

National Transport Authority Blanchardstown to City Centre Core Bus Corridor Scheme

Ground Investigation Report

268401-00

Issue | 22 December 2021

This report takes into account the particular instructions and requirements of our client.

It is not intended for and should not be relied upon by any third party and no responsibility is undertaken to any third party.

Job number 268401-00

Ove Arup & Partners Ireland Ltd

Arup 50 Ringsend Road Dublin 4 D04 T6X0 Ireland www.arup.com



Contents

			Page
1	Introd	luction	1
	1.1	Project Overview	1
	1.2	Scope and Objective of the Report	3
	1.3	Geotechnical Category of the Project	3
	1.4	Study Area	3
	1.5	Symbols and Abbreviations	4
2	Existi	ng Information	6
	2.1	Sources of Information	6
	2.2	Topography	6
	2.3	Geological Maps and Memoirs	7
	2.4	Historical Maps and Aerial Photos	8
	2.5	Records of Mines and Mineral Deposits	12
	2.6	Land Use Information	12
	2.7	Archaeological and Historical Sites	13
	2.8	Hydrology and Hydrogeology	13
	2.9	Contaminated Land	13
	2.10	Seismicity of the Area	14
3	Field a	and Laboratory Studies	16
	3.1	Historical Ground Investigation	16
	3.2	Recent Ground Investigation	18
4	Prelim	ninary Geotechnical Design Parameters	20
	4.1	Topsoil	20
	4.2	Made Ground	20
	4.3	Cohesive Deposits	22
	4.4	Granular Deposits	25
	4.5	Bedrock	27
	4.6	Stratigraphic Profile	28
	4.7	Groundwater	30
	4.8	Summary of Preliminary Design Parameters	30
5	Geote	chnical Risk Register	32

Appendices

Appendix A

Ground Investigation Layout Plan and Geological Survey Ireland Maps

Appendix B

In-Situ Testing Figures

Appendix C

Laboratory Testing Figures

Appendix D

Factual Ground Investigation Report

Appendix E

Historical Ground Investigation Data

Appendix F

Geotechnical Risk Register

1 Introduction

1.1 Project Overview

The BusConnects Dublin - Core Bus Corridors Infrastructure Works (herein after called the 'CBC Infrastructure Works') involves the development of continuous bus priority infrastructure and improved pedestrian and cycling facilities on 16 radial core corridors in the Greater Dublin Area (GDA), across the local authority jurisdictions of Dublin City Council (DCC), South Dublin County Council (SDCC), Dún Laoghaire-Rathdown County Council (DLRCC), Fingal County Council (FCC), and Wicklow County Council (WCC). Overall, the CBC Infrastructure Works encompasses the delivery of approximately 230km of dedicated bus lanes and 200km of cycle tracks along 16 of the busiest corridors in Dublin.

In June 2018, the National Transport Authority (NTA) published the Core Bus Corridors Project Report. The report was a discussion document outlining proposals for the delivery of a CBC network across Dublin. The 'Blanchardstown to City Centre CBC' (hereinafter also known as the 'Proposed Scheme') is identified in this document as forming part of the Radial Core Bus Network.

The BusConnects radial Core Bus Corridor network is shown in Figure 1.

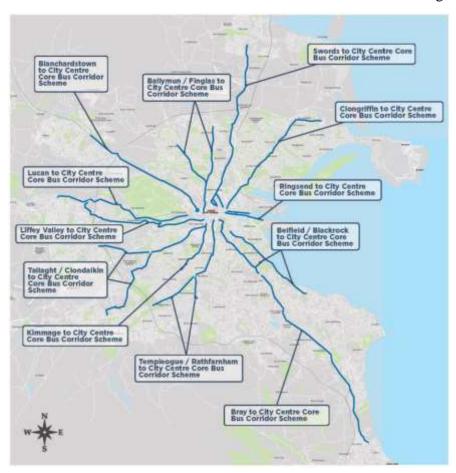


Figure 1: BusConnects Radial CBC Network

This Ground Investigation Report (GIR) has been prepared to inform the Preliminary Design stage of the Proposed Scheme.

The Proposed Scheme commences at Junction 3 (Blanchardstown / Mulhuddart) southbound off-slip from the N3. The Proposed Scheme proceeds along the R121 Blanchardstown Road South into the Blanchardstown Shopping Centre.

