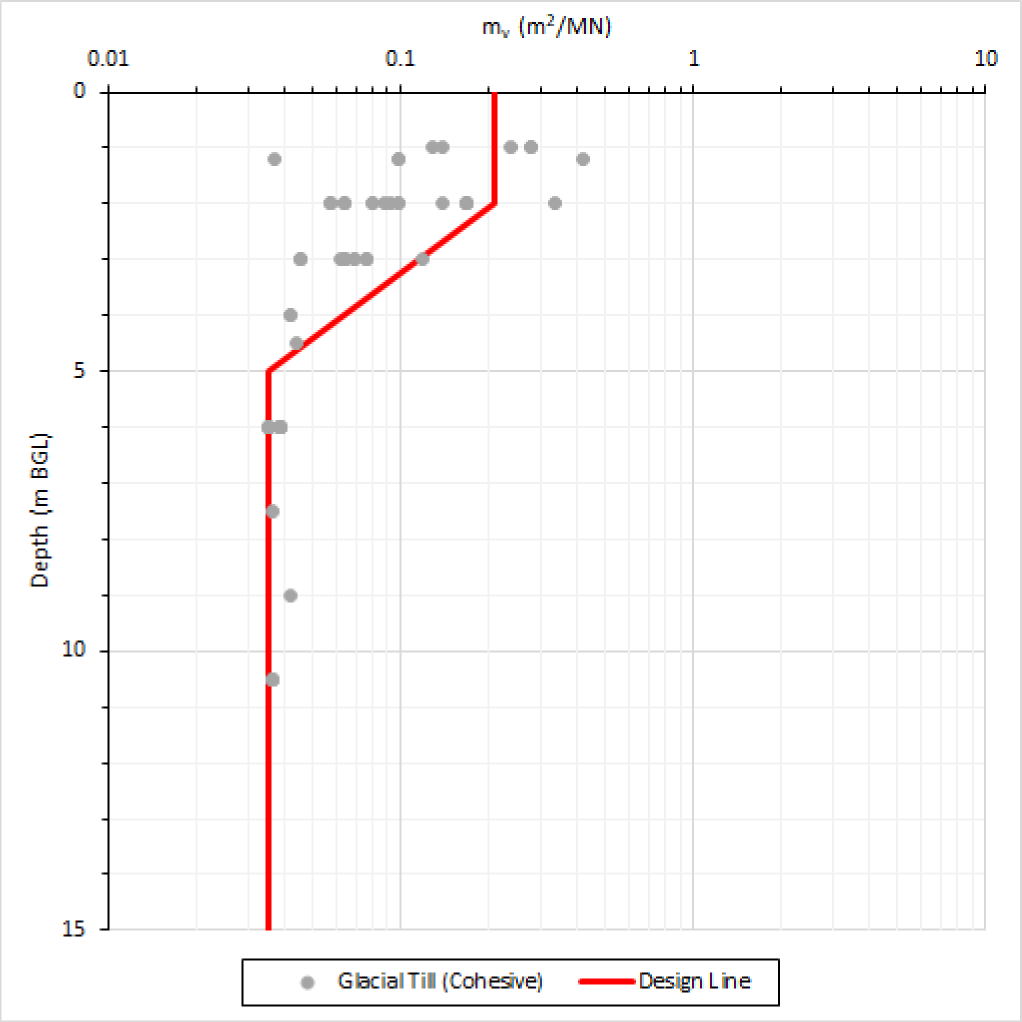


Figure 7-7: Coefficient of volume compressibility m_v values for Glacial Till (Cohesive)

Table 7-9: Summary of the characteristic coefficient of volume compressibility values

Stratum	SPT ‘N’ (blows)	Ip (%)	f_2	Characteristic m_v (m^2/MN)
Made ground	12	23	500	0.17
Glacial Till (Cohesive)	N=4 for z≤2m BGL N=Min(44, 10z-16) for z>2m BGL	18	600	0.208 for z≤2m BGL Min(0.035,$\frac{1}{7.8z-10.8}$) for z>2m BGL

Due to the well-graded nature of Irish Glacial Tills, the recovery of representative undisturbed samples is rarely possible. Such samples were not recovered and as a result direct measurement of mv or similar compressibility parameters such as the compression index (Cc) were not available. It is also understood that the use of standard correlations between plasticity index, SPT N values and m_v, such as Stroud & Butler (1975), result in overly conservative estimates of consolidation settlement. Furthermore, limited published literature refers directly to the stiff Glacial Tills of Ireland, with the vast majority of these focused on the Dublin Boulder Clay material which is localised around Dublin City and County. In the absence of direct geotechnical laboratory testing to determine site specific mv or Cc values or a suitable representative correlation, it is recommended that the Designer should estimate ground deformations using the correlated Eu and E' stiffness values for cohesive Glacial Till.

7.1.7 SUMMARY OF CHARACTERISTIC GEOTECHNICAL PARAMETERS

The characteristic geotechnical parameters to be used for the design were developed based on the available GI, relevant published design standards. A summary of the recommended geotechnical parameters is presented in Table 7-10.The majority of the characteristic parameters are typically based on low estimates, with a discrete number of characteristic parameters based on the best estimates (e.g., unit weight). Variations from this table may be required for other limit states, temporary works designs and constructability-related assessments. This table may be subject to change in later revisions of the GIR should further information become available and justify such alterations.

Table 7-10: Summary of the recommended characteristic geotechnical parameters

Parameter	Symbol (unit)	Characteristic value	
		Made Ground	Glacial Till (Cohesive)
Plasticity Index	I_p (%)	23	17
SPT N value	N (blows)	12	8 for z≤2m BGL Min(47, 13z-18) for z>2m BGL
Bulk unit weight	γ_{bulk} (kN/m3)	20	20
Dry unit weight	γ_{dry} (kN/m^3)	18	18
Undrained shear strength	c_u (kPa)	60	44 for z≤2m BGL Min (258.5, 71.5z-99) for z>2mBGL
Effective angle of shearing resistance	φ' (°)	30	30
Effective cohesion	c' (kPa)	0	0
Static undrained Young's modulus	E_u (MPa)	30	22 for z z≤2m BGL Min (129, 35.8z-49.5) for z>2m BGL
Static drained Young's modulus	E' (MPa)	24	17.6 for z≤2m BGL Min (103, 28.6z-39.6) for z>2m BGL
Coefficient of volume compressibility	m_v (m^2/MN)	0.17	0.42 for z≤2m BGL Min (0.035, $\frac{1}{7.8z-10.8}$) for z>2m BGL

8 CONTAMINATION ASSESSMENT

The following section presents an assessment of the investigation data concerning human health and the wider environment, including water environment, and buildings & structures.

The investigation and interpretation include the development of a Conceptual Site Model and subsequent risk assessment and has been undertaken in accordance with relevant guidance documents, including Land contamination risk management (LCRM) - How to assess and manage the risks from land contamination (UK Environment Agency 2020, last updated July 2023), Guidance On The Management Of Contaminated Land And Groundwater At EPA Licensed Sites (EPA Ireland, 2013), Environmental Risk Assessment for Unregulated Waste Disposal Sites (EPA Ireland, 2007) and Contaminated Land Risk Assessment, A Guide to Good Practice (CIRIA C552, 2001). Full details of the assessment are provided in subsequent sections of this report.

8.1 CONCEPTUAL SITE MODEL

The following assessment is partially qualitative, in that professional value judgments have been applied to the available site data in order to assess levels of risk. The framework for these assessments is set out in CIRIA C552, “Contaminated Land Risk Assessment, A Guide to Good Practice”. This guidance states that the assessment of risk should be based on both the likelihood of an event and the severity of its potential consequences, one of the following six risk levels has been assigned to each potential pollutant linkage identified: Very Low, Low, Low/Moderate, Moderate, High and Very High. A risk of Low/Moderate or above indicates that further assessment, investigation or possibly remediation will be required.

The site to be developed for public open space with associated infrastructure, although parts of the site will be developed for residential dwellings, possibly with private gardens. The following assessment is intended to inform the understanding of potential contamination liabilities with the site and its current use and with respect to its proposed future use.

8.2 HUMAN HEALTH ASSESSMENT

8.2.1.1 DIRECT CONTACT/INGESTION/INHALATION

In order to assess the risks to future construction workers, members of the public and employees, soil chemical analysis results have been screened against Tier 1 values to be protective of the end users. Given the proposed use of site as a public open space with possible residential properties, the assessment has been conservatively based on a residential with gardens end-use. The chemical analysis is included in the Factual Report in Appendix A and the screened results and screening criteria are further included in Appendix B.

All available data have been included within this assessment, this includes the 22 soil samples which were tested and screened against residential Suitable for Use Values (S4ULs) derived by LQM and Category 4 Screening Levels (C4SLs, used to assess whether contaminants are at concentrations that potentially represent Contaminated Land) derived by CL:AIRE, where there is no relevant S4UL. It is noted that the C4SLs are based on the acceptance of a low level of toxicological concern, rather than the more conservative standard adopted in the derivation of S4ULs, which are based on a tolerable or minimal level of risk.

The soil organic matter (SOM) for soil samples ranged from <0.1% to 6.3% with an average of 1.59%. Given the range (of SOM), the soil concentrations were compared with conservative screening values for a 1% SOM where available.

8.2.1.2 ASBESTOS

All soil samples tested as part of this assessment were screened for the presence of asbestos fibres. Below is a summary of the asbestos screen results, which indicate 2 samples of Made Ground contained asbestos in the form of chrysotile or amosite fibre bundles. The site investigation locations in which asbestos was identified were located to the rear of the existing residential properties, in the north of the site. Asbestos quantification was undertaken on 22 samples, which recorded less than LOD for 20 samples. A summary of the positive identification results is presented in the table below.

Table 8-1: Summary of Asbestos results

Location ID	Depth m (bgl)	Strata	Asbestos Type	Asbestos Quantification
TP05	0.5	Clay	Chrysotile	Present in fibre bundles
TP07	1.0	Made Ground	Amosite	Present in fibre bundles

8.2.1.3 POLYCYCLIC AROMATIC HYDROCARBONS (PAH)

All 22 soil samples were screened against their respective assessment criteria. Screening found none of the samples to contain polycyclic aromatic hydrocarbon concentrations exceeding their respective assessment criteria values.

8.2.1.4 PETROLEUM HYDROCARBONS

All 22 soil samples were screened against their respective assessment criteria. Screening found none of the samples to contain petroleum hydrocarbon concentrations exceeding their respective assessment criteria values.

8.2.1.5 METALS

All 22 samples were tested for 12 metals potentially present within the site, against the relevant S4ULs. Two samples showed lead concentrations above the screening value, again located to the rear of the existing residential properties, in the north of the site. Otherwise all samples were below the S4UL threshold on all metal tests.

Table 8-2: Summary of Metal Screening Value Exceedances

Determinand	Maximum Determinand Value (mg/kg)	Screening Assessment Criteria	Source	Number of Exceedances	Locations
Lead	520.0	200.0	C4SL	2(22)	TP05 0.5m TP10 0.5m

8.2.1.6 HUMAN HEALTH RISK ASSESSMENT

Considering the nature of the identified contaminants and their grouped locality between Asbestos and lead have been identified at concentrations above the relevant screening values in TP05, TP07, and TP10, located to the rear of the existing residential properties, in the north of the site. Considering the low magnitude of the concentrations and the limited access, these concentrations are generally considered to present a low risk to human health as part of the current use. However, during construction and as part of the proposed development, soils from this localised area should be considered to present a low to moderate risk due to the presence of lead and asbestos and the potential for human contact. Consequently, mitigation measures during construction and as part of the proposed development will be required.

Overall risk (current use): ***Low***

Overall risk (construction): ***Low/Moderate***

Overall risk (future use): ***Low/Moderate***

8.2.2 GROUND GAS

Future site workers, construction workers and neighbouring site users are considered to be potential receptors, via the ingress of ground gases into buildings and subsequent inhalation, asphyxiation or explosion. The desk study identified no likely sources of significant ground gas on the site, and the investigation did not identify any soils with the potential to generate large volumes of ground gas and therefore in the absence of a source, the risk associated with ground gas is considered to be low.

The information about radon Section 2.10 of the desk study shows that the site is in a region of Medium risk, where approximately 1 in 20 properties may have elevated indoor radon measurements, and consequently any future residential development should consider the possible requirement for radon mitigation measures.

Overall risk (current use): ***Low***

Overall risk (construction): ***Low***

Overall risk (future use): ***Low (Radon should be considered for any future proposed buildings)***

8.3 WATER ENVIRONMENT RISK ASSESSMENT

The proposed development is situated within the town of Monaghan and the desk study did not identify any likely sources of significant contamination to the nearby water environment. However, sensitive nearby receptors were identified, which include the River Shambles (crossing the site), Ulster Canal (50m south of the site) and groundwater (within the Monaghan PWS SO - Outer Protection Area associated with 7 abstractions, the two closest of which are located within approximately 500m of the site, to the west and north). Consequently, to further inform the assessment of risks to the water environment, geochemical testing was undertaken on soil leachate samples collected from across the site, and on surface water samples from the River Shambles. The results have been screened against relevant inland surface water screening values from the Water

Framework Directive 2015, including Environmental Quality Standards (EQS) to assess risks to surface water, and Drinking Water Standards to assess risks to the groundwater resource.

A total of 10 soil samples were collected from trial pits and boreholes across the site for geochemical testing of soil leachate. The obtained sample results were subsequently screened against surface water and groundwater standards separately to identify the potential risk of contaminants migrating from the soil to the surface water and groundwater. The aim was to identify the plausible contaminant sources and pathways, and to assess whether impact on the identified receptors is occurring.

8.3.1 SURFACE WATER RECEPTOR

The following section considers the results of the chemical analysis with respect to potential risks to surface water, i.e. the River Shambles that flows through the site, in a north-east direction.

8.3.1.1 SOIL LEACHATE PROTECTIVE OF SURFACE WATER

A summary of the Tier 1 exceedances recorded in the soil leachate results is provided in Table 8-3, which included occasional metals and PAH compounds. Considering the absence of a significant volume of soils with the potential to leach contamination and the likely dilution in the receiving water, the concentrations of lead, copper, phenanthrene, fluoranthene and pyrene are considered to be of low risk to surface water as they are within an order of magnitude of the screening criteria, or only marginally above LOD.

Table 8-3: Summary of Soil Leachate Results Screened against Surface Water Criteria

Determinand	Maximum Determinand Value	Leachate (SW) Screening Assessment Criteria	Source	Number of Exceedances (No. of Samples)
Copper (dissolved)	2.2 (µg/l)	1 (µg/l)	UK EQS	3(10)
Lead (dissolved)	3.5(µg/l)	1.2(µg/l)	UK EQS	1(10)
Phenanthrene	0.02 (µg/l)	0.1 (µg/l)	LOD	7(10)
Fluoranthene	0.03 (µg/l)	0.0063 (µg/l)	UK EQS	9(10)
Pyrene	0.02 (µg/l)	0.01 (µg/l)	LOD	1(10)

8.3.1.2 SURFACE WATER QUALITY

Two rounds of water sampling from the Shambles River were undertaken from locations upstream (SW1), two middle locations (SW2+SW3), and downstream of the site (SW4). A summary of the results is provided in Table 8-4. Although exceedances for TPH, PAH, copper and zinc were recorded, no observable increase in contamination was recorded between the upstream (background) locations at the point of entering the site, compared with the downgradient locations leaving the site, indicating that the site is not having a measurable effect on surface water quality. Also, the concentration of all contaminants identified in the surface water were at higher concentrations than in the soil leachate, indicating that the site soils are unlikely to be the source of the observed contamination in the surface water. This further supports the previous conclusion that the risk to surface water from the site soils is low.

Table 8-4: Summary of Surface Water Sample Results

Determinand	Maximum Determinand Value	Surface Water Screening Assessment Criteria	Source	Number of Exceedances (No. of Samples)
Copper (dissolved)	3.7 (µg/l)	1.0 (µg/l)	UK EQS	5(8)
Zinc (dissolved)	120 (µg/l)	79 (µg/l)	UK EQS	2(8)
Acenaphthylene	0.28 (µg/l)	0.01 (µg/l)	LOD	2(8)
Acenaphthene	2.2 (µg/l)	0.01 (µg/l)	LOD	2(8)
Fluorene	0.76 (µg/l)	0.01 (µg/l)	LOD	3(8)
Phenanthrene	2.4 (µg/l)	0.01 (µg/l)	LOD	7(8)
Anthracene	0.12 (µg/l)	0.01 (µg/l)	UK EQS	1(8)
Fluoranthene	0.87 (µg/l)	0.0063(µg/l)	UK EQS	3(8)
Pyrene	2.8 (µg/l)	0.01 (µg/l)	LOD	3(8)
Benzo(a)anthracene	0.2 (µg/l)	0.01 (µg/l)	LOD	2(8)
Chrysene	3.4 (µg/l)	0.01 (µg/l)	LOD	3(8)
Benzo(b)fluoranthene	0.9 (µg/l)	0.01 (µg/l)	LOD	3(8)
Benzo(k)fluoranthene	0.15 (µg/l)	0.01 (µg/l)	LOD	2(8)
Benzo(a)pyrene	0.81 (µg/l)	0.00017 (µg/l)	UK EQS	3(8)
Indeno(1,2,3-cd)pyrene	0.18 (µg/l)	0.01 (µg/l)	LOD	2(8)
Dibenz(a.h)anthracene	0.16 (µg/l)	0.01 (µg/l)	LOD	1(8)
Benzo(ghi)perylene	0.28 (µg/l)	0.01 (µg/l)	LOD	2(8)
Aliphatic TPH >C10-C12	780 (µg/l)	300 (µg/l)	UK EQS	1(8)
Aliphatic TPH >C12-C16	5,100 (µg/l)	300 (µg/l)	UK EQS	1(8)
Aliphatic TPH >C16-C21	4,900 (µg/l)	1 (µg/l)	LOD	5(8)
Aliphatic TPH >C21-C35	1,500 (µg/l)	1 (µg/l)	LOD	5(8)
Aliphatic TPH >C35-C44	74 (µg/l)	1 (µg/l)	LOD	1(8)
Aromatic TPH >C10-C12	590 (µg/l)	90 (µg/l)	UK EQS	1(8)
Aromatic TPH >C12-C16	2,900 (µg/l)	90 (µg/l)	UK EQS	1(8)
Aromatic TPH >C16-C21	2,400 (µg/l)	90 (µg/l)	UK EQS	2(8)
Aromatic TPH >C21-C35	640 (µg/l)	90 (µg/l)	UK EQS	1(8)

8.3.2 GROUNDWATER RECEPTOR

The following section considers the results of the chemical analysis with respect to potential risks to groundwater, i.e. the regional groundwater present in the bedrock. Considering the presence of the surface water (Shambles River) within the site, it is likely that the surface water would be considered to be the primary controlled waters receptor, however, the following assessment has been undertaken on a conservative basis due to the proximity of two groundwater abstractions located within approximately 500m of the north and west of the site.

8.3.2.1 SOIL LEACHATE PROTECTIVE OF GROUNDWATER

The soil leachate results were screened against UK Drinking Water Standards, the World Health Organisation Drinking Water Standards, and the Groundwater Quality Standards (GQS), outlined in the 2015 Water Framework Directive. A summary of the results obtained in the testing and their exceedances encountered are provided below in Table 8-5.

The samples which exceeded their respective screening criteria (which was only marginal LOD exceedances of phenanthrene, fluoranthene, and pyrene) are considered to be of low risk to groundwater as they are within an order of magnitude of the screening criteria and even very low dilution factors would render these concentrations undetectable. Additionally, the investigation did not identify any significant volume of soils with the potential to leach contamination, and there is a considerable distance to the nearest abstraction point.

Table 8-5: Summary of Soil Leachate Results Screened Against Groundwater Criteria

Determinand	Maximum Determinand Value	Leachate (GW) Screening Assessment Criteria	Source	Number of Exceedances (No. of Samples)
Phenanthrene	0.2 (µg/l)	0.1 (µg/l)	LOD	7(10)
Fluoranthene	0.3 (µg/l)	0.1 (µg/l)	LOD	6(10)
Pyrene	0.2 (µg/l)	0.1 (µg/l)	LOD	1(10)

8.3.3 WATER ENVIRONMENT RISK ASSESSMENT CONCLUSIONS

The chemical analysis results indicate low concentrations of potentially leachable metals and PAHs within the Made Ground. However, no widespread source of significant soil contamination was recorded, and in general exceedances in the soil leachate were within an order of magnitude of the screening criteria for both groundwater and surface water, and so would be undetectable following dilution in the surface water or groundwater.

Also, no observable increase in contamination was recorded between the upstream (background) locations and the downgradient locations, indicating that the site is not having a measurable effect on surface water quality. Additionally, the surface water samples of the watercourse were higher in most contaminants than that of the soil leachate, further supporting the conclusion that the site is not the source of the observed contamination in the surface water.

On the basis of the above, the overall risk to the water environment (surface water and groundwater) from the site is considered to be Low.

Overall risk (current use): ***Low***

Overall risk (construction): ***Low***

Overall risk (future use): ***Low***

8.4 BUILDINGS AND STRUCTURES

The current use of the site includes commercial and residential uses that are assumed to have some established underground water supply pipes. The following section details the assessment of risk to water supply pipes and any new infrastructure, whilst ground gas risk is discussed in the human health section above.

The proposed development may require water supply pipes, although the final details of the design, including the route and level of proposed water supply pipelines relative to proposed earthworks, is currently unknown. Considering this, no testing following UKWIR requirements (Guidance for the Selection of Water Supply Pipes to be used in Brownfield Sites, UKWIR, 2010) was undertaken. However, comparison of the available chemical analysis results with UKWIR screening values suggests that there may be localised exceedances of the values for SVOCs and TPH, and consequently upgraded pipe materials may need to be considered, depending on what soils the pipes are laid within.

Overall risk (current use): ***Low***

Overall risk (construction): ***Low***

Overall risk (future use): ***Low/Moderate***

8.5 SOIL DISPOSAL

A preliminary assessment based on observations from the trial pits and boreholes suggests that if materials are required to be removed from Site, predominantly inert classifications are likely to be encountered where natural ground is present. The Made Ground will mostly be classified as non-hazardous or locally hazardous for disposal purposes. The area surrounding TP05, TP07, and TP10 should be given additional consideration due to the noted presence of asbestos fibres and should be re-tested if disposal is decided upon. Prior to any material being disposed off-site, an appropriate waste classification and possibly waste acceptance criteria (WAC) testing should be undertaken. Disposal of such waste must be undertaken in accordance with all relevant current waste legislation and duty of care regulations.

9 GEOTECHNICAL RISK REGISTER

GDG is not the Project Supervisor Design Process (PSDP) as defined in the Safety, Health & Welfare at Work (SHW) (Construction) Regulations 2013 but has considered the geotechnical risks associated with the proposed embankment construction. GDG understand that under the Regulations, our duties are generally to:

- Identify any hazards that the design may present.
- Where possible, eliminate the hazards or reduce the risk.
- Communicate necessary control measures, design assumptions and remaining risks to the PSDP so they can be dealt with in the Safety and Health Plan.
- Co-operate with other designers and the PSDP or Project Supervisor Construction Stage (PSCS).

The following items have been identified as plausible geotechnical risks and should be incorporated into any risk registers or assessments for the project as a whole. Mitigation measures have been recommended for each geotechnical risk. The recommended mitigation measures are not mandated as part of the design process, nor do they override a designer's responsibility to assess and eliminate or mitigate risks identified in this GIR. The Designer of each design element shall be responsible for determining and designing the final mitigation measures at the detailed design stage.

The hazards and/or risks identified in Table 9-1 are not part of an exhaustive list. Additional hazards or risks may exist that have not been identified at this stage of the design process. All designers shall review the hazards and risks associated with the relevant design element and shall satisfy themselves that all hazards have been eliminated or mitigate any remaining risks as far as is reasonably practicable. The Designer shall also take all reasonable steps to provide sufficient information about aspects of the structure's design or its construction or maintenance as will adequately assist clients, other designers, and contractors to comply with their duties under the Regulations.

Table 9-1: Geotechnical Risk Register

Id.	Risk	Description	Mitigation
1.	Incorrect estimation of characteristic soil strength parameters.	Geotechnical failure of structures due to insufficient bearing resistance, sliding resistance, loss of stability or lateral passive resistance.	This GIR proposes characteristic values for the soil parameters of each stratum encountered within the confines of the proposed scheme. The element designer shall satisfy themselves that the parameters presented in this GIR are representative of the stress state of the soil at the relevant limit state. The Designer may also choose different characteristic values that are representative of the stress state of the soil at the relevant limit state while paying due consideration to the limitations of the available ground investigation information. All geotechnical design shall be carried out in accordance with the relevant design code at the time of design. In general, the design principles of I.S. EN 1997-1:2005+A1:2013 (Eurocode 7) shall be followed. Partial factors shall be applied to the characteristic soil parameters, actions, and resistances during Ultimate Limit State checks to produce design values of the applied actions and resistances. The design values shall mitigate the risk of geotechnical failure.
2.	Incorrect estimation of characteristic soil stiffness parameters.	Excessive vertical settlement structures resulting in serviceability failure.	This GIR proposes characteristic values for the soil parameters of each stratum encountered within the confines of the proposed scheme. The element designer shall satisfy themselves that the parameters presented in this GIR are representative of the stress state of the soil at the relevant limit state. The Designer may also choose different characteristic values that are representative of the stress state of the soil at the relevant limit state due to the limitations of the available ground investigation information.
3.	Existing services.	Striking of existing services resulting in damage to existing infrastructure, disruption to local residents and businesses, and/or causing delays to construction.	This is an inherent risk particularly associated with excavation works and cannot be eliminated in full. The risk shall be managed at the construction stage by a competent contractor who shall review the full suite of service maps. Particular vigilance should be maintained in relation to uncharted services. Measures should be put in place to ensure that these services are not damaged during construction.
4.	Low-strength soil (Cohesive Deposits)	Failure of low-strength soil during excavation resulting in inundation	Low-strength Glacial Till (Cohesive) were encountered across the Site. These low-strength soils may be at risk of instability during excavation works. Where excavations are required for

Id.	Risk	Description	Mitigation
		and/or damage to property or individuals	temporary or permanent works, the relevant Designer shall assess the risk and design suitable mitigation measures where deemed appropriate. The presence of granular layers could also pose issues where temporary excavations are proposed without side supports.
5.	Raised groundwater level	Reduction in soil strength and stiffness resulting in inadequate geotechnical design resistances.	Continuous groundwater monitoring has not been conducted at either site and groundwater levels usually vary due to seasonal and/or other effects and may at times differ to those recorded during the investigation. It is therefore recommended that a conservative groundwater level is taken for design to mitigate against possible increases in porewater pressures or reductions in design resistances. As a minimum, the design groundwater levels should coincide with the upper bound groundwater profile recorded in the vicinity of the proposed design element.
6.	Presence of gravels and oversized particles	Groundwater flow due high permeability of gravels and oversized particles encountered across the Site (Made ground and Granular Glacial Till)	Gravels and oversized particles (Made ground and Glacial Till - Granular) were encountered across the Site. These soils may be at risk of instability during excavation works. The presence of granular layers (due to its high permeability) could pose issues where temporary excavations are proposed without side supports. Where excavations are required for temporary or permanent works, the relevant Designer shall assess the risk and design suitable mitigation measures where deemed appropriate.
7.	Presence of asbestos, lead and metal	Risk to human health from contamination associated with both construction and the proposed use due to the presence of asbestos fibres, lead and metal	The risk to human health from contamination is considered to be low to moderate predominantly due to the presence of asbestos fibres, lead and metal encountered in a localised area to the rear of the existing residential properties, in the north of the site, and the potential for human contact. The made ground and near-surface clay soils in this area require mitigation measures during construction to reduce risks to human health (both construction workers and off-site receptors), although these are expected to comprise standard construction practices such as damping down soils during dry periods. In addition, these soils should not be placed at the surface of the proposed development, although they will be suitable for reuse beneath a clean cover layer or hardstanding.

Id.	Risk	Description	Mitigation
8.	Presence of radon	Risk to human health from radon as the site is in a region of Medium risk (approximately 1 in 20 properties may have elevated indoor radon measurements).	The information about radon shows that the site is in a region of Medium risk, where approximately 1 in 20 properties may have elevated indoor radon measurements, and consequently any future residential development should consider the possible requirement for radon mitigation measures e.g. sealing, house or room pressurization, heat recovery ventilation and natural ventilation, sealing cracks and other openings in the foundation, vent pipe system and fan, sub-slab depressurization, etc.
9.	Unexpected contamination	Risk to human health from unexpected contation during earthqoirks or construction	If any unforeseen contamination be identified during earthworks or construction (e.g. hydrocarbon impacted soils, asbestos, etc.), then work in such areas should be halted until a suitably qualified professional has been consulted to assess the situation and provide advice.

10 CONCLUSIONS

GDG has completed the geotechnical interpretive report as requested by McAdam for a proposed Dublin Street Monaghan project Monaghan, Co. Monaghan. The aim of this report was to present the findings of an intrusive Ground Investigation at a proposed semi-private public open space development in Monaghan, with recommendations to address geotechnical or contamination issues where required. This has included assessment of potential contamination issues at the site in accordance with the 1992 Environment Protection Agency Act, as well as the suitability of the Site for the proposed use with respect to the Planning and Development Act 2000.

10.1 GEOTECHNICAL ASSESSMENT

From a geotechnical perspective the ground conditions revealed by intrusive investigation have been interpreted and the engineering test results have been assessed to provide outline guidance on geotechnical issues pertinent to the proposed development. It is highlighted that the geotechnical information detailed within this document is limited to the soil information made available at the time of writing.

A desk study, including an assessment of geology, lithology, hydrology and soil conditions, was completed for the entire site, a review of the intrusive ground investigations completed by Causeway Geotech in 2024 is also presented in this GIR as well as the historic data completed by IGSL in 2023 for Site 1 and Site 2. The ground model for the site has been evaluated. Groundwater levels encountered during drilling were reviewed.

Geotechnical soil parameters have been proposed for the soil materials encountered beneath the site including:

- The Standard Penetration Test values of the soil materials,
- The bulk unit weight of the soil materials,
- The undrained shear strength of the cohesive soil materials,
- The effective friction angle and cohesion of the soil materials,
- The drained and undrained stiffness modulus of the soil materials,
- The coefficient of volume compressibility of the cohesive soil materials.

The proposed characteristic soil parameters are presented in Table 7-10. The majority of the characteristic parameters are typically based on the low estimates, with a discrete number of characteristic parameters based on the best estimates (e.g. unit weight) or high estimates (e.g. coefficient of volume compressibility). Variations from this table may be required for other limit states, temporary works designs and constructability-related assessments. This table may be subject to change in later revisions of the GIR and further information become available and justify such alterations.

GDG has also identified several geotechnical risks and provided recommendations for mitigation measures in a geotechnical risk register. GDG further recommends that each Designer create geological sections as required for their relevant design locations.

10.2 GEOENVIRONEMNTAL ASSESSMENT

10.2.1 PROPOSED USE

The site is considered suitable for the proposed development, although the following sub-sections provide supplementary conclusions and/or recommendations to facilitate the site development.

10.2.1.1 HUMAN HEALTH

The risk to human health from contamination within the site associated with both construction and the proposed use is considered to be low to moderate, predominantly due to the presence of asbestos fibres and lead in TP05, TP07, and TP10, located to the rear of the existing residential properties, in the north of the site. The made ground and near-surface clay soils in this area require mitigation measures during construction to reduce risks to human health (both construction workers and off-site receptors), although these are expected to comprise standard construction practices such as damping down soils during dry periods. In addition, these soils should not be placed at the surface of the proposed development, although they will be suitable for reuse beneath a clean cover layer or hardstanding.

10.2.1.2 GROUND GAS

The desk study identified no contamination with the potential to generate significant ground gas, and there are no buildings proposed as part of this development. Consequently, the risk to the construction and the proposed development is low.

However, the site is in a region of Medium radon risk, where approximately 1 in 20 properties may have elevated indoor radon measurements, and consequently any future residential development should consider the possible requirement for radon mitigation measures in properties.

10.2.1.3 WATER ENVIRONMENT

The risk to the water environment is assessed to be low, considering the magnitude of the concentrations of potential contaminants in the soil leachate, the absence of a significant soil source of contamination, the likely dilution factors, that the surface water results do not indicate any impact from the site, and the distance to the groundwater abstraction points.

10.2.1.4 PROPOSED WATER PIPELINES

Considering the available chemical analysis results, risk to water pipelines is low/moderate and consideration may need to be given to upgrading pipes if they are to be laid within the site soils. Further assessment following UKWIR guidance may be required following design of the depth and location of the proposed pipeline in order to satisfy the requirements of the regulator.

10.2.1.5 SOILS DISPOSAL

At this stage of the design, it is not known if there is a requirement to remove soils from site. Preliminary assessment suggests that predominantly inert classifications are likely to be encountered where natural ground is present, and that the Made Ground will mostly be classified as non-hazardous or locally hazardous. If disposal is required, prior to any material being disposed off-site a waste classification should be undertaken, initially using the chemical analysis data from this investigation, although additional chemical analysis and waste acceptance criteria (WAC) testing may be required.

It is also recommended that a suitably experienced geoenvironmental / waste professional is consulted to accurately classify the materials and identify the most cost-effective disposal route. Any disposal of waste must be undertaken in accordance with all relevant current waste legislation and duty of care regulations.

10.2.1.6 POTENTIAL FOR UNEXPECTED CONTAMINATION

If any unforeseen contamination be identified during earthworks or construction (e.g. hydrocarbon impacted soils, asbestos, etc.), then work in such areas should be halted until a suitably qualified professional has been consulted to assess the situation and provide advice.

10.2.1.7 IMPORTED MATERIALS

It is recommended that any imported material required for construction purposes is subject to chemical analysis and assessed against relevant screening values to demonstrate its suitability for use.

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APPENDIX A – FACTUAL REPORTS

DUBLIN ST NORTH, MONAGHAN

GROUND INVESTIGATION REPORT

Report No.:	**24-0640**
Client:	**Monaghan County Council**
Client's Representative:	**McAdam Design Ltd**
Date:	**September 2024**
Report Status:	**FINAL**

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DOCUMENT CONTROL SHEET

PROJECT REF:	24-0640
PROJECT NAME:	Dublin St North, Monaghan
CLIENT:	Monaghan County Council
CLIENT'S REPRESENTATIVE	McAdam Design Ltd

REVISION	A00	**STATUS**	FINAL	**ISSUE DATE**	17th September 2024

Prepared by:	**Reviewed by:**	**Approved by:**
Buhlebenkosi Angie Ndebele BSc. Geology	Celine Rooney Celine Rooney BSc MSc PGeo (EurGeol)	Sean Ross. Sean Ross BSc MSc PGeo MIEI

This report presents a factual account of the ground investigation in accordance with the Specification and Related Documents for Ground Investigation in Ireland 2nd Edition, published by Engineers Ireland (2016).

METHODS OF DESCRIBING SOILS AND ROCKS

Soil and rock descriptions are based on the guidance in BS5930:2015+A1:2020, The Code of Practice for Ground Investigation.

Abbreviations used on exploratory hole logs	
U	Nominal 100mm diameter undisturbed open tube sample (thick walled sampler).
UT	Nominal 100mm diameter undisturbed open tube sample (thin walled sampler).
P	Nominal 100mm diameter undisturbed piston sample.
B	Bulk disturbed sample.
LB	Large bulk disturbed sample.
D	Small disturbed sample.
C	Core sub-sample (displayed in the Field Records column on the logs).
L	Liner sample from dynamic sampled borehole.
W	Water sample.
ES / EW	Soil sample for environmental testing / Water sample for environmental testing.
SPT (s)	Standard penetration test using a split spoon sampler (small disturbed sample obtained).
SPT (c)	Standard penetration test using 60 degree solid cone.
(x,x/x,x,x,x)	Blows per increment during the standard penetration test. The initial two values relate to the seating drive (150mm) and the remaining four to the 75mm increments of the test length.
(Y for Z/ Y for Z)	Incomplete standard penetration test where the full test length was not achieved. The blows 'X' represent the total blows for the given seating or test length 'Z' (mm).
N=X	SPT blow count 'N' given by the summation of the blows 'X' required to drive the full test length (300mm).
HVP / HVR	Uncorrected in situ hand vane test result (HVP) and vane test residual result (HVR). Results presented in kPa.
V VR	Shear vane test (borehole). Shear strength stated in kPa. V: undisturbed vane shear strength VR: remoulded vane shear strength
Soil consistency description	In cohesive soils, where samples are disturbed and there are no suitable laboratory tests, N values may be used to indicate consistency on borehole logs – a median relationship of Nx5=Cu is used (as set out in Stroud & Butler 1975).
dd-mm-yyyy	Date at the end and start of shifts, shown at the relevant borehole depth. Corresponding casing and water depths shown in the adjacent columns.
▽	Water strike: initial depth of strike.
▼	Water strike: depth water rose to.
Abbreviations relating to rock core – reference Clause 36.4.4 of BS 5930: 2015+A1:2020	
TCR (%)	Total Core Recovery: Ratio of rock/soil core recovered (both solid and non-intact) to the total length of core run.
SCR (%)	Solid Core Recovery: Ratio of solid core to the total length of core run. Solid core has a full diameter, uninterrupted by natural discontinuities, but not necessarily a full circumference and is measured along the core axis between natural fractures.
RQD (%)	Rock Quality Designation: Ratio of total length of solid core pieces greater than 100mm to the total length of core run.
FI	Fracture Index: Number of natural discontinuities per metre over an indicated length of core of similar intensity of fracturing.
NI	Non Intact: Used where the rock material was recovered fragmented, for example as fine to coarse gravel size particles.
AZCL	Assessed zone of core loss: The estimated depth range where core was not recovered.
DIF	Drilling induced fracture: A fracture of non-geological origin brought about by the rock coring.
(xxx/xxx/xxx)	Spacing between discontinuities (minimum/mode/maximum) measured in millimetres.

1 AUTHORITY

On the instructions of McAdam Design Ltd, ("the Client's Representative"), acting on the behalf of Monaghan County Council ("the Client"), a ground investigation was undertaken at the site to provide geotechnical and environmental information for input to the design and construction of a proposed residential development.

This report details the work carried out both on site and in the geotechnical and chemical testing laboratories; it contains a description of the site and the works undertaken, the exploratory hole logs and the laboratory test results.

All information given in this report is based upon the ground conditions encountered during the ground investigation works, and on the results of the laboratory and field tests performed. However, there may be conditions at the site that have not been taken into account, such as unpredictable soil strata, contaminant concentrations, and water conditions between or below exploratory holes. It should be noted that groundwater levels usually vary due to seasonal and/or other effects and may at times differ to those recorded during the investigation. No responsibility can be taken for conditions not encountered through the scope of work commissioned, for example between exploratory hole points, or beneath the termination depths achieved.

This report was prepared by Causeway Geotech Ltd for the use of the Client and the Client's Representative in response to a particular set of instructions. Any other parties using the information contained in this report do so at their own risk and any duty of care to those parties is excluded.

2 PURPOSE, RATIONALE & SCOPE OF THE INVESTIGATION

The purpose of this investigation is to assess the ground conditions and to allow an evaluation of the geotechnical and environmental issues with the current site and proposed development.

The rationale has been determined by the Client's Representative, with the extent of the investigation including boreholes, trial pits, archaeological trenches, soil sampling, environmental sampling, surface water, in-situ and laboratory testing, and the preparation of a report on the findings including recommendations for construction.

3 DESCRIPTION OF SITE

The site is located at Irish Transverse Mercator 267299 333480 on the site of residential and industrial properties and access roads, located in Monaghan town, Co. Monaghan. The site location is presented in Appendix A and a summary of the surrounding land uses is presented in Table 1.

Table 1: Summary of surrounding land uses

Location	Description
North	Open green area, North Monaghan Primary Care Centre
South	Dublin Street, Old Cross Square, commercial properties
East	Residential premises, Monaghan WWTP/County Council yard
West	Glaslough Street, Diamond Centre, commercial premises

4 SITE OPERATIONS

4.1 SUMMARY OF SITE WORKS

Site operations, which were conducted between the 29th of July 2024 – 14th of August 2024, comprised:

- 3 no. light cable percussion boreholes
- 10 no. machine-dug trial pits
- 2 no. archaeological trenches
- in-situ testing, including:
    - Standard Penetration Tests
    - 1 no. infiltration test
    - 3 no. plate load tests
    - indirect CBR (DCP) tests at 4 no. locations
- GPS survey of all completed locations
- Surface water sampling at 4 no. locations

The exploratory holes and in-situ tests were located as instructed by the Client's Representative, and as shown on the exploratory hole location plan in Appendix A.

4.2 BOREHOLES

4.2.1 LIGHT PERCUSSION BOREHOLES

Three boreholes (BH01-BH03) were put down to completion in minimum 200mm diameter using a Dando 2000 cable percussion boring rig. All boreholes were terminated on encountering virtual refusal on obstructions, such as large boulders.

Hand dug inspection pits were carried out between ground level and 1.20m depth to ensure boreholes were put down at locations clear of services or subsurface obstructions.

Disturbed (bulk and small tub) samples were taken within the encountered strata. Environmental samples were taken at standard intervals, as directed by the Client's Representative.

Any water strikes encountered during boring were recorded along with any changes in their levels as the borehole proceeded.

Where water was added to assist with boring, a note has been added to the log to account for same.

Appendix B presents the borehole logs.

4.3 STANDARD PENETRATION TESTS

Standard penetration tests were carried out in accordance with BS EN 22476-3:2005+A1:2011 (BSI, 2011) at standard depth intervals using the split spoon sampler ($SPT_{(s)}$) or solid cone attachment ($SPT_{(c)}$). The penetrations are stated for those tests for which the full 150mm seating drive or 300mm test drive was not possible.

The N-values provided on the borehole logs are uncorrected and no allowance has been made for energy ratio corrections. The SPT hammer energy measurement report is provided in Appendix J.

4.4 TRIAL PITS

Ten trial pits (TP01-TP10) were excavated using an 3t and 14t tracked excavator fitted with a 600mm wide bucket, to depths of 3.30m. Trial pit TP10 was excavated to allow completion of an infiltration test.

Environmental samples were taken at standard intervals in each trial pit. Disturbed (small jar and bulk bag) samples were taken at standard depth intervals and at change of strata.

Any water strikes encountered during excavation were recorded and the stability of the trial pit walls was noted on completion.

Appendix C presents the trial pit logs with photographs of the pits and arisings provided in Appendix D.

4.5 ARCHAEOLOGICAL TRENCHES

Two archaeological trenches (TT01 and TT02) were excavated using a 3t tracked excavator fitted with a 600mm wide bucket, to a maximum depth of 0.70m, as directed by the supervising archaeologist.

The pit logs are shown in Appendix C with photographs presented in Appendix D.

4.6 INFILTRATION TESTS

One infiltration/soakaway test (TP10) was carried out in accordance with DG 365 Soakaway Design (BRE, 2016). The absence of the outflow from the pit precluded calculation of infiltration coefficients.

Appendix E presents the result and analysis of the infiltration test.

4.7 PLATE LOAD TESTS

Plate load tests were carried out at three locations (TP08, TP10, TP10A) in similarly numbered trial pits.

The plate load tests were conducted as incremental loading tests in accordance with Clause 4.1 of BS1377: Part 9: 1990 (BSI, 1990). A 450mm diameter bearing plate was used with five equal loadings to a maximum pressure of approximately 280kPa, followed by unloading. The testing was conducted using a wireless plate load testing system, PLATEMAN, which utilises Bluetooth technology with a remotely-operated rugged PDA system.

Plate movements were measured using three strain gauges fitted to a remotely fixed tripod frame. Each loading increment was maintained until the plate movement had essentially stopped.

The test results provided in Appendix F are as follows:

- plots of the plate settlements, average of the three gauges, against pressure.
- plots of average settlement against time during the loading increments/decrement.

The Modulus of Subgrade Reaction, *k*, is estimated by applying a “best fit” to the settlement-pressure plots, and is reported in MPa/m. The numerical value represents the pressure, in kPa, on the bearing plate that induces 1.25mm of settlement.

An approximate CBR value was estimated using the guidance provided in the Interim Advice Note 73/06 (Highways England, 2009) (now withdrawn). The document provides methods to convert the measured k value to the equivalent for a 762mm diameter plate and the consequent relationship with CBR. This method of estimating an equivalent CBR value is relatively conservative.

4.8 INDIRECT CBR TESTS (DCP)

An indirect CBR test was conducted at four locations (TP02, TP03, TP04 and TP07) using a Dynamic Cone Penetrometer (DCP). The equipment was developed in conjunction with the UK Transport Research Laboratory, and is discussed in CS229 (Highways England, 2020) which refers to the methodology described in TRL Overseas Road Note 18 (TRL, 1999).

The test results are presented in Appendix G in the form of plots of the variation with depth of the penetration per blow. Straight lines have been fitted to the plots and the CBR for each depth range estimated using the following relationship, which is taken from TRRL Overseas Road Note 8 (TRRL, 1990).

$$\text{Log CBR} = 2.48 - 1.057 \text{ Log (mm/blow)}$$

The frequently elevated CBR values may be due to the coarse-grained content of the penetrated soils and often do not accurately represent the characteristics of the soil matrix.

4.9 SURVEYING

The as-built exploratory hole positions were surveyed following completion of site operations by a Site Engineer from Causeway Geotech. Surveying was carried out using a Trimble R10 GPS system employing VRS and real time kinetic (RTK) techniques.

The plan coordinates Irish Transverse Mercator and ground elevation (mOD Malin) at each location are recorded on the individual exploratory hole logs. The exploratory hole location plan presented in Appendix A shows these as-built positions.

4.10 SURFACE WATER SAMPLING

Two rounds of surface water sampling were carried out to allow for environmental testing at four locations, (SWS1–SWS4) two upstream and two downstream from the site along the Ulster Canal and Shambles river.

The environmental test results are presented in Appendix H.

5 LABORATORY WORK

Laboratory testing was carried out between 1st August – 16th September 2024.

5.1 GEOTECHNICAL LABORATORY TESTING OF SOILS

Laboratory testing of soils comprised:

- **soil classification:** moisture content measurement, Atterberg Limit tests and particle size distribution analysis.

- **soil chemistry:** pH, water soluble sulphate content and organic matter content

Laboratory testing of soils samples was carried out in accordance with BS 1377, Methods of test for soils for civil engineering purposes; Part 1 (BSI, 2016), and Parts 2-9 (BSI, 1990).

The test results are presented in Appendix I.

5.2 ENVIRONMENTAL LABORATORY TESTING OF SOIL & WATER

Environmental testing, as specified by the Client's Representative, was conducted on selected environmental soil and water samples by Derwentside Environmental Testing Services in Consett, Durham.

This included testing for a range of determinants, including:

- Metals
- Speciated total petroleum hydrocarbons (TPH)

- Speciated polycyclic aromatic hydrocarbons (PAH)
- BTEX compounds
- Volatile Organic Compounds (VOCs)
- Semi-Volatile Organic Compounds (SVOCs)
- Polychlorinated biphenyls (PCBs)
- Phenols
- Organic matter
- Total Organic Carbon (TOC)
- Cyanides
- Asbestos screen
- Sulphate and sulphide
- Sulphur
- Phosphate
- Calcium
- pH
- Waste Acceptance Criteria (WAC)

Results of environmental laboratory testing are presented in Appendix J.

6 GROUND CONDITIONS

6.1 GENERAL GEOLOGY OF THE AREA

Published geological mapping from the online Geological Survey Ireland spatial resources database indicate the superficial deposits underlying the site comprise till derived from limestones. These deposits are shown to be underlain by dark muddy limestone, shale of the Ballysteen Formation.

6.2 GROUND TYPES ENCOUNTERED DURING INVESTIGATION OF THE SITE

A summary of the ground types encountered in the exploratory holes is listed below, in approximate stratigraphic order:

- **Topsoil:** between 50-400mm thick when encountered across the site.

- **Made Ground (fill):** was encountered in all exploratory holes and consisted of reworked sandy gravelly clay/sandy gravel fill with low cobble and boulder content with fragments of concrete, ceramics, plastic sheeting, metal, cloth, wire, tin, timber and brick extending to a depth of 2.20m in TP02 and TP07 where the pits terminated on obstructions.

- **Glacial Till:** sandy gravelly clay/silt, frequently with low cobble content, typically firm or stiff in upper horizons, becoming very stiff with increasing depth.

6.3 GROUNDWATER

Groundwater was noted in TP10 at a depth of 2.70m and damp below 2.20m in TP09. There were no other groundwater strikes noted during drilling/excavation of the remaining exploratory holes. However, it should be noted that the casing used in supporting the borehole walls during drilling may have sealed out any groundwater strikes and the possibility of encountering groundwater during excavation works should not be ruled out.

Seasonal variation in groundwater levels should also be factored into design considerations.

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APPENDIX A

SITE AND EXPLORATORY HOLE LOCATION PLANS

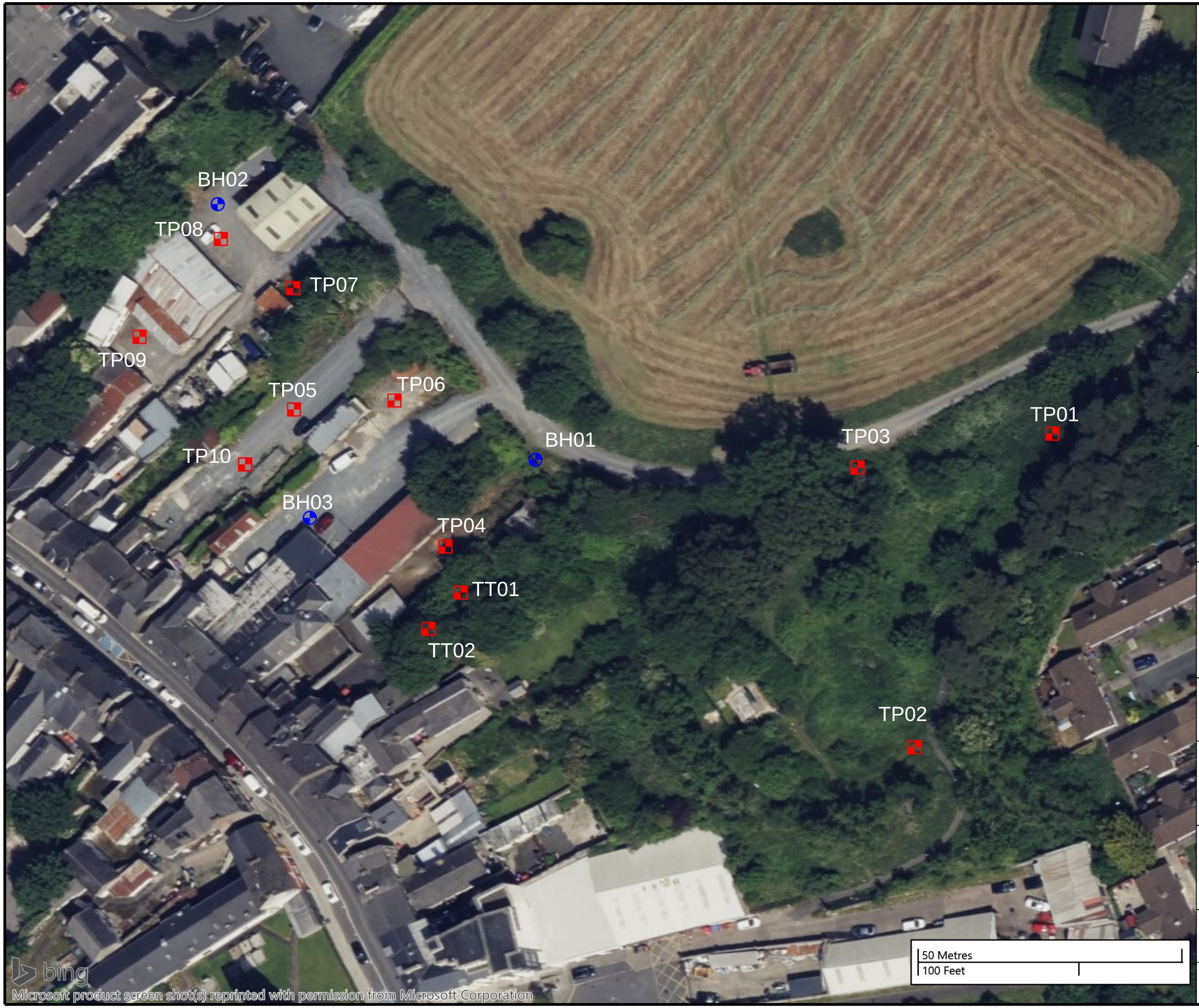
Legend Key

Project No.	24-0640
Client	Monaghan County Council
Client's Rep	McAdam Design Ltd

Site Location Plan

Dublin St North, Monaghan

Last Revision	05/09/2024
Scale	1:10000



Legend Key

- ● Locations By Type - CP
- 🟥 Locations By Type - TP

NOTE: Exploratory hole locations TT01-02 are approximate and generated from logging software.

Project No.	24-0640
Client	Monaghan County Council
Client's Rep	McAdam Design Ltd

Exploratory Hole Location Plan

Dublin St North, Monaghan

CAUSEWAY GEOTECH

Last Revision	10/09/2024
Scale	1:1000

APPENDIX B

BOREHOLE LOGS

CAUSEWAY GEOTECH	**Project No.** **24-0640**	**Project Name:** Dublin St North, Monaghan **Client:** Monaghan County Council **Client's Rep:** McAdam Design Ltd	**Borehole ID** **BH01**

Method	**Plant Used**	Depth Top	Depth Base	**Coordinates**
Cable Percussion	Dando 2000	0.00	3.50	667412.00 E 833749.50 N

Final Depth: 3.50 m	**Start Date:** 30/07/2024	**Driller:** CB	Sheet 1 of 1 Scale: 1:40
Elevation: 66.01 mOD	**End Date:** 30/07/2024	**Logger:** KH	FINAL

Depth (m)	**Sample / Tests**	**Field Records**	**Casing Depth (m)**	**Water Depth (m)**
0.20 - 1.20	B3			
0.50	ES1			
1.00	D6			
1.00	ES2			
1.20 - 1.65	D4			
1.20 - 2.00	B10			
1.20 - 1.65	SPT (S)	N=4 (1,0/0,1,1,2) Hammer SN = 1411	1.20	Dry
2.00	D7			
2.00 - 2.45	D5			
2.00 - 3.00	B11			
2.00 - 2.45	SPT (S)	N=18 (3,6/7,7,2,2) Hammer SN = 1411	2.00	Dry
3.00	D8			
3.00 - 3.45	D9			
3.00 - 3.38	SPT (S)	50 (4,8/50 for 231mm) Hammer SN = 1411	3.00	Dry

Level mOD	**Depth (m)**	**Legend**	**Description**	**Water**	**Backfill**
			MADE GROUND: Reworked slightly gravelly CLAY. Gravel is subangular fine to coarse.		
65.71	0.30		Soft becoming firm dark brown slightly sandy slightly gravelly CLAY with low cobble content. Sand is fine to coarse. Gravel is angular fine to coarse. Cobbles are subangular.		
63.61	2.40		Stiff dark brown slightly sandy slightly gravelly CLAY with medium cobble content. Sand is fine to coarse. Gravel is angular fine to coarse. Cobbles are subangular.		
63.01	3.00		Recovered as angular coarse GRAVEL and COBBLES with clay.		
62.51	3.50		End of Borehole at 3.50m		

Water Strikes

Struck at (m)	Casing to (m)	Time (min)	Rose to (m)

Chiselling Details

From (m)	To (m)	Time (hh:mm)
3.40	3.50	01:00

Casing Details

To (m)	Diameter
3.50	200

Water Added

From (m)	To (m)

Remarks

Inspection pit hand dug to 1.20m. No groundwater encountered.

Termination Reason

Terminated on obstruction.

Last Updated

17/09/2024

AGS

Project No. **24-0640**	**Project Name:** Dublin St North, Monaghan **Client:** Monaghan County Council **Client's Rep:** McAdam Design Ltd		**Borehole ID** **BH02**

Method	**Plant Used**	Depth Top	Depth Base	**Coordinates**
Cable Percussion	Dando 2000	0.00	2.70	667350.60 E 833797.30 N

Final Depth: 2.70 m	**Start Date:** 31/07/2024	**Driller:** CB	Sheet 1 of 1 Scale: 1:40
Elevation: 63.17 mOD	**End Date:** 31/07/2024	**Logger:** CR	FINAL

Depth (m)	**Sample / Tests**	**Field Records**	**Casing Depth (m)**	**Water Depth (m)**	**Level mOD**	**Depth (m)**	**Legend**	**Description**	**Water**	**Backfill**
								MADE GROUND: Compacted angular fine to coarse GRAVEL.		
0.20 - 1.20	B4				62.97	0.20		Firm becoming stiff dark brown slightly sandy gravelly CLAY with medium cobble content. Sand is fine to coarse. Gravel is subangular fine to coarse. Cobbles are subangular.		
0.50	ES1									
1.00	D3									
1.00	ES2									
1.20 - 2.00	B7									
1.20 - 1.65	SPT (S)	N=17 (2,4/4,5,4,4) Hammer SN = 1411	1.20	Dry						
2.00	D5									
2.00 - 2.45	D9									
2.00 - 2.60	B8									
2.00 - 2.37	SPT (S)	50 (4,4/50 for 215mm) Hammer SN = 1411	2.00	Dry						
2.60	D6				60.57	2.60		Recovered as angular coarse GRAVEL with clay.		
					60.47	2.70		End of Borehole at 2.70m		

Water Strikes

Struck at (m)	Casing to (m)	Time (min)	Rose to (m)

Chiselling Details

From (m)	To (m)	Time (hh:mm)
2.60	2.70	01:00

Casing Details

To (m)	Diameter
2.60	200

Water Added

From (m)	To (m)

Remarks

Inspection pit hand dug to 1.20m. No groundwater encountered.

Termination Reason

Terminated on obstruction.

Last Updated

17/09/2024

CAUSEWAY GEOTECH	Project No.	Project Name: Dublin St North, Monaghan	Borehole ID
	24-0640	Client: Monaghan County Council	BH03
		Client's Rep: McAdam Design Ltd	

Method	Plant Used	Depth Top	Depth Base	Coordinates				Sheet 1 of 1
Cable Percussion	Dando 2000	0.00	3.45	667369.00 E 833737.80 N	**Final Depth:** 3.45 m	**Start Date:** 29/07/2024	**Driller:** CB	Scale: 1:40
					Elevation: 61.40 mOD	**End Date:** 30/07/2024	**Logger:** KH	FINAL

Depth (m)	Sample / Tests	Field Records	Casing Depth (m)	Water Depth (m)	Level mOD	Depth (m)	Legend	Description	Water	Backfill
0.10 - 1.20	B1				61.30	0.10		MADE GROUND: Crushed grey angular coarse GRAVEL.		
								MADE GROUND: Greyish brown slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is subangular fine to coarse of various lithologies.		
0.50	ES10									
					60.70	0.70		Firm dark to lightish brown slightly sandy gravelly CLAY with medium cobble content. Sand is fine to coarse. Gravel is subangular fine to coarse. Cobbles are subangular of various lithologies including limestone.		
1.00	D3									
1.00	ES11									
1.20 - 1.65	D2									
1.20 - 2.00	B5									
1.20 - 1.65	SPT (S)	N=45 (2,2/7,8,11,19) Hammer SN = 1411	0.00	Dry						
2.00	D8									
2.00 - 2.45	D9									
2.00 - 3.00	B6									
2.00 - 2.45	SPT (S)	N=12 (2,3/4,3,3,2) Hammer SN = 1411	2.00	Dry						
3.00	D4				58.40	3.00		Recovered as angular coarse GRAVEL and COBBLES with much clay.		
3.00 - 3.30	B7									
3.00 - 3.45	D12									
3.00 - 3.30	SPT (C)	50 (6,9/50 for 150mm) Hammer SN = 1411	3.00	Dry						
					57.95	3.45		End of Borehole at 3.45m		

Water Strikes

Struck at (m)	Casing to (m)	Time (min)	Rose to (m)

Chiselling Details

From (m)	To (m)	Time (hh:mm)
3.00	3.30	01:00

Remarks

Inspection pit hand dug to 1.20m. No groundwater encountered.

Casing Details

To (m)	Diameter
3.30	200

Water Added

From (m)	To (m)

Termination Reason	Last Updated
Terminated on obstruction.	17/09/2024

AGS

Project No. 24-0640

Project Name: Dublin St North, Monaghan

Trial Pit ID

TP01

Coordinates

667510.50 E

833755.90 N

Client: Monaghan County Council

Method: Trial Pitting

Client's Representative: McAdam Design Ltd

Sheet 1 of 1

Scale: 1:25

Plant: 3t Tracked Excavator

Elevation 67.25 mOD

Date: 09/08/2024

Logger: RW

FINAL

Depth (m)	Sample / Tests	Field Records	Level (mOD)	Depth (m)	Legend	Description	Water
			67.05	0.20	▨	TOPSOIL	
0.25 0.25 - 0.25 0.50 0.50	B4 ES1 B5 ES2		66.35	0.90	▩	MADE GROUND: Firm brown slightly sandy slightly gravelly CLAY with fragments of red brick, plastic, tin and ceramics. Sand is fine to coarse. Gravel is subrounded fine to coarse.	
1.00 1.00 - 1.00 2.00	B6 ES3 B7		64.95	2.30	▦	Firm to stiff greyish brown slightly sandy slightly gravelly CLAY with low cobble and boulder content. Sand is fine to coarse. Gravel is subrounded fine to coarse. Cobbles and boulders are subrounded.	

End of trial pit at 2.30m

Water Strikes	
Struck at (m)	Remarks

Depth: 2.30

Width: 0.40

Length: 2.30

Remarks:

No groundwater encountered.

Stability:

Stable

Termination Reason

Terminated at maximum reach of excavator.

Last Updated

17/09/2024

CAUSEWAY GEOTECH	**Project No.** 24-0640	**Project Name:** Dublin St North, Monaghan	**Trial Pit ID** **TP02**
	Coordinates 667485.10 E 833695.80 N	**Client:** Monaghan County Council	
Method: Trial Pitting		**Client's Representative:** McAdam Design Ltd	Sheet 1 of 1 Scale: 1:25
Plant: 3t Tracked Excavator	**Elevation** 64.90 mOD	**Date:** 09/08/2024 **Logger:** RW	FINAL

Depth (m)	Sample / Tests	Field Records	Level (mOD)	Depth (m)	Legend	Description	Water
			64.85	0.05	▨	TOPSOIL	
			64.70	0.20	▨	MADE GROUND: Dark brown slightly sandy clayey angular fine to coarse GRAVEL with fragments of red brick. Sand is fine to coarse.	
0.25	B4				▨	MADE GROUND: Very stiff light greyish brown slightly sandy gravelly CLAY with fragments of red brick. Sand is fine to coarse. Gravel is subangular fine to coarse.	
0.25	ES1						
0.50	B5						
0.50 - 0.50	ES2						
1.00	ES3						
1.00 - 1.00	B6						
1.50	ES7						
			63.30	1.60	▨	MADE GROUND: Very stiff greyish brown slightly sandy slightly gravelly CLAY with low cobble and boulder content and fragments of red brick. Sand is fine to coarse. Gravel is subrounded fine to coarse. Cobbles and boulders are subrounded.	
2.00	B9						
2.00 - 2.00	ES8						
			62.70	2.20		End of trial pit at 2.20m	

Water Strikes

Struck at (m)	Remarks

Depth: 2.20
Width: 0.60
Length: 2.60

Remarks:
No groundwater encountered.
Clay pipe encountered at 1.15m, pit extended to the south-east.

Stability:
Stable

Termination Reason
Terminated at refusal on boulders.

Last Updated
17/09/2024

AGS

CAUSEWAY GEOTECH

Project No. 24-0640	**Project Name:** Dublin St North, Monaghan		**Trial Pit ID** **TP03**
Coordinates 667473.40 E 833748.90 N	**Client:** Monaghan County Council		
Method: Trial Pitting	**Client's Representative:** McAdam Design Ltd		Sheet 1 of 1 Scale: 1:25
Plant: 3t Tracked Excavator	**Elevation** 71.73 mOD	**Date:** 08/08/2024	**Logger:** RW
			FINAL

Depth (m)	Sample / Tests	Field Records
0.25	B4	
0.25 - 0.25	ES1	
0.50 - 0.50	B5	
0.50 - 0.50	ES2	
1.00	B6	
1.00	ES3	
1.30	B7	

Level (mOD)	Depth (m)	Description	Water
71.68	0.05	TOPSOIL	
		MADE GROUND: Grey slightly sandy slightly silty angular fine to coarse GRAVEL. Sand is fine to coarse.	
71.33	0.40	MADE GROUND: Very stiff brown slightly gravelly sandy CLAY with low cobble content and fragments of plastic. Sand is fine to coarse. Gravel is subrounded fine to coarse.	
70.63	1.10	Very stiff brown slightly sandy slightly gravelly CLAY with low cobble and boulder content. Sand is fine to coarse. Gravel is subrounded fine to coarse. Cobbles are subrounded.	
69.73	2.00	End of trial pit at 2.00m	

Water Strikes

Struck at (m)	Remarks

Depth: 2.00
Width: 0.90
Length: 2.50

Remarks:
No groundwater encountered.

Stability:
Stable

Termination Reason
Terminated at refusal on boulders.

Last Updated
17/09/2024

AGS

CAUSEWAY GEOTECH

Method: Trial Pitting	**Project No.** 24-0640	**Project Name:** Dublin St North, Monaghan	**Trial Pit ID** **TP04**
Plant: 3t Tracked Excavator	**Coordinates** 667395.00 E 833732.70 N	**Client:** Monaghan County Council	Sheet 1 of 1 Scale: 1:25
	Elevation 62.99 mOD	**Client's Representative:** McAdam Design Ltd	FINAL
		Date: 08/08/2024	**Logger:** RW

Depth (m)	Sample / Tests	Field Records	Level (mOD)	Depth (m)	Legend	Description	Water
			62.89	0.10	▨	MADE GROUND: Brown clayey WOODCHIP	
0.25 0.25 - 0.25	B4 ES1		62.59	0.40	▨	MADE GROUND: Firm dark brown slightly sandy slightly gravelly CLAY with fragments of red brick, ceramics, plastic and roots. Sand is fine to coarse. Gravel is subrounded fine to coarse.	
0.50 - 0.50 0.50 - 0.50 1.00 1.00	B5 ES2 B6 ES3		61.59	1.40	▨	Stiff orangish brown gravelly sandy SILT with low cobble content. Sand is fine to coarse. Gravel is subangular fine to coarse. Cobbles are subangular of sandstone.	
1.50	B7		60.89	2.10	▨	Greyish brown sandy very silty angular fine to coarse GRAVEL with medium cobble content. Sand is fine to coarse. Cobbles are subangular.	
2.20	B8		60.59	2.40	▨	Very stiff greyish brown slightly sandy slightly gravelly SILT with low cobble content. Sand is fine to coarse. Gravel is subangular fine to coarse. Cobbles are subangular.	
						End of trial pit at 2.40m	

Water Strikes

Struck at (m)	Remarks

Depth: 2.40
Width: 0.60
Length: 1.90

Remarks:
No groundwater encountered.

Stability:
Unstable below 1.40m

Termination Reason
Terminated at refusal in very stiff silt.

Last Updated
17/09/2024

AGS

CAUSEWAY GEOTECH	**Project No.** 24-0640	**Project Name:** Dublin St North, Monaghan	**Trial Pit ID** **TP05**
	Coordinates 667365.70 E 833758.40 N	**Client:** Monaghan County Council	
Method: Trial Pitting		**Client's Representative:** McAdam Design Ltd	Sheet 1 of 1 Scale: 1:25
Plant: 14T Tracked Excavator	**Elevation** 61.80 mOD	**Date:** 13/08/2024 **Logger:** MMC	FINAL

Depth (m)	Sample / Tests	Field Records	Level (mOD)	Depth (m)	Legend	Description	Water
					▨	MADE GROUND: Crushed angular coarse GRAVEL of limestone.	
			61.63	0.17	▨	MADE GROUND: Brown slightly sandy CLAY with fragments of plastic sheeting, metal, hosing, cloth, tyres, carpet, wire, radiator and timber. Sand is fine to coarse.	
0.50 0.50 - 0.50	B3 ES1						
			60.85	0.95	░	Firm rusty brown slightly gravelly CLAY with low cobble content. Gravel is subangular fine to coarse of limestone. Cobbles are subangular to subrounded of limestone.	
1.00 1.00 - 1.00	B4 ES2						
			60.50	1.30	░	Firm slightly greyish brown slightly sandy gravelly CLAY with high cobble content. Sand is fine to coarse. Gravel is subangular to angular of limestone. Cobbles are subangular to angular of limestone.	
1.70 1.70	B3 B5						
2.10	ES2						
2.50	B6						
			59.10	2.70	░	Firm slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is subangular fine to coarse of various lithologies.	
3.20 3.20	B5 B7						
			58.50	3.30		End of trial pit at 3.30m	

Water Strikes

Struck at (m)	Remarks

Depth: 3.30
Width: 1.50
Length: 4.00

Remarks:
No groundwater encountered

Stability:
Unstable

Termination Reason
Terminated at scheduled depth.

Last Updated
17/09/2024

AGS

CAUSEWAY GEOTECH	**Project No.** 24-0640	**Project Name:** Dublin St North, Monaghan	**Trial Pit ID** **TP06**
	Coordinates 667384.90 E 833760.40 N	**Client:** Monaghan County Council	
Method: Trial Pitting		**Client's Representative:** McAdam Design Ltd	Sheet 1 of 1 Scale: 1:25
Plant: 3t Tracked Excavator	**Elevation** 62.08 mOD	**Date:** 08/08/2024 **Logger:** RW	FINAL

Depth (m)	Sample / Tests	Field Records	Level (mOD)	Depth (m)	Legend	Description	Water
			62.03	0.05		MADE GROUND: Bluish grey sandy silty angular fine to medium GRAVEL. Sand is fine to coarse.	
0.25 0.25 0.50 - 0.50 0.50 - 0.50 1.00 1.00	B4 ES1 B5 ES2 B6 ES3		60.58	1.50	▨	MADE GROUND: Very stiff light brown slightly gravelly sandy CLAY with low cobble and boulder content and fragments of plastic, glass and red brick. Sand is fine to coarse. Gravel is subangular fine to coarse. Cobbles and boulders are subangular.	
						End of trial pit at 1.50m	

Water Strikes

Struck at (m)	Remarks

Depth: 1.50
Width: 0.80
Length: 2.20

Remarks:
No groundwater encountered.

Stability:
Stable

Termination Reason
Terminated at refusal on boulders.

Last Updated
17/09/2024

AGS

Project No. 24-0640	**Project Name:** Dublin St North, Monaghan		**Trial Pit ID** **TP07**
Coordinates 667365.20 E 833781.50 N	**Client:** Monaghan County Council		
Method: Trial Pitting	**Client's Representative:** McAdam Design Ltd		Sheet 1 of 1 Scale: 1:25
Plant: 3t Tracked Excavator	**Elevation** 62.54 mOD	**Date:** 08/08/2024	**Logger:** RW
			FINAL

Depth (m)	Sample / Tests	Field Records	Level (mOD)	Depth (m)	Legend	Description	Water
			62.49	0.05		MADE GROUND: Firm dark brown slightly sandy slightly gravelly CLAY with fragments of plastic, metal, styrofoam, wire and glass bottles. Sand is fine to coarse. Gravel is angular fine to coarse.	
0.25 0.25 - 0.25 0.50 0.50	B4 ES1 B5 ES2		61.64	0.90	▨	MADE GROUND: Very stiff light brown slightly sandy gravelly CLAY with low cobble content and fragments of red brick and concrete. Sand is fine to coarse. Gravel is subangular fine to coarse. Cobbles are subangular.	
1.00 1.00 - 1.00	B6 ES3		61.24	1.30	▨	MADE GROUND: Greyish brown sandy very silty angular fine to coarse GRAVEL with medium cobble and boulder content. Sand is fine to coarse. Cobbles and boulders are subangular of limestone.	
1.50 1.50 - 1.50 2.00 2.00	B7 ES8 B9 ES10		60.34	2.20	▨	MADE GROUND: Firm greyish brown slightly sandy slightly gravelly CLAY with low cobble and boulder content and fragments of red brick. Sand is fine to coarse. Gravel is subangular fine to coarse. Cobbles and boulders are subangular.	
						End of trial pit at 2.20m	

Water Strikes

Struck at (m)	Remarks

Depth: 2.20
Width: 0.60
Length: 2.50

Remarks:
No groundwater encountered.

Stability:
Stable

Termination Reason
Terminated at refusal on boulders.

Last Updated
17/09/2024

AGS

	Project No. 24-0640	**Project Name:** Dublin St North, Monaghan	**Trial Pit ID** **TP08**
	Coordinates 667351.30 E 833790.70 N	**Client:** Monaghan County Council	
Method: Trial Pitting		**Client's Representative:** McAdam Design Ltd	Sheet 1 of 1 Scale: 1:25
Plant: 14T Tracked Excavator	**Elevation** 62.81 mOD	**Date:** 13/08/2024 **Logger:** MMC	FINAL

Depth (m)	Sample / Tests	Field Records	Level (mOD)	Depth (m)	Legend	Description	Water
			62.71	0.10		Crushed angular coarse GRAVEL of limestone.	
0.50 0.50 - 0.50	B3 ES1		62.06	0.75		MADE GROUND: Firm brown slightly sandy gravelly CLAY with fragments of brick and tile. Sand is fine to coarse. Gravel is subangular to angular fine to coarse of various lithologies.	
1.00 1.00	B4 ES2		61.61	1.20		Firm greyish brown slightly sandy gravelly CLAY with low cobble content and fragments of brick and cloth. Sand is fine to coarse. Gravel is subangular to angular of limestone. Cobbles are subangular of limestone.	
1.80 1.80 2.80	B3 B5 B6		59.71	3.10		Firm light brown slightly sandy gravelly CLAY with medium cobble content. Sand is fine to coarse. Gravel is subangular fine to coarse of limestone. Cobbles are subangular of limestone.	
						End of trial pit at 3.10m	

Water Strikes

Struck at (m)	Remarks

Depth: 3.10
Width: 1.20
Length: 4.00

Remarks:
No groundwater encountered

Stability:
Stable

Termination Reason
Terminated at scheduled depth.

Last Updated
17/09/2024

CAUSEWAY GEOTECH

Project No.: 24-0640

Project Name: Dublin St North, Monaghan

Trial Pit ID: TP09

Coordinates: 667336.10 E 833771.80 N

Client: Monaghan County Council

Method: Trial Pitting

Client's Representative: McAdam Design Ltd

Sheet 1 of 1

Scale: 1:25

Plant: 3T Tracked Excavator

Elevation: 60.69 mOD

Date: 14/08/2024

Logger: MMC

FINAL

Depth (m)	Sample / Tests	Field Records	Level (mOD)	Depth (m)	Legend	Description	Water
			60.59	0.10	▨	MADE GROUND: Brown very clayey crushed angular fine to coarse GRAVEL with brick.	
0.50 0.50 - 0.50	B3 ES1						
1.00 1.00	B4 ES2		59.64	1.05	▨	MADE GROUND: Dark brown slightly sandy slightly gravelly CLAY with rootlets and fragments of brick. Sand is fine to coarse. Gravel is subangular fine to coarse of limestone.	
1.50 1.50	B3 B5		58.69	2.00	▤	Light yellowish brown slightly gravelly sandy CLAY. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse of limestone and sandstone.	
2.30 2.30	B4 B6	Damp at 2.20m	58.19	2.50	▤	Firm light brown mottled light greyish brown slightly sandy gravelly silty CLAY. Sand is fine to coarse. Gravel is subangular fine to coarse of limestone.	▼
						End of trial pit at 2.50m	

Water Strikes

Struck at (m)	Remarks
2.20	Damp at 2.20m

Depth: 2.50

Width: 0.40

Length: 3.00

Remarks:
No groundwater encountered

Stability:
Stable

Termination Reason
Terminated due to maximum reach of excavator.

Last Updated
17/09/2024

AGS

CAUSEWAY GEOTECH	**Project No.** 24-0640	**Project Name:** Dublin St North, Monaghan		**Trial Pit ID** **TP10**
	Coordinates 667356.50 E 833747.80 N	**Client:** Monaghan County Council		
Method: Trial Pitting		**Client's Representative:** McAdam Design Ltd		Sheet 1 of 1 Scale: 1:25
Plant: 14T Tracked Excavator	**Elevation** 61.31 mOD	**Date:** 13/08/2024	**Logger:** MMC	FINAL

Depth (m)	Sample / Tests	Field Records	Level (mOD)	Depth (m)	Legend	Description	Water
			61.11	0.20		MADE GROUND: Light grey very sandy slightly silty angular fine to coarse GRAVEL of limestone. Sand is fine to coarse.	
0.50 0.50 - 0.50 0.50 - 0.50	B3 B1 ES1		60.71	0.60		Firm dark grey slightly sandy slightly gravelly CLAY with a few rootlets and high organic odour. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse of various lithologies.	
1.00 1.00	B4 ES2		59.71	1.60		Firm brown slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is subangular fine to coarse of sandstone.	
1.70 1.70	B3 B5		58.91	2.40		Firm light brown slightly gravelly SILT. Gravel is medium to coarse of sandstone and limestone.	
2.60 2.60	B4 B6		58.21	3.10		Light brown slightly gravelly slightly sandy silty CLAY with medium cobble content. Sand is fine to coarse. Gravel is subangular to angular fine to coarse of limestone. Cobbles are subangular to angular of limestone.	▼
						End of trial pit at 3.10m	

Water Strikes	
Struck at (m)	Remarks
2.70	

Depth: 3.10

Width: 1.00

Length: 5.00

Remarks:

No groundwater encountered.

Stability:

Unstable

Termination Reason

Terminated at scheduled depth

Last Updated

17/09/2024

AGS

CAUSEWAY GEOTECH	**Project No.** 24-0640	**Project Name:** Dublin St North, Monaghan	**Trial Pit ID** **TT01**
	Coordinates E N	**Client:** Monaghan County Council	
Method: Archaeological Trench		**Client's Representative:** McAdam Design Ltd	Sheet 1 of 1 Scale: 1:25
Plant: 3t Tracked Excavator	**Elevation** mOD	**Date:** 08/08/2024 **Logger:** RW	FINAL

Depth (m)	Sample / Tests	Field Records	Level (mOD)	Depth (m)	Legend	Description	Water
				0.20	▨	TOPSOIL *0.10-0.15m: Concrete encountered in southwestern end of trench.*	
				0.40	▩	MADE GROUND: Grey sandy angular fine to coarse GRAVEL. Sand is fine to coarse.	
				0.45	▩	MADE GROUND: Stiff dark brown slightly sandy slightly gravelly CLAY with fragments of red brick. Sand is fine to coarse. Gravel is angular fine to coarse.	
				0.70	⊠	Very stiff orangish brown slightly gravelly sandy SILT with low cobble content. Sand is fine to coarse. Gravel is subangular fine to coarse. Cobbles are angular.	
						End of trial pit at 0.70m	

Water Strikes	
Struck at (m)	Remarks

Depth: 0.70
Width: 1.60
Length: 7.00

Remarks:
No groundwater encountered.

Stability:
Stable

Termination Reason
Terminated on Archaeologist's instruction. Unable to survey location due to tree cover.

Last Updated
17/09/2024

AGS

CAUSEWAY GEOTECH	**Project No.** 24-0640	**Project Name:** Dublin St North, Monaghan	**Trial Pit ID** **TT02**
	Coordinates E N	**Client:** Monaghan County Council	
Method: Archaeological Trench		**Client's Representative:** McAdam Design Ltd	Sheet 1 of 1 Scale: 1:25
Plant: 3t Tracked Excavator	**Elevation** mOD	**Date:** 08/08/2024 **Logger:** RW	FINAL

Depth (m)	Sample / Tests	Field Records	Level (mOD)	Depth (m)	Legend	Description	Water
				0.40	▨	TOPSOIL	
				0.55	▦	MADE GROUND: Firm orangish brown slightly gravelly sandy SILT with low cobble content and fragments of plastic, red brick, concrete pipe and timber. Sand is fine to coarse. Gravel is angular fine to coarse. Cobbles are subangular.	
				0.60	✕	Stiff orangish brown slightly gravelly sandy SILT with low cobble content. Sand is fine to coarse. Gravel is subangular fine to coarse. Cobbles are subangular.	
						End of trial pit at 0.60m	

Water Strikes

Struck at (m)	Remarks

Depth: 0.60
Width: 1.60
Length: 7.60

Remarks:
No groundwater encountered.

Stability:
Stable

Termination Reason
Terminated on Archaeologist's instruction. Unable to survey location due to tree cover.

Last Updated
17/09/2024

AGS

APPENDIX C

TRIAL PIT LOGS

APPENDIX D

TRIAL PIT PHOTOGRAPHS

TP01

TP01

TP01

TP02

TP02

TP02

TP03

TP03

TP03

TP04

TP04

TP04

TP04

TP05

TP05

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TP09

TP10

TP10

TP10

TP10

TT01

TT01

TT01

TT02

TT02

TT02

CAUSEWAY
GEOTECH

APPENDIX E

INFILTRATION TESTS

Soakaway Infiltration Test

Project No.: 24-0640
Site: Dublin St North Monaghan
Test Location: TP10
Test Date: 13 August 2024

	width (m)	length (m)
test pit top dimensions	0.70	1.60
test pit base dimensions	0.20	0.40
test pit depth (m)	1.50	

Analysis using method as described in BRE Digest 365 and CIRIA Report C697-The SUDS Manual

depth to groundwater before adding water (m) = DRY

Time (mins)	Depth to water surface (m)	Head of water in pit (m)
0	0.51	0.99
0	0.52	0.98
1	0.52	0.98
1	0.53	0.97
2	0.53	0.97
2	0.53	0.97
3	0.54	0.96
3	0.54	0.96
15	0.62	0.88
20	0.64	0.86
30	0.69	0.81
40	0.72	0.78
50	0.75	0.75
60	0.78	0.72
90	0.84	0.66
180	0.88	0.62
210	0.94	0.56
270	1.00	0.50

RESULTS (FROM GRAPH BELOW)

Test start

75% head of water at	0.74 m
depth to water surface (target)	0.76 m
time to reach target depth	50.0 mins

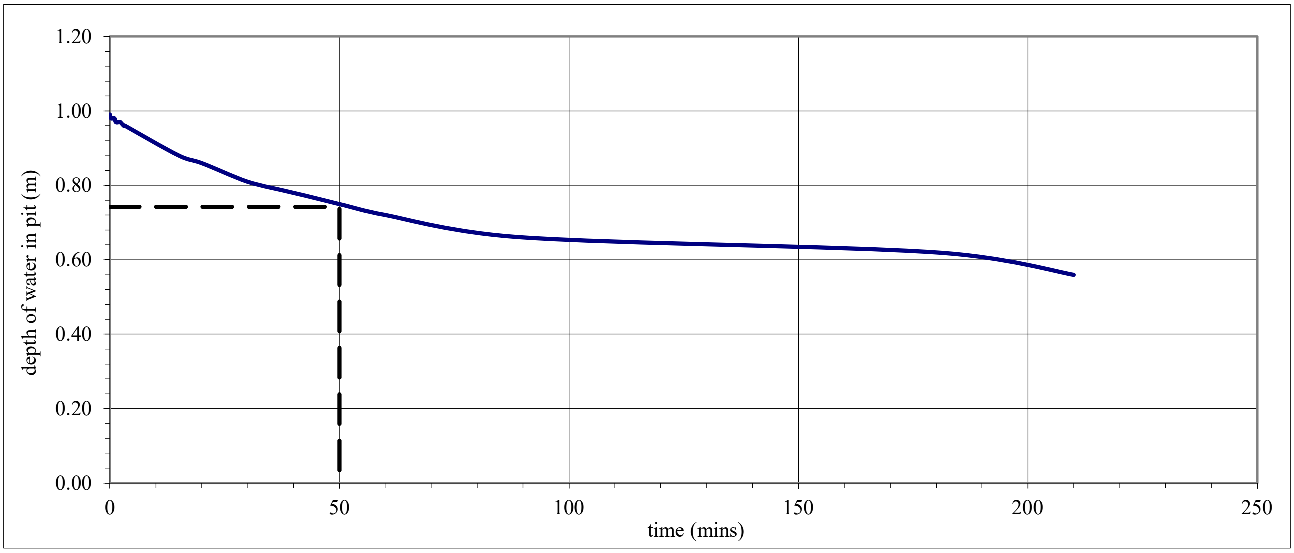
Test end

25% head of water at	0.25 m
depth to water surface (target)	1.25 m
time to reach target depth	not reached

infiltration rate (q) is very low

TARGET DEPTHS AND CALCULATED VALUES

time (mins)	depth to water surface (m)	head of water in pit (m)	time elapsed (mins)	volume of water lost (m^3)	Area of walls and base at 50% drop (m^2)	q (m/min)	q (m/h)
50	0.76	0.74	N/A				



APPENDIX F

PLATE LOAD TEST RESULTS

Causeway Geotech Ltd
8 Drumnahiskey Road, Balnamore , Ballymoney, BT53 7QL
Tel: 028 2766 6640

PLATE LOADING TEST REPORT

in accordance with BS 1377 : Part 9 Cl. 4.1 : 1990
Incremental loading test

Project	Dublin street	**Test No:**	TP-08
Client	Monaghan County Council	**Lab Ref No:**	24-0640
		Date Reported	27.08.24
		Weather Conditions	Dry
Technician	MMC	**Air Temperature °C**	20
Date Tested	13.08.24	**Plate Dia (mm)**	455
Location			
GPS Coord's		**Depth (m)**	0.6
Material Type	Clay	**Reaction Type**	14t Excavator
No Cycles	1	**App Weight (kg)**	62

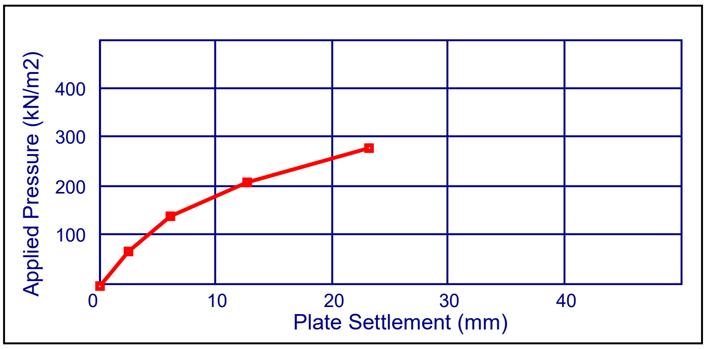
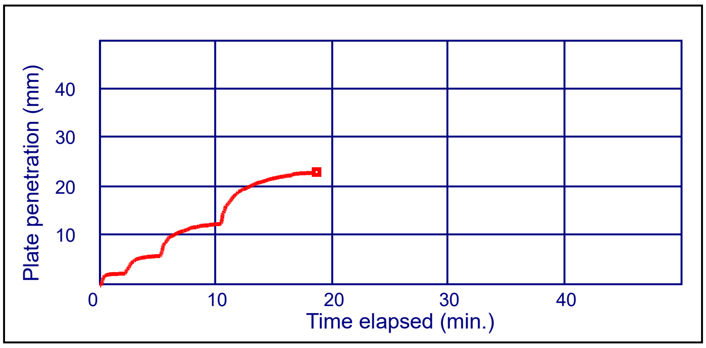


Plate Settlement (mm)	Applied Pressure (kN/m2)
0.00	0.0
2.44	71.2
6.04	143.3
12.63	212.7
23.12	282.9



	Cycle 1
Maximum Applied Pressure (kPa):	**283**
Maximum deformation (mm):	**23.12**
Modulus of subgrade reaction K (MN/m3):	**29.2**
K762 (MN/m3):	**18.4**
Estimated CBR (%):	**1.5**

Comments: Displacement transducer(s) exceeded maximum range after 283kPa.
Test data after that point has not been presented here.

Approved Signature
Causeway Geotech
Matthew Gilbert
Associate

Test Remarks:
Calculation of Equivalent CBR Value from Plate Bearing Test taken from Design Manual for Roads and Bridges Volume 7 Section 2 Chapter 4 Incorporating IAN 73/06 (now withdrawn). The results contained in this report relate to the sample(s) tested at source. Opinions and interpretations expressed herein are outside the scope of UKAS accreditation. This report should not be reproduced except in full without the written approval of the laboratory.

10122

Causeway Geotech Ltd
8 Drumnahiskey Road, Balnamore , Ballymoney, BT53 7QL
Tel: 028 2766 6640

PLATE LOADING TEST REPORT

in accordance with BS 1377 : Part 9 Cl. 4.1 : 1990
Incremental loading test

Project	Dublin Street	**Test No:**	TP-10
Client	Monaghan County Council	**Lab Ref No:**	24-0640
		Date Reported	27.08.24
		Weather Conditions	Dry
Technician	MMC	**Air Temperature °C**	20

Date Tested	13.08.24	**Plate Dia (mm)**	455
Location			
GPS Coord's		**Depth (m)**	0.5
Material Type	Clay	**Reaction Type**	14t Excavator
No Cycles	1	**App Weight (kg)**	62

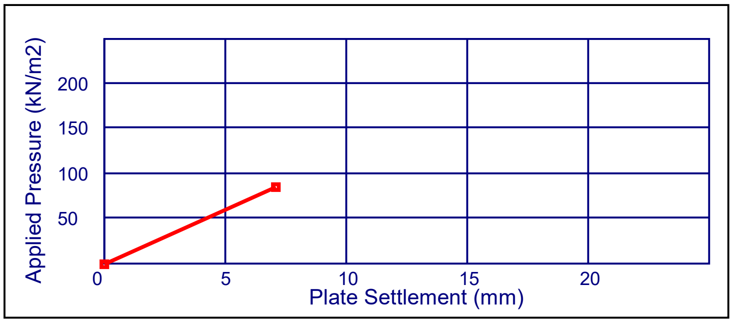
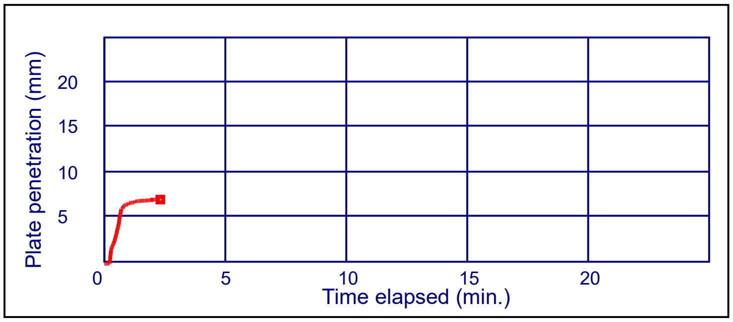


Plate Settlement (mm)	Applied Pressure (kN/m2)
0.00	0.0
7.09	85.9



	Cycle 1
Maximum Applied Pressure (kPa):	**86**
Maximum deformation (mm):	**7.09**
Modulus of subgrade reaction K (MN/m3):	**12.1**
K762 (MN/m3):	**7.6**
Estimated CBR (%):	**0.3**

Comments: Displacement transducer(s) exceeded maximum range after 86kPa.
Test data after that point has not been presented here.

Test Remarks:
Calculation of Equivalent CBR Value from Plate Bearing Test taken from Design Manual for Roads and Bridges Volume 7 Section 2 Chapter 4 Incorporating IAN 73/06 (now withdrawn). The results contained in this report relate to the sample(s) tested at source. Opinions and interpretations expressed herein are outside the scope of UKAS accreditation. This report should not be reproduced except in full without the written approval of the laboratory.

Approved Signature
Causeway Geotech
Matthew Gilbert
Associate

UKAS
TESTING
10122

Causeway Geotech Ltd
8 Drumnahiskey Road, Balnamore , Ballymoney, BT53 7QL
Tel: 028 2766 6640

PLATE LOADING TEST REPORT

in accordance with BS 1377 : Part 9 Cl. 4.1 : 1990
Incremental loading test

Project	Dublin Street	**Test No:**	TP-10A
Client	Monaghan County Council	**Lab Ref No:**	24-0640
		Date Reported	27.08.24
		Weather Conditions	Dry
Technician	MMC	**Air Temperature °C**	20

Date Tested	13.08.24	**Plate Dia (mm)**	455
Location			
GPS Coord's		**Depth (m)**	0.6
Material Type	Clay	**Reaction Type**	14t Excavator
No Cycles	1	**App Weight (kg)**	62

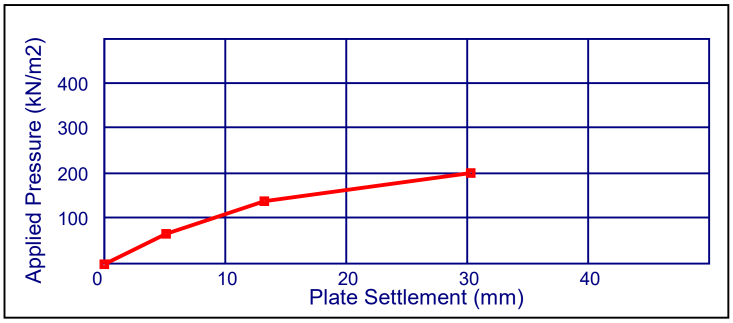
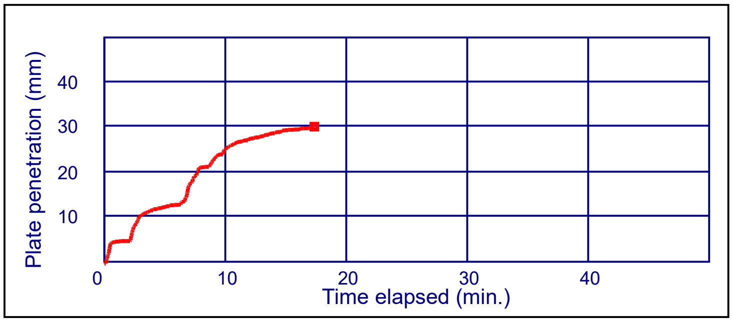


Plate Settlement (mm)	Applied Pressure (kN/m2)
0.00	0.0
5.10	68.3
13.21	140.3
30.29	202.9



	Cycle 1
Maximum Applied Pressure (kPa):	**203**
Maximum deformation (mm):	**30.29**
Modulus of subgrade reaction K (MN/m3):	**13.4**
K762 (MN/m3):	**8.3**
Estimated CBR (%):	**0.4**

Comments: Displacement transducer(s) exceeded maximum range after 203kPa.
Test data after that point has not been presented here.

Approved Signature
Causeway Geotech
Matthew Gilbert
Associate

Test Remarks:
Calculation of Equivalent CBR Value from Plate Bearing Test taken from Design Manual for Roads and Bridges Volume 7 Section 2 Chapter 4 Incorporating IAN 73/06 (now withdrawn). The results contained in this report relate to the sample(s) tested at source. Opinions and interpretations expressed herein are outside the scope of UKAS accreditation. This report should not be reproduced except in full without the written approval of the laboratory.

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APPENDIX G

INDIRECT IN-SITU CBR TEST RESULTS

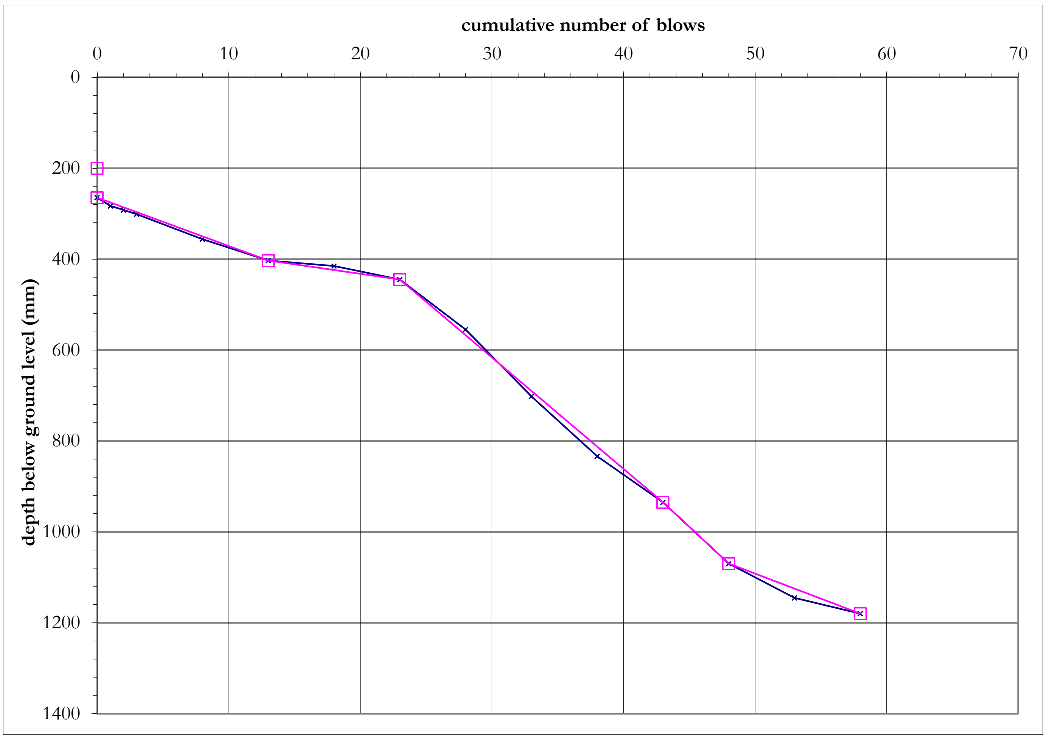
Dynamic Cone Penetrometer (DCP) test results and estimated CBR

Project Number	24-0640
Project Name	Dublin Street North, Monaghan
Site Location	TP02

Test Number	1	**Date Tested**	09/08/2024
Depth bgl (m)	0.20	**Weather**	Dry

Test conducted in accordance with Documented In-House Technical Procedure IMS TP7-4 and DMRB CS 229 Rev 0
CBR calculated using the TRRL CBR DCP relationship: log10(CBR) = 2.48 - 1.057 x log10(mm/blow) in accordance with DMRB CS 229 Rev 0

Surface preparation	Description of surface material at test depth
Dug Down	MADE GROUND: Very stiff slighly sandy gravelly CLAY.



top / base of layer (mm)	mm/ blow	CBR (%)
200 265	N/A	N/A
265 403	11	25
403 445	4.2	66
445 935	25	10
935 1070	27	9.3
1070 1180	11	24

CBR Range	Min: 9.3 Max: 66	The self-weight penetration at the start of the test (shown above) has not been included in the minimum and maximum values shown to the left. The selection of layers is based on visual interpretation of the data. The insitu DCP reading (mm/blow) and CBR values are valid at the time of testing; variation in moisture content or other factors may affect the insitu value. Opinions and interpretations expressed herein are outside the scope of UKAS accreditation. This report should not be reproduced except in full without the written approval of the laboratory.

Deviation(s) from standard procedure	None
Observations and comments	

Approved Name and Appointment

Darren O'Mahony Director		August 2024

UKAS TESTING 10122

Dynamic Cone Penetrometer (DCP) test results and estimated CBR

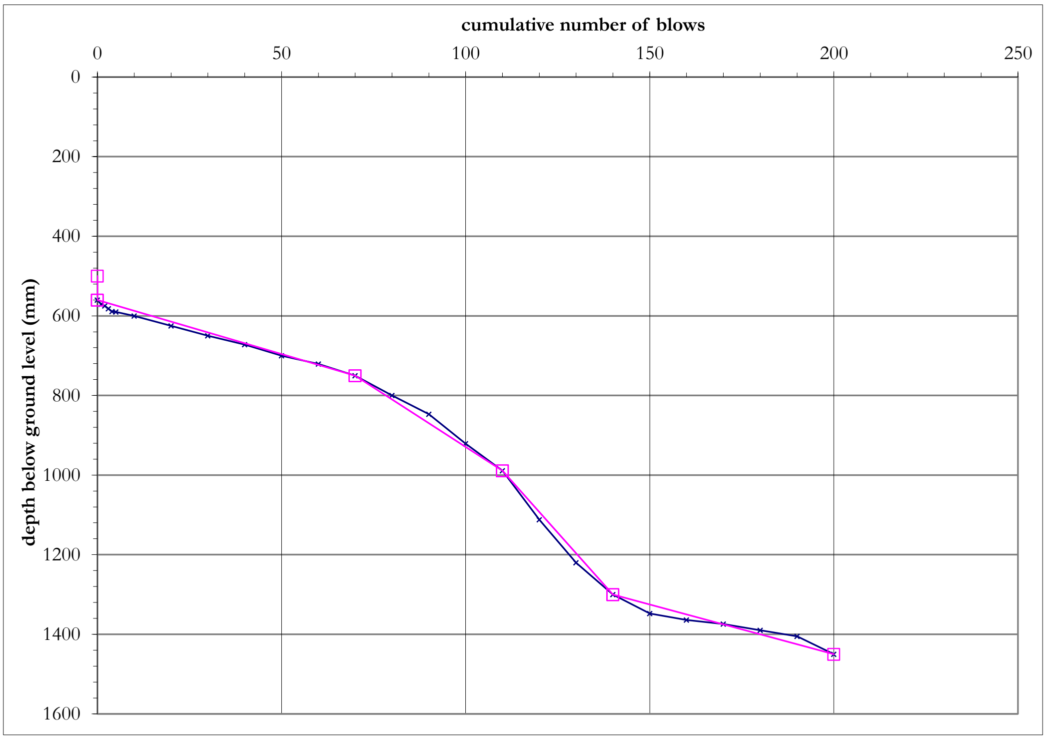
Project Number	24-0640
Project Name	Dublin Street North, Monaghan
Site Location	TP03

CAUSEWAY GEOTECH

Test Number	1	**Date Tested**	08/08/2024
Depth bgl (m)	0.50	**Weather**	Wet

Test conducted in accordance with Documented In-House Technical Procedure IMS TP7-4 and DMRB CS 229 Rev 0
CBR calculated using the TRRL CBR DCP relationship: log10(CBR) = 2.48 - 1.057 x log10(mm/blow) in accordance with DMRB CS 229 Rev 0

Surface preparation	**Description of surface material at test depth**
Dug Down	MADE GROUND: Very stiff slightly gravelly sandy CLAY.



top / base of layer (mm)	mm/ blow	CBR (%)
500 560	N/A	N/A
560 750	2.7	>100
750 989	6	46
989 1300	10	25
1300 1450	2.5	>100

CBR Range	Min: 25 Max: >100	The self-weight penetration at the start of the test (shown above) has not been included in the minimum and maximum values shown to the left. The selection of layers is based on visual interpretation of the data. The insitu DCP reading (mm/blow) and CBR values are valid at the time of testing; variation in moisture content or other factors may affect the insitu value. Opinions and interpretations expressed herein are outside the scope of UKAS accreditation. This report should not be reproduced except in full without the written approval of the laboratory.

Deviation(s) from standard procedure	None
Observations and comments	

Approved Name and Appointment

Darren O'Mahony Director	August 2024

UKAS TESTING 10122

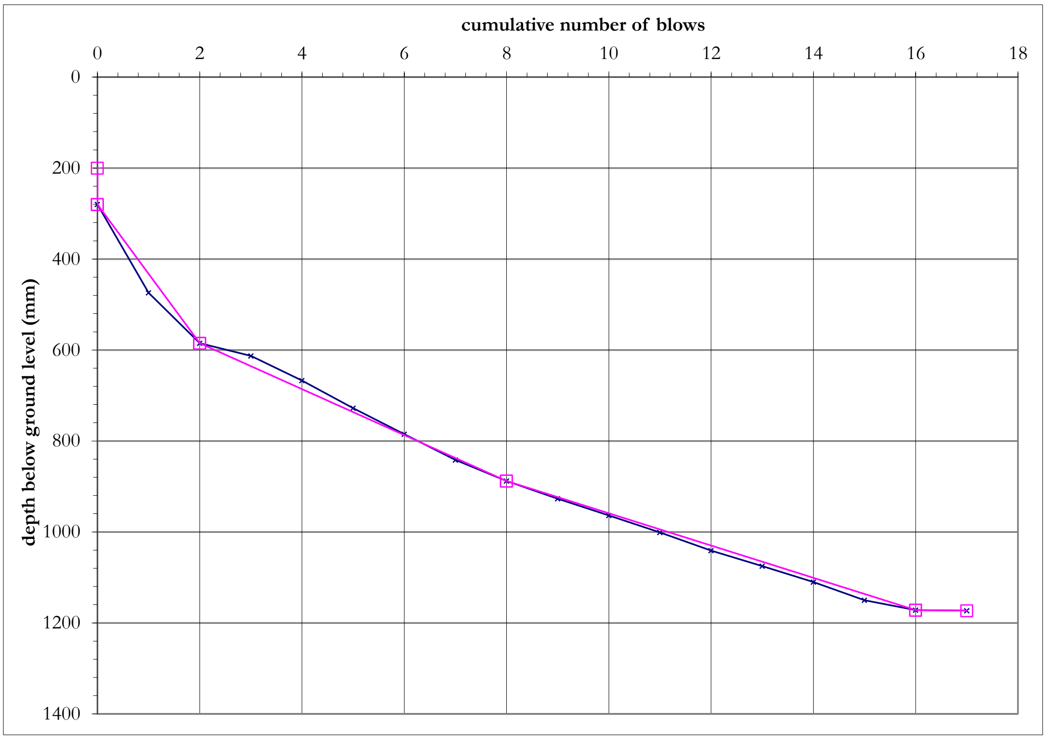
Dynamic Cone Penetrometer (DCP) test results and estimated CBR

Project Number	24-0640
Project Name	Dublin Street North, Monaghan
Site Location	TP04

Test Number	1	**Date Tested**	08/08/2024
Depth bgl (m)	0.20	**Weather**	Dry

Test conducted in accordance with Documented In-House Technical Procedure IMS TP7-4 and DMRB CS 229 Rev 0
CBR calculated using the TRRL CBR DCP relationship: log10(CBR) = 2.48 - 1.057 x log10(mm/blow) in accordance with DMRB CS 229 Rev 0

Surface preparation	**Description of surface material at test depth**
Dug Down	MADE GROUND: Firm slightly sandy slightly gravelly CLAY.



top / base of layer (mm)	**mm/ blow**	**CBR (%)**
200 280	N/A	N/A
280 585	153	1.5
585 888	51	4.8
888 1172	36	6.9
1172 1173	1	>100

CBR Range	Min: 1.5 Max: >100	The self-weight penetration at the start of the test (shown above) has not been included in the minimum and maximum values shown to the left. The selection of layers is based on visual interpretation of the data. The insitu DCP reading (mm/blow) and CBR values are valid at the time of testing; variation in moisture content or other factors may affect the insitu value. Opinions and interpretations expressed herein are outside the scope of UKAS accreditation. This report should not be reproduced except in full without the written approval of the laboratory.

Deviation(s) from standard procedure	None
Observations and comments	

Approved Name and Appointment		
Darren O'Mahony Director		August 2024

UKAS TESTING 10122

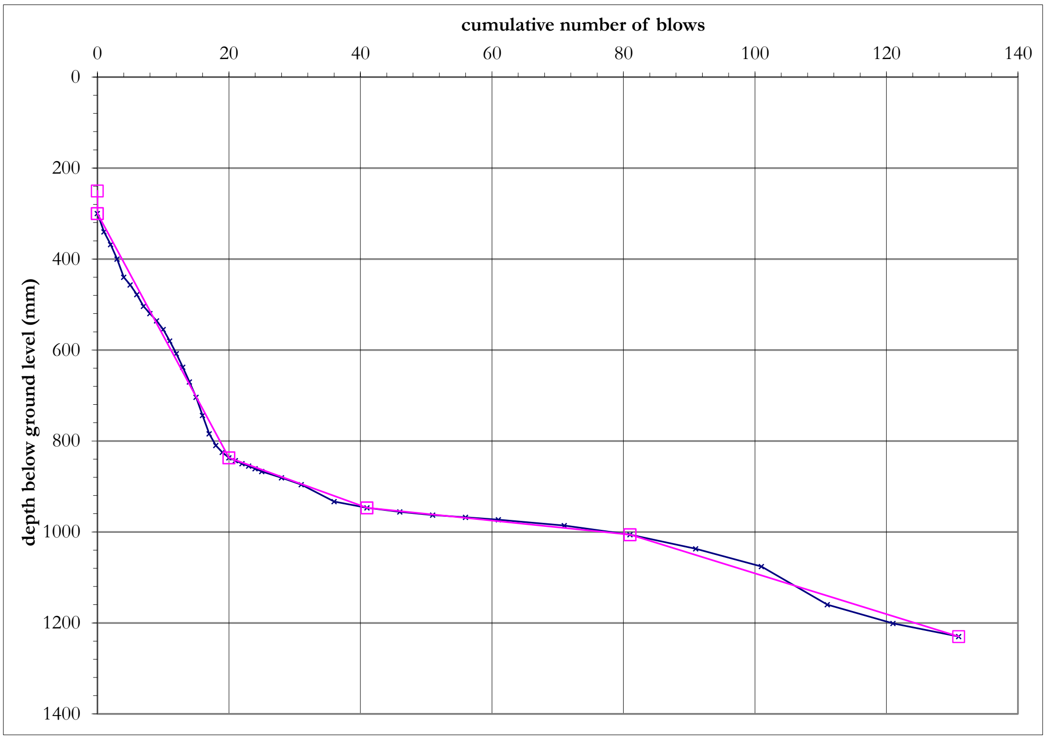
Dynamic Cone Penetrometer (DCP) test results and estimated CBR

Project Number	24-0640
Project Name	Dublin Street North, Monaghan
Site Location	TP07

Test Number	1	**Date Tested**	08/08/2024
Depth bgl (m)	0.25	**Weather**	Wet

Test conducted in accordance with Documented In-House Technical Procedure IMS TP7-4 and DMRB CS 229 Rev 0
CBR calculated using the TRRL CBR DCP relationship: log10(CBR) = 2.48 - 1.057 x log10(mm/blow) in accordance with DMRB CS 229 Rev 0

Surface preparation	Description of surface material at test depth
Dug Down	MADE GROUND: Very stiff slightly sandy gravelly CLAY.



top / base of layer (mm)	mm/ blow	CBR (%)
250 300	N/A	N/A
300 837	27	9.3
837 947	5.2	52
947 1006	1.5	>100
1006 1230	4.5	62

CBR Range Min: 9.3 Max: >100	The self-weight penetration at the start of the test (shown above) has not been included in the minimum and maximum values shown to the left. The selection of layers is based on visual interpretation of the data. The insitu DCP reading (mm/blow) and CBR values are valid at the time of testing; variation in moisture content or other factors may affect the insitu value. Opinions and interpretations expressed herein are outside the scope of UKAS accreditation. This report should not be reproduced except in full without the written approval of the laboratory.

Deviation(s) from standard procedure	None
Observations and comments	

Approved Name and Appointment		
Darren O'Mahony Director		August 2024

UKAS TESTING 10122

APPENDIX H

SURFACE WATER ANALYSIS

Round 1 29/07/2024

Sampling location	pH	°C	PPT	mS
SW1	6.65	21.2	0.18	0.35
SW2	6.9	19.7	0.23	0.45
SW3	7.33	20.1	0.26	0.5
SW4	7.53	20.5	0.36	0.73

Round 2 12/08/2024

Sampling location	pH	°C	PPT	mS
SW1	7.87	17.4	0.14	0.28
SW2	8.11	18.6	0.2	0.4
SW3	7.97	18.6	0.2	0.39
SW4	7.91	18.1	0.32	0.63

CAUSEWAY
GEOTECH

APPENDIX I

GEOTECHNICAL LABORATORY TEST RESULTS

CAUSEWAY GEOTECH

HEAD OFFICE
Causeway Geotech Ltd
8 Drumahiskey Road
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Registered in Northern Ireland.
Company Number: NI610766

REGIONAL OFFICE
Causeway Geotech (IRL) Ltd
Unit 1 Fingal House
Stephenstown Industrial Estate
Balbriggan, Co Dublin, Ireland, K32 VR66
ROI: +353 (0)1 526 7465
Registered in Ireland.
Company Number: 633786

www.causewaygeotech.com

SOIL AND ROCK SAMPLE ANALYSIS LABORATORY TEST REPORT

16 September 2024

Project Name:	Dublin St North, Monaghan
Project No.:	24-0640
Client:	Monaghan County Council
Engineer:	McAdam Design Ltd

We are pleased to attach the results of laboratory testing carried out for the above project. This memo and its attachments constitute a report of the results of tests as detailed in the Contents page(s). This testing was performed between 26/08/2024 and 16/09/2024.

The attached results complete the testing requested and we would therefore wish to confirm that samples will be retained without charge for a period of 28 days from the above date after which they will be appropriately disposed of unless we receive written instructions to the contrary prior to that date.

We trust our report meets with your approval but if you have any queries or require additional information, please do not hesitate to contact the undersigned.

Stephen Watson

Laboratory Manager

Signed for and on behalf of Causeway Geotech Ltd

Project Name: Dublin St North, Monaghan

Report Reference: Schedule 2

The table below details the tests carried out, the specifications used, and the number of tests included in this report. Tests marked with* in this report are not United Kingdom Accreditation Service (UKAS) accredited and are not included in Causeway Geotech Limited's scope of UKAS Accreditation Schedule of Tests.

The results contained in this report relate to the sample(s) as received. Opinions and interpretations expressed herein are outside the scope of UKAS accreditation. This report shall not be reproduced other than in full, without the prior written approval of the laboratory.

Material tested	Type of test/Properties measured/Range of measurement	Standard specifications	No. of results included in the report
SOIL	Water Content of Soil	*BS 1377-2: 2022: Cl 4*	6
SOIL	Liquid and Plastic Limits of soil-1 point cone penetrometer method	*BS 1377-2: 2022: Cl 5.3*	3
SOIL	Particle size distribution - wet sieving	*BS 1377-2: 2022: Cl 10*	5
SOIL	Particle size distribution - sedimentation hydrometer method	*BS 1377-2: 2022: Cl 10*	5

SUB-CONTRACTED TESTS

In agreement with Client, the following tests were conducted by an approved sub-contractor. All sub-contracting laboratories used are UKAS accredited.

Material tested	Type of test/Properties measured/Range of measurement	Standard specifications	No. of results included in the report
SOIL – Subcontracted to Derwentside Environmental Testing Services Limited *(UKAS 2139)*	pH Value of Soil	*Documented In-House Method No DETSC 2008 based on BS 1377: Part 3:1990*	3
SOIL – Subcontracted to Derwentside Environmental Testing Services Limited *(UKAS 2139)*	Sulphate Content water extract	*Documented In-House Method No DETSC 2004 based on BS 1377: Part 3:1990*	3
SOIL – Subcontracted to Derwentside Environmental Testing Services Limited *(UKAS 2139)*	Organic Matter Content	*Documented In-House Method No DETSC 2002 based on BS 1377: Part 3:1990*	1

CAUSEWAY GEOTECH

Summary of Classification Test Results

Project No.
24-0640

Project Name
Dublin St North, Monaghan

Hole No.	Sample				Specimen Description	Density Mg/m3		w	Passing 425µm	LL	PL	PI	Particle density	Casagrande Classification
	Ref	Top	Base	Type		bulk	dry	%	%	%	%	%	Mg/m3	
TP01	6	1.00		B	Brown sandy slightly gravelly silty CLAY.			25	79	45 -1pt	18	27		CI
TP02	6	1.00		B	Brown sandy slightly gravelly silty CLAY.			16						
TP03	6	1.00		B	Brown sandy slightly gravelly silty CLAY.			18						
TP04	6	1.00		B	Brown sandy slightly gravelly silty CLAY.			27	86	34 -1pt	20	14		CL
TP04	8	2.20		B	Brown sandy slightly gravelly silty CLAY.			19	71	35 -1pt	18	17		CL/CI
TP06	5	0.50		B	Brown sandy slightly gravelly silty CLAY.			16						

All tests performed in accordance with BS1377-2:2022 unless specified otherwise

LAB 26R - Version 1

Key

Density test
Linear measurement unless :
wd - water displacement
wi - immersion in water

Liquid Limit
4pt cone unless :
cas - Casagrande method
1pt - single point test

Particle density
sp - small pyknometer
gj - gas jar

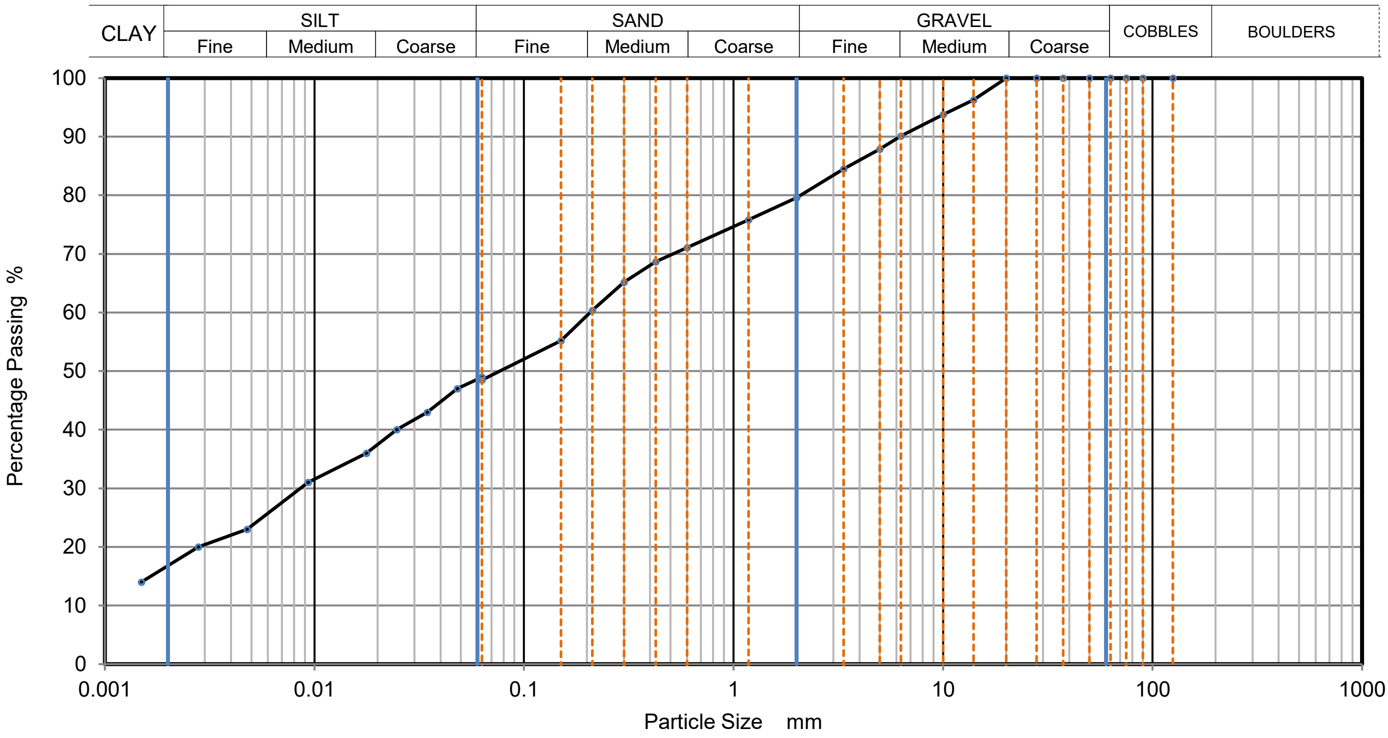
Date Printed
16/09/2024

Approved By
Stephen Watson

UKAS TESTING
10122

PARTICLE SIZE DISTRIBUTION

				Job Ref	**24-0640**
				Borehole/Pit No.	TP01
Site Name	Dublin St North, Monaghan			Sample No.	7
Specimen Description	Brown sandy slightly gravelly silty CLAY.			Sample Depth (m) Top	2.00
				Sample Depth (m) Base	
Specimen Reference	2	Specimen Depth	2 m	Sample Type	B
Test Method	BS1377-2:2022 Clause 10			KeyLAB ID	Caus2024082119



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06300	49
90	100	0.04812	47
75	100	0.03450	43
63	100	0.02472	40
50	100	0.01771	36
37.5	100	0.00932	31
28	100	0.00477	23
20	100	0.00279	20
14	96	0.00149	14
10	94		
6.3	90		
5	88		
3.35	85		
2	80		
1.18	76		
0.6	71	Particle density	(assumed)
0.425	69	2.65	Mg/m3
0.3	65		
0.212	60		
0.15	55		
0.063	49		

Dry Mass of sample, g	535

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	20.4
Sand	31.1
Silt	31.6
Clay	16.9

Grading Analysis	
D100 mm	
D60 mm	0.207
D30 mm	0.00887
D10 mm	
Uniformity Coefficient	
Curvature Coefficient	

Remarks

Preparation and testing in accordance with BS1377-2 :2022 Cl 10

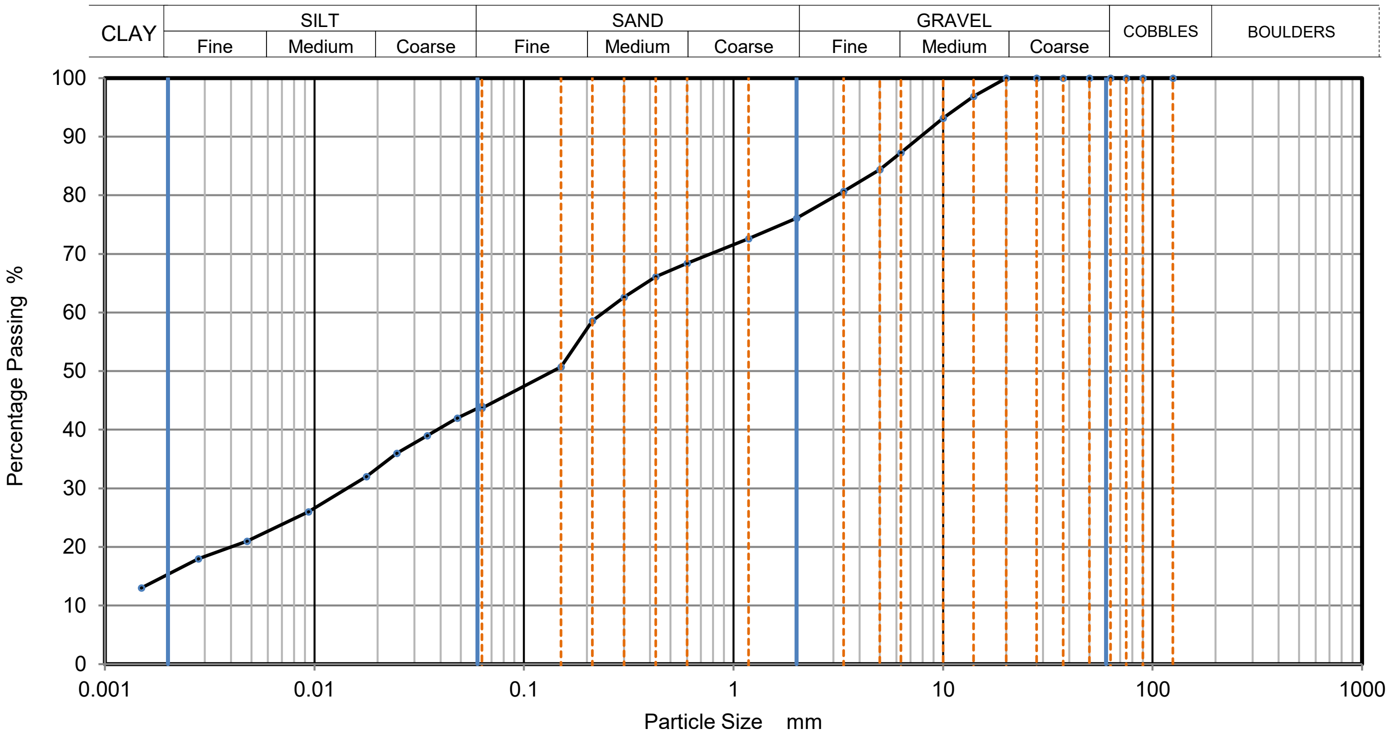
Approved
Stephen Watson

LAB 30R - Version 1

UKAS TESTING 10122

PARTICLE SIZE DISTRIBUTION

				Job Ref	**24-0640**
				Borehole/Pit No.	TP03
Site Name	Dublin St North, Monaghan			Sample No.	7
Specimen Description	Brown sandy slightly gravelly silty CLAY.			Sample Depth (m) Top	1.30
				Base	
Specimen Reference	2	Specimen Depth	1.3 m	Sample Type	B
Test Method	BS1377-2:2022 Clause 10			KeyLAB ID	Caus2024082123



Sieving		**Sedimentation**	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06300	44
90	100	0.04812	42
75	100	0.03450	39
63	100	0.02472	36
50	100	0.01771	32
37.5	100	0.00938	26
28	100	0.00477	21
20	100	0.00279	18
14	97	0.00149	13
10	93		
6.3	87		
5	84		
3.35	81		
2	76		
1.18	73		
0.6	68	Particle density	(assumed)
0.425	66	2.65	Mg/m3
0.3	63		
0.212	59		
0.15	51		
0.063	44		

Dry Mass of sample, g	518

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	23.9
Sand	32.3
Silt	28.6
Clay	15.2

Grading Analysis		
D100	mm	
D60	mm	0.24
D30	mm	0.014
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

Preparation and testing in accordance with BS1377-2 :2022 Cl 10

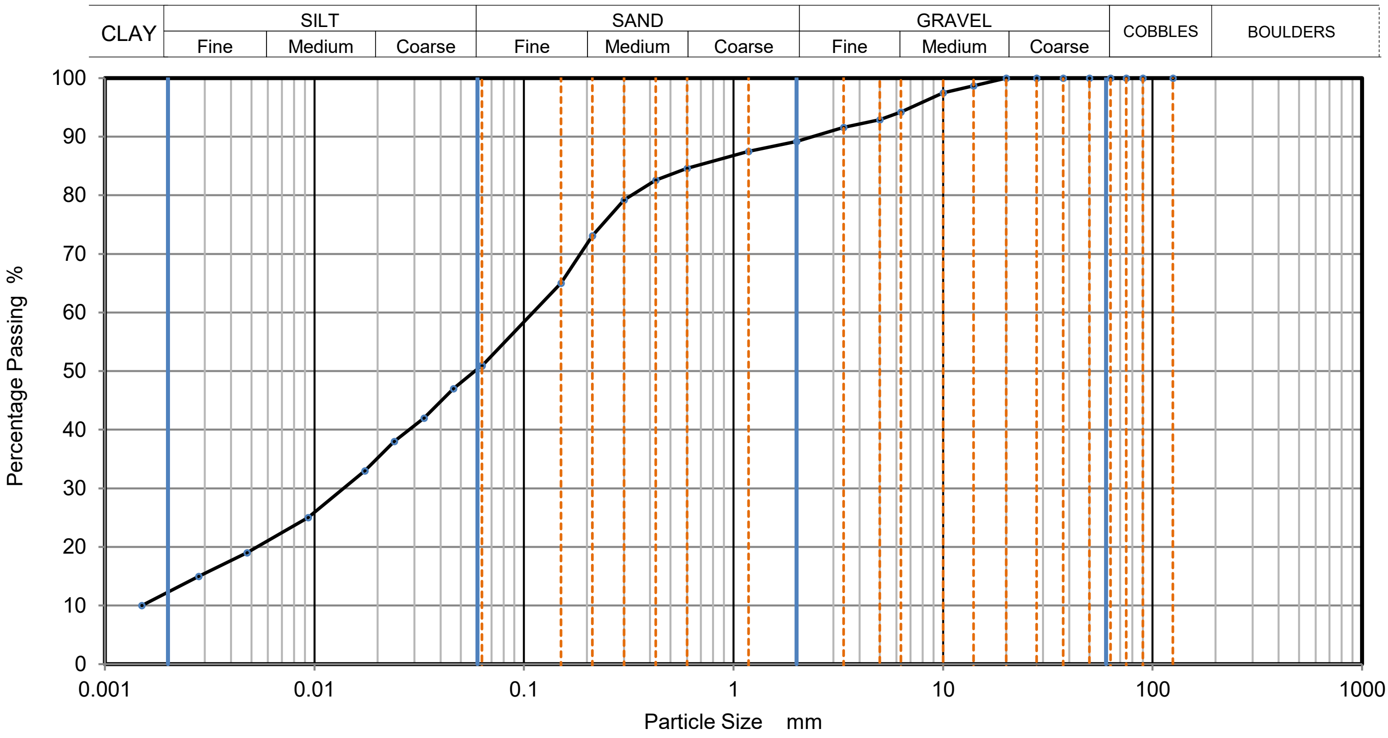
Approved
Stephen Watson

LAB 30R - Version 1

UKAS TESTING 10122

PARTICLE SIZE DISTRIBUTION

		Job Ref	**24-0640**
		Borehole/Pit No.	TP04
Site Name	Dublin St North, Monaghan	Sample No.	5
Specimen Description	Brown sandy slightly gravelly silty CLAY.	Sample Depth (m) Top	0.50
		Sample Depth (m) Base	
Specimen Reference	2	Specimen Depth	0.5 m
Sample Type	B		
Test Method	BS1377-2:2022 Clause 10	KeyLAB ID	Caus2024082124



Sieving		**Sedimentation**	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06300	51
90	100	0.04606	47
75	100	0.03331	42
63	100	0.02406	38
50	100	0.01737	33
37.5	100	0.00932	25
28	100	0.00477	19
20	100	0.00281	15
14	99	0.00150	10
10	98		
6.3	94		
5	93		
3.35	92		
2	89		
1.18	88		
0.6	85	Particle density	(assumed)
0.425	83	2.65	Mg/m3
0.3	79		
0.212	73		
0.15	65		
0.063	51		

Dry Mass of sample, g	341

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	10.8
Sand	38.3
Silt	38.7
Clay	12.2

Grading Analysis		
D100	mm	
D60	mm	0.11
D30	mm	0.0136
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Remarks

Preparation and testing in accordance with BS1377-2 :2022 Cl 10

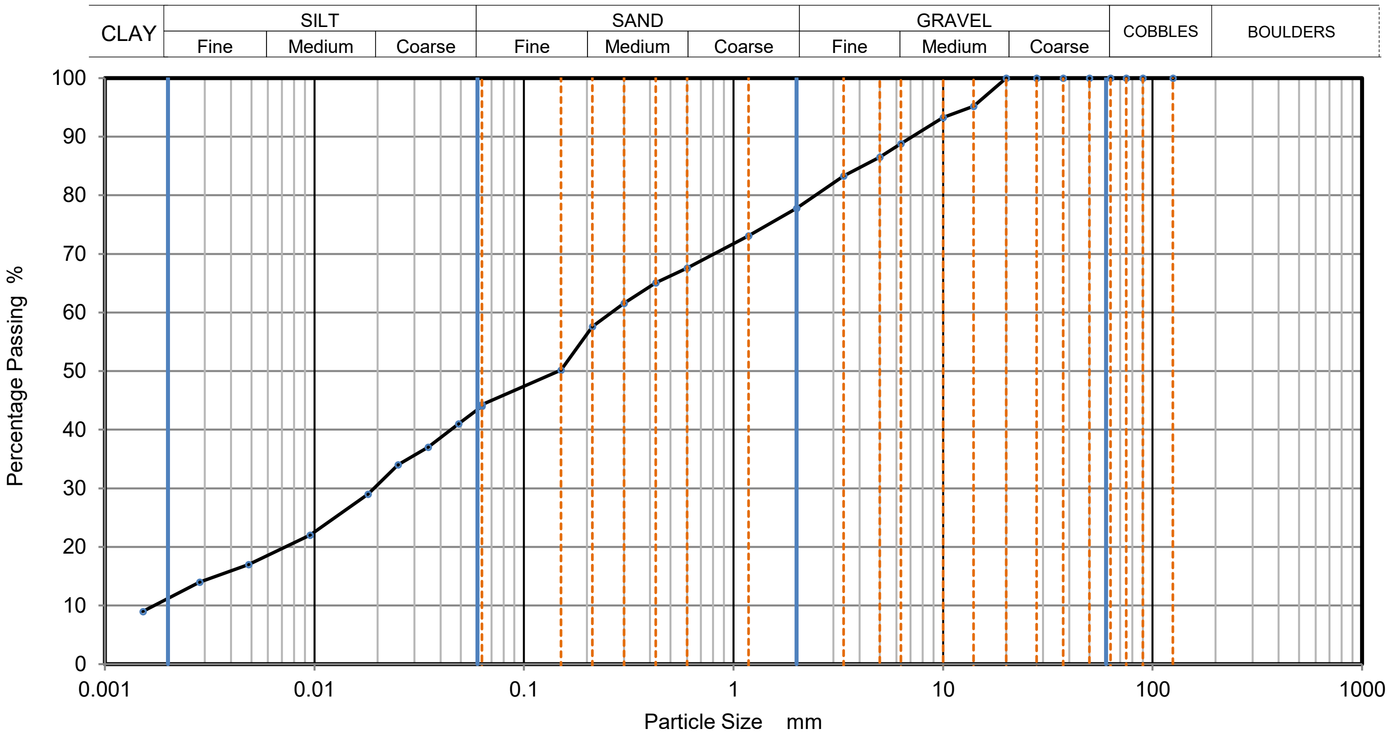
Approved
Stephen Watson

LAB 30R - Version 1

UKAS TESTING
10122

PARTICLE SIZE DISTRIBUTION

Job Ref	24-0640				
Borehole/Pit No.	TP04				
Site Name	Dublin St North, Monaghan			Sample No.	8
Specimen Description	Brown sandy slightly gravelly silty CLAY.			Sample Depth (m) Top	2.20
				Sample Depth (m) Base	
Specimen Reference	6	Specimen Depth	2.2 m	Sample Type	B
Test Method	BS1377-2:2022 Clause 10			KeyLAB ID	Caus2024082126



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06300	44
90	100	0.04879	41
75	100	0.03496	37
63	100	0.02505	34
50	100	0.01805	29
37.5	100	0.00955	22
28	100	0.00486	17
20	100	0.00284	14
14	95	0.00152	9
10	93		
6.3	89		
5	87		
3.35	83		
2	78		
1.18	73		
0.6	68	Particle density	(assumed)
0.425	65	2.65	Mg/m3
0.3	62		
0.212	58		
0.15	50		
0.063	44		

Dry Mass of sample, g	522

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	22.2
Sand	33.5
Silt	33.5
Clay	10.8

Grading Analysis		
D100	mm	
D60	mm	0.26
D30	mm	0.0193
D10	mm	0.00182
Uniformity Coefficient		140
Curvature Coefficient		0.79

Remarks

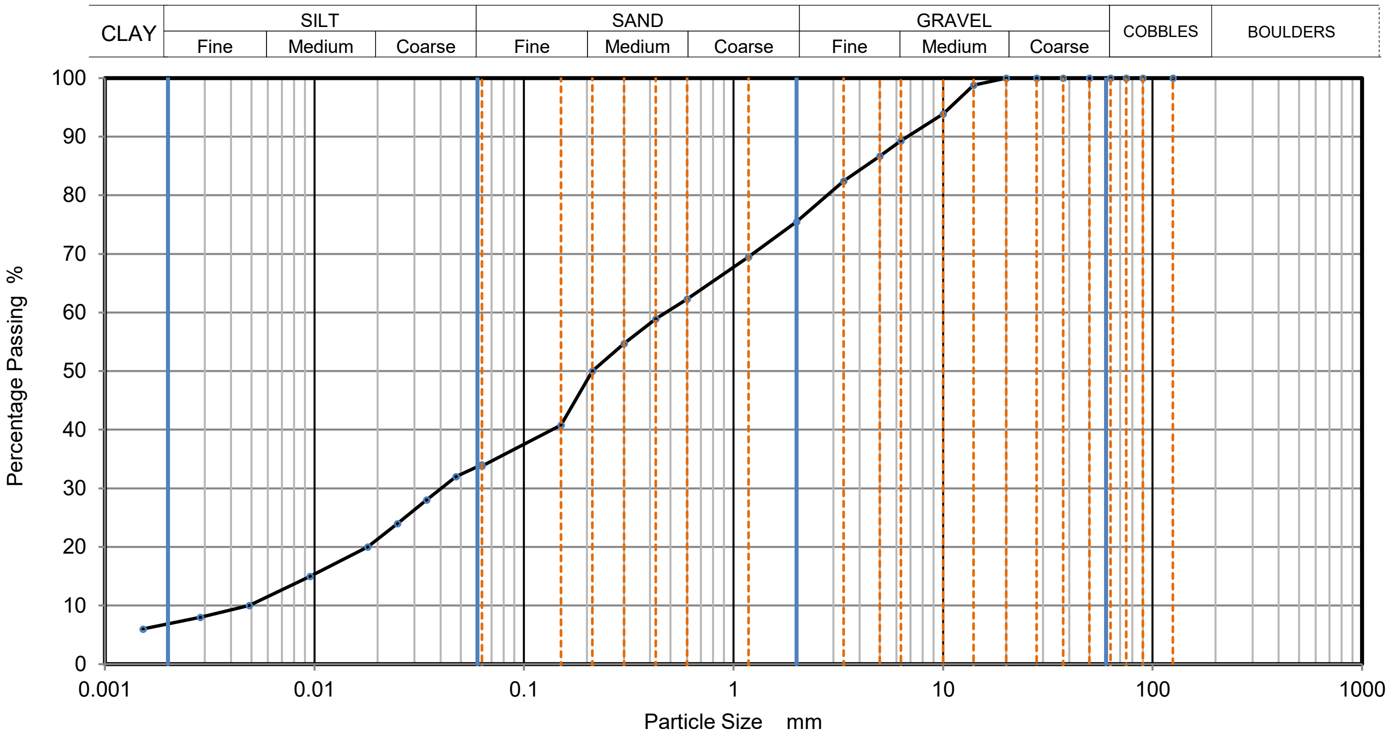
Preparation and testing in accordance with BS1377-2 :2022 Cl 10

Approved
Stephen Watson

LAB 30R - Version 1

UKAS TESTING 10122

CAUSEWAY GEOTECH	**PARTICLE SIZE DISTRIBUTION**	Job Ref	**24-0640**
		Borehole/Pit No.	TP06
Site Name	Dublin St North, Monaghan	Sample No.	6
Specimen Description	Brown sandy slightly gravelly silty CLAY.	Sample Depth (m) Top	1.00
		Base	
Specimen Reference	2 / Specimen Depth / 1 m	Sample Type	B
Test Method	BS1377-2:2022 Clause 10	KeyLAB ID	Caus2024082128



Sieving		**Sedimentation**	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06289	34
90	100	0.04745	32
75	100	0.03426	28
63	100	0.02489	24
50	100	0.01794	20
37.5	100	0.00955	15
28	100	0.00489	10
20	100	0.00285	8
14	99	0.00152	6
10	94		
6.3	89		
5	87		
3.35	82		
2	76		
1.18	70		
0.6	62	Particle density	(assumed)
0.425	59	2.65	Mg/m3
0.3	55		
0.212	50		
0.15	41		
0.063	34		

Dry Mass of sample, g	559

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	24.5
Sand	41.7
Silt	27.2
Clay	6.6

Grading Analysis	
D100 mm	
D60 mm	0.475
D30 mm	0.0409
D10 mm	0.00473
Uniformity Coefficient	100
Curvature Coefficient	0.74

Remarks

Preparation and testing in accordance with BS1377-2 :2022 Cl 10

Approved
Stephen Watson

LAB 30R - Version 1

UKAS TESTING
10122

Certificate of Analysis

Certificate Number	24-18356	*Issued:*	06-Sep-24

Client Causeway Geotech
8 Drumahiskey Road
Ballymoney
County Antrim
BT53 7QL

Our Reference	24-18356
Client Reference ~	24-0640
Order No ~	(not supplied)
Contract Title ~	DUBLIN ST NORTH, MONAGHAN
Description	4 Soil samples.
Date Received	02-Sep-24
Date Started	02-Sep-24
Date Completed	06-Sep-24
Test Procedures	Identified by prefix DETSn (details on request).
Notes	Opinions and interpretations are outside the laboratory's scope of ISO 17025 accreditation. This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced except in full, without the prior written approval of the laboratory.

Approved By

Kirk Bridgewood
General Manager

UKAS TESTING
2139

Summary of Chemical Analysis
Soil Samples

Our Ref 24-18356
Client Ref ~ 24-0640
Contract Title ~ DUBLIN ST NORTH, MONAGHAN

			Lab No	2386017	2386018	2386019	2386020
			Sample ID ~	TP02	TP03	TP04	TP06
			Depth ~	1.00	0.50	0.50	0.50
			Other ID ~	6	5	5	5
			Sample Type ~	B	B	B	B
			Sampling Date ~	30/08/2024	30/08/2024	30/08/2024	30/08/2024
			Sampling Time ~	n/s	n/s	n/s	n/s
Test	**Method**	**LOD**	**Units**				
Inorganics							
pH	DETSC 2008#		pH	8.7	8.2		8.4
Organic matter	DETSC 2002#	0.1	%			1.2	
Sulphate Aqueous Extract as SO4 (2:1)	DETSC 2076#	10	mg/l	130	39		23

Information in Support of the Analytical Results

Our Ref 24-18356
Client Ref ~ 24-0640
Contract ~ DUBLIN ST NORTH, MONAGHAN

Containers Received & Deviating Samples

Lab No	Sample ID ~	Date Sampled ~	Containers Received	Holding time exceeded for tests	Inappropriate container for tests
2386017	TP02 1.00 SOIL	30/08/24	PT 500ml		
2386018	TP03 0.50 SOIL	30/08/24	PT 500ml		
2386019	TP04 0.50 SOIL	30/08/24	PT 500ml		
2386020	TP06 0.50 SOIL	30/08/24	PT 500ml		

Key: P-Plastic T-Tub

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

Soil Analysis Notes

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

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

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

Disposal

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

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

Key:

~ Sample details are provided by the client and can affect the validity of the results
***** -not accredited.
# -MCERTS (accreditation only applies if report carries the MCERTS logo).
$ -subcontracted.
n/s -not supplied.
I/S -insufficient sample.
U/S -unsuitable sample.
t/f -to follow.
nd -not detected.

End of Report

CAUSEWAY GEOTECH

HEAD OFFICE
Causeway Geotech Ltd
8 Drumahiskey Road
Ballymoney
Co. Antrim, N. Ireland, BT53 7QL
NI: +44 (0)28 276 66640
Registered in Northern Ireland.
Company Number: NI610766

REGIONAL OFFICE
Causeway Geotech (IRL) Ltd
Unit 1 Fingal House
Stephenstown Industrial Estate
Balbriggan, Co Dublin, Ireland, K32 VR66
ROI: +353 (0)1 526 7465
Registered in Ireland.
Company Number: 633786

www.causewaygeotech.com

SOIL AND ROCK SAMPLE ANALYSIS LABORATORY TEST REPORT

16 September 2024

Project Name:	Dublin St North, Monaghan
Project No.:	24-0640
Client:	Monaghan County Council
Engineer:	McAdam Design Ltd

We are pleased to attach the results of laboratory testing carried out for the above project. This memo and its attachments constitute a report of the results of tests as detailed in the Contents page(s). This testing was performed between 26/08/2024 and 16/09/2024.

The attached results complete the testing requested and we would therefore wish to confirm that samples will be retained without charge for a period of 28 days from the above date after which they will be appropriately disposed of unless we receive written instructions to the contrary prior to that date.

We trust our report meets with your approval but if you have any queries or require additional information, please do not hesitate to contact the undersigned.

Stephen Watson

Laboratory Manager

Signed for and on behalf of Causeway Geotech Ltd

Project Name: Dublin St North, Monaghan

Report Reference: Schedule 3

The table below details the tests carried out, the specifications used, and the number of tests included in this report. Tests marked with* in this report are not United Kingdom Accreditation Service (UKAS) accredited and are not included in Causeway Geotech Limited's scope of UKAS Accreditation Schedule of Tests.

The results contained in this report relate to the sample(s) as received. Opinions and interpretations expressed herein are outside the scope of UKAS accreditation. This report shall not be reproduced other than in full, without the prior written approval of the laboratory.

Material tested	Type of test/Properties measured/Range of measurement	Standard specifications	No. of results included in the report
SOIL	Water Content of Soil	*BS 1377-2: 2022: Cl 4*	4
SOIL	Liquid and Plastic Limits of soil-1 point cone penetrometer method	*BS 1377-2: 2022: Cl 5.3*	4
SOIL	Particle size distribution - wet sieving	*BS 1377-2: 2022: Cl 10*	4
SOIL	Particle size distribution - sedimentation hydrometer method	*BS 1377-2: 2022: Cl 10*	4

SUB-CONTRACTED TESTS

In agreement with Client, the following tests were conducted by an approved sub-contractor. All sub-contracting laboratories used are UKAS accredited.

Material tested	Type of test/Properties measured/Range of measurement	Standard specifications	No. of results included in the report
SOIL – Subcontracted to Derwentside Environmental Testing Services Limited *(UKAS 2139)*	pH Value of Soil	*Documented In-House Method No DETSC 2008 based on BS 1377: Part 3:1990*	1
SOIL – Subcontracted to Derwentside Environmental Testing Services Limited *(UKAS 2139)*	Sulphate Content water extract	*Documented In-House Method No DETSC 2004 based on BS 1377: Part 3:1990*	1
SOIL – Subcontracted to Derwentside Environmental Testing Services Limited *(UKAS 2139)*	Organic Matter Content	*Documented In-House Method No DETSC 2002 based on BS 1377: Part 3:1990*	1

CAUSEWAY GEOTECH

Summary of Classification Test Results

Project No.
24-0640

Project Name
Dublin St North, Monaghan

Hole No.	Sample				Specimen Description	Density Mg/m3		w %	Passing 425μm %	LL %	PL %	PI %	Particle density Mg/m3	Casagrande Classification
	Ref	Top	Base	Type		bulk	dry							
TP05	3	1.70		B	Brown sandy slightly gravelly silty CLAY.			15	49	32 -1pt	20	12		CL
TP08	3	1.80		B	Brown sandy slightly gravelly silty CLAY.			16	70	32 -1pt	17	15		CL
TP09	3	1.50		B	Brown slightly sandy silty CLAY.			42	81	42 -1pt	24	18		CI
TP10	3	1.70		B	Brown sandy slightly gravelly clayey SILT.			33	79	35 -1pt	25	10		ML/MI

All tests performed in accordance with BS1377-2:2022 unless specified otherwise

LAB 26R - Version 1

Key

Density test	Liquid Limit	Particle density
Linear measurement unless :	4pt cone unless :	sp - small pyknometer
wd - water displacement	cas - Casagrande method	gj - gas jar
wi - immersion in water	1pt - single point test	

Date Printed
16/09/2024

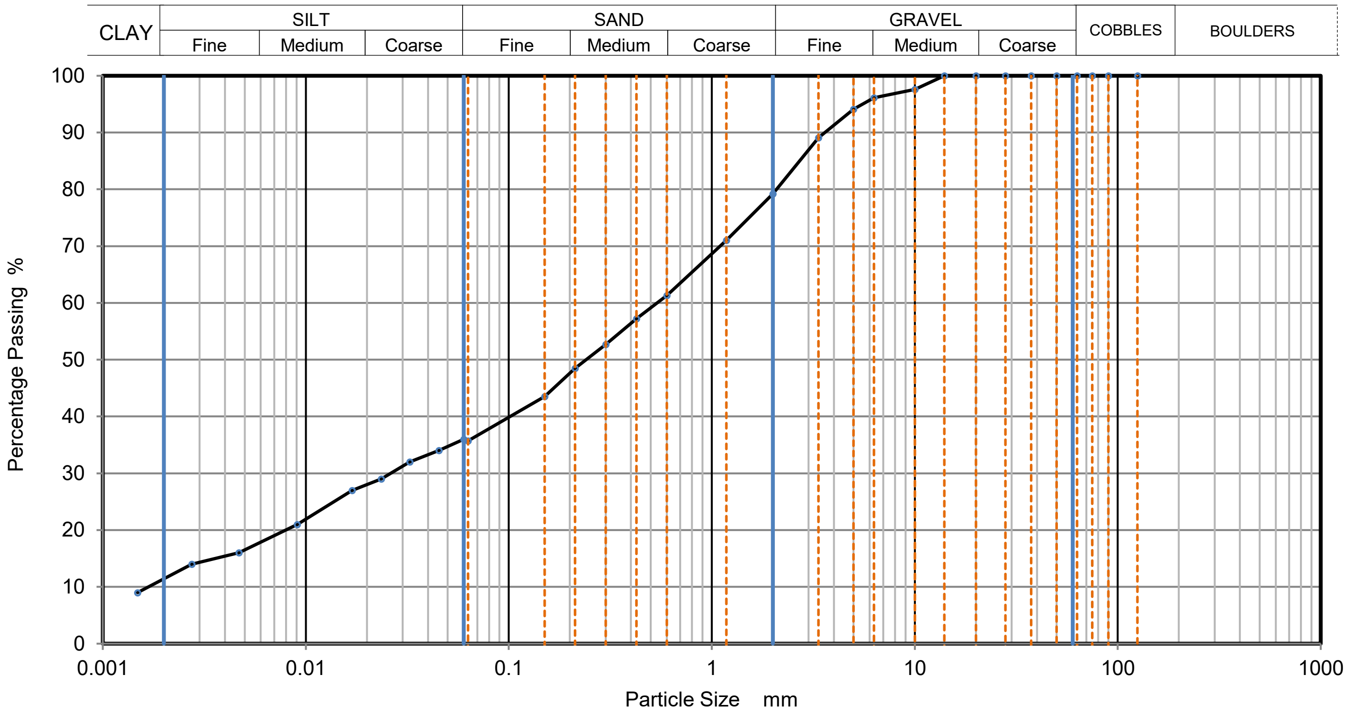
Approved By
Stephen Watson

UKAS TESTING
10122

CAUSEWAY GEOTECH

PARTICLE SIZE DISTRIBUTION

Job Ref	**24-0640**				
Borehole/Pit No.	TP05				
Site Name	Dublin St North, Monaghan			Sample No.	5
Specimen Description	Brown sandy slightly gravelly silty CLAY.			Sample Depth (m) Top	3.20
				Sample Depth (m) Base	
Specimen Reference	2	Specimen Depth	3.2 m	Sample Type	B
Test Method	BS1377-2:2022 Clause 10			KeyLAB ID	Caus2024082130



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06003	36
90	100	0.04536	34
75	100	0.03257	32
63	100	0.02355	29
50	100	0.01689	27
37.5	100	0.00909	21
28	100	0.00469	16
20	100	0.00274	14
14	100	0.00148	9
10	98		
6.3	96		
5	94		
3.35	89		
2	79		
1.18	71		
0.6	61	Particle density	(assumed)
0.425	57	2.65	Mg/m3
0.3	53		
0.212	49		
0.15	44		
0.063	36		

Dry Mass of sample, g	323

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	20.8
Sand	43.4
Silt	24.5
Clay	11.3

Grading Analysis		
D100	mm	
D60	mm	0.537
D30	mm	0.027
D10	mm	0.0017
Uniformity Coefficient		320
Curvature Coefficient		0.8

Remarks

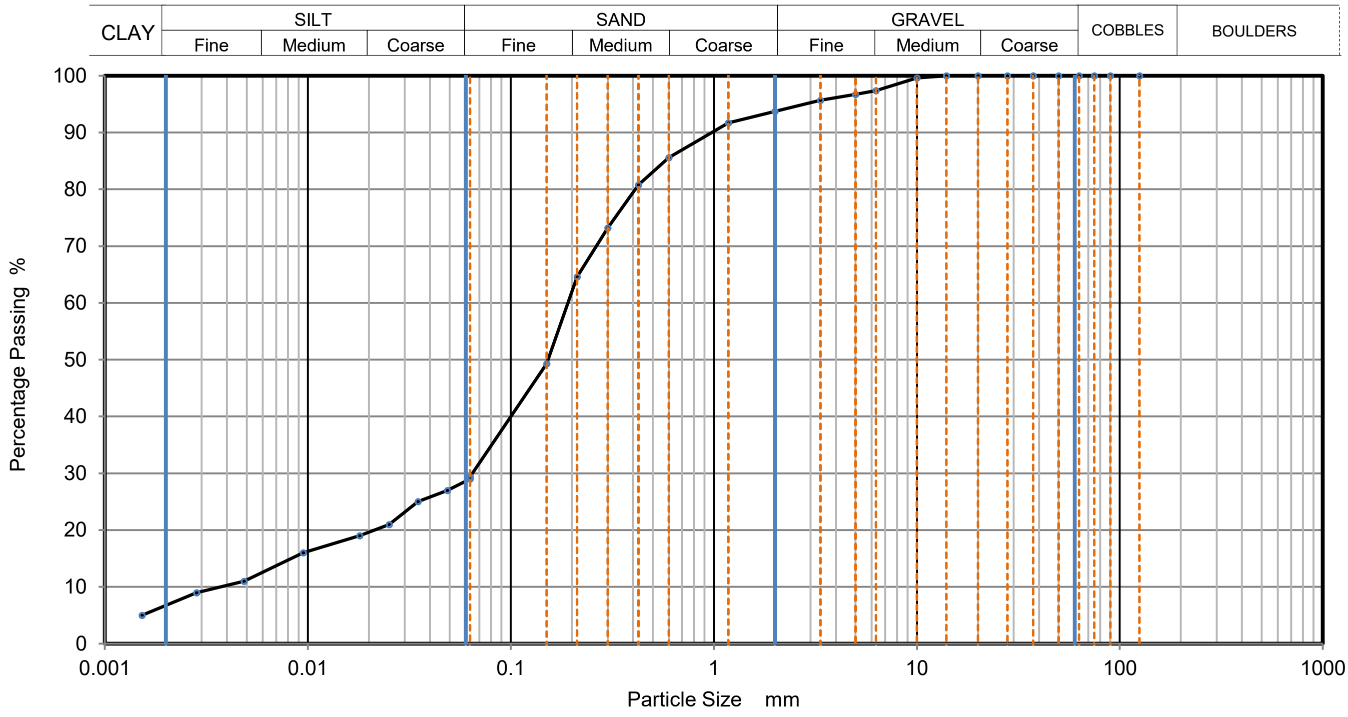
Preparation and testing in accordance with BS1377-2 :2022 Cl 10

Approved
Stephen Watson

LAB 30R - Version 1

UKAS TESTING 10122

CAUSEWAY GEOTECH	PARTICLE SIZE DISTRIBUTION			Job Ref		**24-0640**
				Borehole/Pit No.		TP09
Site Name	Dublin St North, Monaghan			Sample No.		3
Specimen Description	Brown slightly sandy silty CLAY.			Sample Depth (m)	Top	1.50
					Base	
Specimen Reference	6	Specimen Depth	1.5 m	Sample Type		B
Test Method	BS1377-2:2022 Clause 10			KeyLAB ID		Caus2024082132



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06300	29
90	100	0.04879	27
75	100	0.03496	25
63	100	0.02521	21
50	100	0.01805	19
37.5	100	0.00949	16
28	100	0.00486	11
20	100	0.00284	9
14	100	0.00153	5
10	100		
6.3	97		
5	97		
3.35	96		
2	94		
1.18	92		
0.6	86	Particle density	(assumed)
0.425	81	2.65	Mg/m3
0.3	73		
0.212	65		
0.15	49		
0.063	29		

Dry Mass of sample, g	312

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	6.3
Sand	64.3
Silt	22.9
Clay	6.5

Grading Analysis		
D100	mm	
D60	mm	0.191
D30	mm	0.0647
D10	mm	0.00356
Uniformity Coefficient		54
Curvature Coefficient		6.2

Remarks

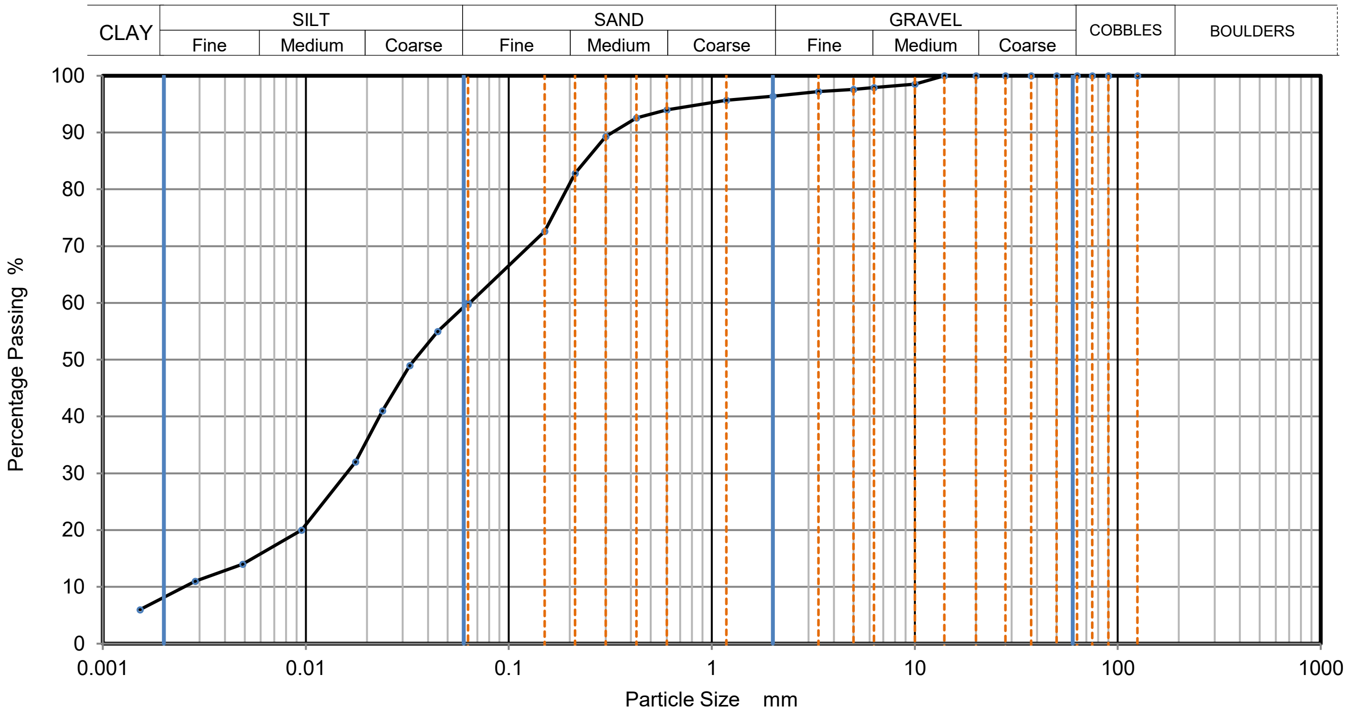
Preparation and testing in accordance with BS1377-2 :2022 Cl 10

Approved
Stephen Watson

LAB 30R - Version 1

UKAS TESTING 10122

CAUSEWAY GEOTECH	**PARTICLE SIZE DISTRIBUTION**	Job Ref	**24-0640**
		Borehole/Pit No.	TP09
Site Name	Dublin St North, Monaghan	Sample No.	4
Specimen Description	Brown sandy slightly gravelly clayey SILT.	Sample Depth (m) Top	2.30
		Sample Depth (m) Base	
Specimen Reference	2 Specimen Depth 2.3 m	Sample Type	B
Test Method	BS1377-2:2022 Clause 10	KeyLAB ID	Caus2024082133



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06300	60
90	100	0.04464	55
75	100	0.03257	49
63	100	0.02389	41
50	100	0.01760	32
37.5	100	0.00955	20
28	100	0.00489	14
20	100	0.00285	11
14	100	0.00153	6
10	99		
6.3	98		
5	98		
3.35	97		
2	96		
1.18	96		
0.6	94	Particle density	(assumed)
0.425	93	2.65	Mg/m3
0.3	89		
0.212	83		
0.15	73		
0.063	60		

Dry Mass of sample, g	366

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	3.6
Sand	36.7
Silt	51.6
Clay	8.1

Grading Analysis	
D100 mm	
D60 mm	0.0643
D30 mm	0.0158
D10 mm	0.00259
Uniformity Coefficient	25
Curvature Coefficient	1.5

Remarks

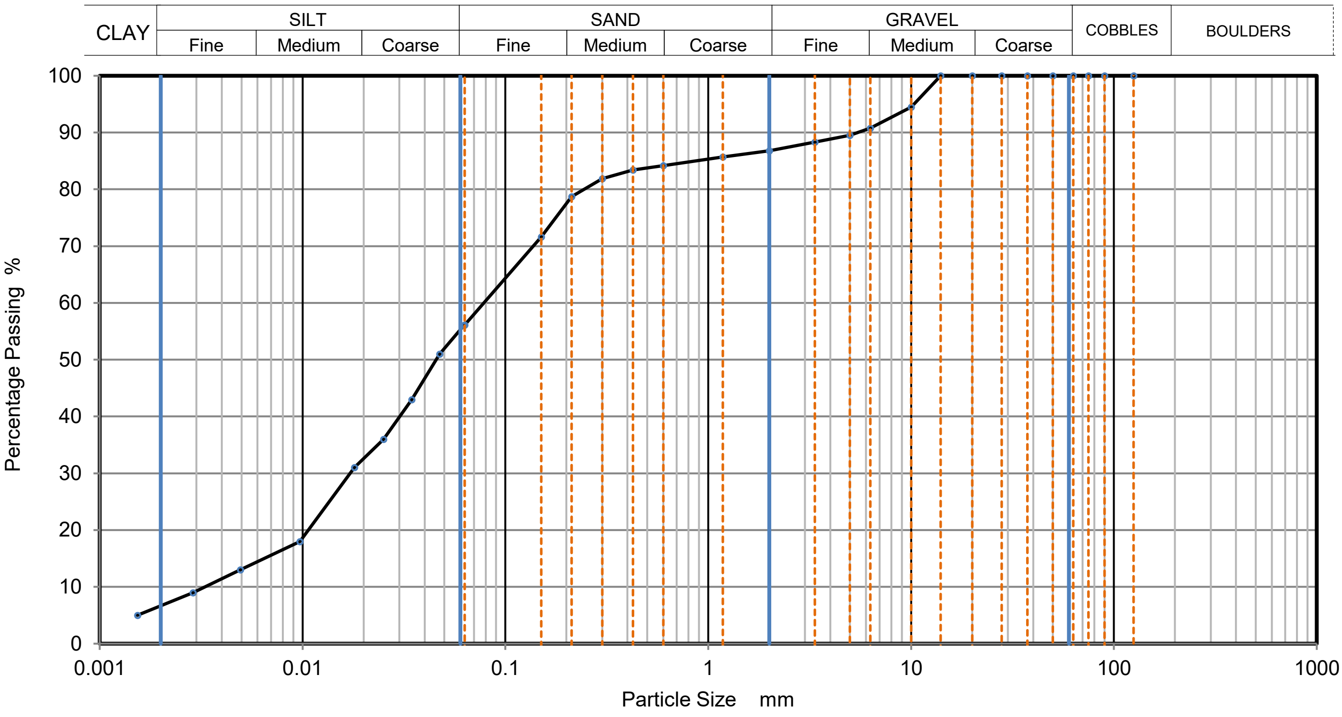
Preparation and testing in accordance with BS1377-2 :2022 Cl 10

Approved
Stephen Watson

UKAS TESTING 10122

PARTICLE SIZE DISTRIBUTION

Job Ref	24-0640		
Borehole/Pit No.	TP10		
Site Name	Dublin St North, Monaghan	Sample No.	4
Specimen Description	Brown sandy slightly gravelly silty CLAY.	Sample Depth (m) Top	2.60
		Sample Depth (m) Base	
Specimen Reference	2	Specimen Depth	2.6 m
Sample Type	B		
Test Method	BS1377-2:2022 Clause 10	KeyLAB ID	Caus2024082135



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100	0.06242	56
90	100	0.04745	51
75	100	0.03450	43
63	100	0.02505	36
50	100	0.01805	31
37.5	100	0.00972	18
28	100	0.00494	13
20	100	0.00288	9
14	100	0.00153	5
10	95		
6.3	91		
5	90		
3.35	88		
2	87		
1.18	86		
0.6	84	Particle density	(assumed)
0.425	83	2.65	Mg/m3
0.3	82		
0.212	79		
0.15	72		
0.063	56		

Dry Mass of sample, g	317

Sample Proportions	% dry mass
Cobbles	0.0
Gravel	13.2
Sand	30.6
Silt	49.2
Clay	7.0

Grading Analysis	
D100 mm	
D60 mm	0.0783
D30 mm	0.0174
D10 mm	0.00332
Uniformity Coefficient	24
Curvature Coefficient	1.2

Remarks

Preparation and testing in accordance with BS1377-2 :2022 Cl 10

Approved
Stephen Watson

LAB 30R - Version 1

UKAS TESTING 10122

Certificate of Analysis

Certificate Number	24-18355	*Issued:*	06-Sep-24

Client Causeway Geotech
8 Drumahiskey Road
Ballymoney
County Antrim
BT53 7QL

Our Reference	24-18355
Client Reference ~	24-0640
Order No ~	(not supplied)
Contract Title ~	DUBLIN ST NORTH, MONAGHAN
Description	One Soil sample.
Date Received	02-Sep-24
Date Started	02-Sep-24
Date Completed	06-Sep-24
Test Procedures	Identified by prefix DETSn (details on request).
Notes	Opinions and interpretations are outside the laboratory's scope of ISO 17025 accreditation. This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced except in full, without the prior written approval of the laboratory.

Approved By

Kirk Bridgewood
General Manager

ilac-MRA

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Summary of Chemical Analysis
Soil Samples

Our Ref 24-18355
Client Ref ~ 24-0640
Contract Title ~ DUBLIN ST NORTH, MONAGHAN

Lab No	2386016
Sample ID ~	TP10
Depth ~	0.50
Other ID ~	1
Sample Type ~	B
Sampling Date ~	30/08/2024
Sampling Time ~	n/s

Test	**Method**	**LOD**	**Units**	
Inorganics				
pH	DETSC 2008#		pH	7.9
Organic matter	DETSC 2002#	0.1	%	9.0
Sulphate Aqueous Extract as SO4 (2:1)	DETSC 2076#	10	mg/l	86

Information in Support of the Analytical Results

Our Ref 24-18355
Client Ref ~ 24-0640
Contract ~ DUBLIN ST NORTH, MONAGHAN

Containers Received & Deviating Samples

Lab No	**Sample ID ~**	**Date Sampled ~**	**Containers Received**	**Holding time exceeded for tests**	**Inappropriate container for tests**
2386016	TP10 0.50 SOIL	30/08/24	PT 500ml		

Key: P-Plastic T-Tub

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

Soil Analysis Notes

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

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

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

Disposal

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

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

Key:

~ Sample details are provided by the client and can affect the validity of the results
***** -not accredited.
# -MCERTS (accreditation only applies if report carries the MCERTS logo).
$ -subcontracted.
n/s -not supplied.
I/S -insufficient sample.
U/S -unsuitable sample.
t/f -to follow.
nd -not detected.

End of Report

APPENDIX J

ENVIRONMENTAL LABORATORY TEST RESULTS

Certificate of Analysis

Certificate Number	24-15995	*Issued:*	08-Aug-24

Client Causeway Geotech
Unit 1 Fingal House
Stephenstown Industrial Estate
Balbriggan
Co. Dublin
K32 VR66

Our Reference 24-15995

Client Reference ~ 24-0640

Order No ~ (not supplied)

Contract Title ~ Dublin St North Monaghan

Description 4 Water samples.

Date Received 01-Aug-24

Date Started 01-Aug-24

Date Completed 08-Aug-24

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

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

Approved By

K Bridgewood.

Kirk Bridgewood
General Manager

UKAS TESTING
2139

Summary of Chemical Analysis
Water Samples

Our Ref 24-15995
Client Ref ~ 24-0640
Contract Title ~ Dublin St North Monaghan

			Lab No	2372308	2372309	2372310	2372311
			Sample ID ~	SW1	SW2	SW3	SW4
			Depth ~				
			Other ID ~				
			Sample Type ~	EW	EW	EW	EW
			Sampling Date ~	29/07/2024	29/07/2024	29/07/2024	29/07/2024
			Sampling Time ~	n/s	n/s	n/s	n/s
Test	**Method**	**LOD**	**Units**				
Metals							
Arsenic, Dissolved	DETSC 2306	0.16	ug/l	0.84	1.3	1.2	0.77
Boron, Dissolved	DETSC 2306*	0.012	mg/l	0.076	0.049	0.051	0.045
Cadmium, Dissolved	DETSC 2306	0.03	ug/l	< 0.03	< 0.03	< 0.03	< 0.03
Calcium, Dissolved	DETSC 2306	0.09	mg/l	46	53	55	61
Chromium III, Dissolved	DETSC 2306*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0
Chromium, Hexavalent	DETSC 2203	7	ug/l	< 7.0	< 7.0	< 7.0	< 7.0
Copper, Dissolved	DETSC 2306	0.4	ug/l	0.4	0.8	0.7	3.7
Lead, Dissolved	DETSC 2306	0.09	ug/l	0.32	0.28	0.33	< 0.09
Mercury, Dissolved	DETSC 2306	0.01	ug/l	< 0.01	< 0.01	< 0.01	< 0.01
Nickel, Dissolved	DETSC 2306	0.5	ug/l	1.1	1.9	1.5	2.6
Selenium, Dissolved	DETSC 2306	0.25	ug/l	< 0.25	< 0.25	< 0.25	< 0.25
Vanadium, Dissolved	DETSC 2306	0.6	ug/l	< 0.6	< 0.6	< 0.6	< 0.6
Zinc, Dissolved	DETSC 2306	1.3	ug/l	120	79	46	62
Inorganics							
Conductivity	DETSC 2009	1	uS/cm	282	439	467	641
pH	DETSC 2008		pH	7.1	7.1	7.1	7.4
Cyanide, Total Low Level	DETSC 2131	0.0001	mg/l	< 0.0400	< 0.0400	< 0.0400	< 0.0400
Cyanide, Free Low Level	DETSC 2131	0.0001	mg/l	< 0.0200	< 0.0200	< 0.0200	< 0.0200
Phenol - Monohydric Low Level	DETSC 2131	0.0015	mg/l	< 0.1000	< 0.1000	< 0.1000	< 0.1000
Thiocyanate	DETSC 2130	20	ug/l	< 20	< 20	< 20	< 20
Dissolved Organic Carbon	DETSC 2085	2	mg/l	5.5	7.1	7.3	8.8
Total Hardness as CaCO3	DETSC 2303	0.1	mg/l	125	156	163	187
Ammoniacal Nitrogen as N	DETSC 2207	0.015	mg/l	0.051	2.7	1.9	0.66
Sulphate as SO4	DETSC 2055	0.1	mg/l	3.1	15	15	33
Sulphide	DETSC 2208	0.01	mg/l	0.02	0.01	0.01	0.03
Sulphur as S, Total	DETSC 2320*	10	mg/l	< 10	< 10	61	11
Petroleum Hydrocarbons							
Aliphatic C5-C6: HS_1D_AL	DETSC 3322	0.1	ug/l	< 0.1	< 1.0	< 0.1	< 0.1
Aliphatic C6-C8: HS_1D_AL	DETSC 3322	0.1	ug/l	< 0.1	< 1.0	< 0.1	< 0.1
Aliphatic C8-C10: HS_1D_AL	DETSC 3322	0.1	ug/l	< 0.1	< 1.0	< 0.1	< 0.1
Aliphatic C10-C12: EH_CU_1D_AL	DETSC 3072*	1	ug/l	< 1.0	< 1.0	11	< 1.0
Aliphatic C10-C44: EH_CU_1D_AL	DETSC 3072*	1	ug/l	870	180	1100	< 1.0
Aliphatic C12-C16: EH_CU_1D_AL	DETSC 3072*	1	ug/l	170	81	130	< 1.0
Aliphatic C16-C21: EH_CU_1D_AL	DETSC 3072*	1	ug/l	530	75	240	< 1.0
Aliphatic C21-C35: EH_CU_1D_AL	DETSC 3072*	1	ug/l	170	21	680	< 1.0
Aliphatic C35-C44: EH_CU_1D_AL	DETSC 3072*	1	ug/l	< 1.0	< 1.0	74	< 1.0
Aromatic C5-C7: HS_1D_AR	DETSC 3322	0.1	ug/l	< 0.1	< 1.0	< 0.1	< 0.1
Aromatic C7-C8: HS_1D_AR	DETSC 3322	0.1	ug/l	< 0.1	< 1.0	< 0.1	< 0.1
Aromatic C8-C10: HS_1D_AR	DETSC 3322	0.1	ug/l	< 0.1	< 1.0	< 0.1	< 0.1
Aromatic C10-C12: EH_CU_1D_AR	DETSC 3072*	1	ug/l	1.3	< 1.0	< 1.0	< 1.0
Aromatic C12-C16: EH_CU_1D_AR	DETSC 3072*	1	ug/l	34	< 1.0	< 1.0	< 1.0

Summary of Chemical Analysis
Water Samples

Our Ref 24-15995
Client Ref ~ 24-0640
Contract Title ~ Dublin St North Monaghan

			Lab No	2372308	2372309	2372310	2372311
			Sample ID ~	SW1	SW2	SW3	SW4
			Depth ~				
			Other ID ~				
			Sample Type ~	EW	EW	EW	EW
			Sampling Date ~	29/07/2024	29/07/2024	29/07/2024	29/07/2024
			Sampling Time ~	n/s	n/s	n/s	n/s
Test	**Method**	**LOD**	**Units**				
Aromatic C16-C21: EH_CU_1D_AR	DETSC 3072*	1	ug/l	210	< 1.0	< 1.0	< 1.0
Aromatic C21-C35: EH_CU_1D_AR	DETSC 3072*	1	ug/l	79	< 1.0	< 1.0	< 1.0
Aromatic C35-C44: EH_CU_1D_AR	DETSC 3072*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic C10-C44: EH_CU_1D_AR	DETSC 3072*	1	ug/l	1200	< 1.0	< 1.0	< 1.0
Ali/Aro C10-C44: EH_CU_1D_Total	DETSC 3072*	1	ug/l	1200	180	1100	< 1.0
Benzene	DETSC 3322	1	ug/l	< 1.0	< 10.0	< 1.0	< 1.0
Toluene	DETSC 3322	1	ug/l	< 1.0	< 10.0	< 1.0	< 1.0
Ethylbenzene	DETSC 3322	1	ug/l	< 1.0	< 10.0	< 1.0	< 1.0
Xylene	DETSC 3322	1	ug/l	< 1.0	< 10.0	< 1.0	< 1.0
MTBE	DETSC 3322	1	ug/l	< 1.0	< 10.0	< 1.0	< 1.0
PAHs							
Naphthalene	DETSC 3304	0.05	ug/l	< 0.50	< 0.50	< 0.50	< 0.50
Acenaphthylene	DETSC 3304	0.01	ug/l	< 0.10	< 0.10	< 0.10	0.15
Acenaphthene	DETSC 3304	0.01	ug/l	< 0.10	< 0.10	< 0.10	< 0.10
Fluorene	DETSC 3304	0.01	ug/l	< 0.10	< 0.10	< 0.10	0.17
Phenanthrene	DETSC 3304	0.01	ug/l	0.19	0.19	0.15	0.71
Anthracene	DETSC 3304	0.01	ug/l	< 0.10	< 0.10	< 0.10	< 0.10
Fluoranthene	DETSC 3304	0.01	ug/l	< 0.10	< 0.10	< 0.10	0.87
Pyrene	DETSC 3304	0.01	ug/l	< 0.10	< 0.10	< 0.10	2.8
Benzo(a)anthracene	DETSC 3304*	0.01	ug/l	< 0.10	< 0.10	< 0.10	< 0.10
Chrysene	DETSC 3304	0.01	ug/l	< 0.10	< 0.10	< 0.10	3.4
Benzo(b)fluoranthene	DETSC 3304	0.01	ug/l	< 0.10	< 0.10	< 0.10	0.90
Benzo(k)fluoranthene	DETSC 3304	0.01	ug/l	< 0.10	< 0.10	< 0.10	< 0.10
Benzo(a)pyrene	DETSC 3304	0.01	ug/l	< 0.10	< 0.10	< 0.10	0.81
Indeno(1,2,3-c,d)pyrene	DETSC 3304	0.01	ug/l	< 0.10	< 0.10	< 0.10	< 0.10
Dibenzo(a,h)anthracene	DETSC 3304	0.01	ug/l	< 0.10	< 0.10	< 0.10	< 0.10
Benzo(g,h,i)perylene	DETSC 3304	0.01	ug/l	< 0.10	< 0.10	< 0.10	< 0.10
PAH Total	DETSC 3304	0.2	ug/l	< 2.00	< 2.00	< 2.00	9.8

Information in Support of the Analytical Results

Our Ref 24-15995
Client Ref ~ 24-0640
Contract ~ Dublin St North Monaghan

Containers Received & Deviating Samples

Lab No	Sample ID ~	Date Sampled ~	Containers Received	Holding time exceeded for tests	Inappropriate container for tests
2372308	SW1 WATER	29/07/24	GB 1L, GV x2, PB 1L	pH/Cond (1 days)	
2372309	SW2 WATER	29/07/24	GB 1L, GV x2, PB 1L	pH/Cond (1 days)	
2372310	SW3 WATER	29/07/24	GB 1L, GV x2, PB 1L	pH/Cond (1 days)	
2372311	SW4 WATER	29/07/24	GB 1L, GV x2, PB 1L	pH/Cond (1 days)	

Key: G-Glass P-Plastic B-Bottle V-Vial

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

Disposal

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

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

Information in Support of the Analytical Results

List of HWOL Acronyms and Operators

Acronym	Description
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
2D	GC-GC - Double coil gas chromatography
Total	Aliphatics & Aromatics
AL	Aliphatics only
AR	Aromatics only
#1	EH_2D_Total but with humics mathematically subtracted
#2	EH_2D_Total but with fatty acids mathematically subtracted
_	Operator - underscore to separate acronyms (exception for +)
+	Operator to indicate cumulative eg. EH+HS_Total or EH_CU+HS_Total

Det	Acronym
Aliphatic C5-C6	HS_1D_AL
Aliphatic C6-C8	HS_1D_AL
Aliphatic C8-C10	HS_1D_AL
Aliphatic C10-C12	EH_CU_1D_AL
Aliphatic C10-C44	EH_CU_1D_AL
Aliphatic C12-C16	EH_CU_1D_AL
Aliphatic C16-C21	EH_CU_1D_AL
Aliphatic C21-C35	EH_CU_1D_AL
Aliphatic C35-C44	EH_CU_1D_AL
Aromatic C5-C7	HS_1D_AR
Aromatic C7-C8	HS_1D_AR
Aromatic C8-C10	HS_1D_AR
Aromatic C10-C12	EH_CU_1D_AR
Aromatic C12-C16	EH_CU_1D_AR
Aromatic C16-C21	EH_CU_1D_AR
Aromatic C21-C35	EH_CU_1D_AR
Aromatic C35-C44	EH_CU_1D_AR
Aromatic C10-C44	EH_CU_1D_AR
Ali/Aro C10-C44	EH_CU_1D_Total

Key:

~ Sample details are provided by the client and can affect the validity of the results

***** -not accredited.

-MCERTS (accreditation only applies if report carries the MCERTS logo).

$ -subcontracted.

n/s -not supplied.

I/S -insufficient sample.

U/S -unsuitable sample.

t/f -to follow.

nd -not detected.

End of Report

DETS

Certificate of Analysis

Certificate Number 24-17001 *Issued:* 20-Aug-24

Client Causeway Geotech
Unit 1 Fingal House
Stephenstown Industrial Estate
Balbriggan
Co. Dublin
K32 VR66

Our Reference 24-17001

Client Reference ~ 24-0640

Order No ~ (not supplied)

Contract Title ~ Dublin St North Monaghan

Description 4 Water No Information Supplied samples.

Date Received 14-Aug-24

Date Started 14-Aug-24

Date Completed 20-Aug-24

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

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

Approved By

Kirk Bridgewood
General Manager

UKAS TESTING 2139

Summary of Chemical Analysis
Water Samples

Our Ref 24-17001
Client Ref ~ 24-0640
Contract Title ~ Dublin St North Monaghan

			Lab No	2378088	2378089	2378090	2378091
			Sample ID ~	SWS1	SWS2	SWS3	SWS4
			Depth ~				
			Other ID ~	2	2	2	2
			Sample Type ~	EW	EW	EW	EW
			Sampling Date ~	12/08/2024	12/08/2024	12/08/2024	12/08/2024
			Sampling Time ~	n/s	n/s	n/s	n/s
Test	**Method**	**LOD**	**Units**				
Metals							
Arsenic, Dissolved	DETSC 2306	0.16	ug/l	0.53	0.77	0.85	1.0
Boron, Dissolved	DETSC 2306*	0.012	mg/l	0.020	0.031	0.024	0.040
Cadmium, Dissolved	DETSC 2306	0.03	ug/l	< 0.03	< 0.03	< 0.03	< 0.03
Calcium, Dissolved	DETSC 2306	0.09	mg/l	40	50	43	57
Chromium III, Dissolved	DETSC 2306*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0
Chromium, Hexavalent	DETSC 2203	7	ug/l	< 7.0	< 7.0	< 7.0	< 7.0
Copper, Dissolved	DETSC 2306	0.4	ug/l	1.2	2.1	1.9	2.7
Lead, Dissolved	DETSC 2306	0.09	ug/l	0.50	0.28	0.56	0.30
Mercury, Dissolved	DETSC 2306	0.01	ug/l	< 0.01	< 0.01	< 0.01	< 0.01
Nickel, Dissolved	DETSC 2306	0.5	ug/l	0.9	1.4	1.4	2.2
Selenium, Dissolved	DETSC 2306	0.25	ug/l	0.35	0.34	< 0.25	0.33
Vanadium, Dissolved	DETSC 2306	0.6	ug/l	< 0.6	< 0.6	< 0.6	< 0.6
Zinc, Dissolved	DETSC 2306	1.3	ug/l	61	65	11	90
Inorganics							
Conductivity	DETSC 2009	1	uS/cm	232	381	347	625
pH	DETSC 2008		pH	6.5	6.7	6.8	6.9
Cyanide, Total Low Level	DETSC 2131	0.0001	mg/l	0.0011	0.0011	0.0018	0.0030
Cyanide, Free Low Level	DETSC 2131	0.0001	mg/l	0.0007	0.0007	0.0012	0.0014
Phenol - Monohydric Low Level	DETSC 2131	0.0015	mg/l	0.0022	< 0.0015	0.0026	0.0046
Thiocyanate	DETSC 2130	20	ug/l	< 20	< 20	< 20	< 20
Dissolved Organic Carbon	DETSC 2085	2	mg/l	6.4	6.6	5.8	9.3
Total Hardness as CaCO3	DETSC 2303	0.1	mg/l	111	149	130	176
Ammoniacal Nitrogen as N	DETSC 2207	0.015	mg/l	0.33	1.2	1.6	3.4
Sulphate as SO4	DETSC 2055	0.1	mg/l	7.3	18	17	27
Sulphide	DETSC 2208	0.01	mg/l	0.03	0.01	0.11	0.01
Sulphur as S, Total	DETSC 2320*	10	mg/l	< 10	< 10	< 10	12
Petroleum Hydrocarbons							
Aliphatic C5-C6: HS_1D_AL	DETSC 3322	0.1	ug/l	< 0.1	< 0.1	< 0.1	< 0.1
Aliphatic C6-C8: HS_1D_AL	DETSC 3322	0.1	ug/l	< 0.1	< 0.1	< 0.1	< 0.1
Aliphatic C8-C10: HS_1D_AL	DETSC 3322	0.1	ug/l	< 0.1	26	< 0.1	< 0.1
Aliphatic C10-C12: EH_CU_1D_AL	DETSC 3072*	1	ug/l	< 1.0	780	52	< 1.0
Aliphatic C10-C44: EH_CU_1D_AL	DETSC 3072*	1	ug/l	< 1.0	12000	990	< 1.0
Aliphatic C12-C16: EH_CU_1D_AL	DETSC 3072*	1	ug/l	< 1.0	5100	280	< 1.0
Aliphatic C16-C21: EH_CU_1D_AL	DETSC 3072*	1	ug/l	< 1.0	4900	400	< 1.0
Aliphatic C21-C35: EH_CU_1D_AL	DETSC 3072*	1	ug/l	< 1.0	1500	160	< 1.0
Aliphatic C35-C44: EH_CU_1D_AL	DETSC 3072*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic C5-C7: HS_1D_AR	DETSC 3322	0.1	ug/l	< 0.1	< 0.1	< 0.1	< 0.1
Aromatic C7-C8: HS_1D_AR	DETSC 3322	0.1	ug/l	< 0.1	20	< 0.1	< 0.1
Aromatic C8-C10: HS_1D_AR	DETSC 3322	0.1	ug/l	< 0.1	48	< 0.1	< 0.1
Aromatic C10-C12: EH_CU_1D_AR	DETSC 3072*	1	ug/l	< 1.0	590	< 1.0	< 1.0
Aromatic C12-C16: EH_CU_1D_AR	DETSC 3072*	1	ug/l	< 1.0	2900	< 1.0	< 1.0
Aromatic C16-C21: EH_CU_1D_AR	DETSC 3072*	1	ug/l	< 1.0	2400	< 1.0	< 1.0

Summary of Chemical Analysis
Water Samples

Our Ref 24-17001
Client Ref ~ 24-0640
Contract Title ~ Dublin St North Monaghan

			Lab No	2378088	2378089	2378090	2378091
			Sample ID ~	SWS1	SWS2	SWS3	SWS4
			Depth ~				
			Other ID ~	2	2	2	2
			Sample Type ~	EW	EW	EW	EW
			Sampling Date ~	12/08/2024	12/08/2024	12/08/2024	12/08/2024
			Sampling Time ~	n/s	n/s	n/s	n/s
Test	**Method**	**LOD**	**Units**				
Aromatic C21-C35: EH_CU_1D_AR	DETSC 3072*	1	ug/l	< 1.0	640	< 1.0	< 1.0
Aromatic C35-C44: EH_CU_1D_AR	DETSC 3072*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic C10-C44: EH_CU_1D_AR	DETSC 3072*	1	ug/l	< 1.0	6600	< 1.0	< 1.0
Ali/Aro C10-C44: EH_CU_1D_Total	DETSC 3072*	1	ug/l	< 1.0	19000	990	< 1.0
Benzene	DETSC 3322	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0
Toluene	DETSC 3322	1	ug/l	< 1.0	20	< 1.0	< 1.0
Ethylbenzene	DETSC 3322	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0
Xylene	DETSC 3322	1	ug/l	< 1.0	11	< 1.0	< 1.0
MTBE	DETSC 3322	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0
PAHs							
Naphthalene	DETSC 3304	0.05	ug/l	< 0.50	1.1	1.7	0.07
Acenaphthylene	DETSC 3304	0.01	ug/l	< 0.10	0.28	< 0.10	< 0.01
Acenaphthene	DETSC 3304	0.01	ug/l	< 0.10	2.2	0.96	0.01
Fluorene	DETSC 3304	0.01	ug/l	< 0.10	0.76	0.42	0.01
Phenanthrene	DETSC 3304	0.01	ug/l	0.17	2.4	0.68	0.01
Anthracene	DETSC 3304	0.01	ug/l	< 0.10	< 0.10	0.12	< 0.01
Fluoranthene	DETSC 3304	0.01	ug/l	< 0.10	0.58	0.44	< 0.01
Pyrene	DETSC 3304	0.01	ug/l	< 0.10	1.8	0.51	< 0.01
Benzo(a)anthracene	DETSC 3304*	0.01	ug/l	< 0.10	0.17	0.20	< 0.01
Chrysene	DETSC 3304	0.01	ug/l	< 0.10	0.13	0.16	< 0.01
Benzo(b)fluoranthene	DETSC 3304	0.01	ug/l	< 0.10	0.28	0.30	< 0.01
Benzo(k)fluoranthene	DETSC 3304	0.01	ug/l	< 0.10	0.11	0.15	< 0.01
Benzo(a)pyrene	DETSC 3304	0.01	ug/l	< 0.10	0.22	0.27	< 0.01
Indeno(1,2,3-c,d)pyrene	DETSC 3304	0.01	ug/l	< 0.10	0.16	0.18	< 0.01
Dibenzo(a,h)anthracene	DETSC 3304	0.01	ug/l	< 0.10	< 0.10	0.16	< 0.01
Benzo(g,h,i)perylene	DETSC 3304	0.01	ug/l	< 0.10	0.20	0.28	< 0.01
PAH Total	DETSC 3304	0.2	ug/l	< 2.00	10	6.6	< 0.20

2378088, 2378089, 2378090, 2378091 - WATER
UNKNOWN testing is not accredited

Information in Support of the Analytical Results

Our Ref 24-17001
Client Ref ~ 24-0640
Contract ~ Dublin St North Monaghan

Containers Received & Deviating Samples

Lab No	Sample ID ~	Date Sampled ~	Containers Received	Holding time exceeded for tests	inappropriat e container for tests
2378088	SWS1 WATER UNKNOWN	12/08/24	GB 1L, GV x2, PB 1L	pH/Cond (1 days)	
2378089	SWS2 WATER UNKNOWN	12/08/24	GB 1L, GV x2, PB 1L	pH/Cond (1 days)	
2378090	SWS3 WATER UNKNOWN	12/08/24	GB 1L, GV x2, PB 1L	pH/Cond (1 days)	
2378091	SWS4 WATER UNKNOWN	12/08/24	GB 1L, GV x2, PB 1L	pH/Cond (1 days)	

Key: G-Glass P-Plastic B-Bottle V-Vial

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

Disposal

From the issue date of this test certificate, samples will be held for the following times prior to disposal :-
Soils - 1 month, Liquids - 2 weeks, Asbestos (test portion) - 6 months

Information in Support of the Analytical Results

List of HWOL Acronyms and Operators

Acronym	Description
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
2D	GC-GC - Double coil gas chromatography
Total	Aliphatics & Aromatics
AL	Aliphatics only
AR	Aromatics only
#1	EH_2D_Total but with humics mathematically subtracted
#2	EH_2D_Total but with fatty acids mathematically subtracted
_	Operator - underscore to separate acronyms (exception for +)
+	Operator to indicate cumulative eg. EH+HS_Total or EH_CU+HS_Total

Det	Acronym
Aliphatic C5-C6	HS_1D_AL
Aliphatic C6-C8	HS_1D_AL
Aliphatic C8-C10	HS_1D_AL
Aliphatic C10-C12	EH_CU_1D_AL
Aliphatic C10-C44	EH_CU_1D_AL
Aliphatic C12-C16	EH_CU_1D_AL
Aliphatic C16-C21	EH_CU_1D_AL
Aliphatic C21-C35	EH_CU_1D_AL
Aliphatic C35-C44	EH_CU_1D_AL
Aromatic C5-C7	HS_1D_AR
Aromatic C7-C8	HS_1D_AR
Aromatic C8-C10	HS_1D_AR
Aromatic C10-C12	EH_CU_1D_AR
Aromatic C12-C16	EH_CU_1D_AR
Aromatic C16-C21	EH_CU_1D_AR
Aromatic C21-C35	EH_CU_1D_AR
Aromatic C35-C44	EH_CU_1D_AR
Aromatic C10-C44	EH_CU_1D_AR
Ali/Aro C10-C44	EH_CU_1D_Total

Key:

~ Sample details are provided by the client and can affect the validity of the results
***** -not accredited.
# -MCERTS (accreditation only applies if report carries the MCERTS logo).
$ -subcontracted.
n/s -not supplied.
I/S -insufficient sample.
U/S -unsuitable sample.
t/f -to follow.
nd -not detected.

End of Report

DETS

Certificate of Analysis

Certificate Number	24-17569	*Issued:*	30-Aug-24
Client	Causeway Geotech Unit 1 Fingal House Stephenstown Industrial Estate Balbriggan Co. Dublin K32 VR66		
Our Reference	24-17569		
Client Reference ~	24-0640		
Order No ~	(not supplied)		
Contract Title ~	Dublin St North Monaghan		
Description	12 Soil samples, 12 Leachate prepared by DETS samples.		
Date Received	21-Aug-24		
Date Started	21-Aug-24		
Date Completed	30-Aug-24		
Test Procedures	Identified by prefix DETSn (details on request).		
Notes	Opinions and interpretations are outside the laboratory's scope of ISO 17025 accreditation. This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced except in full, without the prior written approval of the laboratory.		

Approved By

Kirk Bridgewood
General Manager

ilac-MRA

UKAS
TESTING
2139

Summary of Chemical Analysis
Soil Samples

Our Ref 24-17569
Client Ref ~ 24-0640
Contract Title ~ Dublin St North Monaghan

			Lab No	2381306	2381307	2381308	2381309	2381310	2381311
			Sample ID ~	TP01	TP01	TP02	TP02	TP03	TP03
			Depth ~	0.25	1.00	0.50	2.00	0.25	0.50
			Other ID ~	1	3	2	8	1	2
			Sample Type ~	ES	ES	ES	ES	ES	ES
			Sampling Date ~	09/08/2024	09/08/2024	09/08/2024	09/08/2024	08/08/2024	08/08/2024
			Sampling Time ~	n/s	n/s	n/s	n/s	n/s	n/s
Test	**Method**	**LOD**	**Units**						
Preparation									
Moisture Content	DETSC 1004	0.1	%	19	18	11	11	6.6	14
Metals									
Arsenic	DETSC 2301#	0.2	mg/kg	7.7	7.1	5.5	5.5	6.7	6.1
Boron, Water Soluble (2.5:1)	DETSC 2311#	0.2	mg/kg	0.6	< 0.2	0.3	0.2	< 0.2	0.3
Cadmium	DETSC 2301#	0.1	mg/kg	0.5	0.4	0.2	0.2	< 0.1	0.3
Chromium III	DETSC 2301*	0.15	mg/kg	24	32	23	24	50	30
Chromium, Hexavalent	DETSC 2204*	1	mg/kg	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Copper	DETSC 2301#	0.2	mg/kg	20	25	19	20	33	23
Lead	DETSC 2301#	0.3	mg/kg	55	14	16	22	15	17
Mercury	DETSC 2325#	0.05	mg/kg	0.16	< 0.05	0.16	0.16	< 0.05	0.06
Nickel	DETSC 2301#	1	mg/kg	28	43	33	34	62	38
Selenium	DETSC 2301#	0.5	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Vanadium	DETSC 2301#	0.8	mg/kg	26	29	22	23	34	27
Zinc	DETSC 2301#	1	mg/kg	71	55	46	55	70	64
Inorganics									
pH	DETSC 2008#		pH	7.8	7.8	8.5	8.5	8.6	8.4
Acid / Alkali Reserve	DETSC 2011*	1	Oh/100g	< 1.0	< 1.0	1.1	< 1.0	< 1.0	< 1.0
Acid Neutralisation Capacity (pH4)	DETSC 2073*	1	moles/kg	< 1.0	1.7	3.2	2.6	< 1.0	2.6
Cyanide, Total	DETSC 2130#	0.1	mg/kg	0.3	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Cyanide, Free	DETSC 2130#	0.1	mg/kg	0.4	0.1	< 0.1	< 0.1	< 0.1	< 0.1
Thiocyanate	DETSC 2130#	0.6	mg/kg	1.1	< 0.6	< 0.6	< 0.6	< 0.6	< 0.6
Organic matter	DETSC 2002#	0.1	%	3.1	1.7	0.4	0.9	0.5	1.2
Chloride	DETSC 2055	1	mg/kg	33.2	36.9	26.1	23.7	22.1	24.9
Nitrate as NO3	DETSC 2055	1	mg/kg	8.6	13	2.5	2.8	3.6	5.1
Sulphide	DETSC 2024*	10	mg/kg	< 10	< 10	< 10	20	< 10	16
Sulphate as SO4, Total	DETSC 2321#	0.01	%	0.07	0.04	0.05	0.04	0.02	0.04
Petroleum Hydrocarbons									
Aliphatic C5-C6: HS_1D_AL	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aliphatic C6-C8: HS_1D_AL	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aliphatic C8-C10: HS_1D_AL	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aliphatic >EC10-EC12: EH_2D_AL	DETSC 3521#	1.5	mg/kg	< 1.50	< 1.50	< 1.50	< 1.50	< 1.50	< 1.50
Aliphatic >EC12-EC16: EH_2D_AL	DETSC 3521#	1.2	mg/kg	< 1.20	< 1.20	< 1.20	< 1.20	< 1.20	< 1.20
Aliphatic >EC16-EC21: EH_2D_AL	DETSC 3521#	1.5	mg/kg	< 1.50	< 1.50	< 1.50	< 1.50	< 1.50	< 1.50
Aliphatic >EC21-EC35: EH_2D_AL	DETSC 3521#	3.4	mg/kg	< 3.40	< 3.40	< 3.40	4.75	< 3.40	8.80
Aliphatic >EC35-EC40: EH_2D_AL	DETSC 3521*	3.4	mg/kg	< 3.40	< 3.40	< 3.40	< 3.40	< 3.40	< 3.40
Aliphatic >EC40-EC44: EH_2D_AL	DETSC 3521*	3.4	mg/kg	< 3.40	< 3.40	< 3.40	< 3.40	< 3.40	< 3.40
Aliphatic C5-C44: EH_2D+HS_1D_AL	DETSC 3521*	10	mg/kg	< 10.00	< 10.00	< 10.00	< 10.00	< 10.00	< 10.00
Aromatic C5-C7: HS_1D_AR	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aromatic C7-C8: HS_1D_AR	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aromatic C8-C10: HS_1D_AR	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aromatic >EC10-EC12: EH_2D_AR	DETSC 3521#	0.9	mg/kg	< 0.90	< 0.90	< 0.90	< 0.90	< 0.90	< 0.90

Summary of Chemical Analysis
Soil Samples

Our Ref 24-17569
Client Ref ~ 24-0640
Contract Title ~ Dublin St North Monaghan

			Lab No	2381306	2381307	2381308	2381309	2381310	2381311
			Sample ID ~	TP01	TP01	TP02	TP02	TP03	TP03
			Depth ~	0.25	1.00	0.50	2.00	0.25	0.50
			Other ID ~	1	3	2	8	1	2
			Sample Type ~	ES	ES	ES	ES	ES	ES
			Sampling Date ~	09/08/2024	09/08/2024	09/08/2024	09/08/2024	08/08/2024	08/08/2024
			Sampling Time ~	n/s	n/s	n/s	n/s	n/s	n/s
Test	**Method**	**LOD**	**Units**						
Aromatic >EC12-EC16: EH_2D_AR	DETSC 3521#	0.5	mg/kg	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Aromatic >EC16-EC21: EH_2D_AR	DETSC 3521#	0.6	mg/kg	1.46	1.25	0.93	0.92	< 0.60	1.15
Aromatic >EC21-EC35: EH_2D_AR	DETSC 3521#	1.4	mg/kg	3.58	1.97	4.57	2.31	1.59	3.85
Aromatic >EC35-EC40: EH_2D_AR	DETSC 3521*	1.4	mg/kg	< 1.40	< 1.40	< 1.40	< 1.40	< 1.40	< 1.40
Aromatic >EC40-EC44: EH_2D_AR	DETSC 3521*	1.4	mg/kg	< 1.40	< 1.40	< 1.40	< 1.40	< 1.40	< 1.40
Aromatic C5-C44: EH_2D+HS_1D_AR	DETSC 3521*	10	mg/kg	< 10.00	< 10.00	< 10.00	< 10.00	< 10.00	< 10.00
TPH Ali/Aro C5-C44: EH_2D+HS_1D_Total	DETSC 3521*	10	mg/kg	< 10.00	< 10.00	< 10.00	< 10.00	< 10.00	< 10.00
Benzene	DETSC 3321#	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Ethylbenzene	DETSC 3321#	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Toluene	DETSC 3321#	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Xylene	DETSC 3321#	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
MTBE	DETSC 3321	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
PAHs									
Naphthalene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Acenaphthylene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Acenaphthene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Fluorene	DETSC 3303	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Phenanthrene	DETSC 3303#	0.03	mg/kg	0.10	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Anthracene	DETSC 3303	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Fluoranthene	DETSC 3303#	0.03	mg/kg	0.23	0.03	< 0.03	< 0.03	< 0.03	< 0.03
Pyrene	DETSC 3303#	0.03	mg/kg	0.20	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Benzo(a)anthracene	DETSC 3303#	0.03	mg/kg	0.08	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Chrysene	DETSC 3303	0.03	mg/kg	0.09	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Benzo(b)fluoranthene	DETSC 3303#	0.03	mg/kg	0.09	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Benzo(k)fluoranthene	DETSC 3303#	0.03	mg/kg	0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Benzo(a)pyrene	DETSC 3303#	0.03	mg/kg	0.06	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Indeno(1,2,3-c,d)pyrene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Dibenzo(a,h)anthracene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Benzo(g,h,i)perylene	DETSC 3303#	0.03	mg/kg	0.04	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
PAH - USEPA 16, Total	DETSC 3303	0.1	mg/kg	0.84	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Phenols									
Phenol - Monohydric	DETSC 2130#	0.3	mg/kg	0.4	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3

Summary of Chemical Analysis
Soil Samples

Our Ref 24-17569
Client Ref ~ 24-0640
Contract Title ~ Dublin St North Monaghan

			Lab No	2381312	2381313	2381314	2381315	2381316	2381317
			Sample ID ~	TP04	TP04	TP06	TP07	TP07	TP07
			Depth ~	0.25	0.50	0.50	0.25	1.00	1.50
			Other ID ~	1	2	2	1	3	8
			Sample Type ~	ES	ES	ES	ES	ES	ES
			Sampling Date ~	08/08/2024	08/08/2024	08/08/2024	08/08/2024	08/08/2024	08/08/2024
			Sampling Time ~	n/s	n/s	n/s	n/s	n/s	n/s
Test	**Method**	**LOD**	**Units**						
Preparation									
Moisture Content	DETSC 1004	0.1	%	18	16	9.2	9.3	9.4	11
Metals									
Arsenic	DETSC 2301#	0.2	mg/kg	13	7.2	4.6	9.7	5.9	5.4
Boron, Water Soluble (2.5:1)	DETSC 2311#	0.2	mg/kg	0.4	0.2	0.2	0.2	0.3	0.2
Cadmium	DETSC 2301#	0.1	mg/kg	0.4	0.3	0.3	0.9	0.4	0.3
Chromium III	DETSC 2301*	0.15	mg/kg	28	24	16	28	25	33
Chromium, Hexavalent	DETSC 2204*	1	mg/kg	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Copper	DETSC 2301#	0.2	mg/kg	38	25	15	36	27	26
Lead	DETSC 2301#	0.3	mg/kg	64	16	11	180	65	39
Mercury	DETSC 2325#	0.05	mg/kg	0.30	0.08	< 0.05	0.42	0.15	< 0.05
Nickel	DETSC 2301#	1	mg/kg	33	35	23	36	29	39
Selenium	DETSC 2301#	0.5	mg/kg	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Vanadium	DETSC 2301#	0.8	mg/kg	33	24	15	31	28	36
Zinc	DETSC 2301#	1	mg/kg	89	61	41	250	99	65
Inorganics									
pH	DETSC 2008#		pH	7.9	8.0	8.6	8.1	8.3	8.6
Acid / Alkali Reserve	DETSC 2011*	1	Oh/100g	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Acid Neutralisation Capacity (pH4)	DETSC 2073*	1	moles/kg	< 1.0	< 1.0	4.2	< 1.0	3.5	3.8
Cyanide, Total	DETSC 2130#	0.1	mg/kg	0.3	0.1	< 0.1	0.4	0.2	0.1
Cyanide, Free	DETSC 2130#	0.1	mg/kg	0.3	0.1	< 0.1	0.2	0.1	< 0.1
Thiocyanate	DETSC 2130#	0.6	mg/kg	0.9	< 0.6	< 0.6	< 0.6	< 0.6	< 0.6
Organic matter	DETSC 2002#	0.1	%	2.7	0.9	0.6	1.4	1.5	0.5
Chloride	DETSC 2055	1	mg/kg	18.8	26.0	57.3	17.7	36.8	29.1
Nitrate as NO3	DETSC 2055	1	mg/kg	8.3	3.9	7.1	2.8	4.3	2.4
Sulphide	DETSC 2024*	10	mg/kg	< 10	< 10	24	12	< 10	< 10
Sulphate as SO4, Total	DETSC 2321#	0.01	%	0.05	0.02	0.04	0.06	0.06	0.04
Petroleum Hydrocarbons									
Aliphatic C5-C6: HS_1D_AL	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aliphatic C6-C8: HS_1D_AL	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aliphatic C8-C10: HS_1D_AL	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aliphatic >EC10-EC12: EH_2D_AL	DETSC 3521#	1.5	mg/kg	< 1.50	< 1.50	< 1.50	< 1.50	< 1.50	< 1.50
Aliphatic >EC12-EC16: EH_2D_AL	DETSC 3521#	1.2	mg/kg	< 1.20	< 1.20	< 1.20	< 1.20	< 1.20	< 1.20
Aliphatic >EC16-EC21: EH_2D_AL	DETSC 3521#	1.5	mg/kg	< 1.50	< 1.50	< 1.50	< 1.50	< 1.50	< 1.50
Aliphatic >EC21-EC35: EH_2D_AL	DETSC 3521#	3.4	mg/kg	< 3.40	< 3.40	< 3.40	< 3.40	< 3.40	< 3.40
Aliphatic >EC35-EC40: EH_2D_AL	DETSC 3521*	3.4	mg/kg	< 3.40	< 3.40	< 3.40	< 3.40	< 3.40	< 3.40
Aliphatic >EC40-EC44: EH_2D_AL	DETSC 3521*	3.4	mg/kg	< 3.40	< 3.40	< 3.40	< 3.40	< 3.40	< 3.40
Aliphatic C5-C44: EH_2D+HS_1D_AL	DETSC 3521*	10	mg/kg	< 10.00	< 10.00	< 10.00	< 10.00	< 10.00	< 10.00
Aromatic C5-C7: HS_1D_AR	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aromatic C7-C8: HS_1D_AR	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aromatic C8-C10: HS_1D_AR	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aromatic >EC10-EC12: EH_2D_AR	DETSC 3521#	0.9	mg/kg	< 0.90	< 0.90	< 0.90	< 0.90	< 0.90	< 0.90

Summary of Chemical Analysis
Soil Samples

Our Ref 24-17569
Client Ref ~ 24-0640
Contract Title ~ Dublin St North Monaghan

			Lab No	2381312	2381313	2381314	2381315	2381316	2381317
			Sample ID ~	TP04	TP04	TP06	TP07	TP07	TP07
			Depth ~	0.25	0.50	0.50	0.25	1.00	1.50
			Other ID ~	1	2	2	1	3	8
			Sample Type ~	ES	ES	ES	ES	ES	ES
			Sampling Date ~	08/08/2024	08/08/2024	08/08/2024	08/08/2024	08/08/2024	08/08/2024
			Sampling Time ~	n/s	n/s	n/s	n/s	n/s	n/s
Test	**Method**	**LOD**	**Units**						
Aromatic >EC12-EC16: EH_2D_AR	DETSC 3521#	0.5	mg/kg	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Aromatic >EC16-EC21: EH_2D_AR	DETSC 3521#	0.6	mg/kg	1.01	1.05	0.99	1.79	< 0.60	< 0.60
Aromatic >EC21-EC35: EH_2D_AR	DETSC 3521#	1.4	mg/kg	< 1.40	< 1.40	< 1.40	2.14	2.82	1.97
Aromatic >EC35-EC40: EH_2D_AR	DETSC 3521*	1.4	mg/kg	< 1.40	< 1.40	< 1.40	< 1.40	< 1.40	< 1.40
Aromatic >EC40-EC44: EH_2D_AR	DETSC 3521*	1.4	mg/kg	< 1.40	< 1.40	< 1.40	< 1.40	< 1.40	< 1.40
Aromatic C5-C44: EH_2D+HS_1D_AR	DETSC 3521*	10	mg/kg	< 10.00	< 10.00	< 10.00	< 10.00	< 10.00	< 10.00
TPH Ali/Aro C5-C44: EH_2D+HS_1D_Total	DETSC 3521*	10	mg/kg	< 10.00	< 10.00	< 10.00	< 10.00	< 10.00	< 10.00
Benzene	DETSC 3321#	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Ethylbenzene	DETSC 3321#	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Toluene	DETSC 3321#	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Xylene	DETSC 3321#	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
MTBE	DETSC 3321	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
PAHs									
Naphthalene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Acenaphthylene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Acenaphthene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Fluorene	DETSC 3303	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Phenanthrene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	0.08	0.06	< 0.03
Anthracene	DETSC 3303	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Fluoranthene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	0.18	0.17	0.05
Pyrene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	0.15	0.15	0.04
Benzo(a)anthracene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	0.07	0.07	< 0.03
Chrysene	DETSC 3303	0.03	mg/kg	< 0.03	< 0.03	< 0.03	0.07	0.08	< 0.03
Benzo(b)fluoranthene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	0.08	0.08	< 0.03
Benzo(k)fluoranthene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	0.03	0.03	< 0.03
Benzo(a)pyrene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	0.06	0.06	< 0.03
Indeno(1,2,3-c,d)pyrene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	0.03	0.03	< 0.03
Dibenzo(a,h)anthracene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Benzo(g,h,i)perylene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	0.04	0.04	< 0.03
PAH - USEPA 16, Total	DETSC 3303	0.1	mg/kg	< 0.10	< 0.10	< 0.10	0.77	0.77	< 0.10
Phenols									
Phenol - Monohydric	DETSC 2130#	0.3	mg/kg	< 0.3	0.3	< 0.3	< 0.3	< 0.3	< 0.3

WASTE ACCEPTANCE CRITERIA TESTING ANALYTICAL REPORT

Our Ref	24-17569		
Client Ref	24-0640		
Contract Title	Dublin St North Monaghan	*Sample Numbers*	2381307 2381326
Sample Id	TP01 3 1.00	*Date Analysed*	28/08/2024

Test Results On Waste

			WAC Limit Values		
Determinand and Method Reference	**Units**	**Result**	**Inert Waste**	**SNRHW**	**Hazardous Waste**
DETSC 2084# Total Organic Carbon	%	0.8	3	5	6
DETSC 2003# Loss On Ignition	%	4.6	n/a	n/a	10
DETSC 3321# BTEX	mg/kg	< 0.04	6	n/a	n/a
DETSC 3401# PCBs (7 congeners)	mg/kg	< 0.01	1	n/a	n/a
DETSC 3311# EPH (C10 - C40): EH_1D_Total	mg/kg	< 10	500	n/a	n/a
DETSC 3301 PAHs	mg/kg	< 1.6	100	n/a	n/a
DETSC 2008# pH	pH Units	7.8	n/a	>6	n/a
DETSC 2073* Acid Neutralisation Capacity (pH4)	mol/kg	1.7	n/a	TBE	TBE
DETSC 2073* Acid Neutralisation Capacity (pH7)	mol/kg	< 1.0	n/a	TBE	TBE

Test Results On Leachate

			WAC Limit Values Limit values for LS10 Leachate		
Determinand and Method Reference	**Conc in Eluate ug/l**	**Amount Leached* mg/kg**	**Inert Waste**	**SNRHW**	**Hazardous Waste**
	10:1	**LS10**			
DETSC 2306 Arsenic as As	0.28	< 0.01	0.5	2	25
DETSC 2306 Barium as Ba	3	< 0.1	20	100	300
DETSC 2306 Cadmium as Cd	< 0.030	< 0.02	0.04	1	5
DETSC 2306 Chromium as Cr	< 0.25	< 0.1	0.5	10	70
DETSC 2306 Copper as Cu	0.73	< 0.02	2	50	100
DETSC 2306 Mercury as Hg	< 0.010	< 0.002	0.01	0.2	2
DETSC 2306 Molybdenum as Mo	< 1.1	< 0.1	0.5	10	30
DETSC 2306 Nickel as Ni	< 0.50	< 0.1	0.4	10	40
DETSC 2306 Lead as Pb	0.1	< 0.05	0.5	10	50
DETSC 2306 Antimony as Sb	< 0.17	< 0.05	0.06	0.7	5
DETSC 2306 Selenium as Se	< 0.25	< 0.03	0.1	0.5	7
DETSC 2306 Zinc as Zn	< 1.3	< 0.01	4	50	200
DETSC 2055 Chloride as Cl	1200	< 100	800	15,000	25,000
DETSC 2055* Fluoride as F	270	2.7	10	150	500
DETSC 2055 Sulphate as SO4	2000	< 100	1000	20,000	50,000
DETSC 2009* Total Dissolved Solids	28000	280	4000	60,000	100,000
DETSC 2130 Phenol Index	< 100	< 1	1	n/a	n/a
DETSC 2085 Dissolved Organic Carbon	< 2000	< 50	500	800	1000

TBE - To Be Evaluated

SNRHW - Stable Non-Reactive Hazardous Waste

Additional Information

DETSC 2008 pH	7.2
DETSC 2009 Conductivity uS/cm	40.1
* Temperature*	19.0

Mass of Sample Kg*	0.120
Mass of dry Sample Kg*	0.099

Stage 1

Volume of Leachant L2*	0.966
Volume of Eluate VE1*	0.908

Disclaimer: *The WAC limit values are provided for guidance only. DETS does not accept responsibility for errors or omissions. Values are correct at time of issue.*

V.2.06 ** DETS are accredited for the testing of leachates and not the leachate preparation stage which is unaccredited.*

WASTE ACCEPTANCE CRITERIA TESTING ANALYTICAL REPORT

Our Ref 24-17569
Client Ref 24-0640
Contract Title Dublin St North Monaghan
Sample Id TP02 2 0.50

Sample Numbers 2381308 2381327
Date Analysed 28/08/2024

Test Results On Waste			**WAC Limit Values**		
Determinand and Method Reference	**Units**	**Result**	**Inert Waste**	**SNRHW**	**Hazardous Waste**
DETSC 2084# Total Organic Carbon	%	0.5	3	5	6
DETSC 2003# Loss On Ignition	%	2.2	n/a	n/a	10
DETSC 3321# BTEX	mg/kg	< 0.04	6	n/a	n/a
DETSC 3401# PCBs (7 congeners)	mg/kg	< 0.01	1	n/a	n/a
DETSC 3311# EPH (C10 - C40): EH_1D_Total	mg/kg	< 10	500	n/a	n/a
DETSC 3301 PAHs	mg/kg	< 1.6	100	n/a	n/a
DETSC 2008# pH	pH Units	8.5	n/a	>6	n/a
DETSC 2073* Acid Neutralisation Capacity (pH4)	mol/kg	3.2	n/a	TBE	TBE
DETSC 2073* Acid Neutralisation Capacity (pH7)	mol/kg	< 1.0	n/a	TBE	TBE

Test Results On Leachate			**WAC Limit Values** Limit values for LS10 Leachate		
Determinand and Method Reference	**Conc in Eluate ug/l** **10:1**	**Amount Leached* mg/kg** **LS10**	**Inert Waste**	**SNRHW**	**Hazardous Waste**
DETSC 2306 Arsenic as As	0.78	< 0.01	0.5	2	25
DETSC 2306 Barium as Ba	5.8	< 0.1	20	100	300
DETSC 2306 Cadmium as Cd	< 0.030	< 0.02	0.04	1	5
DETSC 2306 Chromium as Cr	< 0.25	< 0.1	0.5	10	70
DETSC 2306 Copper as Cu	0.77	< 0.02	2	50	100
DETSC 2306 Mercury as Hg	< 0.010	< 0.002	0.01	0.2	2
DETSC 2306 Molybdenum as Mo	< 1.1	< 0.1	0.5	10	30
DETSC 2306 Nickel as Ni	< 0.50	< 0.1	0.4	10	40
DETSC 2306 Lead as Pb	< 0.090	< 0.05	0.5	10	50
DETSC 2306 Antimony as Sb	< 0.17	< 0.05	0.06	0.7	5
DETSC 2306 Selenium as Se	< 0.25	< 0.03	0.1	0.5	7
DETSC 2306 Zinc as Zn	< 1.3	< 0.01	4	50	200
DETSC 2055 Chloride as Cl	1500	< 100	800	15,000	25,000
DETSC 2055* Fluoride as F	380	3.8	10	150	500
DETSC 2055 Sulphate as SO4	9000	< 100	1000	20,000	50,000
DETSC 2009* Total Dissolved Solids	52000	520	4000	60,000	100,000
DETSC 2130 Phenol Index	< 100	< 1	1	n/a	n/a
DETSC 2085 Dissolved Organic Carbon	< 2000	< 50	500	800	1000

TBE - To Be Evaluated
SNRHW - Stable Non-Reactive Hazardous Waste

Additional Information

DETSC 2008 pH	7.1
DETSC 2009 Conductivity uS/cm	74.8
* Temperature*	19.0

Mass of Sample Kg*	0.110
Mass of dry Sample Kg*	0.098
Stage 1	
Volume of Leachant L2*	0.972
Volume of Eluate VE1*	0.922

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WASTE ACCEPTANCE CRITERIA TESTING ANALYTICAL REPORT

Our Ref 24-17569
Client Ref 24-0640
Contract Title Dublin St North Monaghan
Sample Id TP04 1 0.25
Sample Numbers 2381312 2381328
Date Analysed 28/08/2024

Test Results On Waste			**WAC Limit Values**		
Determinand and Method Reference	**Units**	**Result**	**Inert Waste**	**SNRHW**	**Hazardous Waste**
DETSC 2084# Total Organic Carbon	%	2.0	3	5	6
DETSC 2003# Loss On Ignition	%	5.0	n/a	n/a	10
DETSC 3321# BTEX	mg/kg	< 0.04	6	n/a	n/a
DETSC 3401# PCBs (7 congeners)	mg/kg	< 0.01	1	n/a	n/a
DETSC 3311# EPH (C10 - C40): EH_1D_Total	mg/kg	< 10	500	n/a	n/a
DETSC 3301 PAHs	mg/kg	< 1.6	100	n/a	n/a
DETSC 2008# pH	pH Units	7.9	n/a	>6	n/a
DETSC 2073* Acid Neutralisation Capacity (pH4)	mol/kg	< 1.0	n/a	TBE	TBE
DETSC 2073* Acid Neutralisation Capacity (pH7)	mol/kg	< 1.0	n/a	TBE	TBE

Test Results On Leachate			**WAC Limit Values** Limit values for LS10 Leachate		
Determinand and Method Reference	**Conc in Eluate ug/l**	**Amount Leached* mg/kg**	**Inert Waste**	**SNRHW**	**Hazardous Waste**
	10:1	**LS10**			
DETSC 2306 Arsenic as As	2.6	0.026	0.5	2	25
DETSC 2306 Barium as Ba	4	< 0.1	20	100	300
DETSC 2306 Cadmium as Cd	< 0.030	< 0.02	0.04	1	5
DETSC 2306 Chromium as Cr	< 0.25	< 0.1	0.5	10	70
DETSC 2306 Copper as Cu	1.5	< 0.02	2	50	100
DETSC 2306 Mercury as Hg	< 0.010	< 0.002	0.01	0.2	2
DETSC 2306 Molybdenum as Mo	< 1.1	< 0.1	0.5	10	30
DETSC 2306 Nickel as Ni	0.54	< 0.1	0.4	10	40
DETSC 2306 Lead as Pb	0.58	< 0.05	0.5	10	50
DETSC 2306 Antimony as Sb	0.43	< 0.05	0.06	0.7	5
DETSC 2306 Selenium as Se	< 0.25	< 0.03	0.1	0.5	7
DETSC 2306 Zinc as Zn	2.6	0.026	4	50	200
DETSC 2055 Chloride as Cl	1300	< 100	800	15,000	25,000
DETSC 2055* Fluoride as F	440	4.4	10	150	500
DETSC 2055 Sulphate as SO4	2200	< 100	1000	20,000	50,000
DETSC 2009* Total Dissolved Solids	22000	220	4000	60,000	100,000
DETSC 2130 Phenol Index	< 100	< 1	1	n/a	n/a
DETSC 2085 Dissolved Organic Carbon	2200	< 50	500	800	1000

TBE - To Be Evaluated
SNRHW - Stable Non-Reactive Hazardous Waste

Additional Information

DETSC 2008 pH	7.2
DETSC 2009 Conductivity uS/cm	31.7
* Temperature*	19.0

Mass of Sample Kg*	0.120
Mass of dry Sample Kg*	0.098

Stage 1

Volume of Leachant L2*	0.961
Volume of Eluate VE1*	0.91

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WASTE ACCEPTANCE CRITERIA TESTING ANALYTICAL REPORT

Our Ref 24-17569
Client Ref 24-0640
Contract Title Dublin St North Monaghan
Sample Id TP06 2 0.50

Sample Numbers 2381314 2381329
Date Analysed 28/08/2024

Test Results On Waste

Determinand and Method Reference	Units	Result	WAC Limit Values Inert Waste	 SNRHW	 Hazardous Waste
DETSC 2084# Total Organic Carbon	%	1.2	3	5	6
DETSC 2003# Loss On Ignition	%	1.4	n/a	n/a	10
DETSC 3321# BTEX	mg/kg	< 0.04	6	n/a	n/a
DETSC 3401# PCBs (7 congeners)	mg/kg	< 0.01	1	n/a	n/a
DETSC 3311# EPH (C10 - C40): EH_1D_Total	mg/kg	< 10	500	n/a	n/a
DETSC 3301 PAHs	mg/kg	< 1.6	100	n/a	n/a
DETSC 2008# pH	pH Units	8.6	n/a	>6	n/a
DETSC 2073* Acid Neutralisation Capacity (pH4)	mol/kg	4.2	n/a	TBE	TBE
DETSC 2073* Acid Neutralisation Capacity (pH7)	mol/kg	< 1.0	n/a	TBE	TBE

Test Results On Leachate

WAC Limit Values
Limit values for LS10 Leachate

Determinand and Method Reference	Conc in Eluate ug/l	Amount Leached* mg/kg	Inert Waste	SNRHW	Hazardous Waste
	10:1	LS10			
DETSC 2306 Arsenic as As	0.59	< 0.01	0.5	2	25
DETSC 2306 Barium as Ba	4.9	< 0.1	20	100	300
DETSC 2306 Cadmium as Cd	< 0.030	< 0.02	0.04	1	5
DETSC 2306 Chromium as Cr	< 0.25	< 0.1	0.5	10	70
DETSC 2306 Copper as Cu	0.99	< 0.02	2	50	100
DETSC 2306 Mercury as Hg	< 0.010	< 0.002	0.01	0.2	2
DETSC 2306 Molybdenum as Mo	< 1.1	< 0.1	0.5	10	30
DETSC 2306 Nickel as Ni	< 0.50	< 0.1	0.4	10	40
DETSC 2306 Lead as Pb	0.12	< 0.05	0.5	10	50
DETSC 2306 Antimony as Sb	< 0.17	< 0.05	0.06	0.7	5
DETSC 2306 Selenium as Se	< 0.25	< 0.03	0.1	0.5	7
DETSC 2306 Zinc as Zn	< 1.3	< 0.01	4	50	200
DETSC 2055 Chloride as Cl	1400	< 100	800	15,000	25,000
DETSC 2055* Fluoride as F	360	3.6	10	150	500
DETSC 2055 Sulphate as SO4	2500	< 100	1000	20,000	50,000
DETSC 2009* Total Dissolved Solids	39000	390	4000	60,000	100,000
DETSC 2130 Phenol Index	< 100	< 1	1	n/a	n/a
DETSC 2085 Dissolved Organic Carbon	< 2000	< 50	500	800	1000

TBE - To Be Evaluated
SNRHW - Stable Non-Reactive Hazardous Waste

Additional Information

DETSC 2008 pH	7.1
DETSC 2009 Conductivity uS/cm	56.2
* Temperature*	19.0

Mass of Sample Kg*	0.110
Mass of dry Sample Kg*	0.100

Stage 1

Volume of Leachant L2*	0.989
Volume of Eluate VE1*	0.941

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** DETS are accredited for the testing of leachates and not the leachate preparation stage which is unaccredited.*

Summary of Chemical Analysis
Leachate Samples

Our Ref 24-17569
Client Ref ~ 24-0640
Contract Title ~ Dublin St North Monaghan

Lab No	2381318	2381319	2381320	2381321	2381322	2381323
Sample ID ~	TP01	TP02	TP02	TP03	TP04	TP06
Depth ~	0.25	0.50	2.00	0.50	0.25	0.50
Other ID ~	1	2	8	2	1	2
Sample Type ~	ES	ES	ES	ES	ES	ES
Sampling Date ~	09/08/2024	09/08/2024	09/08/2024	08/08/2024	08/08/2024	08/08/2024
Sampling Time ~	n/s	n/s	n/s	n/s	n/s	n/s

Test	**Method**	**LOD**	**Units**						
Preparation									
BS EN 12457 10:1	DETSC 1009*			Y	Y	Y	Y	Y	Y
Metals									
Arsenic, Dissolved	DETSC 2306	0.16	ug/l	0.25	< 0.16	0.21	0.25	1.4	0.43
Boron, Dissolved	DETSC 2306*	0.012	mg/l	0.013	< 0.012	< 0.012	< 0.012	< 0.012	< 0.012
Cadmium, Dissolved	DETSC 2306	0.03	ug/l	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Calcium, Dissolved	DETSC 2306	0.09	mg/l	2.9	7.8	7.1	7.4	2.4	8.9
Chromium III, Dissolved	DETSC 2306*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Chromium, Hexavalent	DETSC 2203	7	ug/l	< 7.0	< 7.0	< 7.0	< 7.0	< 7.0	< 7.0
Copper, Dissolved	DETSC 2306	0.4	ug/l	0.9	0.6	0.6	0.7	2.2	0.9
Lead, Dissolved	DETSC 2306	0.09	ug/l	0.19	< 0.09	< 0.09	< 0.09	3.5	< 0.09
Mercury, Dissolved	DETSC 2306	0.01	ug/l	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Nickel, Dissolved	DETSC 2306	0.5	ug/l	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Selenium, Dissolved	DETSC 2306	0.25	ug/l	< 0.25	< 0.25	< 0.25	< 0.25	< 0.25	< 0.25
Vanadium, Dissolved	DETSC 2306	0.6	ug/l	< 0.6	< 0.6	< 0.6	< 0.6	2.0	< 0.6
Zinc, Dissolved	DETSC 2306	1.3	ug/l	2.6	< 1.3	< 1.3	< 1.3	2.7	< 1.3
Inorganics									
Conductivity	DETSC 2009	1	uS/cm	24.6	66.4	51.5	39.5	28.3	56.9
pH	DETSC 2008		pH	7.7	7.3	7.4	7.3	7.3	7.1
Cyanide, Total Low Level	DETSC 2131	0.0001	mg/l	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001
Cyanide, Free Low Level	DETSC 2131	0.0001	mg/l	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001
Phenol - Monohydric Low Level	DETSC 2131	0.0015	mg/l	< 0.0015	0.0024	0.0024	0.0021	0.0021	< 0.0015
Thiocyanate	DETSC 2130	20	ug/l	23	24	33	26	30	32
Dissolved Organic Carbon	DETSC 2085	2	mg/l	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
Total Hardness as CaCO3	DETSC 2303	0.1	mg/l	8.12	22.4	19.8	20.6	7.14	23.9
Ammoniacal Nitrogen as N	DETSC 2207	0.015	mg/l	< 0.015	< 0.015	< 0.015	< 0.015	< 0.015	< 0.015
Sulphate as SO4	DETSC 2055	0.1	mg/l	2.1	8.8	3.3	3.9	1.7	2.3
Sulphide	DETSC 2208	0.01	mg/l	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.01
Sulphur as S, Total	DETSC 2320*	10	mg/l	< 10	< 10	< 10	< 10	< 10	< 10
Petroleum Hydrocarbons									
Aliphatic C5-C6: HS_1D_AL	DETSC 3322	0.1	ug/l	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Aliphatic C6-C8: HS_1D_AL	DETSC 3322	0.1	ug/l	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Aliphatic C8-C10: HS_1D_AL	DETSC 3322	0.1	ug/l	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Aliphatic C10-C12: EH_CU_1D_AL	DETSC 3072*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic C10-C44: EH_CU_1D_AL	DETSC 3072*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic C12-C16: EH_CU_1D_AL	DETSC 3072*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic C16-C21: EH_CU_1D_AL	DETSC 3072*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic C21-C35: EH_CU_1D_AL	DETSC 3072*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic C35-C44: EH_CU_1D_AL	DETSC 3072*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic C5-C7: HS_1D_AR	DETSC 3322	0.1	ug/l	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Aromatic C7-C8: HS_1D_AR	DETSC 3322	0.1	ug/l	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Aromatic C8-C10: HS_1D_AR	DETSC 3322	0.1	ug/l	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1

Key: * -not accredited. n/s -not supplied.

Summary of Chemical Analysis
Leachate Samples

Our Ref 24-17569
Client Ref ~ 24-0640
Contract Title ~ Dublin St North Monaghan

			Lab No	2381318	2381319	2381320	2381321	2381322	2381323
			Sample ID ~	TP01	TP02	TP02	TP03	TP04	TP06
			Depth ~	0.25	0.50	2.00	0.50	0.25	0.50
			Other ID ~	1	2	8	2	1	2
			Sample Type ~	ES	ES	ES	ES	ES	ES
			Sampling Date ~	09/08/2024	09/08/2024	09/08/2024	08/08/2024	08/08/2024	08/08/2024
			Sampling Time ~	n/s	n/s	n/s	n/s	n/s	n/s
Test	**Method**	**LOD**	**Units**						
Aromatic C10-C12: EH_CU_1D_AR	DETSC 3072*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic C12-C16: EH_CU_1D_AR	DETSC 3072*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic C16-C21: EH_CU_1D_AR	DETSC 3072*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic C21-C35: EH_CU_1D_AR	DETSC 3072*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic C35-C44: EH_CU_1D_AR	DETSC 3072*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic C10-C44: EH_CU_1D_AR	DETSC 3072*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Ali/Aro C10-C44: EH_CU_1D_Total	DETSC 3072*	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Benzene	DETSC 3322	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Toluene	DETSC 3322	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Ethylbenzene	DETSC 3322	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Xylene	DETSC 3322	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
MTBE	DETSC 3322	1	ug/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
PAHs									
Naphthalene	DETSC 3304	0.05	ug/l	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Acenaphthylene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Acenaphthene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Fluorene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Phenanthrene	DETSC 3304	0.01	ug/l	0.02	< 0.01	0.01	0.02	0.02	0.02
Anthracene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Fluoranthene	DETSC 3304	0.01	ug/l	0.03	0.01	0.03	0.01	0.02	0.02
Pyrene	DETSC 3304	0.01	ug/l	0.02	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Benzo(a)anthracene	DETSC 3304*	0.01	ug/l	< 0.01	< 0.01	0.01	< 0.01	< 0.01	< 0.01
Chrysene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01	0.01	< 0.01	< 0.01	< 0.01
Benzo(b)fluoranthene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01	0.01	< 0.01	< 0.01	< 0.01
Benzo(k)fluoranthene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Benzo(a)pyrene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Indeno(1,2,3-c,d)pyrene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Dibenzo(a,h)anthracene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Benzo(g,h,i)perylene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
PAH Total	DETSC 3304	0.2	ug/l	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20

Key: * -not accredited. n/s -not supplied.

Summary of Chemical Analysis
Leachate Samples

Our Ref 24-17569
Client Ref ~ 24-0640
Contract Title ~ Dublin St North Monaghan

			Lab No	2381324	2381325
			Sample ID ~	TP07	TP07
			Depth ~	1.00	1.50
			Other ID ~	3	8
			Sample Type ~	ES	ES
			Sampling Date ~	08/08/2024	08/08/2024
			Sampling Time ~	n/s	n/s
Test	**Method**	**LOD**	**Units**		
Preparation					
BS EN 12457 10:1	DETSC 1009*			Y	Y
Metals					
Arsenic, Dissolved	DETSC 2306	0.16	ug/l	0.73	0.63
Boron, Dissolved	DETSC 2306*	0.012	mg/l	< 0.012	< 0.012
Cadmium, Dissolved	DETSC 2306	0.03	ug/l	< 0.03	< 0.03
Calcium, Dissolved	DETSC 2306	0.09	mg/l	5.9	7.0
Chromium III, Dissolved	DETSC 2306*	1	ug/l	< 1.0	< 1.0
Chromium, Hexavalent	DETSC 2203	7	ug/l	< 7.0	< 7.0
Copper, Dissolved	DETSC 2306	0.4	ug/l	1.1	0.9
Lead, Dissolved	DETSC 2306	0.09	ug/l	0.38	0.10
Mercury, Dissolved	DETSC 2306	0.01	ug/l	< 0.01	< 0.01
Nickel, Dissolved	DETSC 2306	0.5	ug/l	< 0.5	< 0.5
Selenium, Dissolved	DETSC 2306	0.25	ug/l	< 0.25	< 0.25
Vanadium, Dissolved	DETSC 2306	0.6	ug/l	1.0	< 0.6
Zinc, Dissolved	DETSC 2306	1.3	ug/l	2.2	< 1.3
Inorganics					
Conductivity	DETSC 2009	1	uS/cm	42.9	48.3
pH	DETSC 2008		pH	7.2	7.2
Cyanide, Total Low Level	DETSC 2131	0.0001	mg/l	< 0.0001	< 0.0001
Cyanide, Free Low Level	DETSC 2131	0.0001	mg/l	< 0.0001	< 0.0001
Phenol - Monohydric Low Level	DETSC 2131	0.0015	mg/l	< 0.0015	0.0021
Thiocyanate	DETSC 2130	20	ug/l	26	31
Dissolved Organic Carbon	DETSC 2085	2	mg/l	< 2.0	< 2.0
Total Hardness as CaCO3	DETSC 2303	0.1	mg/l	16.3	18.9
Ammoniacal Nitrogen as N	DETSC 2207	0.015	mg/l	< 0.015	< 0.015
Sulphate as SO4	DETSC 2055	0.1	mg/l	2.3	2.8
Sulphide	DETSC 2208	0.01	mg/l	< 0.01	0.04
Sulphur as S, Total	DETSC 2320*	10	mg/l	< 10	< 10
Petroleum Hydrocarbons					
Aliphatic C5-C6: HS_1D_AL	DETSC 3322	0.1	ug/l	< 0.1	< 0.1
Aliphatic C6-C8: HS_1D_AL	DETSC 3322	0.1	ug/l	< 0.1	< 0.1
Aliphatic C8-C10: HS_1D_AL	DETSC 3322	0.1	ug/l	< 0.1	< 0.1
Aliphatic C10-C12: EH_CU_1D_AL	DETSC 3072*	1	ug/l	< 1.0	< 1.0
Aliphatic C10-C44: EH_CU_1D_AL	DETSC 3072*	1	ug/l	< 1.0	< 1.0
Aliphatic C12-C16: EH_CU_1D_AL	DETSC 3072*	1	ug/l	< 1.0	< 1.0
Aliphatic C16-C21: EH_CU_1D_AL	DETSC 3072*	1	ug/l	< 1.0	< 1.0
Aliphatic C21-C35: EH_CU_1D_AL	DETSC 3072*	1	ug/l	< 1.0	< 1.0
Aliphatic C35-C44: EH_CU_1D_AL	DETSC 3072*	1	ug/l	< 1.0	< 1.0
Aromatic C5-C7: HS_1D_AR	DETSC 3322	0.1	ug/l	< 0.1	< 0.1
Aromatic C7-C8: HS_1D_AR	DETSC 3322	0.1	ug/l	< 0.1	< 0.1
Aromatic C8-C10: HS_1D_AR	DETSC 3322	0.1	ug/l	< 0.1	< 0.1

Key: * -not accredited. n/s -not supplied.

Summary of Chemical Analysis
Leachate Samples

Our Ref 24-17569
Client Ref ~ 24-0640
Contract Title ~ Dublin St North Monaghan

			Lab No	2381324	2381325
			Sample ID ~	TP07	TP07
			Depth ~	1.00	1.50
			Other ID ~	3	8
			Sample Type ~	ES	ES
			Sampling Date ~	08/08/2024	08/08/2024
			Sampling Time ~	n/s	n/s
Test	**Method**	**LOD**	**Units**		
Aromatic C10-C12: EH_CU_1D_AR	DETSC 3072*	1	ug/l	< 1.0	< 1.0
Aromatic C12-C16: EH_CU_1D_AR	DETSC 3072*	1	ug/l	< 1.0	< 1.0
Aromatic C16-C21: EH_CU_1D_AR	DETSC 3072*	1	ug/l	< 1.0	< 1.0
Aromatic C21-C35: EH_CU_1D_AR	DETSC 3072*	1	ug/l	< 1.0	< 1.0
Aromatic C35-C44: EH_CU_1D_AR	DETSC 3072*	1	ug/l	< 1.0	< 1.0
Aromatic C10-C44: EH_CU_1D_AR	DETSC 3072*	1	ug/l	< 1.0	< 1.0
Ali/Aro C10-C44: EH_CU_1D_Total	DETSC 3072*	1	ug/l	< 1.0	< 1.0
Benzene	DETSC 3322	1	ug/l	< 1.0	< 1.0
Toluene	DETSC 3322	1	ug/l	< 1.0	< 1.0
Ethylbenzene	DETSC 3322	1	ug/l	< 1.0	< 1.0
Xylene	DETSC 3322	1	ug/l	< 1.0	< 1.0
MTBE	DETSC 3322	1	ug/l	< 1.0	< 1.0
PAHs					
Naphthalene	DETSC 3304	0.05	ug/l	< 0.05	< 0.05
Acenaphthylene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01
Acenaphthene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01
Fluorene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01
Phenanthrene	DETSC 3304	0.01	ug/l	0.02	0.02
Anthracene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01
Fluoranthene	DETSC 3304	0.01	ug/l	< 0.01	0.02
Pyrene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01
Benzo(a)anthracene	DETSC 3304*	0.01	ug/l	< 0.01	< 0.01
Chrysene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01
Benzo(b)fluoranthene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01
Benzo(k)fluoranthene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01
Benzo(a)pyrene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01
Indeno(1,2,3-c,d)pyrene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01
Dibenzo(a,h)anthracene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01
Benzo(g,h,i)perylene	DETSC 3304	0.01	ug/l	< 0.01	< 0.01
PAH Total	DETSC 3304	0.2	ug/l	< 0.20	< 0.20

Key: * -not accredited. n/s -not supplied.

Summary of Asbestos Analysis
Soil Samples

Our Ref 24-17569
Client Ref ~ 24-0640
Contract Title ~ Dublin St North Monaghan

Lab No	Sample ID	Material Type	Result	Comment*	Analyst
2381306	TP01 1 0.25	SOIL	NAD	none	Jason Barsby
2381307	TP01 3 1.00	SOIL	NAD	none	Jason Barsby
2381308	TP02 2 0.50	SOIL	NAD	none	Jason Barsby
2381309	TP02 8 2.00	SOIL	NAD	none	Jason Barsby
2381310	TP03 1 0.25	SOIL	NAD	none	Jason Barsby
2381311	TP03 2 0.50	SOIL	NAD	none	Jason Barsby
2381312	TP04 1 0.25	SOIL	NAD	none	Jason Barsby
2381313	TP04 2 0.50	SOIL	NAD	none	Jason Barsby
2381314	TP06 2 0.50	SOIL	NAD	none	Jason Barsby
2381315	TP07 1 0.25	SOIL	NAD	none	Jason Barsby
2381316	TP07 3 1.00	SOIL	Amosite	Amosite present as fibre bundles	Jason Barsby
2381317	TP07 8 1.50	SOIL	NAD	none	Jason Barsby

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

Information in Support of the Analytical Results

Our Ref 24-17569
Client Ref ~ 24-0640
Contract ~ Dublin St North Monaghan

Containers Received & Deviating Samples

Lab No	Sample ID ~	Date Sampled ~	Containers Received	Holding time exceeded for tests	Inappropriate container for tests
2381306	TP01 0.25 SOIL	09/08/24	GJ 250ml, GJ 60ml, PT 1L	pH + Conductivity (7 days)	
2381307	TP01 1.00 SOIL	09/08/24	GJ 250ml, GJ 60ml, PT 1L	pH + Conductivity (7 days)	
2381308	TP02 0.50 SOIL	09/08/24	GJ 250ml, GJ 60ml, PT 1L	pH + Conductivity (7 days)	
2381309	TP02 2.00 SOIL	09/08/24	GJ 250ml, GJ 60ml, PT 1L	pH + Conductivity (7 days)	
2381310	TP03 0.25 SOIL	08/08/24	GJ 250ml, GJ 60ml, PT 1L	pH + Conductivity (7 days)	
2381311	TP03 0.50 SOIL	08/08/24	GJ 250ml, GJ 60ml, PT 1L	pH + Conductivity (7 days)	
2381312	TP04 0.25 SOIL	08/08/24	GJ 250ml, GJ 60ml, PT 1L	pH + Conductivity (7 days)	
2381313	TP04 0.50 SOIL	08/08/24	GJ 250ml, GJ 60ml, PT 1L	pH + Conductivity (7 days)	
2381314	TP06 0.50 SOIL	08/08/24	GJ 250ml, GJ 60ml, PT 1L	pH + Conductivity (7 days)	
2381315	TP07 0.25 SOIL	08/08/24	GJ 250ml, GJ 60ml, PT 1L	pH + Conductivity (7 days)	
2381316	TP07 1.00 SOIL	08/08/24	GJ 250ml, GJ 60ml, PT 1L	pH + Conductivity (7 days)	
2381317	TP07 1.50 SOIL	08/08/24	GJ 250ml, GJ 60ml, PT 1L	pH + Conductivity (7 days)	
2381318	TP01 0.25 LEACHATE	09/08/24	GJ 250ml, GJ 60ml, PT 1L	Aliphatics/Aromatics (4 days), Chromium, Hexavalent (4 days), Hardness (7 days), Kone (4 days), Kone (Sulphide) (5 days), pH/Cond (1 days), Ammoniacal Nitrogen as N (10 days), PAH MS (4 days)	
2381319	TP02 0.50 LEACHATE	09/08/24	GJ 250ml, GJ 60ml, PT 1L	Aliphatics/Aromatics (4 days), Chromium, Hexavalent (4 days), Hardness (7 days), Kone (4 days), Kone (Sulphide) (5 days), pH/Cond (1 days), Ammoniacal Nitrogen as N (10 days), PAH MS (4 days)	
2381320	TP02 2.00 LEACHATE	09/08/24	GJ 250ml, GJ 60ml, PT 1L	Aliphatics/Aromatics (4 days), Chromium, Hexavalent (4 days), Hardness (7 days), Kone (4 days), Kone (Sulphide) (5 days), pH/Cond (1 days), Ammoniacal Nitrogen as N (10 days), PAH MS (4 days)	
2381321	TP03 0.50 LEACHATE	08/08/24	GJ 250ml, GJ 60ml, PT 1L	Aliphatics/Aromatics (4 days), Chromium, Hexavalent (4 days), Hardness (7 days), Kone (4 days), Kone (Sulphide) (5 days), pH/Cond (1 days), Ammoniacal Nitrogen as N (10 days), PAH MS (4 days)	
2381322	TP04 0.25 LEACHATE	08/08/24	GJ 250ml, GJ 60ml, PT 1L	Aliphatics/Aromatics (4 days), Chromium, Hexavalent (4 days), Hardness (7 days), Kone (4 days), Kone (Sulphide) (5 days), pH/Cond (1 days), Ammoniacal Nitrogen as N (10 days), PAH MS (4 days)	
2381323	TP06 0.50 LEACHATE	08/08/24	GJ 250ml, GJ 60ml, PT 1L	Aliphatics/Aromatics (4 days), Chromium, Hexavalent (4 days), Hardness (7 days), Kone (4 days), Kone (Sulphide) (5 days), pH/Cond (1 days), Ammoniacal Nitrogen as N (10 days), PAH MS (4 days)	
2381324	TP07 1.00 LEACHATE	08/08/24	GJ 250ml, GJ 60ml, PT 1L	Aliphatics/Aromatics (4 days), Chromium, Hexavalent (4 days), Hardness (7 days), Kone (4 days), Kone (Sulphide) (5 days), pH/Cond (1 days), Ammoniacal Nitrogen as N (10 days), PAH MS (4 days)	

Information in Support of the Analytical Results

Our Ref 24-17569
Client Ref ~ 24-0640
Contract ~ Dublin St North Monaghan

Lab No	Sample ID ~	Date Sampled ~	Containers Received	Holding time exceeded for tests	Inappropriate container for tests
2381325	TP07 1.50 LEACHATE	08/08/24	GJ 250ml, GJ 60ml, PT 1L	Aliphatics/Aromatics (4 days), Chromium, Hexavalent (4 days), Hardness (7 days), Kone (4 days), Kone (Sulphide) (5 days), pH/Cond (1 days), Ammoniacal Nitrogen as N (10 days), PAH MS (4 days)	
2381326	TP01 1.00 LEACHATE	09/08/24	GJ 250ml, GJ 60ml, PT 1L	pH/Cond (1 days)	
2381327	TP02 0.50 LEACHATE	09/08/24	GJ 250ml, GJ 60ml, PT 1L	pH/Cond (1 days)	
2381328	TP04 0.25 LEACHATE	08/08/24	GJ 250ml, GJ 60ml, PT 1L	pH/Cond (1 days)	
2381329	TP06 0.50 LEACHATE	08/08/24	GJ 250ml, GJ 60ml, PT 1L	pH/Cond (1 days)	

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

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

Soil Analysis Notes

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

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

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

Disposal

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

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

Information in Support of the Analytical Results

List of HWOL Acronyms and Operators

Acronym	Description
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
2D	GC-GC - Double coil gas chromatography
Total	Aliphatics & Aromatics
AL	Aliphatics only
AR	Aromatics only
#1	EH_2D_Total but with humics mathematically subtracted
#2	EH_2D_Total but with fatty acids mathematically subtracted
_	Operator - underscore to separate acronyms (exception for +)
+	Operator to indicate cumulative eg. EH+HS_Total or EH_CU+HS_Total

Det	Acronym
Aliphatic C5-C6	HS_1D_AL
Aliphatic C6-C8	HS_1D_AL
Aliphatic C8-C10	HS_1D_AL
Aliphatic >EC10-EC12	EH_2D_AL
Aliphatic >EC12-EC16	EH_2D_AL
Aliphatic >EC16-EC21	EH_2D_AL
Aliphatic >EC21-EC35	EH_2D_AL
Aliphatic >EC35-EC40	EH_2D_AL
Aliphatic >EC40-EC44	EH_2D_AL
Aliphatic C5-C44	EH_2D+HS_1D_AL
Aromatic C5-C7	HS_1D_AR
Aromatic C7-C8	HS_1D_AR
Aromatic C8-C10	HS_1D_AR
Aromatic >EC10-EC12	EH_2D_AR
Aromatic >EC12-EC16	EH_2D_AR
Aromatic >EC16-EC21	EH_2D_AR
Aromatic >EC21-EC35	EH_2D_AR
Aromatic >EC35-EC40	EH_2D_AR
Aromatic >EC40-EC44	EH_2D_AR
Aromatic C5-C44	EH_2D+HS_1D_AR
TPH Ali/Aro C5-C44	EH_2D+HS_1D_Total
TPH (C10-C40)	EH_1D_Total
Aliphatic C10-C12	EH_CU_1D_AL
Aliphatic C10-C44	EH_CU_1D_AL
Aliphatic C12-C16	EH_CU_1D_AL
Aliphatic C16-C21	EH_CU_1D_AL
Aliphatic C21-C35	EH_CU_1D_AL

Aliphatic C35-C44	EH_CU_1D_AL
Aromatic C10-C12	EH_CU_1D_AR
Aromatic C12-C16	EH_CU_1D_AR
Aromatic C16-C21	EH_CU_1D_AR
Aromatic C21-C35	EH_CU_1D_AR
Aromatic C35-C44	EH_CU_1D_AR
Aromatic C10-C44	EH_CU_1D_AR
Ali/Aro C10-C44	EH_CU_1D_Total

Key:

~ Sample details are provided by the client and can affect the validity of the results
***** -not accredited.
# -MCERTS (accreditation only applies if report carries the MCERTS logo).
$ -subcontracted.
n/s -not supplied.
I/S -insufficient sample.
U/S -unsuitable sample.
t/f -to follow.
nd -not detected.

End of Report

DETS

Certificate of Analysis

Certificate Number 24-17570 *Issued:* 29-Aug-24

Client Causeway Geotech
Unit 1 Fingal House
Stephenstown Industrial Estate
Balbriggan
Co. Dublin
K32 VR66

Our Reference 24-17570

Client Reference ~ 24-0640

Order No ~ (not supplied)

Contract Title ~ Dublin St North Monaghan

Description 5 Soil samples, 2 Leachate prepared by DETS samples.

Date Received 21-Aug-24

Date Started 21-Aug-24

Date Completed 29-Aug-24

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

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

Approved By

Kirk Bridgewood
General Manager

ilac-MRA

UKAS TESTING
2139

Summary of Chemical Analysis
Soil Samples

Our Ref 24-17570
Client Ref ~ 24-0640
Contract Title ~ Dublin St North Monaghan

			Lab No	2381330	2381331	2381332	2381333	2381334
			Sample ID ~	TP05	TP05	TP08	TP09	TP010
			Depth ~	0.50	1.00	0.50	0.50	0.50
			Other ID ~	1	2	1	1	1
			Sample Type ~	ES	ES	ES	ES	ES
			Sampling Date ~	13/08/2024	13/08/2024	13/08/2024	13/08/2024	13/08/2024
			Sampling Time ~	n/s	n/s	n/s	n/s	n/s
Test	**Method**	**LOD**	**Units**					
Preparation								
Moisture Content	DETSC 1004	0.1	%	9.1	14	15	24	17
Metals								
Arsenic	DETSC 2301#	0.2	mg/kg	11	9.5	8.2	7.2	35
Boron, Water Soluble (2.5:1)	DETSC 2311#	0.2	mg/kg	0.6	0.3	0.5	1.0	0.6
Cadmium	DETSC 2301#	0.1	mg/kg	0.2	0.6	0.4	0.5	0.7
Chromium III	DETSC 2301*	0.15	mg/kg	35	32	28	24	43
Chromium, Hexavalent	DETSC 2204*	1	mg/kg	< 1.0	< 1.0	< 1.0	< 1.0	1.5
Copper	DETSC 2301#	0.2	mg/kg	41	25	38	41	130
Lead	DETSC 2301#	0.3	mg/kg	520	29	110	41	300
Mercury	DETSC 2325#	0.05	mg/kg	0.13	0.10	0.27	0.28	0.68
Nickel	DETSC 2301#	1	mg/kg	45	40	35	27	66
Selenium	DETSC 2301#	0.5	mg/kg	< 0.5	< 0.5	< 0.5	0.6	< 0.5
Vanadium	DETSC 2301#	0.8	mg/kg	26	33	29	26	70
Zinc	DETSC 2301#	1	mg/kg	120	83	100	85	330
Inorganics								
pH	DETSC 2008#		pH	8.7	10.0	8.2	8.0	9.7
Acid / Alkali Reserve	DETSC 2011*	1	Oh/100g	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Acid Neutralisation Capacity (pH4)	DETSC 2073*	1	moles/kg	< 1.0	1.6	1.6	1.6	1.8
Cyanide, Total	DETSC 2130#	0.1	mg/kg	0.4	0.1	0.2	0.3	1.5
Cyanide, Free	DETSC 2130#	0.1	mg/kg	0.2	0.1	0.2	0.4	0.3
Thiocyanate	DETSC 2130#	0.6	mg/kg	1.8	< 0.6	0.6	2.5	2.1
Organic matter	DETSC 2002#	0.1	%	1.8	1.1	1.7	4.5	6.3
Chloride	DETSC 2055	1	mg/kg	30.8	60.7	29.0	26.4	32.7
Nitrate as NO3	DETSC 2055	1	mg/kg	24	79	25	13	66
Sulphide	DETSC 2024*	10	mg/kg	16	24	< 10	20	24
Sulphate as SO4, Total	DETSC 2321#	0.01	%	0.07	0.08	0.06	0.10	0.12
Petroleum Hydrocarbons								
Aliphatic C5-C6: HS_1D_AL	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aliphatic C6-C8: HS_1D_AL	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aliphatic C8-C10: HS_1D_AL	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aliphatic >EC10-EC12: EH_2D_AL	DETSC 3521#	1.5	mg/kg	< 1.50	< 1.50	< 1.50	< 1.50	< 1.50
Aliphatic >EC12-EC16: EH_2D_AL	DETSC 3521#	1.2	mg/kg	< 1.20	< 1.20	< 1.20	< 1.20	< 1.20
Aliphatic >EC16-EC21: EH_2D_AL	DETSC 3521#	1.5	mg/kg	< 1.50	< 1.50	< 1.50	< 1.50	< 1.50
Aliphatic >EC21-EC35: EH_2D_AL	DETSC 3521#	3.4	mg/kg	< 3.40	4.61	< 3.40	< 3.40	11.44
Aliphatic >EC35-EC40: EH_2D_AL	DETSC 3521*	3.4	mg/kg	< 3.40	< 3.40	< 3.40	< 3.40	4.32
Aliphatic >EC40-EC44: EH_2D_AL	DETSC 3521*	3.4	mg/kg	< 3.40	< 3.40	< 3.40	< 3.40	< 3.40
Aliphatic C5-C44: EH_2D+HS_1D_AL	DETSC 3521*	10	mg/kg	< 10.00	< 10.00	< 10.00	< 10.00	15.76
Aromatic C5-C7: HS_1D_AR	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aromatic C7-C8: HS_1D_AR	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aromatic C8-C10: HS_1D_AR	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Aromatic >EC10-EC12: EH_2D_AR	DETSC 3521#	0.9	mg/kg	< 0.90	< 0.90	< 0.90	< 0.90	< 0.90

Summary of Chemical Analysis
Soil Samples

Our Ref 24-17570
Client Ref ~ 24-0640
Contract Title ~ Dublin St North Monaghan

			Lab No	2381330	2381331	2381332	2381333	2381334
			Sample ID ~	TP05	TP05	TP08	TP09	TP010
			Depth ~	0.50	1.00	0.50	0.50	0.50
			Other ID ~	1	2	1	1	1
			Sample Type ~	ES	ES	ES	ES	ES
			Sampling Date ~	13/08/2024	13/08/2024	13/08/2024	13/08/2024	13/08/2024
			Sampling Time ~	n/s	n/s	n/s	n/s	n/s
Test	**Method**	**LOD**	**Units**					
Aromatic >EC12-EC16: EH_2D_AR	DETSC 3521#	0.5	mg/kg	< 0.50	< 0.50	0.80	< 0.50	< 0.50
Aromatic >EC16-EC21: EH_2D_AR	DETSC 3521#	0.6	mg/kg	0.98	< 0.60	2.76	< 0.60	1.52
Aromatic >EC21-EC35: EH_2D_AR	DETSC 3521#	1.4	mg/kg	5.39	2.09	2.96	1.95	31.53
Aromatic >EC35-EC40: EH_2D_AR	DETSC 3521*	1.4	mg/kg	< 1.40	< 1.40	< 1.40	< 1.40	< 1.40
Aromatic >EC40-EC44: EH_2D_AR	DETSC 3521*	1.4	mg/kg	< 1.40	< 1.40	< 1.40	< 1.40	< 1.40
Aromatic C5-C44: EH_2D+HS_1D_AR	DETSC 3521*	10	mg/kg	< 10.00	< 10.00	< 10.00	< 10.00	33.04
TPH Ali/Aro C5-C44: EH_2D+HS_1D_Total	DETSC 3521*	10	mg/kg	< 10.00	< 10.00	< 10.00	< 10.00	48.80
Benzene	DETSC 3321#	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Ethylbenzene	DETSC 3321#	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Toluene	DETSC 3321#	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Xylene	DETSC 3321#	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
MTBE	DETSC 3321	0.01	mg/kg	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
PAHs								
Naphthalene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Acenaphthylene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	0.16	< 0.03	< 0.03
Acenaphthene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	0.03	< 0.03	< 0.03
Fluorene	DETSC 3303	0.03	mg/kg	< 0.03	< 0.03	0.15	< 0.03	< 0.03
Phenanthrene	DETSC 3303#	0.03	mg/kg	0.11	< 0.03	0.76	< 0.03	0.08
Anthracene	DETSC 3303	0.03	mg/kg	< 0.03	< 0.03	0.20	< 0.03	< 0.03
Fluoranthene	DETSC 3303#	0.03	mg/kg	0.20	< 0.03	0.53	0.05	0.23
Pyrene	DETSC 3303#	0.03	mg/kg	0.16	< 0.03	0.39	0.04	0.19
Benzo(a)anthracene	DETSC 3303#	0.03	mg/kg	0.07	< 0.03	0.10	< 0.03	0.10
Chrysene	DETSC 3303	0.03	mg/kg	0.09	< 0.03	0.09	< 0.03	0.11
Benzo(b)fluoranthene	DETSC 3303#	0.03	mg/kg	0.08	< 0.03	0.05	< 0.03	0.11
Benzo(k)fluoranthene	DETSC 3303#	0.03	mg/kg	0.04	< 0.03	< 0.03	< 0.03	0.05
Benzo(a)pyrene	DETSC 3303#	0.03	mg/kg	0.05	< 0.03	0.04	< 0.03	0.07
Indeno(1,2,3-c,d)pyrene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	0.04
Dibenzo(a,h)anthracene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Benzo(g,h,i)perylene	DETSC 3303#	0.03	mg/kg	0.03	< 0.03	< 0.03	< 0.03	0.04
PAH - USEPA 16, Total	DETSC 3303	0.1	mg/kg	0.84	< 0.10	2.4	< 0.10	1.0
Phenols								
Phenol - Monohydric	DETSC 2130#	0.3	mg/kg	< 0.3	< 0.3	< 0.3	0.5	0.6

Summary of Chemical Analysis
Leachate Samples

Our Ref 24-17570
Client Ref ~ 24-0640
Contract Title ~ Dublin St North Monaghan

Lab No	2381335
Sample ID ~	TP05
Depth ~	0.50
Other ID ~	1
Sample Type ~	ES
Sampling Date ~	13/08/2024
Sampling Time ~	n/s

Test	Method	LOD	Units	
Preparation				
BS EN 12457 10:1	DETSC 1009*			Y
Metals				
Arsenic, Dissolved	DETSC 2306	0.16	ug/l	0.75
Boron, Dissolved	DETSC 2306*	0.012	mg/l	< 0.012
Cadmium, Dissolved	DETSC 2306	0.03	ug/l	< 0.03
Calcium, Dissolved	DETSC 2306	0.09	mg/l	9.4
Chromium III, Dissolved	DETSC 2306*	1	ug/l	< 1.0
Chromium, Hexavalent	DETSC 2203	7	ug/l	< 7.0
Copper, Dissolved	DETSC 2306	0.4	ug/l	2.2
Lead, Dissolved	DETSC 2306	0.09	ug/l	0.23
Mercury, Dissolved	DETSC 2306	0.01	ug/l	< 0.01
Nickel, Dissolved	DETSC 2306	0.5	ug/l	< 0.5
Selenium, Dissolved	DETSC 2306	0.25	ug/l	< 0.25
Vanadium, Dissolved	DETSC 2306	0.6	ug/l	< 0.6
Zinc, Dissolved	DETSC 2306	1.3	ug/l	2.4
Inorganics				
Conductivity	DETSC 2009	1	uS/cm	74.0
pH	DETSC 2008		pH	7.1
Cyanide, Total Low Level	DETSC 2131	0.0001	mg/l	< 0.0001
Cyanide, Free Low Level	DETSC 2131	0.0001	mg/l	< 0.0001
Phenol - Monohydric Low Level	DETSC 2131	0.0015	mg/l	< 0.0015
Thiocyanate	DETSC 2130	20	ug/l	< 20
Dissolved Organic Carbon	DETSC 2085	2	mg/l	< 2.0
Total Hardness as CaCO3	DETSC 2303	0.1	mg/l	26.9
Ammoniacal Nitrogen as N	DETSC 2207	0.015	mg/l	< 0.015
Sulphate as SO4	DETSC 2055	0.1	mg/l	15
Sulphide	DETSC 2208	0.01	mg/l	0.06
Sulphur as S, Total	DETSC 2320*	10	mg/l	< 10
Petroleum Hydrocarbons				
Aliphatic C5-C6: HS_1D_AL	DETSC 3322	0.1	ug/l	< 0.1
Aliphatic C6-C8: HS_1D_AL	DETSC 3322	0.1	ug/l	< 0.1
Aliphatic C8-C10: HS_1D_AL	DETSC 3322	0.1	ug/l	< 0.1
Aliphatic C10-C12: EH_CU_1D_AL	DETSC 3072*	1	ug/l	< 1.0
Aliphatic C10-C44: EH_CU_1D_AL	DETSC 3072*	1	ug/l	< 1.0
Aliphatic C12-C16: EH_CU_1D_AL	DETSC 3072*	1	ug/l	< 1.0
Aliphatic C16-C21: EH_CU_1D_AL	DETSC 3072*	1	ug/l	< 1.0
Aliphatic C21-C35: EH_CU_1D_AL	DETSC 3072*	1	ug/l	< 1.0
Aliphatic C35-C44: EH_CU_1D_AL	DETSC 3072*	1	ug/l	< 1.0
Aromatic C5-C7: HS_1D_AR	DETSC 3322	0.1	ug/l	< 0.1
Aromatic C7-C8: HS_1D_AR	DETSC 3322	0.1	ug/l	< 0.1
Aromatic C8-C10: HS_1D_AR	DETSC 3322	0.1	ug/l	< 0.1

Summary of Chemical Analysis
Leachate Samples

Our Ref 24-17570
Client Ref ~ 24-0640
Contract Title ~ Dublin St North Monaghan

Lab No	2381335
Sample ID ~	TP05
Depth ~	0.50
Other ID ~	1
Sample Type ~	ES
Sampling Date ~	13/08/2024
Sampling Time ~	n/s

Test	**Method**	**LOD**	**Units**	
Aromatic C10-C12: EH_CU_1D_AR	DETSC 3072*	1	ug/l	< 1.0
Aromatic C12-C16: EH_CU_1D_AR	DETSC 3072*	1	ug/l	< 1.0
Aromatic C16-C21: EH_CU_1D_AR	DETSC 3072*	1	ug/l	< 1.0
Aromatic C21-C35: EH_CU_1D_AR	DETSC 3072*	1	ug/l	< 1.0
Aromatic C35-C44: EH_CU_1D_AR	DETSC 3072*	1	ug/l	< 1.0
Aromatic C10-C44: EH_CU_1D_AR	DETSC 3072*	1	ug/l	< 1.0
Ali/Aro C10-C44: EH_CU_1D_Total	DETSC 3072*	1	ug/l	< 1.0
Benzene	DETSC 3322	1	ug/l	< 1.0
Toluene	DETSC 3322	1	ug/l	< 1.0
Ethylbenzene	DETSC 3322	1	ug/l	< 1.0
Xylene	DETSC 3322	1	ug/l	< 1.0
MTBE	DETSC 3322	1	ug/l	< 1.0
PAHs				
Naphthalene	DETSC 3304	0.05	ug/l	< 0.05
Acenaphthylene	DETSC 3304	0.01	ug/l	< 0.01
Acenaphthene	DETSC 3304	0.01	ug/l	< 0.01
Fluorene	DETSC 3304	0.01	ug/l	< 0.01
Phenanthrene	DETSC 3304	0.01	ug/l	0.02
Anthracene	DETSC 3304	0.01	ug/l	< 0.01
Fluoranthene	DETSC 3304	0.01	ug/l	0.02
Pyrene	DETSC 3304	0.01	ug/l	< 0.01
Benzo(a)anthracene	DETSC 3304*	0.01	ug/l	< 0.01
Chrysene	DETSC 3304	0.01	ug/l	< 0.01
Benzo(b)fluoranthene	DETSC 3304	0.01	ug/l	< 0.01
Benzo(k)fluoranthene	DETSC 3304	0.01	ug/l	< 0.01
Benzo(a)pyrene	DETSC 3304	0.01	ug/l	< 0.01
Indeno(1,2,3-c,d)pyrene	DETSC 3304	0.01	ug/l	< 0.01
Dibenzo(a,h)anthracene	DETSC 3304	0.01	ug/l	< 0.01
Benzo(g,h,i)perylene	DETSC 3304	0.01	ug/l	< 0.01
PAH Total	DETSC 3304	0.2	ug/l	< 0.20

WASTE ACCEPTANCE CRITERIA TESTING ANALYTICAL REPORT

Our Ref	24-17570
Client Ref	24-0640
Contract Title	Dublin St North Monaghan
Sample Id	TP010 1 0.50
Sample Numbers	2381334 2381336
Date Analysed	29/08/2024

Test Results On Waste

Determinand and Method Reference	Units	Result	WAC Limit Values: Inert Waste	SNRHW	Hazardous Waste
DETSC 2084# Total Organic Carbon	%	8.0	3	5	6
DETSC 2003# Loss On Ignition	%	11.0	n/a	n/a	10
DETSC 3321# BTEX	mg/kg	< 0.04	6	n/a	n/a
DETSC 3401# PCBs (7 congeners)	mg/kg	< 0.01	1	n/a	n/a
DETSC 3311# EPH (C10 - C40): EH_1D_Total	mg/kg	60.0	500	n/a	n/a
DETSC 3301 PAHs	mg/kg	4.3	100	n/a	n/a
DETSC 2008# pH	pH Units	9.7	n/a	>6	n/a
DETSC 2073* Acid Neutralisation Capacity (pH4)	mol/kg	1.8	n/a	TBE	TBE
DETSC 2073* Acid Neutralisation Capacity (pH7)	mol/kg	< 1.0	n/a	TBE	TBE

Test Results On Leachate

WAC Limit Values — Limit values for LS10 Leachate

Determinand and Method Reference	Conc in Eluate ug/l 10:1	Amount Leached* mg/kg LS10	Inert Waste	SNRHW	Hazardous Waste
DETSC 2306 Arsenic as As	2.5	0.025	0.5	2	25
DETSC 2306 Barium as Ba	15	0.15	20	100	300
DETSC 2306 Cadmium as Cd	< 0.030	< 0.02	0.04	1	5
DETSC 2306 Chromium as Cr	< 0.25	< 0.1	0.5	10	70
DETSC 2306 Copper as Cu	1.7	< 0.02	2	50	100
DETSC 2306 Mercury as Hg	< 0.010	< 0.002	0.01	0.2	2
DETSC 2306 Molybdenum as Mo	1.1	< 0.1	0.5	10	30
DETSC 2306 Nickel as Ni	< 0.50	< 0.1	0.4	10	40
DETSC 2306 Lead as Pb	0.69	< 0.05	0.5	10	50
DETSC 2306 Antimony as Sb	1.4	< 0.05	0.06	0.7	5
DETSC 2306 Selenium as Se	0.4	< 0.03	0.1	0.5	7
DETSC 2306 Zinc as Zn	2.3	0.023	4	50	200
DETSC 2055 Chloride as Cl	1300	< 100	800	15,000	25,000
DETSC 2055* Fluoride as F	430	4.3	10	150	500
DETSC 2055 Sulphate as SO4	8700	< 100	1000	20,000	50,000
DETSC 2009* Total Dissolved Solids	43000	430	4000	60,000	100,000
DETSC 2130 Phenol Index	< 100	< 1	1	n/a	n/a
DETSC 2085 Dissolved Organic Carbon	2100	< 50	500	800	1000

TBE - To Be Evaluated
SNRHW - Stable Non-Reactive Hazardous Waste

Additional Information

DETSC 2008 pH	7.1
DETSC 2009 Conductivity uS/cm	60.8
* Temperature*	19.0

Mass of Sample Kg*	0.120
Mass of dry Sample Kg*	0.100

Stage 1

Volume of Leachant L2*	0.978
Volume of Eluate VE1*	0.918

Disclaimer: *The WAC limit values are provided for guidance only. DETS does not accept responsibility for errors or omissions. Values are correct at time of issue.*

** DETS are accredited for the testing of leachates and not the leachate preparation stage which is unaccredited.*

Summary of Asbestos Analysis
Soil Samples

Our Ref 24-17570
Client Ref ~ 24-0640
Contract Title ~ Dublin St North Monaghan

Lab No	Sample ID	Material Type	Result	Comment*	Analyst
2381330	TP05 1 0.50	SOIL	Chrysotile	Chrysotile present as fibre bundles	Andrew Graham
2381331	TP05 2 1.00	SOIL	NAD	none	Andrew Graham
2381332	TP08 1 0.50	SOIL	NAD	none	Andrew Graham
2381333	TP09 1 0.50	SOIL	NAD	none	Andrew Graham
2381334	TP010 1 0.50	SOIL	NAD	none	Andrew Graham

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

Information in Support of the Analytical Results

Our Ref 24-17570
Client Ref ~ 24-0640
Contract ~ Dublin St North Monaghan

Containers Received & Deviating Samples

Lab No	Sample ID ~	Date Sampled ~	Containers Received	Holding time exceeded for tests	Inappropriate container for tests
2381330	TP05 0.50 SOIL	13/08/24	GJ 250ml, GJ 60ml, PT 1L	pH + Conductivity (7 days)	
2381331	TP05 1.00 SOIL	13/08/24	GJ 250ml, GJ 60ml, PT 1L	pH + Conductivity (7 days)	
2381332	TP08 0.50 SOIL	13/08/24	GJ 250ml, GJ 60ml, PT 1L	pH + Conductivity (7 days)	
2381333	TP09 0.50 SOIL	13/08/24	GJ 250ml, GJ 60ml, PT 1L	pH + Conductivity (7 days)	
2381334	TP010 0.50 SOIL	13/08/24	GJ 250ml, GJ 60ml, PT 1L	pH + Conductivity (7 days)	
2381335	TP05 0.50 LEACHATE	13/08/24	GJ 250ml, GJ 60ml, PT 1L	Aliphatics/Aromatics (4 days), Chromium, Hexavalent (4 days), Hardness (7 days), Kone (4 days), Kone (Sulphide) (5 days), pH/Cond (1 days), PAH MS (4 days)	
2381336	TP010 0.50 LEACHATE	13/08/24	GJ 250ml, GJ 60ml, PT 1L	pH/Cond (1 days)	

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

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

Soil Analysis Notes

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

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

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

Disposal

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

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

Information in Support of the Analytical Results

List of HWOL Acronyms and Operators

Acronym	Description
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
2D	GC-GC - Double coil gas chromatography
Total	Aliphatics & Aromatics
AL	Aliphatics only
AR	Aromatics only
#1	EH_2D_Total but with humics mathematically subtracted
#2	EH_2D_Total but with fatty acids mathematically subtracted
_	Operator - underscore to separate acronyms (exception for +)
+	Operator to indicate cumulative eg. EH+HS_Total or EH_CU+HS_Total

Det	Acronym
Aliphatic C5-C6	HS_1D_AL
Aliphatic C6-C8	HS_1D_AL
Aliphatic C8-C10	HS_1D_AL
Aliphatic >EC10-EC12	EH_2D_AL
Aliphatic >EC12-EC16	EH_2D_AL
Aliphatic >EC16-EC21	EH_2D_AL
Aliphatic >EC21-EC35	EH_2D_AL
Aliphatic >EC35-EC40	EH_2D_AL
Aliphatic >EC40-EC44	EH_2D_AL
Aliphatic C5-C44	EH_2D+HS_1D_AL
Aromatic C5-C7	HS_1D_AR
Aromatic C7-C8	HS_1D_AR
Aromatic C8-C10	HS_1D_AR
Aromatic >EC10-EC12	EH_2D_AR
Aromatic >EC12-EC16	EH_2D_AR
Aromatic >EC16-EC21	EH_2D_AR
Aromatic >EC21-EC35	EH_2D_AR
Aromatic >EC35-EC40	EH_2D_AR
Aromatic >EC40-EC44	EH_2D_AR
Aromatic C5-C44	EH_2D+HS_1D_AR
TPH Ali/Aro C5-C44	EH_2D+HS_1D_Total
TPH (C10-C40)	EH_1D_Total
Aliphatic C10-C12	EH_CU_1D_AL
Aliphatic C10-C44	EH_CU_1D_AL
Aliphatic C12-C16	EH_CU_1D_AL
Aliphatic C16-C21	EH_CU_1D_AL
Aliphatic C21-C35	EH_CU_1D_AL

Aliphatic C35-C44	EH_CU_1D_AL
Aromatic C10-C12	EH_CU_1D_AR
Aromatic C12-C16	EH_CU_1D_AR
Aromatic C16-C21	EH_CU_1D_AR
Aromatic C21-C35	EH_CU_1D_AR
Aromatic C35-C44	EH_CU_1D_AR
Aromatic C10-C44	EH_CU_1D_AR
Ali/Aro C10-C44	EH_CU_1D_Total

Key:

~ Sample details are provided by the client and can affect the validity of the results
***** -not accredited.
# -MCERTS (accreditation only applies if report carries the MCERTS logo).
$ -subcontracted.
n/s -not supplied.
I/S -insufficient sample.
U/S -unsuitable sample.
t/f -to follow.
nd -not detected.

End of Report

Certificate of Analysis

Certificate Number	24-18647	*Issued:*	10-Sep-24

Client Causeway Geotech
Unit 1 Fingal House
Stephenstown Industrial Estate
Balbriggan
Co. Dublin
K32 VR66

Our Reference 24-18647

Client Reference ~ 24-0640

Order No ~ (not supplied)

Contract Title ~ Dublin St North Monaghan

Description 3 Soil samples, 2 Leachate prepared by DETS samples.

Date Received 04-Sep-24

Date Started 04-Sep-24

Date Completed 10-Sep-24

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

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

Approved By

Kirk Bridgewood
General Manager

ilac-MRA

UKAS TESTING
2139

Summary of Chemical Analysis
Soil Samples

Our Ref 24-18647
Client Ref ~ 24-0640
Contract Title ~ Dublin St North Monaghan

			Lab No	2387708	2387709	2387710
			Sample ID ~	BH01	BH02	BH02
			Depth ~	0.50	0.50	1.00
			Other ID ~	1	1	2
			Sample Type ~	ES	ES	ES
			Sampling Date ~	30/07/2024	31/07/2024	31/07/2024
			Sampling Time ~	n/s	n/s	n/s
Test	**Method**	**LOD**	**Units**			
Preparation						
Moisture Content	DETSC 1004	0.1	%	17	10	9.8
Metals						
Arsenic	DETSC 2301#	0.2	mg/kg	5.6	3.4	3.7
Boron, Water Soluble (2.5:1)	DETSC 2311#	0.2	mg/kg	< 0.2	< 0.2	0.2
Cadmium	DETSC 2301#	0.1	mg/kg	0.3	0.2	0.2
Chromium III	DETSC 2301*	0.15	mg/kg	56	19	17
Chromium, Hexavalent	DETSC 2204*	1	mg/kg	< 1.0	< 1.0	< 1.0
Copper	DETSC 2301#	0.2	mg/kg	56	13	12
Lead	DETSC 2301#	0.3	mg/kg	28	11	9.0
Mercury	DETSC 2325#	0.05	mg/kg	0.11	< 0.05	< 0.05
Nickel	DETSC 2301#	1	mg/kg	53	23	20
Selenium	DETSC 2301#	0.5	mg/kg	< 0.5	< 0.5	< 0.5
Vanadium	DETSC 2301#	0.8	mg/kg	39	18	16
Zinc	DETSC 2301#	1	mg/kg	94	69	46
Inorganics						
pH	DETSC 2008#		pH	7.7	8.8	8.6
Acid / Alkali Reserve	DETSC 2011*	1	Oh/100g	< 1.0	5.8	18
Acid Neutralisation Capacity (pH4)	DETSC 2073*	1	moles/kg	< 1.0	< 1.0	< 1.0
Cyanide, Total	DETSC 2130#	0.1	mg/kg	0.3	< 0.1	< 0.1
Cyanide, Free	DETSC 2130#	0.1	mg/kg	0.1	< 0.1	< 0.1
Thiocyanate	DETSC 2130#	0.6	mg/kg	3.7	< 0.6	< 0.6
Organic matter	DETSC 2002#	0.1	%	< 0.1	0.2	< 0.1
Chloride	DETSC 2055	1	mg/kg	20.2	32.6	46.5
Nitrate as NO3	DETSC 2055	1	mg/kg	17	20	12
Sulphide	DETSC 2024*	10	mg/kg	< 10	24	36
Sulphate as SO4, Total	DETSC 2321#	0.01	%	0.04	0.06	0.05
Petroleum Hydrocarbons						
Aliphatic C5-C6: HS_1D_AL	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01
Aliphatic C6-C8: HS_1D_AL	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01
Aliphatic C8-C10: HS_1D_AL	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01
Aliphatic >EC10-EC12: EH_2D_AL	DETSC 3521#	1.5	mg/kg	< 1.50	< 1.50	< 1.50
Aliphatic >EC12-EC16: EH_2D_AL	DETSC 3521#	1.2	mg/kg	< 1.20	< 1.20	< 1.20
Aliphatic >EC16-EC21: EH_2D_AL	DETSC 3521#	1.5	mg/kg	< 1.50	< 1.50	< 1.50
Aliphatic >EC21-EC35: EH_2D_AL	DETSC 3521#	3.4	mg/kg	< 3.40	< 3.40	< 3.40
Aliphatic >EC35-EC40: EH_2D_AL	DETSC 3521*	3.4	mg/kg	< 3.40	< 3.40	< 3.40
Aliphatic >EC40-EC44: EH_2D_AL	DETSC 3521*	3.4	mg/kg	< 3.40	< 3.40	< 3.40
Aliphatic C5-C44: EH_2D+HS_1D_AL	DETSC 3521*	10	mg/kg	< 10.00	< 10.00	< 10.00
Aromatic C5-C7: HS_1D_AR	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01
Aromatic C7-C8: HS_1D_AR	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01
Aromatic C8-C10: HS_1D_AR	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01	< 0.01
Aromatic >EC10-EC12: EH_2D_AR	DETSC 3521#	0.9	mg/kg	< 0.90	< 0.90	< 0.90

Summary of Chemical Analysis
Soil Samples

Our Ref 24-18647
Client Ref ~ 24-0640
Contract Title ~ Dublin St North Monaghan

Lab No	2387708	2387709	2387710
Sample ID ~	BH01	BH02	BH02
Depth ~	0.50	0.50	1.00
Other ID ~	1	1	2
Sample Type ~	ES	ES	ES
Sampling Date ~	30/07/2024	31/07/2024	31/07/2024
Sampling Time ~	n/s	n/s	n/s

Test	**Method**	**LOD**	**Units**			
Aromatic >EC12-EC16: EH_2D_AR	DETSC 3521#	0.5	mg/kg	1.73	< 0.50	< 0.50
Aromatic >EC16-EC21: EH_2D_AR	DETSC 3521#	0.6	mg/kg	< 0.60	< 0.60	< 0.60
Aromatic >EC21-EC35: EH_2D_AR	DETSC 3521#	1.4	mg/kg	6.29	< 1.40	< 1.40
Aromatic >EC35-EC40: EH_2D_AR	DETSC 3521*	1.4	mg/kg	< 1.40	< 1.40	< 1.40
Aromatic >EC40-EC44: EH_2D_AR	DETSC 3521*	1.4	mg/kg	< 1.40	< 1.40	< 1.40
Aromatic C5-C44: EH_2D+HS_1D_AR	DETSC 3521*	10	mg/kg	< 10.00	< 10.00	< 10.00
TPH Ali/Aro C5-C44: EH_2D+HS_1D_Total	DETSC 3521*	10	mg/kg	< 10.00	< 10.00	< 10.00
Benzene	DETSC 3321#	0.01	mg/kg	< 0.01	< 0.01	< 0.01
Ethylbenzene	DETSC 3321#	0.01	mg/kg	< 0.01	< 0.01	< 0.01
Toluene	DETSC 3321#	0.01	mg/kg	< 0.01	< 0.01	< 0.01
Xylene	DETSC 3321#	0.01	mg/kg	< 0.01	< 0.01	< 0.01
MTBE	DETSC 3321	0.01	mg/kg	< 0.01	< 0.01	< 0.01
PAHs						
Naphthalene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03
Acenaphthylene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03
Acenaphthene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03
Fluorene	DETSC 3303	0.03	mg/kg	< 0.03	< 0.03	< 0.03
Phenanthrene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03
Anthracene	DETSC 3303	0.03	mg/kg	< 0.03	< 0.03	< 0.03
Fluoranthene	DETSC 3303#	0.03	mg/kg	0.06	< 0.03	< 0.03
Pyrene	DETSC 3303#	0.03	mg/kg	0.05	< 0.03	< 0.03
Benzo(a)anthracene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03
Chrysene	DETSC 3303	0.03	mg/kg	< 0.03	< 0.03	< 0.03
Benzo(b)fluoranthene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03
Benzo(k)fluoranthene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03
Benzo(a)pyrene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03
Indeno(1,2,3-c,d)pyrene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03
Dibenzo(a,h)anthracene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03
Benzo(g,h,i)perylene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03	< 0.03
PAH - USEPA 16, Total	DETSC 3303	0.1	mg/kg	0.11	< 0.10	< 0.10
Phenols						
Phenol - Monohydric	DETSC 2130#	0.3	mg/kg	< 0.3	< 0.3	< 0.3

Summary of Asbestos Analysis
Soil Samples

Our Ref 24-18647
Client Ref ~ 24-0640
Contract Title ~ Dublin St North Monaghan

Lab No	Sample ID	Material Type	Result	Comment*	Analyst
2387708	BH01 1 0.50	SOIL	NAD	none	Ben Rose
2387709	BH02 1 0.50	SOIL	NAD	none	Ben Rose
2387710	BH02 2 1.00	SOIL	NAD	none	Ben Rose

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

WASTE ACCEPTANCE CRITERIA TESTING ANALYTICAL REPORT

Our Ref 24-18647
Client Ref 24-0640
Contract Title Dublin St North Monaghan
Sample Id BH01 1 0.50
Sample Numbers 2387708 2387711
Date Analysed 10/09/2024

Test Results On Waste

Determinand and Method Reference	Units	Result	WAC Limit Values Inert Waste	SNRHW	Hazardous Waste
DETSC 2084# Total Organic Carbon	%	1.9	3	5	6
DETSC 2003# Loss On Ignition	%	5.1	n/a	n/a	10
DETSC 3321# BTEX	mg/kg	< 0.04	6	n/a	n/a
DETSC 3401# PCBs (7 congeners)	mg/kg	< 0.01	1	n/a	n/a
DETSC 3311# EPH (C10 - C40): EH_1D_Total	mg/kg	< 10	500	n/a	n/a
DETSC 3301 PAHs	mg/kg	< 1.6	100	n/a	n/a
DETSC 2008# pH	pH Units	7.7	n/a	>6	n/a
DETSC 2073* Acid Neutralisation Capacity (pH4)	mol/kg	< 1.0	n/a	TBE	TBE
DETSC 2073* Acid Neutralisation Capacity (pH7)	mol/kg	< 1.0	n/a	TBE	TBE

Test Results On Leachate

WAC Limit Values
Limit values for LS10 Leachate

Determinand and Method Reference	Conc in Eluate ug/l	Amount Leached* mg/kg	Inert Waste	SNRHW	Hazardous Waste
	10:1	LS10			
DETSC 2306 Arsenic as As	0.4	< 0.01	0.5	2	25
DETSC 2306 Barium as Ba	7.3	< 0.1	20	100	300
DETSC 2306 Cadmium as Cd	< 0.030	< 0.02	0.04	1	5
DETSC 2306 Chromium as Cr	< 0.25	< 0.1	0.5	10	70
DETSC 2306 Copper as Cu	1.3	< 0.02	2	50	100
DETSC 2306 Mercury as Hg	< 0.010	< 0.002	0.01	0.2	2
DETSC 2306 Molybdenum as Mo	< 1.1	< 0.1	0.5	10	30
DETSC 2306 Nickel as Ni	< 0.50	< 0.1	0.4	10	40
DETSC 2306 Lead as Pb	0.34	< 0.05	0.5	10	50
DETSC 2306 Antimony as Sb	< 0.17	< 0.05	0.06	0.7	5
DETSC 2306 Selenium as Se	< 0.25	< 0.03	0.1	0.5	7
DETSC 2306 Zinc as Zn	< 1.3	< 0.01	4	50	200
DETSC 2055 Chloride as Cl	960	< 100	800	15,000	25,000
DETSC 2055* Fluoride as F	270	2.7	10	150	500
DETSC 2055 Sulphate as SO4	2000	< 100	1000	20,000	50,000
DETSC 2009* Total Dissolved Solids	21000	210	4000	60,000	100,000
DETSC 2130 Phenol Index	< 100	< 1	1	n/a	n/a
DETSC 2085 Dissolved Organic Carbon	2100	< 50	500	800	1000

TBE - To Be Evaluated
SNRHW - Stable Non-Reactive Hazardous Waste

Additional Information

DETSC 2008 pH	6.8
DETSC 2009 Conductivity uS/cm	29.5
* Temperature*	19.0

Mass of Sample Kg*	0.120
Mass of dry Sample Kg*	0.100

Stage 1

Volume of Leachant L2*	0.98
Volume of Eluate VE1*	0.932

Disclaimer: *The WAC limit values are provided for guidance only. DETS does not accept responsibility for errors or omissions. Values are correct at time of issue.*

V.2.06

** DETS are accredited for the testing of leachates and not the leachate preparation stage which is unaccredited.*

WASTE ACCEPTANCE CRITERIA TESTING ANALYTICAL REPORT

Our Ref	24-18647
Client Ref	24-0640
Contract Title	Dublin St North Monaghan
Sample Id	BH02 1 0.50
Sample Numbers	2387709 2387712
Date Analysed	10/09/2024

Test Results On Waste			**WAC Limit Values**		
Determinand and Method Reference	**Units**	**Result**	**Inert Waste**	**SNRHW**	**Hazardous Waste**
DETSC 2084# Total Organic Carbon	%	1.8	3	5	6
DETSC 2003# Loss On Ignition	%	2.1	n/a	n/a	10
DETSC 3321# BTEX	mg/kg	< 0.04	6	n/a	n/a
DETSC 3401# PCBs (7 congeners)	mg/kg	< 0.01	1	n/a	n/a
DETSC 3311# EPH (C10 - C40): EH_1D_Total	mg/kg	< 10	500	n/a	n/a
DETSC 3301 PAHs	mg/kg	< 1.6	100	n/a	n/a
DETSC 2008# pH	pH Units	8.8	n/a	>6	n/a
DETSC 2073* Acid Neutralisation Capacity (pH4)	mol/kg	< 1.0	n/a	TBE	TBE
DETSC 2073* Acid Neutralisation Capacity (pH7)	mol/kg	< 1.0	n/a	TBE	TBE

Test Results On Leachate			**WAC Limit Values** Limit values for LS10 Leachate		
Determinand and Method Reference	**Conc in Eluate ug/l**	**Amount Leached* mg/kg**	**Inert Waste**	**SNRHW**	**Hazardous Waste**
	10:1	**LS10**			
DETSC 2306 Arsenic as As	0.65	< 0.01	0.5	2	25
DETSC 2306 Barium as Ba	6.2	< 0.1	20	100	300
DETSC 2306 Cadmium as Cd	< 0.030	< 0.02	0.04	1	5
DETSC 2306 Chromium as Cr	0.41	< 0.1	0.5	10	70
DETSC 2306 Copper as Cu	1.1	< 0.02	2	50	100
DETSC 2306 Mercury as Hg	< 0.010	< 0.002	0.01	0.2	2
DETSC 2306 Molybdenum as Mo	< 1.1	< 0.1	0.5	10	30
DETSC 2306 Nickel as Ni	< 0.50	< 0.1	0.4	10	40
DETSC 2306 Lead as Pb	< 0.090	< 0.05	0.5	10	50
DETSC 2306 Antimony as Sb	< 0.17	< 0.05	0.06	0.7	5
DETSC 2306 Selenium as Se	0.36	< 0.03	0.1	0.5	7
DETSC 2306 Zinc as Zn	< 1.3	< 0.01	4	50	200
DETSC 2055 Chloride as Cl	1400	< 100	800	15,000	25,000
DETSC 2055* Fluoride as F	230	2.3	10	150	500
DETSC 2055 Sulphate as SO4	4800	< 100	1000	20,000	50,000
DETSC 2009* Total Dissolved Solids	46000	460	4000	60,000	100,000
DETSC 2130 Phenol Index	< 100	< 1	1	n/a	n/a
DETSC 2085 Dissolved Organic Carbon	< 2000	< 50	500	800	1000

TBE - To Be Evaluated
SNRHW - Stable Non-Reactive Hazardous Waste

Additional Information

DETSC 2008 pH	6.7
DETSC 2009 Conductivity uS/cm	66.3
* Temperature*	19.0

Mass of Sample Kg*	0.110
Mass of dry Sample Kg*	0.099

Stage 1

Volume of Leachant L2*	0.978
Volume of Eluate VE1*	0.923

Disclaimer: *The WAC limit values are provided for guidance only. DETS does not accept responsibility for errors or omissions. Values are correct at time of issue.*

V.2.06

** DETS are accredited for the testing of leachates and not the leachate preparation stage which is unaccredited.*

Information in Support of the Analytical Results

Our Ref 24-18647
Client Ref ~ 24-0640
Contract ~ Dublin St North Monaghan

Containers Received & Deviating Samples

Lab No	Sample ID ~	Date Sampled ~	Containers Received	Holding time exceeded for tests	Inappropriate container for tests
2387708	BH01 0.50 SOIL	30/07/2024	GJ 250ml, GJ 60ml, PT 1L	BTEX / C5-C10 (14 days), EPH/Aliphatic/Aromatic (14 days), Mercury (28 days), Total Sulphate ICP (30 days), Anions (30 days), Kone Cr6 (30 days), Naphthalene (14 days), Organic Matter (Auto) (28 days), Organic Matter (Manual) (28 days), PAH FID (14 days), PAH MS (14 days), PCB (30 days), pH + Conductivity (7 days), Cyanide/Mono pHoh (14 days), EPH/TPH (14 days)	
2387709	BH02 0.50 SOIL	31/07/2024	GJ 250ml, GJ 60ml, PT 1L	BTEX / C5-C10 (14 days), EPH/Aliphatic/Aromatic (14 days), Mercury (28 days), Total Sulphate ICP (30 days), Anions (30 days), Kone Cr6 (30 days), Naphthalene (14 days), Organic Matter (Auto) (28 days), Organic Matter (Manual) (28 days), PAH FID (14 days), PAH MS (14 days), PCB (30 days), pH + Conductivity (7 days), Cyanide/Mono pHoh (14 days), EPH/TPH (14 days)	
2387710	BH02 1.00 SOIL	31/07/2024	GJ 250ml, GJ 60ml, PT 1L	BTEX / C5-C10 (14 days), EPH/Aliphatic/Aromatic (14 days), Mercury (28 days), Total Sulphate ICP (30 days), Anions (30 days), Kone Cr6 (30 days), Naphthalene (14 days), Organic Matter (Manual) (28 days), PAH MS (14 days), pH + Conductivity (7 days), Cyanide/Mono pHoh (14 days)	
2387711	BH01 0.50 LEACHATE	30/07/2024	GJ 250ml, GJ 60ml, PT 1L	Conductivity (non reportable) (28 days), Conductivity uS/cm (28 days), Anions (28 days), pH/Cond (1 days), Phenol Index (30 days), Cyanide/Mono pHoh (14 days), Total Dissolved s (28 days), TOC AN (28 days)	
2387712	BH02 0.50 LEACHATE	31/07/2024	GJ 250ml, GJ 60ml, PT 1L	Conductivity (non reportable) (28 days), Conductivity uS/cm (28 days), Anions (28 days), pH/Cond (1 days), Phenol Index (30 days), Cyanide/Mono pHoh (14 days), Total Dissolved s (28 days), TOC AN (28 days)	

Information in Support of the Analytical Results

Our Ref 24-18647
Client Ref ~ 24-0640
Contract ~ Dublin St North Monaghan

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

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

Soil Analysis Notes

Inorganic soil analysis was carried out on a dried sample, crushed to pass a 425µm sieve, in accordance with BS1377.
Organic soil analysis was carried out on an 'as received' sample. Organics results are corrected for moisture and expressed on a dry weight basis.
The Loss on Drying, used to express organics analysis on an air dried basis, is carried out at a temperature of 28°C +/-2°C.

Disposal

From the issue date of this test certificate, samples will be held for the following times prior to disposal :-
Soils - 1 month, Liquids - 2 weeks, Asbestos (test portion) - 6 months

Information in Support of the Analytical Results

List of HWOL Acronyms and Operators

Acronym	Description
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
2D	GC-GC - Double coil gas chromatography
Total	Aliphatics & Aromatics
AL	Aliphatics only
AR	Aromatics only
#1	EH_2D_Total but with humics mathematically subtracted
#2	EH_2D_Total but with fatty acids mathematically subtracted
_	Operator - underscore to separate acronyms (exception for +)
+	Operator to indicate cumulative eg. EH+HS_Total or EH_CU+HS_Total

Det	Acronym
Aliphatic C5-C6	HS_1D_AL
Aliphatic C6-C8	HS_1D_AL
Aliphatic C8-C10	HS_1D_AL
Aliphatic >EC10-EC12	EH_2D_AL
Aliphatic >EC12-EC16	EH_2D_AL
Aliphatic >EC16-EC21	EH_2D_AL
Aliphatic >EC21-EC35	EH_2D_AL
Aliphatic >EC35-EC40	EH_2D_AL
Aliphatic >EC40-EC44	EH_2D_AL
Aliphatic C5-C44	EH_2D+HS_1D_AL
Aromatic C5-C7	HS_1D_AR
Aromatic C7-C8	HS_1D_AR
Aromatic C8-C10	HS_1D_AR
Aromatic >EC10-EC12	EH_2D_AR
Aromatic >EC12-EC16	EH_2D_AR
Aromatic >EC16-EC21	EH_2D_AR
Aromatic >EC21-EC35	EH_2D_AR
Aromatic >EC35-EC40	EH_2D_AR
Aromatic >EC40-EC44	EH_2D_AR
Aromatic C5-C44	EH_2D+HS_1D_AR
TPH Ali/Aro C5-C44	EH_2D+HS_1D_Total
TPH (C10-C40)	EH_1D_Total

Key:

- **~** Sample details are provided by the client and can affect the validity of the results
- ***** -not accredited.
- **#** -MCERTS (accreditation only applies if report carries the MCERTS logo).
- **$** -subcontracted.
- **n/s** -not supplied.
- **I/S** -insufficient sample.
- **U/S** -unsuitable sample.
- **t/f** -to follow.
- **nd** -not detected.

End of Report

Certificate of Analysis

Certificate Number 24-18649 *Issued:* 11-Sep-24

Client Causeway Geotech
Unit 1 Fingal House
Stephenstown Industrial Estate
Balbriggan
Co. Dublin
K32 VR66

Our Reference 24-18649

Client Reference ~ 24-0640

Order No ~ (not supplied)

Contract Title ~ Dublin St North Monaghan

Description 2 Soil samples, 2 Leachate prepared by DETS samples.

Date Received 04-Sep-24

Date Started 04-Sep-24

Date Completed 11-Sep-24

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

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

Approved By

Kirk Bridgewood
General Manager

Summary of Chemical Analysis
Soil Samples

Our Ref 24-18649
Client Ref ~ 24-0640
Contract Title ~ Dublin St North Monaghan

			Lab No	2387714	2387715
			Sample ID ~	BH03	BH03
			Depth ~	0.50	1.00
			Other ID ~	10	11
			Sample Type ~	ES	ES
			Sampling Date ~	29/07/2024	29/07/2024
			Sampling Time ~	n/s	n/s
Test	**Method**	**LOD**	**Units**		
Preparation					
Moisture Content	DETSC 1004	0.1	%	11	13
Metals					
Arsenic	DETSC 2301#	0.2	mg/kg	3.9	4.5
Boron, Water Soluble (2.5:1)	DETSC 2311#	0.2	mg/kg	0.4	0.3
Cadmium	DETSC 2301#	0.1	mg/kg	0.2	0.2
Chromium III	DETSC 2301*	0.15	mg/kg	29	33
Chromium, Hexavalent	DETSC 2204*	1	mg/kg	< 1.0	< 1.0
Copper	DETSC 2301#	0.2	mg/kg	26	28
Lead	DETSC 2301#	0.3	mg/kg	11	27
Mercury	DETSC 2325#	0.05	mg/kg	< 0.05	< 0.05
Nickel	DETSC 2301#	1	mg/kg	38	43
Selenium	DETSC 2301#	0.5	mg/kg	< 0.5	< 0.5
Vanadium	DETSC 2301#	0.8	mg/kg	26	28
Zinc	DETSC 2301#	1	mg/kg	58	61
Inorganics					
pH	DETSC 2008#		pH	8.3	8.9
Acid / Alkali Reserve	DETSC 2011*	1	Oh/100g	12	< 1.0
Acid Neutralisation Capacity (pH4)	DETSC 2073*	1	moles/kg	4.0	< 1.0
Cyanide, Total	DETSC 2130#	0.1	mg/kg	0.1	< 0.1
Cyanide, Free	DETSC 2130#	0.1	mg/kg	< 0.1	< 0.1
Thiocyanate	DETSC 2130#	0.6	mg/kg	< 0.6	< 0.6
Organic matter	DETSC 2002#	0.1	%	3.4	0.5
Chloride	DETSC 2055	1	mg/kg	27.5	34.3
Nitrate as NO3	DETSC 2055	1	mg/kg	1.2	3.9
Sulphide	DETSC 2024*	10	mg/kg	44	40
Sulphate as SO4, Total	DETSC 2321#	0.01	%	0.05	0.05
Petroleum Hydrocarbons					
Aliphatic C5-C6: HS_1D_AL	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01
Aliphatic C6-C8: HS_1D_AL	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01
Aliphatic C8-C10: HS_1D_AL	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01
Aliphatic >EC10-EC12: EH_2D_AL	DETSC 3521#	1.5	mg/kg	< 1.50	< 1.50
Aliphatic >EC12-EC16: EH_2D_AL	DETSC 3521#	1.2	mg/kg	< 1.20	< 1.20
Aliphatic >EC16-EC21: EH_2D_AL	DETSC 3521#	1.5	mg/kg	< 1.50	< 1.50
Aliphatic >EC21-EC35: EH_2D_AL	DETSC 3521#	3.4	mg/kg	< 3.40	< 3.40
Aliphatic >EC35-EC40: EH_2D_AL	DETSC 3521*	3.4	mg/kg	< 3.40	< 3.40
Aliphatic >EC40-EC44: EH_2D_AL	DETSC 3521*	3.4	mg/kg	< 3.40	< 3.40
Aliphatic C5-C44: EH_2D+HS_1D_AL	DETSC 3521*	10	mg/kg	< 10.00	< 10.00
Aromatic C5-C7: HS_1D_AR	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01
Aromatic C7-C8: HS_1D_AR	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01
Aromatic C8-C10: HS_1D_AR	DETSC 3321*	0.01	mg/kg	< 0.01	< 0.01
Aromatic >EC10-EC12: EH_2D_AR	DETSC 3521#	0.9	mg/kg	< 0.90	< 0.90

Summary of Chemical Analysis
Soil Samples

Our Ref 24-18649
Client Ref ~ 24-0640
Contract Title ~ Dublin St North Monaghan

			Lab No	2387714	2387715
			Sample ID ~	BH03	BH03
			Depth ~	0.50	1.00
			Other ID ~	10	11
			Sample Type ~	ES	ES
			Sampling Date ~	29/07/2024	29/07/2024
			Sampling Time ~	n/s	n/s
Test	**Method**	**LOD**	**Units**		
Aromatic >EC12-EC16: EH_2D_AR	DETSC 3521#	0.5	mg/kg	< 0.50	< 0.50
Aromatic >EC16-EC21: EH_2D_AR	DETSC 3521#	0.6	mg/kg	< 0.60	< 0.60
Aromatic >EC21-EC35: EH_2D_AR	DETSC 3521#	1.4	mg/kg	< 1.40	< 1.40
Aromatic >EC35-EC40: EH_2D_AR	DETSC 3521*	1.4	mg/kg	< 1.40	< 1.40
Aromatic >EC40-EC44: EH_2D_AR	DETSC 3521*	1.4	mg/kg	< 1.40	< 1.40
Aromatic C5-C44: EH_2D+HS_1D_AR	DETSC 3521*	10	mg/kg	< 10.00	< 10.00
TPH Ali/Aro C5-C44: EH_2D+HS_1D_Total	DETSC 3521*	10	mg/kg	< 10.00	< 10.00
Benzene	DETSC 3321#	0.01	mg/kg	< 0.01	< 0.01
Ethylbenzene	DETSC 3321#	0.01	mg/kg	< 0.01	< 0.01
Toluene	DETSC 3321#	0.01	mg/kg	< 0.01	< 0.01
Xylene	DETSC 3321#	0.01	mg/kg	< 0.01	< 0.01
MTBE	DETSC 3321	0.01	mg/kg	< 0.01	< 0.01
PAHs					
Naphthalene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03
Acenaphthylene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03
Acenaphthene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03
Fluorene	DETSC 3303	0.03	mg/kg	< 0.03	< 0.03
Phenanthrene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03
Anthracene	DETSC 3303	0.03	mg/kg	< 0.03	< 0.03
Fluoranthene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03
Pyrene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03
Benzo(a)anthracene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03
Chrysene	DETSC 3303	0.03	mg/kg	< 0.03	< 0.03
Benzo(b)fluoranthene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03
Benzo(k)fluoranthene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03
Benzo(a)pyrene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03
Indeno(1,2,3-c,d)pyrene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03
Dibenzo(a,h)anthracene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03
Benzo(g,h,i)perylene	DETSC 3303#	0.03	mg/kg	< 0.03	< 0.03
PAH - USEPA 16, Total	DETSC 3303	0.1	mg/kg	< 0.10	< 0.10
Phenols					
Phenol - Monohydric	DETSC 2130#	0.3	mg/kg	< 0.3	< 0.3

WASTE ACCEPTANCE CRITERIA TESTING ANALYTICAL REPORT

Our Ref 24-18649
Client Ref 24-0640
Contract Title Dublin St North Monaghan
Sample Id BH03 10 0.50

Sample Numbers 2387714 2387717
Date Analysed 10/09/2024

Test Results On Waste

Determinand and Method Reference	Units	Result	WAC Limit Values		
			Inert Waste	**SNRHW**	**Hazardous Waste**
DETSC 2084# Total Organic Carbon	%	0.8	3	5	6
DETSC 2003# Loss On Ignition	%	3.2	n/a	n/a	10
DETSC 3321# BTEX	mg/kg	< 0.04	6	n/a	n/a
DETSC 3401# PCBs (7 congeners)	mg/kg	< 0.01	1	n/a	n/a
DETSC 3311# EPH (C10 - C40): EH_1D_Total	mg/kg	< 10	500	n/a	n/a
DETSC 3301 PAHs	mg/kg	< 1.6	100	n/a	n/a
DETSC 2008# pH	pH Units	8.3	n/a	>6	n/a
DETSC 2073* Acid Neutralisation Capacity (pH4)	mol/kg	4.0	n/a	TBE	TBE
DETSC 2073* Acid Neutralisation Capacity (pH7)	mol/kg	< 1.0	n/a	TBE	TBE

Test Results On Leachate

Determinand and Method Reference	Conc in Eluate ug/l	Amount Leached* mg/kg	WAC Limit Values Limit values for LS10 Leachate		
	10:1	**LS10**	**Inert Waste**	**SNRHW**	**Hazardous Waste**
DETSC 2306 Arsenic as As	0.56	< 0.01	0.5	2	25
DETSC 2306 Barium as Ba	4.6	< 0.1	20	100	300
DETSC 2306 Cadmium as Cd	< 0.030	< 0.02	0.04	1	5
DETSC 2306 Chromium as Cr	< 0.25	< 0.1	0.5	10	70
DETSC 2306 Copper as Cu	0.77	< 0.02	2	50	100
DETSC 2306 Mercury as Hg	< 0.010	< 0.002	0.01	0.2	2
DETSC 2306 Molybdenum as Mo	< 1.1	< 0.1	0.5	10	30
DETSC 2306 Nickel as Ni	< 0.50	< 0.1	0.4	10	40
DETSC 2306 Lead as Pb	< 0.090	< 0.05	0.5	10	50
DETSC 2306 Antimony as Sb	< 0.17	< 0.05	0.06	0.7	5
DETSC 2306 Selenium as Se	< 0.25	< 0.03	0.1	0.5	7
DETSC 2306 Zinc as Zn	< 1.3	< 0.01	4	50	200
DETSC 2055 Chloride as Cl	800	< 100	800	15,000	25,000
DETSC 2055* Fluoride as F	130	1.3	10	150	500
DETSC 2055 Sulphate as SO4	1500	< 100	1000	20,000	50,000
DETSC 2009* Total Dissolved Solids	32000	320	4000	60,000	100,000
DETSC 2130 Phenol Index	< 100	< 1	1	n/a	n/a
DETSC 2085 Dissolved Organic Carbon	< 2000	< 50	500	800	1000

TBE - To Be Evaluated
SNRHW - Stable Non-Reactive Hazardous Waste

Additional Information

DETSC 2008 pH	6.7
DETSC 2009 Conductivity uS/cm	45.6
* Temperature*	19.0
Mass of Sample Kg*	0.110
Mass of dry Sample Kg*	0.098
Stage 1	
Volume of Leachant L2*	0.966
Volume of Eluate VE1*	0.909

Disclaimer: *The WAC limit values are provided for guidance only. DETS does not accept responsibility for errors or omissions. Values are correct at time of issue.*

V.2.06 ** DETS are accredited for the testing of leachates and not the leachate preparation stage which is unaccredited.*

Summary of Chemical Analysis
Leachate Samples

Our Ref 24-18649
Client Ref ~ 24-0640
Contract Title ~ Dublin St North Monaghan

			Lab No	2387716	2387717
			Sample ID ~	BH03	BH03
			Depth ~	0.50	0.50
			Other ID ~	10	10
			Sample Type ~	ES	ES
			Sampling Date ~	29/07/2024	29/07/2024
			Sampling Time ~	n/s	n/s
Test	**Method**	**LOD**	**Units**		
Preparation					
BS EN 12457 10:1	DETSC 1009*			Y	
BS EN 12457 10:1	DETSC 1009*				Y
Metals					
Arsenic, Dissolved	DETSC 2306	0.16	ug/l	0.24	
Boron, Dissolved	DETSC 2306*	0.012	mg/l	< 0.012	
Cadmium, Dissolved	DETSC 2306	0.03	ug/l	< 0.03	
Calcium, Dissolved	DETSC 2306	0.09	mg/l	7.9	
Chromium III, Dissolved	DETSC 2306*	1	ug/l	< 1.0	
Chromium, Hexavalent	DETSC 2203	7	ug/l	< 7.0	
Copper, Dissolved	DETSC 2306	0.4	ug/l	0.8	
Lead, Dissolved	DETSC 2306	0.09	ug/l	< 0.09	
Mercury, Dissolved	DETSC 2306	0.01	ug/l	< 0.01	
Nickel, Dissolved	DETSC 2306	0.5	ug/l	< 0.5	
Selenium, Dissolved	DETSC 2306	0.25	ug/l	< 0.25	
Vanadium, Dissolved	DETSC 2306	0.6	ug/l	< 0.6	
Zinc, Dissolved	DETSC 2306	1.3	ug/l	< 1.3	
Inorganics					
Conductivity	DETSC 2009	1	uS/cm	48.2	
pH	DETSC 2008		pH	6.7	
Cyanide, Total Low Level	DETSC 2131	0.0001	mg/l	< 0.0001	
Cyanide, Free Low Level	DETSC 2131	0.0001	mg/l	< 0.0001	
Phenol - Monohydric Low Level	DETSC 2131	0.0015	mg/l	< 0.0015	
Thiocyanate	DETSC 2130	20	ug/l	< 20	
Dissolved Organic Carbon	DETSC 2085	2	mg/l	< 2.0	
Total Hardness as CaCO3	DETSC 2303	0.1	mg/l	21.8	
Ammoniacal Nitrogen as N	DETSC 2207	0.015	mg/l	2.0	
Sulphate as SO4	DETSC 2055	0.1	mg/l	2.3	
Sulphide	DETSC 2208	0.01	mg/l	< 0.01	
Sulphur as S, Total	DETSC 2320*	10	mg/l	< 10	
Petroleum Hydrocarbons					
Aliphatic C5-C6: HS_1D_AL	DETSC 3322	0.1	ug/l	< 0.1	
Aliphatic C6-C8: HS_1D_AL	DETSC 3322	0.1	ug/l	< 0.1	
Aliphatic C8-C10: HS_1D_AL	DETSC 3322	0.1	ug/l	< 0.1	
Aliphatic C10-C12: EH_CU_1D_AL	DETSC 3072*	1	ug/l	< 1.0	
Aliphatic C10-C44: EH_CU_1D_AL	DETSC 3072*	1	ug/l	< 1.0	
Aliphatic C12-C16: EH_CU_1D_AL	DETSC 3072*	1	ug/l	< 1.0	
Aliphatic C16-C21: EH_CU_1D_AL	DETSC 3072*	1	ug/l	< 1.0	
Aliphatic C21-C35: EH_CU_1D_AL	DETSC 3072*	1	ug/l	< 1.0	
Aliphatic C35-C44: EH_CU_1D_AL	DETSC 3072*	1	ug/l	< 1.0	
Aromatic C5-C7: HS_1D_AR	DETSC 3322	0.1	ug/l	< 0.1	
Aromatic C7-C8: HS_1D_AR	DETSC 3322	0.1	ug/l	< 0.1	

Summary of Chemical Analysis
Leachate Samples

Our Ref 24-18649
Client Ref ~ 24-0640
Contract Title ~ Dublin St North Monaghan

			Lab No	2387716	2387717
			Sample ID ~	BH03	BH03
			Depth ~	0.50	0.50
			Other ID ~	10	10
			Sample Type ~	ES	ES
			Sampling Date ~	29/07/2024	29/07/2024
			Sampling Time ~	n/s	n/s
Test	**Method**	**LOD**	**Units**		
Aromatic C8-C10: HS_1D_AR	DETSC 3322	0.1	ug/l	< 0.1	
Aromatic C10-C12: EH_CU_1D_AR	DETSC 3072*	1	ug/l	< 1.0	
Aromatic C12-C16: EH_CU_1D_AR	DETSC 3072*	1	ug/l	< 1.0	
Aromatic C16-C21: EH_CU_1D_AR	DETSC 3072*	1	ug/l	< 1.0	
Aromatic C21-C35: EH_CU_1D_AR	DETSC 3072*	1	ug/l	< 1.0	
Aromatic C35-C44: EH_CU_1D_AR	DETSC 3072*	1	ug/l	< 1.0	
Aromatic C10-C44: EH_CU_1D_AR	DETSC 3072*	1	ug/l	< 1.0	
Ali/Aro C10-C44: EH_CU_1D_Total	DETSC 3072*	1	ug/l	< 1.0	
Benzene	DETSC 3322	1	ug/l	< 1.0	
Toluene	DETSC 3322	1	ug/l	< 1.0	
Ethylbenzene	DETSC 3322	1	ug/l	< 1.0	
Xylene	DETSC 3322	1	ug/l	< 1.0	
MTBE	DETSC 3322	1	ug/l	< 1.0	
PAHs					
Naphthalene	DETSC 3304	0.05	ug/l	< 0.05	
Acenaphthylene	DETSC 3304	0.01	ug/l	< 0.01	
Acenaphthene	DETSC 3304	0.01	ug/l	< 0.01	
Fluorene	DETSC 3304	0.01	ug/l	< 0.01	
Phenanthrene	DETSC 3304	0.01	ug/l	< 0.01	
Anthracene	DETSC 3304	0.01	ug/l	< 0.01	
Fluoranthene	DETSC 3304	0.01	ug/l	0.01	
Pyrene	DETSC 3304	0.01	ug/l	< 0.01	
Benzo(a)anthracene	DETSC 3304*	0.01	ug/l	< 0.01	
Chrysene	DETSC 3304	0.01	ug/l	< 0.01	
Benzo(b)fluoranthene	DETSC 3304	0.01	ug/l	< 0.01	
Benzo(k)fluoranthene	DETSC 3304	0.01	ug/l	< 0.01	
Benzo(a)pyrene	DETSC 3304	0.01	ug/l	< 0.01	
Indeno(1,2,3-c,d)pyrene	DETSC 3304	0.01	ug/l	< 0.01	
Dibenzo(a,h)anthracene	DETSC 3304	0.01	ug/l	< 0.01	
Benzo(g,h,i)perylene	DETSC 3304	0.01	ug/l	< 0.01	
PAH Total	DETSC 3304	0.2	ug/l	< 0.20	

Summary of Asbestos Analysis
Soil Samples

Our Ref 24-18649
Client Ref ~ 24-0640
Contract Title ~ Dublin St North Monaghan

Lab No	Sample ID	Material Type	Result	Comment*	Analyst
2387714	BH03 10 0.50	SOIL	NAD	none	Ben Rose
2387715	BH03 11 1.00	SOIL	NAD	none	Ben Rose

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

Information in Support of the Analytical Results

Our Ref 24-18649
Client Ref ~ 24-0640
Contract ~ Dublin St North Monaghan

Containers Received & Deviating Samples

Lab No	Sample ID ~	Date Sampled ~	Containers Received	Holding time exceeded for tests	Inappropriate container for tests
2387714	BH03 0.50 SOIL	29/07/24	GJ 250ml, GJ 60ml, PT 1L	BTEX / C5-C10 (14 days), EPH/Aliphatic/Aromatic (14 days), Mercury (28 days), Total Sulphate ICP (30 days), Anions (30 days), Kone Cr6 (30 days), Naphthalene (14 days), Organic Matter (Auto) (28 days), Organic Matter (Manual) (28 days), PAH FID (14 days), PAH MS (14 days), PCB (30 days), pH + Conductivity (7 days), Cyanide/Mono pHoh (14 days), EPH/TPH (14 days)	
2387715	BH03 1.00 SOIL	29/07/24	GJ 250ml, GJ 60ml, PT 1L	BTEX / C5-C10 (14 days), EPH/Aliphatic/Aromatic (14 days), Mercury (28 days), Total Sulphate ICP (30 days), Anions (30 days), Kone Cr6 (30 days), Naphthalene (14 days), Organic Matter (Manual) (28 days), PAH MS (14 days), pH + Conductivity (7 days), Cyanide/Mono pHoh (14 days)	
2387716	BH03 0.50 LEACHATE	29/07/24	GJ 250ml, GJ 60ml, PT 1L	Aliphatics/Aromatics (4 days), BTEX / C5-C10 (14 days), Conductivity (28 days), Conductivity (non reportable) (28 days), Chromium, Hexavalent (4 days), Hardness (7 days), Metals ICP Total (30 days), Anions (28 days), Kone (4 days), Kone (Sulphide) (5 days), pH/Cond (1 days), Naphthalene (14 days), Ammoniacal Nitrogen as N (10 days), PAH MS (4 days), Phenol - Monohydric Low Level (30 days), Cyanide/Mono pHoh (14 days), Cyanide/Mono PhOH Low Level (14 days), TOC AN (28 days)	
2387717	BH03 0.50 LEACHATE	29/07/24	GJ 250ml, GJ 60ml, PT 1L	Conductivity (non reportable) (28 days), Conductivity uS/cm (28 days), Anions (28 days), pH/Cond (1 days), Phenol Index (30 days), Cyanide/Mono pHoh (14 days), Total Dissolved s (28 days), TOC AN (28 days)	

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

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

Information in Support of the Analytical Results

Our Ref 24-18649
Client Ref ~ 24-0640
Contract ~ Dublin St North Monaghan

Soil Analysis Notes

Inorganic soil analysis was carried out on a dried sample, crushed to pass a 425µm sieve, in accordance with BS1377.
Organic soil analysis was carried out on an 'as received' sample. Organics results are corrected for moisture and expressed on a dry weight basis.
The Loss on Drying, used to express organics analysis on an air dried basis, is carried out at a temperature of 28°C +/-2°C.

Disposal

From the issue date of this test certificate, samples will be held for the following times prior to disposal :-
Soils - 1 month, Liquids - 2 weeks, Asbestos (test portion) - 6 months

Information in Support of the Analytical Results

List of HWOL Acronyms and Operators

Acronym	Description
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
2D	GC-GC - Double coil gas chromatography
Total	Aliphatics & Aromatics
AL	Aliphatics only
AR	Aromatics only
#1	EH_2D_Total but with humics mathematically subtracted
#2	EH_2D_Total but with fatty acids mathematically subtracted
_	Operator - underscore to separate acronyms (exception for +)
+	Operator to indicate cumulative eg. EH+HS_Total or EH_CU+HS_Total

Det	Acronym
Aliphatic C5-C6	HS_1D_AL
Aliphatic C6-C8	HS_1D_AL
Aliphatic C8-C10	HS_1D_AL
Aliphatic >EC10-EC12	EH_2D_AL
Aliphatic >EC12-EC16	EH_2D_AL
Aliphatic >EC16-EC21	EH_2D_AL
Aliphatic >EC21-EC35	EH_2D_AL
Aliphatic >EC35-EC40	EH_2D_AL
Aliphatic >EC40-EC44	EH_2D_AL
Aliphatic C5-C44	EH_2D+HS_1D_AL
Aromatic C5-C7	HS_1D_AR
Aromatic C7-C8	HS_1D_AR
Aromatic C8-C10	HS_1D_AR
Aromatic >EC10-EC12	EH_2D_AR
Aromatic >EC12-EC16	EH_2D_AR
Aromatic >EC16-EC21	EH_2D_AR
Aromatic >EC21-EC35	EH_2D_AR
Aromatic >EC35-EC40	EH_2D_AR
Aromatic >EC40-EC44	EH_2D_AR
Aromatic C5-C44	EH_2D+HS_1D_AR
TPH Ali/Aro C5-C44	EH_2D+HS_1D_Total
TPH (C10-C40)	EH_1D_Total
Aliphatic C10-C12	EH_CU_1D_AL
Aliphatic C10-C44	EH_CU_1D_AL
Aliphatic C12-C16	EH_CU_1D_AL
Aliphatic C16-C21	EH_CU_1D_AL
Aliphatic C21-C35	EH_CU_1D_AL

Aliphatic C35-C44	EH_CU_1D_AL
Aromatic C10-C12	EH_CU_1D_AR
Aromatic C12-C16	EH_CU_1D_AR
Aromatic C16-C21	EH_CU_1D_AR
Aromatic C21-C35	EH_CU_1D_AR
Aromatic C35-C44	EH_CU_1D_AR
Aromatic C10-C44	EH_CU_1D_AR
Ali/Aro C10-C44	EH_CU_1D_Total

Key:

- **~** Sample details are provided by the client and can affect the validity of the results
- ***** -not accredited.
- **#** -MCERTS (accreditation only applies if report carries the MCERTS logo).
- **$** -subcontracted.
- **n/s** -not supplied.
- **I/S** -insufficient sample.
- **U/S** -unsuitable sample.
- **t/f** -to follow.
- **nd** -not detected.

End of Report

APPENDIX K

SPT HAMMER ENERGY MEASUREMENT REPORT

SPT Hammer Energy Test Report

in accordance with BSEN ISO 22476-3:2005

Southern Testing
Unit 11
Charlwoods Road
East Grinstead
West Sussex
RH19 2HU

SPT Hammer Ref: 1411
Test Date: 17/02/2024
Report Date: 19/02/2024
File Name: 1411.spt
Test Operator: RS

Instrumented Rod Data

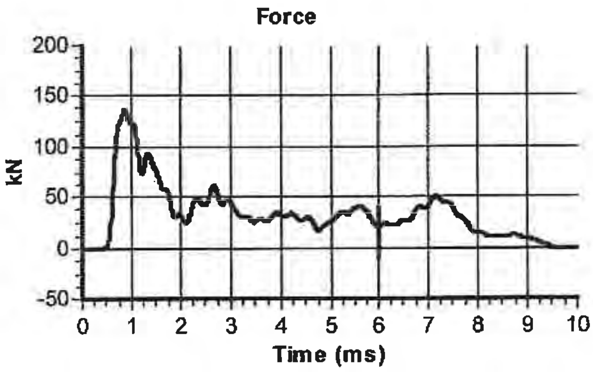
Diameter d_r (mm):	54
Wall Thickness t_r (mm):	6.6
Assumed Modulus E_a (GPa):	208
Accelerometer No.1:	64786
Accelerometer No.2:	64789

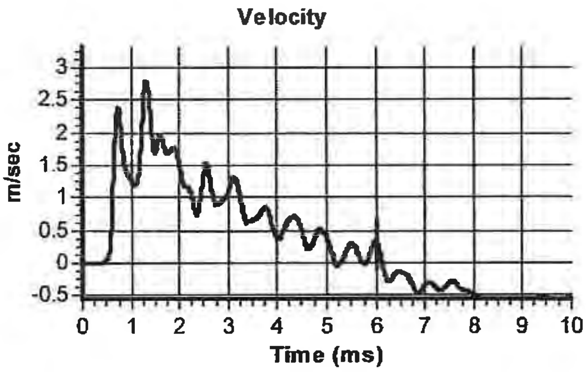
SPT Hammer Information

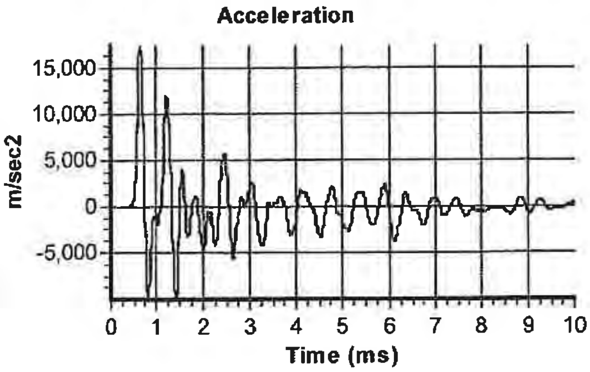
Hammer Mass m (kg):	63.5
Falling Height h (mm):	760
SPT String Length L (m):	10.0

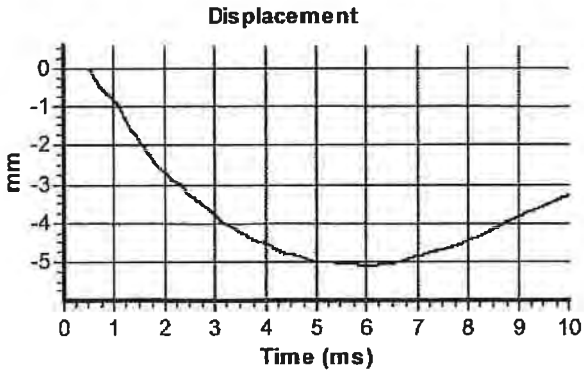
Comments / Location

CAUSEWAY









Calculations

Area of Rod A (mm2):	983
Theoretical Energy E_{theor} (J):	473
Measured Energy E_{meas} (J):	313

Energy Ratio E_r (%): 66

Signed: Bob Stewart
Title: Technician

The recommended calibration interval is 12 months

PROPOSED DEVELOPMENT
NEW CIVIC CENTRE
MONAGHAN
MONAGHAN CO. COUNCIL

CORA
CONSULTING ENGINEERS

CONTENTS

APPENDICES

FOREWORD

The following Conditions and Notes on Site Investigation Procedures should be read in conjunction with this report.

General.

Recommendations made, and opinions expressed in the report are based on the strata observed in the exploratory holes, together with the results of in-situ and laboratory tests. No responsibility can be held for conditions which have not been revealed by exploratory work, or which occur between exploratory hole locations. Whilst the report may suggest the likely configuration of strata, both between exploratory hole locations, or below the maximum depth of the investigation, this is only indicative, and liability cannot be accepted for its accuracy.

Unless specifically stated, no account has been taken of possible subsidence due to mineral extraction below or close to the site.

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 (1999), BS 1377 (Parts 1 to 9) and Engineers Ireland Specification & Related Documents for Ground Investigation in Ireland (2006). The following Irish (IS) and European Standards or Norms are referenced:

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

Routine Sampling.

Undisturbed samples of soils, predominantly cohesive in nature are obtained unless otherwise stated by a 104mm diameter open-drive tube sampler or Piston Sampler. In granular soils, and where undisturbed sampling is inappropriate, disturbed samples are collected. Smaller disturbed samples are also recovered at intervals to allow a visual examination of the full strata section.

In-Situ Testing.

Standard penetration tests were 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 to obtain the Energy Ratio (E_r) of each hammer. 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 recorded 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).

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 14688-1:2002 and IS EN ISO 14689-1:2004.

Where peat has been encountered during site works, 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 & 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 is 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.

Reporting

Recommendations made and opinions expressed in this report are based on the strata observed in the exploratory holes, together with the results of in-situ and laboratory tests. 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.

This report has been prepared for the project client and the information should not be used without prior written permission. Any recommendations developed in this report specifically relate to the proposed development. IGSL Ltd accepts no responsibility or liability for this document being used other than for the purposes for which it was intended.

REPORT ON A SITE INVESTIGATION

NEW CIVIC OFFICES
FOR
MONAGHAN COUNTY COUNCIL

CORA
CONSULTING ENGINEERS

Report No. 24665 **July 2023**

I Introduction

A major new development is proposed for a site in Monaghan where new Civic Offices are to be located.

An investigation of sub soil conditions in the area of the new development has been carried out by IGSL for CORA, Consulting Engineers, on behalf of Monaghan County Council.

The scheduled site investigation included the following elements.

*	Cable Percussion Boreholes	8 nr.
•	Rotary Core Holes	3 nr.
•	Standpipe Installations	1 nr.
•	Trial Pits	14 nr.
•	BRE Digest 365 Infiltration Tests	4 nr.
•	Geotechnical Laboratory Tests	
*	Chemical and Environmental Tests	

This report includes all factual data from field and laboratory operations and discusses these findings relative to foundation and infrastructural design for the proposed new development.

II Fieldwork

This development is to take place on an undulating greenfield site in Monaghan Town.

The exploratory locations are noted on the drawing enclosed in Appendix VI and were marked out by IGSL on site. All locations have been referenced to national grid and ground levels established.

The various elements of the investigation are detailed in the following paragraphs. All field works were supervised by an experienced geotechnical engineer who carefully recorded stratification, took photographs as necessary, recovered samples and prepared detailed records.

Close liaison was maintained throughout with CORA Consulting Engineers and Monaghan County Council personnel.

All appropriate documentation was submitted and approved prior to site commencement. Each location was scanned electronically (CAT) to ensure that existing services were not damaged. A shallow trial pit was also opened by hand at borehole / corehole locations to confirm this.

Drawings from the various utilities were also examined to ensure that major services were avoided.

Statutory HSE safety precautions relating to general safety and COVID 19 were strictly observed, with working areas restricted to IGSL personnel only, to ensure safety of the general public.

Boreholes

Boreholes were 200mm diameter and were constructed using conventional cable percussion equipment. Holes were referenced BH01 to BH08. A trial pit was opened at each borehole location to 1.00 metre deep to ensure that underground services were not damaged.

Shallow refusal was recorded on boulder obstructions at two locations (BH04 and BH06). Following a period of abortive chiselling, the equipment was moved by about 3 metres and re-bores were taken. These are referenced BH04A and BH06A.

Detailed geotechnical records are contained in Appendix I to this report - the records give details of stratification, sampling, in-situ testing and groundwater. Note is also taken of any obstructions to normal boring requiring the use of the heavy chisel for advancement. It was not possible to recover undisturbed samples because of the hard and granular nature of the strata encountered.

The findings are fairly consistent, with topsoil generally overlying a1.50 stratum of soft to firm brown sandy SILT /CLAY.

Stiff brown sandy gravelly CLAY , typically containing cobble and boulder material, is encountered at shallow depth (generally 0.50 to 1.00 metres). This stratum continues to about 2.50 metres where very stiff to hard dark grey gravelly CLAY is noted. This stratum also contains significant cobbles and boulder.

Boreholes were terminated on boulder obstructions in all locations at varying depths. Chiselling techniques were used in all locations in an attempt to advance borehole depths without success.

The stiff brown and grey gravelly CLAY encountered on this site is a GLACIAL TILL or BOULDER CLAY with the high percentage of coarse material typical of the stratum.

The increasing strength with depth pattern particularly in the base grey boulder clay is also noted. The final refusal depths are **NOT** indicative of rock horizon.

The borehole findings are summarised in the following **TABLE A:**

TABLE A

Ref	**Sandy Clay**	**Stiff brown BC**	**Stiff grey BC**	**Refusal Depth**
BH01	0.30 – 1.20	1.20 – 3.00		3.00
BH02	0.30 – 0.70	0.70 – 2.50	2.50 – 4.50	4.50
BH03	0.30 – 1.50	1.50 – 3.70		3.70
BH04	0.30 – 1.20			1.20
BH04A	0.30 – 0.50	0.50 – 2.50	2.50 – 4.50	4.50
BH05	0.30 – 1.50	1.50 – 2.00	2.00 – 4.50	4.50
BH06	0.30 – 0.50	0.50 – 1.00		1.00
BH06A	0.30 – 0.50	0.50 – 1.00		1.00
BH07	0.20 – 0.50	0.50 – 1.00		1.00
BH08	0.30 – 1.00	1.00 – 1.80	1.80 – 3.40	3.40

Ground water ingress was note in two locations, at 3.00 metre BGL in BH01 and at 4.50 metres BGL in BH05. The remaining boreholes were DRY.

Rotary Core Drilling

Rotary core drilling was employed at three of the borehole locations to advance investigation depth, establish bedrock horizon and recover representative rock core if practical.

A BT-44 drilling rig was used to drill in each location using triple tube core drilling technique and an air-mist coolant. Symmetrix open hole drilling (100mm diameter) was used through the overburden deposits.

Detailed drilling records are presented in Appendix II with accompanying core photographs. The records note Total and Solid Core Recovery (TCR / SCR) and provide a detailed geological description of the rock.

Drilling continued in each location to depths between 10.50 and 15.00 metres, penetrating very stiff to hard GLACIAL TILL consisting of brown or grey gravelly CLAY with extensive boulder presence.

Some core was recovered in the hard base till. The enclosed core photographs clearly indicate the significant boulder presence.

The strength of the boulder clay was established by standard penetration tests taken at 1.50 metre intervals during the drilling operation. Results are noted in the right hand column of the records. SPT values typically exceed N=40 with numerous test refusals recorded.

A slotted PVC standpipe was installed in RC02 to facilitate on-going monitoring of ground water level. The installation was sealed at surface and protected by a steel cover.

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The rotary core findings are summarised in the following table.

TABLE B

Hole No.	Overburden	Core Recovered	Standpipe
RC02	0 – 10.50		0 – 10.50
RC03	0 – 10.50	8.10 – 10.50	
RC06	0 – 15.00	13.5 – 15.00	

Trial Pits

Trial Pits were scheduled in fourteen specified locations and referenced TP01 to TP14. A tracked excavator was used under engineering supervision. Detailed records for each location are presented in Appendix III. These records note the soil stratification and record sampling and ground water details.

Topsoil surface was noted in each location generally overlying a zone of soft SILT/CLAY. Firm to stiff brown or grey gravelly CLAY was then encountered, this stratum typically containing cobbles and boulders.

The findings are consistent with the stratification noted in the boreholes.

Several trial pits were terminated on large boulders. The findings are summarised and presented as follows:

TABLE C

Ref No.	Topsoil	Soft SILT- CLAY	Stiff gravelly CLAY	Water
TP01	0 – 0.25	0.25 – 0.90	0.90 – 1.80	Dry
TP02	0 – 0.25	0.25 - 0.55	0.55 – 1.40	Dry
TP03	0 – 0.20	0.20 – 0.80	0.80 – 1.70	Dry
TP04	0 – 0.10	0.10 – 0.60	0.60 – 1.80	Dry
TP05	0 – 0.20	0.20 – 0.50	0.50 – 2.10	Dry
TP06	0 – 0.25	0.25 – 0.80	0.80 – 1.50	1.00
TP07	0 – 0.25	0.25 – 1.50	1.50 – 1.90	Dry
TP08	0 – 0.25	0.25 – 0.50	0.50 – 2.20	Dry
TP09	0 – 0.25	0.25 – 0.50	0.50 – 1.50	Dry
TP10	0 – 0.30	0.30 – 0.50	0.50 – 2.50	Dry
TP11	0 – 0.20	0.20 – 1.10	1.10 – 2.30	Dry
TP12	0 – 0.30	0.30 – 1.00	1.00 – 1.80	Dry
TP13	0 – 0.20	0.20 – 0.50	0.50 – 1.40	Dry
TP14	0 – 0.20	0.20 – 0.50	0.50 – 2.10	Dry

Trial Pits were backfilled with the excavated spoil, compacted in layers, the disturbed areas were levelled and coarse material was removed.

BRE Digest 365 Test

Infiltration testing was performed at four locations as specified in accordance with BRE Digest 365 'Soakaway Design'. Tests are referenced SA01 to SA04. Detailed data is presented in Appendix IV.

To obtain a measure of the infiltration rate of the sub-soils, water is poured into the test pit, and records taken of the fall in water level against time. The test is carried out over two cycles following initial soakage.

The infiltration rate is the volume of water dispersed per unit exposed area per unit of time, and is generally expressed as metres/minute. In these calculations the exposed area is the sum of the base area and the average internal area of the permeable stratum over the test duration. Design is based on the slowest infiltration rate, which has been calculated from the final cycle.

The stratification in the test area comprised Topsoil over gravelly sandy SILT/ CLAY.

Results are summarised as follows:

TABLE D

Test No.	**Depth**	**Soil Type**	**Infiltration Rate (f) (Metres/ Minute)**
SA 01	1.30	Gravelly CLAY	0.00173
SA02	1.60	Gravelly CLAY	0.00023
SA03	1.60	Gravelly CLAY	5.3E-05
SA04	1.30	Gravelly CLAY	0.0000

The results confirm low to very low permeability for the cohesive gravelly clay soils present on the site.

III. Testing

In Situ

Standard penetration tests were carried out at approximate 1.00 metre intervals in the geotechnical boreholes and at 1.50 metres in the Rotary Core Holes to measure relative in-situ soil strength. N values are noted in the right hand column of the individual records, representing the blow count required to drive the standard sampler 300mm into the soil, following initial seating blows. Where full test penetration was not achieved the blow count for a specific penetration is recorded, or refusal is indicated where appropriate. The results of the tests are summarised as follows:

STRATUM	N VALUE RANGE	COMMENT
Gravelly CLAY (Boulder Clay)		
1.00 m BGL	6 to 13	Soft to Firm
2.00 m BGL	10 to 29	Firm to Stiff
3.00 m BGL	26 to 50	Stiff to Hard
4.00 m BGL	> 50	Hard
4.00 to 15.00 m BGL (Rotary Holes)	40 to >50	Hard

Limited penetration SPT tests with refusal were recorded on numerous occasions, reflecting a high concentration of cobble / boulder material in the glacial till

Laboratory

A programme of laboratory testing was scheduled following completion of site operations. Geotechnical testing was carried out by IGSL in it's INAB-Accredited laboratory. Chemical and environmental testing was carried out in the UK by EUROFINS / CHEMTEST Ltd. The test programme included the following elements:

Liquid and Plastic Limits / Moisture Content	IGSL
PSD Grading by Wet Sieve and Hydrometer	IGSL
MCV	IGSL
CBR	IGSL
Compaction	IGSL
Organic Content	EUROFINS
Sulphate / Chloride / pH	EUROFINS
RILTA Suite Environmental	EUROFINS

All laboratory data is presented in Appendices Va and Vb and individual tests are discussed briefly as follows:

Index Properties / Natural Moisture Content

Classification tests have been carried out on samples of the cohesive soils from borehole and trial pit locations.

The glacial tills plot generally in the CI/CL zone of the standard Classification chart indicative of low plasticity gravelly CLAY matrix material. Natural Moisture Content ranges from 14 to 19 %.

Grading

Wet sieve and hydrometer analysis has been carried out on samples of the cohesive soils from both boreholes and trial pits. The graphs are typically straight line, grading from the fine clay to coarse gravel fraction. The pattern is very typical of glacial till or boulder clay deposition.

Organic Content

Six samples of the soils from the site had organic contents established. Samples were generally taken from shallow depths below the topsoil. Values of 1.0 to 2.5% were determined indicative of very low to negligible organic content.

MCV/CBR/Compaction

Six large composite samples were selected from Trial Pits 01 / 03 / 05 / 09 / 12 and 14 and a series of tests were scheduled to establish the soil characteristics relative to possible re-use during the new development.

The tests carried out included MCV (Moisture Condition Value), Natural Moisture Content, CBR (California Bearing Ratio), Dry Density / Moisture Content relationship.

The results are summarised as follows:

Ref No.	**TP01**	**TP03**	**TP05**	**TP09**	**TP12**	**TP14**
Depth	0.70	0.6	0.7	0.7	0.8	1.5
Natural MC (%)	15	13	13	13	10	14
MCV	6.6	7.3	6.8	6.8	6.7	7.8
CBR (%)	5.6	4.6	4.1	2.0	7.7	3.0
Max.Dry Density (mg/cu.m.)	1.90	1.86	1.86	1.88	1.89	1.85
Optimum Moisture (%)	11	12	12	12	12	14

Chemical Suite (Sulphate Chloride pH)

Six samples were sent for analysis to BRE Chemical Suite parameters.

Sulphate concentrations (SO4 2:1 extract) of <0.010 to 0.240 g/l were established with pH values ranging from 7.8 to 8.6. Chloride concentrations (<0.010 to 0.24 g/l) were also determined.

The results indicate a design class of DS-1 (ACEC Classification for Concrete) for sulphate concentrations below 0.5 g/l. No special precautions are necessary to protect below ground foundation concrete.

RILTA Environmental Suite

Six samples of the sub soils were sent to specialist environmental laboratory EUROFINS and testing was carried out in accordance with RILTA requirements to establish Landfill Waste Acceptance Criteria (WAC).

Detailed results are presented in Appendix V o. All samples tested fall into the INERT category with no elevated contaminant levels recorded.

Material excavated from this site can be safely disposed of either within the site boundary or off site to a suitably licensed Landfill Facility

Asbestos screening was carried out on all RILTA samples with no traces of Asbestos noted.

A comprehensive Waste Characterisation Assessment may be required by landfill operators. This can be prepared by specialist environmental consultants using the factual data from field and laboratory as presented in this report.

IV. Discussion:

A major development is being undertaken at this site in Monaghan. A new CIVIC CENTRE is to be constructed for Monaghan County Council.

A detailed investigation of subsoil and bedrock has been carried out under the direction of CORA Consulting Engineers in the area of development.

The exploratory locations are detailed on the site plan in Appendix VI.

The factual data from the field and laboratory is presented in Sections 1 to III of this report.

The site is grassed with some significant variation in ground level.

SUMMARY STRATIFICATION

TOPSOIL overlies soft to firm sandy SILT/CLAY. This upper material extends to depth between 0.50 and 1.50 metres as shown in TABLE A and TABLE B.

Stiff brown gravelly CLAY (brown BOULDER CLAY) is then encountered and continues to about 2.00 metres where it changes to very stiff to hard grey gravelly CLAY (grey black BOULDER CLAY). Proof core drilling confirmed that the GLACIAL TILL continues to at least 15 metres BGL. Bedrock was not established.

UPPER SILT/CLAY

The soils extending from surface to depths up to 1.50 metre are described as soft to firm sandy slightly gravelly SILT/CLAY. SPT values of N=6 to N=10 have been recorded at a depth of 1.00 metre.

BOULDER CLAY

GLACIAL TILL or BOULDER CLAY has been confirmed below approximately 1.50 metres, the stratum continues to at least 15.00 metres BGL. Visual inspection of trial pit excavations and results of in-situ Standard Penetration Tests are indicative of stiff to hard consistency.

The characteristics of the regional boulder clay or glacial till are very well documented and the findings from this detailed investigation are consistent with extensive published data.

ALLOWABLE BEARING PRESSURES

The soil strength has been assessed visually in the trial pits and confirmed by Standard Penetration Tests in boreholes and core holes. The allowable bearing pressures indicated by the field data are summarised as follows:

Depth	**Average N Value**	**Allowable Bearing Pressure**	
1.00	7	75 kPa	(Upper Silt/Clay)
2.00	20	200 kPa	(Boulder Clay)
3.00	35	300 kPa	
4.00	>50	400 kPa	

FOUNDATION RECOMMENDATIONS

The use of traditional reinforced foundations for the new Civic Offices development is proposed. Foundations to be placed on the stiff brown or grey boulder CLAY using the allowable bearing pressures indicated above.

We strongly recommend visual inspection of foundation excavations by experienced personnel to ensure uniformity and suitability of the founding medium. Any soft or suspect material should be removed and where necessary replaced with low-grade concrete. The glacial till soils are sensitive to moisture variation and should be protected by blinding following excavation.

The presence of extensive boulders should also be noted with possible over-break in excavation occurring.

The majority of boreholes and trial pits were dry with only occasional water seepages recorded. This may indicate isolated water bearing gravelly zones, typical of the heterogeneous nature of the regional Glacial Till.

SETTLEMENT

Settlement of the order of 5 to 10mm can be expected under the foundation loadings indicated above. Settlement should be quite uniform and differential movement is not anticipated.

EXCAVATION

Given the variations in site levels it is likely that significant cut and fill operations will be required. No major issues will arise with excavation, other than the presence of boulder obstructions and possibly water ingress if gravel zones are encountered.

A detailed programme of laboratory testing has been carried out to establish soil parameters relative to the suitability of excavated material for re-use as engineered fill.

The results reflect a high degree of consistency in the boulder clay over the site area and will allow the appointed contractor to design a suitable programme for earthworks on this site.

BRE DIGEST 365 TESTS

The test results reflect very low permeability characteristics in the gravelly CLAY soils. This is very typical of the cohesive material. Clay matrix material is generally unsuited to dispersion of storm or surface water and consideration should be given to the use of the Local Authority Drainage System for this development.

FOUNDATION CONCRETE

No special precautions are necessary for protection of below ground concrete.

ENVIRONMENTAL

Six samples have been tested to RILTA Suite Parameters and the results confirm an INERT classification for the soils. Excavated material can be safely used on the site or can be disposed of to a suitably licensed Landfill.

A waste Characterisation Assessment (WCA) may be necessary and should be carried out by environmental specialists. This WCA should be submitted to the relevant waste management facility, to confirm suitability for acceptance.

IGSL/JC
July 2023

Appendix I Boring Records

GEOTECHNICAL BORING RECORD

REPORT NUMBER 24665

CONTRACT	Monaghan Active Travel - Main Site	**BOREHOLE NO.**	**BH01**
		SHEET	Sheet 1 of 1
CO-ORDINATES		**RIG TYPE**	Dando 2000
		BOREHOLE DIAMETER (mm)	200
GROUND LEVEL (m AOD)		**BOREHOLE DEPTH (m)**	3.00
DATE COMMENCED	13/05/2023	**DATE COMPLETED**	13/05/2023
CLIENT	Monaghan Co.Co.	**SPT HAMMER REF. NO.**	
ENGINEER	DBFL	**ENERGY RATIO (%)**	
BORED BY	P.Allan	**PROCESSED BY**	F.C

Depth (m)	Description	Legend	Elevation	Depth (m)	Samples Ref. Number	Sample Type	Depth (m)	Recovery	Field Test Results	Standpipe Details
0	TOPSOIL			0.30						
	Firm brown sandy SILT/CLAY with occasional gravel			1.00	AA192931	B	0.50			
1	Firm grey sandy SILT/CLAY			1.20	AA192932	B	1.00		N = 13 (2, 3, 2, 3, 4, 4)	
	Brown sandy gravelly CLAY with occasional cobbles									
2				2.70	AA192933	B	2.00		N = 17 (2, 2, 2, 4, 5, 6)	
	Brown sandy gravelly CLAY with some cobble			3.00						
3	Obstruction End of Borehole at 3.00 m								N = 50/75 mm (25, 25, 50)	
4										
5										
6										
7										
8										
9										

HARD STRATA BORING/CHISELLING

From (m)	To (m)	Time (h)	Comments
2.8	3	1.5	

WATER STRIKE DETAILS

Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments
3.00	3.00	No	1.50	20	Moderate

GROUNDWATER PROGRESS

Date	Hole Depth	Casing Depth	Depth to Water	Comments
11-05-23	3.00	Nil	1.50	End of BH

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 24665M.GPJ IGSL.GDT 26/5/23

GEOTECHNICAL BORING RECORD

REPORT NUMBER	24665
CONTRACT	Monaghan Active Travel - Main Site
BOREHOLE NO.	BH02
SHEET	Sheet 1 of 1
CO-ORDINATES	
GROUND LEVEL (m AOD)	
RIG TYPE	Dando 2000
BOREHOLE DIAMETER (mm)	200
BOREHOLE DEPTH (m)	4.50
DATE COMMENCED	13/05/2023
DATE COMPLETED	14/05/2023
CLIENT	Monaghan Co.Co.
ENGINEER	DBFL
SPT HAMMER REF. NO.	
ENERGY RATIO (%)	
BORED BY	P.Allan
PROCESSED BY	F.C

Depth (m)	Description	Legend	Elevation	Depth (m)	Samples				Field Test Results	Standpipe Details
					Ref. Number	Sample Type	Depth (m)	Recovery		
0	TOPSOIL			0.30						
	Soft brown sandy SILT/CLAY with occasional gravel			0.70	AA197801	B	0.50			
1	Stiff brown sandy SILT/CLAY with some gravel				AA197802	B	1.00		N = 6 (1, 0, 1, 1, 2, 2)	
2				2.50	AA197803	B	2.00		N = 26 (2, 3, 6, 8, 5, 7)	
3	Stiff to very stiff grey sandy gravelly CLAY with occasional cobbles				AA197804	B	3.00		N = 50/225 mm (4, 5, 9, 15, 26)	
4				4.50	AA197805	B	4.00		N = 50/150 mm (6, 10, 20, 30)	
	Obstruction End of Borehole at 4.50 m									
5										
6										
7										
8										
9										

HARD STRATA BORING/CHISELLING

From (m)	To (m)	Time (h)	Comments
0.7	0.9	1	
4.3	4.5	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

GEOTECHNICAL BORING RECORD

REPORT NUMBER 24665

CONTRACT Monaghan Active Travel - Main Site

BOREHOLE NO. **BH03**
SHEET Sheet 1 of 1

CO-ORDINATES
GROUND LEVEL (m AOD)

RIG TYPE Dando 2000
BOREHOLE DIAMETER (mm) 200
BOREHOLE DEPTH (m) 3.70

DATE COMMENCED 12/05/2023
DATE COMPLETED 12/05/2023

CLIENT Monaghan Co.Co.
ENGINEER DBFL

SPT HAMMER REF. NO.
ENERGY RATIO (%)

BORED BY P.Allan
PROCESSED BY F.C

Depth (m)	Description	Legend	Elevation	Depth (m)	Samples				Field Test Results	Standpipe Details
					Ref. Number	Sample Type	Depth (m)	Recovery		
0	TOPSOIL			0.30						
	Soft to firm brown sandy SILT/CLAY with occasional gravel				AA192934	B	0.50			
1					AA192935	B	1.00		N = 7 (1, 2, 1, 2, 2, 2)	
2				2.30	AA192936	B	2.00		N = 10 (2, 2, 2, 3, 2, 3)	
	Very brown sandy gravelly CLAY with occasional cobbles									
3				3.70	AA192937	B	3.00		N = 50 (6, 6, 10, 10, 20, 10)	
	Obstruction End of Borehole at 3.70 m								N = 50/75 mm (25, 50)	
4										
5										
6										
7										
8										
9										

HARD STRATA BORING/CHISELLING

From (m)	To (m)	Time (h)	Comments
2.7	2.9	1	
3.5	3.7	1.5	

WATER STRIKE DETAILS

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

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type

GROUNDWATER PROGRESS

Date	Hole Depth	Casing Depth	Depth to Water	Comments

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

GEOTECHNICAL BORING RECORD

REPORT NUMBER 24665

CONTRACT	Monaghan Active Travel - Main Site	**BOREHOLE NO.**	**BH04**
		SHEET	Sheet 1 of 1
CO-ORDINATES		**DATE COMMENCED**	12/05/2023
GROUND LEVEL (m AOD)		**DATE COMPLETED**	12/05/2023
RIG TYPE	Dando 2000	**BORED BY**	P.Allan
BOREHOLE DIAMETER (mm)	200	**PROCESSED BY**	F.C
BOREHOLE DEPTH (m)	1.20		
CLIENT	Monaghan Co.Co.	**SPT HAMMER REF. NO.**	
ENGINEER	DBFL	**ENERGY RATIO (%)**	

Depth (m)	Description	Legend	Elevation	Depth (m)	Samples				Field Test Results	Standpipe Details
					Ref. Number	Sample Type	Depth (m)	Recovery		
0	TOPSOIL			0.30						
	Grey SILT/CLAY with some gravel and occasional cobbles			1.20	AA192938	B	0.50		N = 50/75 mm (25, 50)	
1	Obstruction End of Borehole at 1.20 m									
2										
3										
4										
5										
6										
7										
8										
9										

HARD STRATA BORING/CHISELLING

From (m)	To (m)	Time (h)	Comments
1.1	1.2	1	

WATER STRIKE DETAILS

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

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type

GROUNDWATER PROGRESS

Date	Hole Depth	Casing Depth	Depth to Water	Comments

REMARKS CAT scanned location and hand dug inspection pit was carried out . Obstruction encountered . Moved to BH04A and attempted rebore .

Sample Legend

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

GEOTECHNICAL BORING RECORD

REPORT NUMBER 24665

CONTRACT	Monaghan Active Travel - Main Site	**BOREHOLE NO.**	**BH04A**
		SHEET	Sheet 1 of 1
CO-ORDINATES		**DATE COMMENCED**	13/05/2023
GROUND LEVEL (m AOD)		**DATE COMPLETED**	13/05/2023
RIG TYPE	Dando 2000	**BORED BY**	P.Allan
BOREHOLE DIAMETER (mm)	200	**PROCESSED BY**	F.C
BOREHOLE DEPTH (m)	4.50		
CLIENT	Monaghan Co.Co.	**SPT HAMMER REF. NO.**	
ENGINEER	DBFL	**ENERGY RATIO (%)**	

Depth (m)	Description	Legend	Elevation	Depth (m)	Samples: Ref. Number	Sample Type	Depth (m)	Recovery	Field Test Results	Standpipe Details
0	TOPSOIL			0.30						
	Stiff bown sandy SILT/CLAY with some gravel									
1					AA192939	B	1.00			
2					AA192940	B	2.00		N = 21 (2, 2, 3, 6, 8, 4)	
				2.50						
	Very stiff grey sandy gravelly CLAY with some cobbles									
3					AA192941	B	3.00		N = 50 (4, 4, 5, 10, 20, 15)	
4					AA192942	B	4.00		N = 40/150 mm (6, 10, 19, 21)	
				4.50					N = 50/75 mm (25, 50)	
	Obstruction End of Borehole at 4.50 m									
5										
6										
7										
8										
9										

HARD STRATA BORING/CHISELLING

From (m)	To (m)	Time (h)	Comments
1.1	1.3	1	
4.4	4.5	1.5	

WATER STRIKE DETAILS

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

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type

GROUNDWATER PROGRESS

Date	Hole Depth	Casing Depth	Depth to Water	Comments

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 24665M.GPJ IGSL.GDT 26/5/23

GEOTECHNICAL BORING RECORD

REPORT NUMBER	24665		
CONTRACT	Monaghan Active Travel - Main Site	**BOREHOLE NO.**	BH05
		SHEET	Sheet 1 of 1
CO-ORDINATES		**RIG TYPE**	Dando 2000
GROUND LEVEL (m AOD)		**BOREHOLE DIAMETER (mm)**	200
		BOREHOLE DEPTH (m)	4.50
DATE COMMENCED	15/05/2023	**DATE COMPLETED**	15/05/2023
CLIENT	Monaghan Co.Co.	**SPT HAMMER REF. NO.**	
ENGINEER	DBFL	**ENERGY RATIO (%)**	
BORED BY	P.Allan	**PROCESSED BY**	F.C

Depth (m)	Description	Legend	Elevation	Depth (m)	Samples Ref. Number	Sample Type	Depth (m)	Recovery	Field Test Results	Standpipe Details
0	TOPSOIL			0.30						
	Soft to firm brown sandy SILT/CLAY with occasional gravel				AA192946	B	0.50			
1					AA192947	B	1.00		N = 6 (2, 6, 1, 1, 2, 2)	
				2.00						
2	Stiff to very stiff grey sandy gravelly CLAY with occasion cobbles Firm to stiff brown sandy gravelly CLAY with some cobbles				AA192948	B	2.00		N = 19 (2, 2, 3, 4, 5, 7)	
3	Stiff to very stiff grey sandy gravelly CLAY with occasion cobbles Firm to stiff brown sandy gravelly CLAY with some cobbles				AA192949	B	3.00		N = 26 (2, 3, 4, 6, 8, 8)	
4					AA192950	B	4.00		N = 50/150 mm (6, 8, 20, 30)	
				4.50					N = 50/75 mm (17, 8, 50)	
	Obstruction End of Borehole at 4.50 m									
5										
6										
7										
8										
9										

HARD STRATA BORING/CHISELLING

From (m)	To (m)	Time (h)	Comments
3.7	3.9	1	
4.3	4.5	1.5	

WATER STRIKE DETAILS

Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments
4.50	4.50	No	3.50	0	Moderate

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type

GROUNDWATER PROGRESS

Date	Hole Depth	Casing Depth	Depth to Water	Comments

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

GEOTECHNICAL BORING RECORD

REPORT NUMBER 24665

CONTRACT	Monaghan Active Travel - Main Site	**BOREHOLE NO.**	**BH06**
		SHEET	Sheet 1 of 1
CO-ORDINATES		**RIG TYPE**	Dando 2000
		BOREHOLE DIAMETER (mm)	200
GROUND LEVEL (m AOD)		**BOREHOLE DEPTH (m)**	1.00
DATE COMMENCED	16/05/2023	**DATE COMPLETED**	16/05/2023
CLIENT	Monaghan Co.Co.	**SPT HAMMER REF. NO.**	
ENGINEER	DBFL	**ENERGY RATIO (%)**	
BORED BY	P.Allan	**PROCESSED BY**	F.C

Depth (m)	Description	Legend	Elevation	Depth (m)	Samples: Ref. Number	Sample Type	Depth (m)	Recovery	Field Test Results	Standpipe Details
0	TOPSOIL			0.30						
	Very stiff brown sandy SILT/CLAY with some gravel and occasional cobbles			1.00	AA197914	B	0.80		N = 50/75 mm (25, 50)	
1	Obstruction End of Borehole at 1.00 m									
2										
3										
4										
5										
6										
7										
8										
9										

HARD STRATA BORING/CHISELLING

From (m)	To (m)	Time (h)	Comments
0.9	1	1	

WATER STRIKE DETAILS

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

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type

GROUNDWATER PROGRESS

Date	Hole Depth	Casing Depth	Depth to Water	Comments

REMARKS CAT scanned location and hand dug inspection pit was carried out . Obstruction encountered . Moved to BH06A 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

GEOTECHNICAL BORING RECORD

REPORT NUMBER 24665

CONTRACT	Monaghan Active Travel - Main Site	**BOREHOLE NO.**	**BH06A**
		SHEET	Sheet 1 of 1
CO-ORDINATES		**RIG TYPE**	Dando 2000
		BOREHOLE DIAMETER (mm)	
GROUND LEVEL (m AOD)		**BOREHOLE DEPTH (m)**	1.00
DATE COMMENCED	16/05/2023	**DATE COMPLETED**	16/05/2023
CLIENT	Monaghan Co.Co.	**SPT HAMMER REF. NO.**	
ENGINEER	DBFL	**ENERGY RATIO (%)**	
BORED BY	P.Allan	**PROCESSED BY**	F.C

Depth (m)	Description	Legend	Elevation	Depth (m)	Samples				Field Test Results	Standpipe Details
					Ref. Number	Sample Type	Depth (m)	Recovery		
0	TOPSOIL			0.30						
	Very stiff brown sandy SILT/CLAY with some gravel and occasional cobbles			1.00	AA171709	B	0.80			
1	Obstruction End of Borehole at 1.00 m								N = 50/75 mm (25, 50)	
2										
3										
4										
5										
6										
7										
8										
9										

HARD STRATA BORING/CHISELLING

From (m)	To (m)	Time (h)	Comments
0.9	1	1	

WATER STRIKE DETAILS

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

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type

GROUNDWATER PROGRESS

Date	Hole Depth	Casing Depth	Depth to Water	Comments

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

GEOTECHNICAL BORING RECORD

REPORT NUMBER 24665

CONTRACT	Monaghan Active Travel - Main Site	**BOREHOLE NO.**	**BH07**
		SHEET	Sheet 1 of 1
CO-ORDINATES		**RIG TYPE**	Dando 2000
		BOREHOLE DIAMETER (mm)	200
GROUND LEVEL (m AOD)		**BOREHOLE DEPTH (m)**	1.00
DATE COMMENCED	16/05/2023	**DATE COMPLETED**	16/05/2023
CLIENT	Monaghan Co.Co.	**SPT HAMMER REF. NO.**	
ENGINEER	DBFL	**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			0.20						
	Very stiff brown sandy SILT/CLAY with some gravel and occasional cobbles			1.00	AA171710	B	0.80		N = 50/75 mm (25, 50)	
1	Obstruction End of Borehole at 1.00 m									
2										
3										
4										
5										
6										
7										
8										
9										

HARD STRATA BORING/CHISELLING

From (m)	To (m)	Time (h)	Comments
0.9	1	1	

WATER STRIKE DETAILS

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

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type

GROUNDWATER PROGRESS

Date	Hole Depth	Casing Depth	Depth to Water	Comments

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

Sample Legend

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

IGSL BH LOG 24665M.GPJ IGSL.GDT 26/5/23

GEOTECHNICAL BORING RECORD

REPORT NUMBER	24665
CONTRACT	Monaghan Active Travel - Main Site
BOREHOLE NO.	BH08
SHEET	Sheet 1 of 1
CO-ORDINATES	
GROUND LEVEL (m AOD)	
RIG TYPE	Dando 2000
BOREHOLE DIAMETER (mm)	200
BOREHOLE DEPTH (m)	3.40
DATE COMMENCED	14/05/2023
DATE COMPLETED	14/05/2023
CLIENT	Monaghan Co.Co.
ENGINEER	DBFL
SPT HAMMER REF. NO.	
ENERGY RATIO (%)	
BORED BY	P.Allan
PROCESSED BY	F.C

Description	Legend	Elevation	Depth (m)	Samples: Ref. Number	Sample Type	Depth (m)	Recovery	Field Test Results	Standpipe Details
TOPSOIL			0.30						
Firm brown sandy SILT/CLAY with occasional gravel				AA192945	B	0.50			
				AA192946	B	1.00		N = 12 (1, 2, 2, 2, 3, 5)	
			1.80						
Stiff to very stiff grey sandy gravelly CLAY with occasional cobbles				AA192947	B	2.00		N = 29 (2, 3, 3, 10, 10, 6)	
								N = 50/150 mm (10, 15, 25, 25)	
			3.40					N = 50/75 mm (34, 25, 50)	
Obstruction End of Borehole at 3.40 m									

HARD STRATA BORING/CHISELLING

From (m)	To (m)	Time (h)	Comments
2.6	2.8	0.75	
3.2	3.4	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

Appendix II Rotary Core Logs Photographs

GEOTECHNICAL CORE LOG RECORD

REPORT NUMBER 24665

CONTRACT	Monaghan Active Travel - Main Site	**DRILLHOLE NO**	**RC02**
		SHEET	Sheet 1 of 2
CO-ORDINATES		**DATE DRILLED**	25/05/2023
GROUND LEVEL (mOD)		**DATE LOGGED**	25/05/2023
RIG TYPE	Beretta T44	**DRILLED BY**	IGSL - JK
FLUSH	Air/Mist	**LOGGED BY**	D.O'Shea
CLIENT	Monaghan Co.Co.	**INCLINATION (deg)**	-90
ENGINEER	CORA	**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		0	0	0				SYMMETRIX DRILLING: No recovery, observed by driller as returns of soft CLAY.				
1	1.50											
2		0	0	0								
3	3.00	0	0	0								N = 24 (3, 2, 4, 7, 7, 6)
4	4.50								4.50			
		0	0	0				SYMMETRIX DRILLING: No recovery, observed by driller as returns of gravelly CLAY with occasional cobbles				N = 53 (7, 7, 11, 10, 15, 17)
5												
6	6.00	0	0	0								N = 43 (4, 6, 10, 10, 10, 13)
7	7.50	0	0	0								N = 51 (17, 9, 11, 13, 13, 14)
8												
9	9.00	0	0	0								N = 51/102 mm (7, 18, 33, 18)

REMARKS

Hole cased from 0.00-10.50m

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
25-05-23	10.50	1.00	10.50	50mm SP

GROUNDWATER DETAILS

Date	Hole Depth	Casing Depth	Depth to Water	Comments

GEOTECHNICAL CORE LOG RECORD

REPORT NUMBER 24665

CONTRACT	Monaghan Active Travel - Main Site	**DRILLHOLE NO**	**RC02**
		SHEET	Sheet 2 of 2
CO-ORDINATES		**DATE DRILLED**	25/05/2023
GROUND LEVEL (mOD)		**DATE LOGGED**	25/05/2023
CLIENT	Monaghan Co.Co.	**DRILLED BY**	IGSL - JK
ENGINEER	CORA	**LOGGED BY**	D.O'Shea

RIG TYPE	Beretta T44
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)
10	10.50							SYMMETRIX DRILLING: No recovery, observed by driller as returns of gravelly CLAY with occasional cobbles *(continued)*	10.50			N = 48 (6, 8, 11, 12, 12, 13)
								End of Borehole at 10.50 m				
11												
12												
13												
14												
15												
16												
17												
18												
19												

REMARKS

Hole cased from 0.00-10.50m

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
25-05-23	10.50	1.00	10.50	50mm SP

GROUNDWATER DETAILS

Date	Hole Depth	Casing Depth	Depth to Water	Comments

GEOTECHNICAL CORE LOG RECORD

REPORT NUMBER 24665

CONTRACT	Monaghan Active Travel - Main Site	**DRILLHOLE NO**	**RC03**
		SHEET	Sheet 1 of 2
CO-ORDINATES		**DATE DRILLED**	26/05/2023
GROUND LEVEL (mOD)		**DATE LOGGED**	28/05/2023
CLIENT	Monaghan Co.Co.	**DRILLED BY**	IGSL - JK
ENGINEER	CORA	**LOGGED BY**	D.O'Shea

RIG TYPE	Beretta T44
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 gravelly CLAY with occasional cobbles				
1												
2												
3												N = 57 (9, 13, 17, 11, 15, 14)
4		0	0	0								
												N = 50 (5, 11, 10, 17, 11, 12)
5												
6												N = 47 (4, 7, 9, 9, 14, 15)
7												N = 53 (4, 11, 11, 13, 13, 16)
8	8.10							Returns of stiff to very stiff, dark brown, slightly sandy, gravelly CLAY, with occasional cobbles. Sand is fine. Gravel is angular to subrounded fine to coarse of limestone. Cobbles are of limestone.	8.10			
		100	0	0								
9	9.10											N = 50 (8, 11, 12, 13, 10, 15)
		71	0	0								

REMARKS

Hole cased from 0.00-8.00m

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

GEOTECHNICAL CORE LOG RECORD

REPORT NUMBER 24665

CONTRACT	Monaghan Active Travel - Main Site	**DRILLHOLE NO**	**RC03**
		SHEET	Sheet 2 of 2
CO-ORDINATES		**DATE DRILLED**	26/05/2023
GROUND LEVEL (mOD)		**DATE LOGGED**	28/05/2023
CLIENT	Monaghan Co.Co.	**DRILLED BY**	IGSL - JK
ENGINEER	CORA	**LOGGED BY**	D.O'Shea

RIG TYPE	Beretta T44
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)
10												
	10.50								10.50			
								End of Borehole at 10.50 m				
11												
12												
13												
14												
15												
16												
17												
18												
19												

REMARKS

Hole cased from 0.00-8.00m

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
29-05-23	10.50	8.00	10.40	Water levels recorded 5 mins after end of drilling.

GEOTECHNICAL CORE LOG RECORD

REPORT NUMBER 24665

CONTRACT	Monaghan Active Travel - Main Site	**DRILLHOLE NO**	**RC06**
		SHEET	Sheet 1 of 2
CO-ORDINATES		**DATE DRILLED**	23/05/0223
GROUND LEVEL (mOD)		**DATE LOGGED**	23/05/2023
CLIENT	Monaghan Co.Co.	**DRILLED BY**	IGSL - JK
ENGINEER	CORA	**LOGGED BY**	D.O'Shea

RIG TYPE	Beretta T44
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 – 1	1.50	0	0	0				SYMMETRIX DRILLING: No recovery, observed by driller as returns of CLAY.	1.50			
2	2.60	73	0	0				Returns of stiff to very stiff, dark brown, slightly sandy, gravelly CLAY, with occasional cobbles. Sand is fine. Gravel is angular to subrounded fine to coarse of limestone. Cobbles are of limestone.	2.60			
3	4.00	0	0	0				SYMMETRIX DRILLING: No recovery, observed by driller as returns of gravelly CLAY with occasional cobbles				N = 57 (13, 12, 27, 11, 9, 10)
4 – 5	5.50	100	0	0								N = 55 (6, 17, 18, 11, 12, 14)
6	7.00	0	0	0								N = 44 (5, 7, 10, 11, 10, 13)
7 – 8	8.50	0	0	0								N = 46 (8, 9, 8, 14, 13, 11)
9	10.00	0	0	0								N = 10/75 mm (7, 14, 10)

REMARKS

Hole cased from 0.00-15.00m

WATER STRIKE DETAILS

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

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 24665

CONTRACT	Monaghan Active Travel - Main Site	**DRILLHOLE NO**	**RC06**
		SHEET	Sheet 2 of 2
CO-ORDINATES		**DATE DRILLED**	23/05/0223
GROUND LEVEL (mOD)		**DATE LOGGED**	23/05/2023
RIG TYPE	Beretta T44		
FLUSH	Air/Mist		
CLIENT	Monaghan Co.Co.	**DRILLED BY**	IGSL - JK
ENGINEER	CORA	**LOGGED BY**	D.O'Shea
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)
10 11	11.50	0	0	0				SYMMETRIX DRILLING: No recovery, observed by driller as returns of gravelly CLAY with occasional cobbles *(continued)*				N = 46 (4, 11, 12, 9, 11, 14)
12	13.00	0	0	0								N = 55 (15, 16, 19, 11, 12, 13)
13	13.50	0	0	0					13.50			
14	15.00	100	0	0				Returns of stiff to very stiff, dark brown, slightly sandy, gravelly CLAY, with occasional cobbles. Sand is fine. Gravel is angular to subrounded fine to coarse of limestone. Cobbles are of limestone.	15.00			N = 50/32 mm (25, 50)
15 16 17 18 19								End of Borehole at 15.00 m				

REMARKS

Hole cased from 0.00-15.00m

WATER STRIKE DETAILS

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

GROUNDWATER DETAILS

Date	Hole Depth	Casing Depth	Depth to Water	Comments
23-05-23	15.00	15.00	13.40	Water levels recorded 5 mins after end of drilling.

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type

RC03 – Box 1 of 1 – 8.10-10.50m

RC06 – Box 1 of 1 – 1.50-15.00m

Appendix III Trial Pit Records Photographs

TRIAL PIT RECORD

REPORT NUMBER 24665

CONTRACT	Monaghan Active Travel	**TRIAL PIT NO.**	**TP01**
		SHEET	Sheet 1 of 1
LOGGED BY	I.Reder	**DATE STARTED**	28/04/2023
CO-ORDINATES	667,406.85 E 833,817.07 N	**DATE COMPLETED**	28/04/2023
GROUND LEVEL (m)	72.34	**EXCAVATION METHOD**	3T Tracked machine
CLIENT	Monaghan Co.Co.		
ENGINEER	DBFL/Cora		

	Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples			Vane Test (KPa)	Hand Penetrometer (KPa)
						Sample Ref	Type	Depth		
0.0	TOPSOIL		0.25	72.09						
	Firm, greyish brown to brown, slightly sandy gravelly CLAY with medium cobbles content. Sand is fine to coarse, gravel is fine to coarse subangular to subrounded, cobbles are small to coarse subangular to subrounded		0.90	71.44		AA200193	B	0.70		
1.0	Firm to stiff, grey, slightly sandy gravelly slightly 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 angular.		1.80	70.54		AA200194	B	1.60		
	TP terminated at 1.8m due to many boulders End of Trial Pit at 1.80m									
2.0										
3.0										
4.0										

Groundwater Conditions
TP dry

Stability
TP stable

General Remarks
TP done for civic offices project

TRIAL PIT RECORD

REPORT NUMBER

24665

CONTRACT	Monaghan Active Travel	**TRIAL PIT NO.**	**TP02**
		SHEET	Sheet 1 of 1
LOGGED BY	I.Reder	**CO-ORDINATES**	667,417.94 E 833,782.52 N
CLIENT	Monaghan Co.Co.	**GROUND LEVEL (m)**	69.34
ENGINEER	DBFL/Cora	**DATE STARTED**	27/04/2023
		DATE COMPLETED	27/04/2023
		EXCAVATION METHOD	3T Tracked machine

	Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples			Vane Test (KPa)	Hand Penetrometer (KPa)
						Sample Ref	Type	Depth		
0.0	TOPSOIL		0.25	69.09						
	Soft to firm, brown, slightly sandy slighlty gravelly CLAY with low cobbles content. Sand is fine to coarse, gravel is fine to coarse subangular to subrounded, cobbles are small subangular to subrounded.		0.55	68.79						
	Dense, brownish grey, very clayey very sandy fine to coarse subrounded to subangular GRAVEL with high subangular to angular cobbles and boulders content.					AA200181	B	0.80		
1.0			1.40	67.94						
	TP terminated at 1.4m due to many boulders End of Trial Pit at 1.40m									
2.0										
3.0										
4.0										

Groundwater Conditions

TP dry

Stability

TP slightly unstable from 0.55m

General Remarks

TP done for civic offices project

TRIAL PIT RECORD

REPORT NUMBER 24665

CONTRACT	Monaghan Active Travel	**TRIAL PIT NO.**	**TP03**
		SHEET	Sheet 1 of 1
LOGGED BY	I.Reder	**DATE STARTED**	27/04/2023
CO-ORDINATES	667,451.08 E 833,766.18 N	**DATE COMPLETED**	27/04/2023
GROUND LEVEL (m)	72.15	**EXCAVATION METHOD**	3T Tracked machine
CLIENT	Monaghan Co.Co.		
ENGINEER	DBFL/Cora		

	Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples			Vane Test (KPa)	Hand Penetrometer (KPa)
						Sample Ref	Type	Depth		
0.0	TOPSOIL		0.20	71.95						
	Soft, brown, sandy slighlty gravelly CLAY with low cobbles content. Sand is fine to coarse, gravel is fine to coarse subangular to subrounded, cobbles are small subangular to subrounded.		0.80	71.35		AA200179	B	0.60		
1.0	Firm to stiff, greyish brown, slightly sandy gravelly slightly 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 angular.		1.70	70.45		AA200180	B	1.50		
2.0 3.0 4.0	TP terminated at 1.7m due to many boulders End of Trial Pit at 1.70m									

Groundwater Conditions
TP dry

Stability
TP stable

General Remarks
TP done for civic offices project

IGSL TP LOG 24665.GPJ IGSL.GDT 10/5/23

TRIAL PIT RECORD

REPORT NUMBER	24665		
CONTRACT	Monaghan Active Travel	**TRIAL PIT NO.**	**TP04**
		SHEET	Sheet 1 of 1
LOGGED BY	I.Reder	**DATE STARTED**	28/04/2023
CO-ORDINATES	667,481.57 E 833,781.44 N	**DATE COMPLETED**	28/04/2023
GROUND LEVEL (m)	73.74	**EXCAVATION METHOD**	3T Tracked machine
CLIENT	Monaghan Co.Co.		
ENGINEER	DBFL/Cora		

	Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples Sample Ref	Type	Depth	Vane Test (KPa)	Hand Penetrometer (KPa)
0.0	TOPSOIL		0.10	73.64						
	Firm, brown, slightly 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 subangular to angular. (POSSIBLE FILL)		0.60	73.14		AA200184	B	0.50		
1.0	Firm to stiff, greyish brown, sandy gravelly slightly 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 angular.		1.80	71.94		AA200185	B	1.30		
2.0	TP terminated at 1.8m due to many boulders End of Trial Pit at 1.80m									
3.0										
4.0										

Groundwater Conditions
TP dry

Stability
TP stable

General Remarks
TP done for civic offices project

TRIAL PIT RECORD

REPORT NUMBER 24665

CONTRACT	Monaghan Active Travel	**TRIAL PIT NO.**	**TP05**
		SHEET	Sheet 1 of 1
LOGGED BY	I.Reder	**DATE STARTED**	28/04/2023
CO-ORDINATES	667,507.95 E 833,782.70 N	**DATE COMPLETED**	28/04/2023
GROUND LEVEL (m)	69.54	**EXCAVATION METHOD**	3T Tracked machine
CLIENT	Monaghan Co.Co.		
ENGINEER	DBFL/Cora		

	Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples			Vane Test (KPa)	Hand Penetrometer (KPa)
						Sample Ref	Type	Depth		
0.0	TOPSOIL		0.20	69.34						
	Soft, brown, slightly sandy slighlty gravelly CLAY. Sand is fine to coarse, gravel is fine to coarse subangular to subrounded.		0.50	69.04						
	Firm to stiff, brownish grey, slightly sandy 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.					AA200182	B	0.70		
1.0						AA200183	B	1.70		
2.0			2.10	67.44						
	TP terminated at 2.1m due to many boulders End of Trial Pit at 2.10m									
3.0										
4.0										

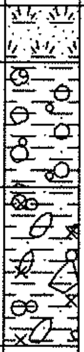
Groundwater Conditions
TP dry

Stability
TP stable

General Remarks
TP done for civic offices project

TRIAL PIT RECORD

REPORT NUMBER	24665
CONTRACT	Monaghan Active Travel
TRIAL PIT NO.	**TP06**
SHEET	Sheet 1 of 1
LOGGED BY	I.Reder
CO-ORDINATES	667,474.33 E 833,810.79 N
GROUND LEVEL (m)	74.34
DATE STARTED	28/04/2023
DATE COMPLETED	28/04/2023
CLIENT	Monaghan Co.Co.
ENGINEER	DBFL/Cora
EXCAVATION METHOD	3T Tracked machine

	Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples			Vane Test (KPa)	Hand Penetrometer (KPa)
						Sample Ref	Type	Depth		
0.0	TOPSOIL		0.25	74.09						
	Firm, brown, slightly sandy slightly gravelly CLAY with low cobbles content. Sand is fine to coarse, gravel is fine to coarse subangular to subrounded, cobbles are subangular to subrounded.		0.80	73.54		AA200186	B	0.70		
1.0	Firm to stiff, greyish brown, slightly sandy gravelly slightly 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 angular.		1.50	72.84	1 (Seepage)	AA200187	B	1.40		
2.0 3.0 4.0	TP terminated at 1.5m due to many boulders End of Trial Pit at 1.50m									

Groundwater Conditions
Seepage flow at 1.0m

Stability
TP stable

General Remarks
TP done for civic offices project

TRIAL PIT RECORD

REPORT NUMBER	24665		
CONTRACT	Monaghan Active Travel	**TRIAL PIT NO.**	TP07
		SHEET	Sheet 1 of 1
LOGGED BY	I.Reder	**DATE STARTED**	28/04/2023
CO-ORDINATES	667,458.22 E 833,833.25 N	**DATE COMPLETED**	28/04/2023
GROUND LEVEL (m)	75.79	**EXCAVATION METHOD**	3T Tracked machine
CLIENT	Monaghan Co.Co.		
ENGINEER	DBFL/Cora		

Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples			Vane Test (KPa)	Hand Penetrometer (KPa)
					Sample Ref	Type	Depth		
TOPSOIL		0.25	75.54						
Soft, brown, slightly sandy slighlty gravelly CLAY with some hair roots. Sand is fine to coarse, gravel is fine to coarse subangular to subrounded.		0.60	75.19		AA200188	B	0.50		
Soft to firm, greyish brown, very sandy gravelly CLAY with medium cobbles content. Sand is fine to coarse, gravel is fine to coarse subangular to subrounded, cobbles are small subangular to angular. (Possible very clayey gravelly sand).		1.50	74.29		AA200189	B	1.30		
Firm to stiff, brown, slightly 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 angular.		1.90	73.89		AA200190	B	1.80		
TP terminated at 1.9m due to many boulders End of Trial Pit at 1.90m									

Groundwater Conditions
TP dry

Stability
TP stable

General Remarks
TP done for civic offices project

TRIAL PIT RECORD

REPORT NUMBER	24665				
CONTRACT	Monaghan Active Travel			**TRIAL PIT NO.**	**TP08**
				SHEET	Sheet 1 of 1
LOGGED BY	I.Reder	**CO-ORDINATES**	667,426.80 E 833,858.25 N	**DATE STARTED**	28/04/2023
				DATE COMPLETED	28/04/2023
CLIENT	Monaghan Co.Co.	**GROUND LEVEL (m)**	79.90	**EXCAVATION METHOD**	3T Tracked machine
ENGINEER	DBFL/Cora				

	Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples			Vane Test (KPa)	Hand Penetrometer (KPa)
						Sample Ref	Type	Depth		
0.0	TOPSOIL		0.25	79.65						
	Soft to firm, brown, slightly sandy gravelly CLAY with low cobbles and hair roots content. Sand is fine to coarse, gravel is fine to coarse subangular to subrounded, cobbles are small subangular to subrounded.		0.50	79.40						
	Firm to stiff, greyish brown, slightly 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 angular.					AA200195	B	0.80		
1.0										
						AA200196	B	1.80		
2.0			2.20	77.70						
	TP terminated at 2.2m due to many boulders End of Trial Pit at 2.20m									
3.0										
4.0										

Groundwater Conditions
TP dry

Stability
TP stable

General Remarks
TP done for civic offices project

TRIAL PIT RECORD

REPORT NUMBER	24665		
CONTRACT	Monaghan Active Travel	**TRIAL PIT NO.**	**TP09**
		SHEET	Sheet 1 of 1
LOGGED BY	I.Reder	**DATE STARTED**	28/04/2023
CO-ORDINATES	667,477.14 E 833,842.01 N	**DATE COMPLETED**	28/04/2023
GROUND LEVEL (m)	75.17	**EXCAVATION METHOD**	3T Tracked machine
CLIENT	Monaghan Co.Co.		
ENGINEER	DBFL/Cora		

	Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples			Vane Test (KPa)	Hand Penetrometer (KPa)
						Sample Ref	Type	Depth		
0.0	TOPSOIL		0.25	74.92						
	Soft, brown, slightly sandy slightly gravelly CLAY with hair roots content. Sand is fine to coarse, gravel is fine to coarse subangular to subrounded.		0.50	74.67						
1.0	Firm to stiff, greyish brown, slightly sandy gravelly slightly 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 angular.		1.50	73.67		AA200191	B	0.70		
	TP terminated at 1.5m due to many boulders End of Trial Pit at 1.50m					AA200192	B	1.50		
2.0										
3.0										
4.0										

Groundwater Conditions
TP dry

Stability
TP stable

General Remarks
TP done for civic offices project

TRIAL PIT RECORD

REPORT NUMBER	24665		
CONTRACT	Monaghan Active Travel	**TRIAL PIT NO.**	**TP10**
		SHEET	Sheet 1 of 1
LOGGED BY	I.Reder	**DATE STARTED**	28/04/2023
CO-ORDINATES	667,449.28 E 833,875.03 N	**DATE COMPLETED**	28/04/2023
GROUND LEVEL (m)	81.69	**EXCAVATION METHOD**	3T Tracked machine
CLIENT	Monaghan Co.Co.		
ENGINEER	DBFL/Cora		

	Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples			Vane Test (KPa)	Hand Penetrometer (KPa)
						Sample Ref	Type	Depth		
0.0	TOPSOIL									
	Soft, brown, slightly sandy slightly gravelly CLAY with hair roots content. Sand is fine to coarse, gravel is fine to coarse subangular to subrounded.		0.30	81.39						
	Stiff to very stiff, greyish brown to brown, slightly sandy 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 subangular to angular.		0.50	81.19		AA200197	B	0.60		
1.0										
						AA200198	B	1.60		
2.0										
	End of Trial Pit at 2.50m		2.50	79.19		AA200199	B	2.50		
3.0										
4.0										

Groundwater Conditions
TP dry

Stability
TP stable

General Remarks
TP done for civic offices project

TRIAL PIT RECORD

REPORT NUMBER	24665		
CONTRACT	Monaghan Active Travel	**TRIAL PIT NO.**	**TP11**
		SHEET	Sheet 1 of 1
LOGGED BY	I.Reder	**DATE STARTED**	28/04/2023
CO-ORDINATES	667,482.17 E 833,886.75 N	**DATE COMPLETED**	28/04/2023
GROUND LEVEL (m)	76.84	**EXCAVATION METHOD**	3T Tracked machine
CLIENT	Monaghan Co.Co.		
ENGINEER	DBFL/Cora		

	Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples			Vane Test (KPa)	Hand Penetrometer (KPa)
						Sample Ref	Type	Depth		
0.0	TOPSOIL		0.20	76.64						
1.0	Soft to firm, brown/grey mottled, slightly sandy slightly gravelly CLAY with low cobbles content. Sand is fine to coarse, gravel is fine to coarse subangular to subrounded, cobbles are small subangular to subrounded.		1.10	75.74		AA205152	B	0.70		
2.0	Firm to stiff, greyish brown, slightly sandy gravelly CLAY with medium cobbles and low boulders content. Sand is fine to coarse, gravel is fine to coarse subangular to subrounded, cobbles and boulders are subangular to angular.		2.30	74.54		AA205153 AA205154	B B	1.50 2.20		
3.0 4.0	TP terminated at 2.3m due to many boulders End of Trial Pit at 2.30m									

Groundwater Conditions
TP dry

Stability
TP stable

General Remarks
TP done for civic offices project

TRIAL PIT RECORD

REPORT NUMBER 24665

CONTRACT	Monaghan Active Travel	**TRIAL PIT NO.**	**TP12**
		SHEET	Sheet 1 of 1
LOGGED BY	I.Reder	**DATE STARTED**	04/05/2023
CO-ORDINATES	667,491.71 E 833,909.43 N	**DATE COMPLETED**	04/05/2023
GROUND LEVEL (m)	77.46	**EXCAVATION METHOD**	3T Tracked machine
CLIENT	Monaghan Co.Co.		
ENGINEER	DBFL/Cora		

	Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples			Vane Test (KPa)	Hand Penetrometer (KPa)
						Sample Ref	Type	Depth		
0.0	TOPSOIL		0.30	77.16						
	Soft, brown, slightly sandy slightly slightly gravelly CLAY with hair roots content. Sand is fine to coarse, gravel is fine to coarse subangular to subrounded.		0.55	76.91						
	Soft to firm, greyish brown , slightly sandy slightly gravelly CLAY with low cobbles content. Sand is fine to coarse, gravel is fine to coarse subangular to subrounded, cobbles are small subangular to subrounded.		1.00	76.46		AA205178	B	0.80		
1.0	Soft to firm, greyish brown , slightly sandy very gravelly CLAY with high cobbles and boulders content. Sand is fine to coarse, gravel is fine to coarse subangular to angular, cobbles and boulders are subangular to angular. (possible very clayey angular gravel and cobbles)		1.80	75.66		AA205179	B	1.70		
	TP terminated at 1.8m due to boulders or rock End of Trial Pit at 1.80m									
2.0										
3.0										
4.0										

Groundwater Conditions
TP dry

Stability
TP stable

General Remarks
TP done for civic offices project

TRIAL PIT RECORD

REPORT NUMBER 24665

CONTRACT	Monaghan Active Travel	**TRIAL PIT NO.**	**TP13**
		SHEET	Sheet 1 of 1
LOGGED BY	I.Reder	**DATE STARTED**	04/05/2023
CO-ORDINATES	667,464.88 E 833,929.00 N	**DATE COMPLETED**	04/05/2023
CLIENT	Monaghan Co.Co.	**GROUND LEVEL (m)**	83.28
ENGINEER	DBFL/Cora	**EXCAVATION METHOD**	3T Tracked machine

Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples: Sample Ref	Samples: Type	Samples: Depth	Vane Test (KPa)	Hand Penetrometer (KPa)
TOPSOIL		0.20	83.08						
Soft, brown, slightly sandy slightly slightly gravelly CLAY with hair roots content. Sand is fine to coarse, gravel is fine to coarse subangular to subrounded.		0.50	82.78						
Firm to stiff, greyish brown, slightly sandy slightly gravelly CLAY with low cobbles and boulders content. Sand is fine to coarse, gravel is fine to coarse subangular to subrounded, cobbles and boulders are subangular to subrounded.		1.40	81.88		AA205173	B	0.60		
TP terminated at 1.4m due to many boulders End of Trial Pit at 1.40m					AA205174	B	1.40		

Groundwater Conditions
TP dry

Stability
TP stable

General Remarks
TP done for civic offices project

TRIAL PIT RECORD

REPORT NUMBER 24665

CONTRACT	Monaghan Active Travel	**TRIAL PIT NO.**	**TP14**
		SHEET	Sheet 1 of 1
LOGGED BY	I.Reder	**DATE STARTED**	04/05/2023
CO-ORDINATES	667,490.90 E 833,949.34 N	**DATE COMPLETED**	04/05/2023
GROUND LEVEL (m)	80.90	**EXCAVATION METHOD**	3T Tracked machine
CLIENT	Monaghan Co.Co.		
ENGINEER	DBFL/Cora		

	Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples			Vane Test (KPa)	Hand Penetrometer (KPa)
						Sample Ref	Type	Depth		
0.0	TOPSOIL		0.20	80.70						
	Soft to firm, brown, slightly sandy slightly slightly gravelly CLAY with hair roots content. Sand is fine to coarse, gravel is fine to coarse subangular to subrounded.		0.50	80.40						
	Firm to stiff, greyish brown, slightly sandy gravelly CLAY with low 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.					AA205175	B	0.70		
1.0						AA205176	B	1.50		
2.0			2.10	78.80						
	TP terminated at 2.1m due to many boulders End of Trial Pit at 2.10m					AA105177	B	2.10		
3.0										
4.0										

Groundwater Conditions
TP dry

Stability
TP stable

General Remarks
TP done for civic offices project

TRIAL PIT PHOTOGRAPHY RECORD

TP 01

TP 01 – spoil

TRIAL PIT PHOTOGRAPHY RECORD

TP 02

TP 02 – spoil

TRIAL PIT PHOTOGRAPHY RECORD

TP 03

TP 03 – spoil

TRIAL PIT PHOTOGRAPHY RECORD

TP 04

TP 04 – spoil

TRIAL PIT PHOTOGRAPHY RECORD
TP 05

TP 05 – spoil

TRIAL PIT PHOTOGRAPHY RECORD

TP 06

TP 06 – spoil

TRIAL PIT PHOTOGRAPHY RECORD
TP 07

TP 07 – spoil

TRIAL PIT PHOTOGRAPHY RECORD
TP 08

TP 08 – spoil

TRIAL PIT PHOTOGRAPHY RECORD
TP 09

TP 09 – spoil

TRIAL PIT PHOTOGRAPHY RECORD
TP 10

TP 10 – spoil

TRIAL PIT PHOTOGRAPHY RECORD
TP 11

TP 11 – spoil

Project Number: 24665
Site: Monaghan Active Travel
Project Engineer: DBFL/CORA

TRIAL PIT PHOTOGRAPHY RECORD

TP 12

TP 12 – spoil

Project Number: 24665
Site: Monaghan Active Travel
Project Engineer: DBFL/CORA

TRIAL PIT PHOTOGRAPHY RECORD

TP 13

TP 13 – spoil

TRIAL PIT PHOTOGRAPHY RECORD
TP 14

TP 14 – spoil

Appendix IV   BRE Digest 365 Test

Soakaway Design f -value from field tests IGSL

Contract: Monaghan, Active Travel 24665
Test No. SA01
Engineer CORA
Date: 04/05/2023

Summary of ground conditions

from	to	Description	Ground water
0.00	0.25	TOPSOIL	DRY
0.25	0.50	Soft, brown, slightly sandy slightly gravelly CLAY with low hair roots content	
0.50	1.30	Soft to firm, brown/grey mottled, slightly sandy gravelly slightly silty CLAY with high subangular to angular cobbles and boulders content	
1.30		Obstruction - boulders	

Location: E:667491.477; N:833784.047; G.L. 71.944mOD
Notes: SA01 done for Civic Offices project

Field Data

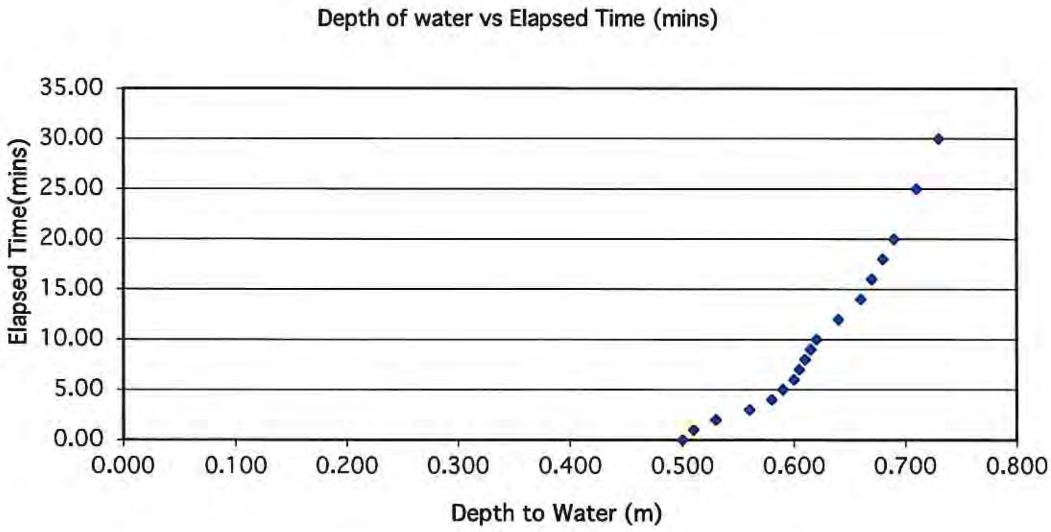
Depth to Water (m)	Elapsed Time (min)
0.500	0.00
0.510	1.00
0.530	2.00
0.560	3.00
0.580	4.00
0.590	5.00
0.600	6.00
0.605	7.00
0.610	8.00
0.615	9.00
0.620	10.00
0.640	12.00
0.660	14.00
0.670	16.00
0.680	18.00
0.690	20.00
0.710	25.00
0.730	30.00

Field Test

Depth of Pit (D)	1.30	m
Width of Pit (B)	0.50	m
Length of Pit (L)	2.00	m
Initial depth to Water =	0.50	m
Final depth to water =	0.73	m
Elapsed time (mins)=	30.00	
Top of permeable soil		m
Base of permeable soil		m
Base area=	1	m2
*Av. side area of permeable stratum over test period	3.425	m2
Total Exposed area =	4.425	m2

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

f= 0.00173 m/min or 2.88763E-05 m/sec



Soakaway Design f -value from field tests

IGSL

Contract: Monaghan, Active Travel

24665

Test No. SA02

Engineer CORA

Date: 04/05/2023

Summary of ground conditions

from	to	Description	Ground water
0.00	0.20	TOPSOIL	DRY
0.20	0.70	Soft to firm, brown, slightly sandy slightly gravelly CLAY with medium cobbles	
0.70	1.60	Firm to stiff, greyish brown, slightly sandy gravelly slightly silty CLAY with low	
		subangular to angular cobbles and boulders content	

Location: E:667480.695; N:833861.983; G.L. 75.647mOD

Notes: SA02 done for Civic Offices project

Field Data

Depth to Water (m)	Elapsed Time (min)
0.600	0.00
0.610	1.00
0.620	2.00
0.630	3.00
0.630	4.00
0.640	5.00
0.640	6.00
0.640	7.00
0.640	8.00
0.640	9.00
0.640	10.00
0.640	12.00
0.640	14.00
0.640	16.00
0.650	18.00
0.660	20.00
0.660	25.00
0.670	30.00
0.670	40.00
0.680	50.00
0.680	60.00

Field Test

Depth of Pit (D)	1.60	m
Width of Pit (B)	0.50	m
Length of Pit (L)	2.00	m
Initial depth to Water =	0.60	m
Final depth to water =	0.68	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	4.8	m2
Total Exposed area =	5.8	m2

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

f= 0.00023 m/min or 3.83142E-06 m/sec