From a new terminus to the north-west of Blanchardstown Shopping Centre the Proposed Scheme is routed onto the N3 Navan Road via the Snugborough Road junction and follows the N3 and Navan Road as far as the junction with the Old Cabra Road. From here, the Proposed Scheme is routed along Old Cabra Road, Prussia Street, Manor Street and Stoneybatter to the junction with King Street North. The core bus corridor is then routed via Blackhall Place as far as the junction with Ellis Quay, where it joins the prevailing traffic management regime on the North Quays. At the Stoneybatter / Brunswick Street North junction, cyclists proceed along Brunswick Street North, George's Lane and Queen Street as far as Ellis Quay/Arran Quay.

Refer to Figure 2 for overall layout of the Blanchardstown to City Centre CBC.

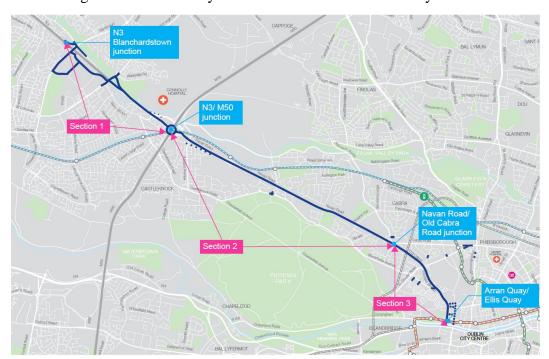


Figure 2: Blanchardstown to City Centre CBC

The Proposed Scheme has been broken into five sections as follows:

- N3 Blanchardstown Junction to Snugborough Road
- Snugborough Road to N3/M50 Junction
- N3/M50 Junction to Navan Road/Ashtown Road Junction
- Navan Road/Ashtown Road Junction to Navan Road/Old Cabra Road Junction
- Navan Road/Old Cabra Road Junction to Ellis Quay

1.2 Scope and Objective of the Report

This GIR has been prepared in accordance with IS EN 1997-1:2005 'Eurocode 7: Geotechnical Design – Part 1: General Rules' and. IS EN 1997-2: 2007 'Eurocode 7: Geotechnical Design – Part 2: Ground Investigation and testing'. This GIR contains information for the Proposed Scheme only.

The purpose of the GIR is to:

- Present a review of desk study and existing ground investigation information relevant to the project.
- Summarise details of the existing ground investigations undertaken and the available geotechnical information.
- Present the interpreted ground conditions and material properties for the main geological units encountered across the scheme.

This GIR has been prepared for the purposes of informing the preliminary design only and is not intended to be used for detailed design.

1.3 Geotechnical Category of the Project

The project has been identified as a Geotechnical Category 2 scheme in accordance with IS EN 1997-1:2004. Geotechnical Category 2 is defined as a project which includes "conventional types of geotechnical structures, earthworks and activities, with no exceptional geotechnical risks, unusual or difficult ground conditions or loading conditions".

1.4 Study Area

The study area includes the proposed alignment and the immediate surrounding area, as shown in the site location plans presented in Appendix A.

Structures in the study area are listed below:

- Retaining Walls
 - o Retaining Wall 01 (RW01), 270m long and max 3.0m height approximate ITM coordinates 706861:E, 739684:N
 - Retaining Wall 03 (RW03), 100m long and max 4.0m height approximate ITM coordinates 709301:E, 737937:N
 - Retaining Wall 07A (RW07A), 100m long and max 1.5 height approximate ITM coordinates 710202:E, 737440:N
 - o Retaining Wall 07B (RW07B), 250m long and max 3.0m height approximate ITM coordinates 710202:E, 737440:N
 - Retaining Wall 09 (RW09), approximate ITM coordinates 708752:E, 738337:N. RW09
- Bridges
 - O Tolka River Bridge Widening (BR01), approximate ITM coordinates 708240:E, 738731:N

 Mill Road Bridge Widening (BR02), approximate ITM coordinates 707796:E, 739014:N

1.5 Symbols and Abbreviations

The following symbols and abbreviations are used to define the ground properties:

NMC – Natural moisture content, as encountered on-site in the soil, in %

MC – Moisture content, in %

LL – Liquid Limit, in %

PL – Plastic Limit, in %

 I_p - the soils plasticity index

*c*_u− undrained shear strength, in kPa

f' – effective angle of shearing resistance, in degrees

 f'_p – peak effective angle of shearing resistance, in degrees

 f'_{cv} is the soils constant volume angle of shearing resistance, in degrees

 f'_{dil} is the contribution to φ'_{pk} from soil dilatancy, in ° (degrees)

c' – drained cohesion, in kPa

 γ –unit weight density, in kN/m³

 γ ' –submerged unit weight density, in kN/m³

 γ_{sat} –submerged unit weight density, in kN/m³

 γ_b –bulk unit weight density, in kN/m³

 m_v – Coefficient of volume compressibility, in m²/MN

E – Young modulus, Elastic modulus, in MPa

 E_{uv} – Undrained elastic modulus, in MPa

 E'_{v} – Drained Young modulus, in MPa

M – Constrained modulus, in MPa

u – Poisson's ratio, unitless

SPT – Standard Penetration Test, results expressed using "N"

N – uncorrected SPT readings, in blows/300mm.

CBR – California Bearing Ratio, results expressed in %

DCP – Dynamic Cone Penetrometer

DPH – Dynamic Probe Heavy, results expressed using "N₁₀₀"

$$\label{eq:DPSH-Dynamic} \begin{split} DPSH-Dynamic \ Probe \ Super-Heavy, \ results \ expressed \ using \ ``N_{100}'' \\ N_{100} \ - \ in \ blows/100mm. \end{split}$$

2 Existing Information

2.1 Sources of Information

The site setting and geotechnical information for the site were interpreted from both publicly available information and from the site specific ground investigation carried out from October 2020 to March in 2021 by GII Ltd. (Project No:9754-07-20 R5, Rev D, 18.June.2021). The project specific ground investigation report is given in Appendix D.

The publicly available sources of information reviewed are as follows:

- Geological Survey of Ireland (GSI) (<u>www.gsi.ie</u>):
 - o Bedrock map;
 - Quaternary Sediments;
 - Quaternary Geomorphology;
 - o GeoUrban Unconsolidated Sediments;
 - GeoUrban Depth to Bedrock;
 - o Groundwater Aquifer;
 - o Groundwater Recharge Map;
 - Groundwater well database;
 - o Groundwater vulnerability;
 - o Subsoil Permeability Map
 - Karst landforms database;
 - o Mineral locations map;
 - o Quarry locations map;
 - Historical Geotechnical boreholes.
- Environmental Protection Agency (EPA) Map Viewer (https://gis.epa.ie/EPAMaps/):
 - o Soils (National);
 - o Subsoils (National);
 - River Waterbodies
- Aerial images and mapping:
 - Ordnance Survey of Ireland (http://map.geohive.ie/mapviewer.html) mapping;
 - Bing maps (www.bing.com/maps) aerial photography and mapping (licensed); and
 - Google maps (www.google.com/maps) aerial photography online mapping.
- Rivers of Dublin (C.L. Sweeney, 1991)

2.2 Topography

The EPA contour map shows that the alignment slopes from approximately 60m OD at Blanchardstown Road down to 40m OD at Old Cabra Road.

Then, the elevation continues dropping further reaching the 10m OD contour close to River Liffey.

2.3 Geological Maps and Memoirs

2.3.1 Quaternary Sediments

The GSI Quaternary Geomorphology map shows several glacial features, the majority of which are noted at the northern part of the proposed route. A glaciofluvial terrace is present under the N3 at Blanchardstown, immediately north and south of Junction 3. An historic meltwater channel underlies the River Tolka. Hummocky sands and gravels intersect the CBC at the Junction of Blanchardstown Road South and Blakestown Way to the west of Blanchardstown Shopping Centre. Another glaciofluvial terrace intersects the CBC at Junction 2 of the N3 and extends east and west underlying the Tolka River Valley Park and the green urban area north east of Main Street in Blanchardstown. A localised pocket of hummocky sands and gravels is recorded underlying the N3 at Talbot Court south of the N3/M50 Junction. Going further south, a glaciofluvial terrace is present east of the N3/M50 Junction underlying New River Road to River Road. The last glacial feature (glaciofluvial terrace) intersects the CBC along the R805 between King Street North and Blackhall Court.

The GSI Quaternary Subsoil map shows that the alignment is underlain mainly by Till derived from Limestone with localised areas of Gravels derived from Limestone and Alluvium. Along the River Tolka pockets of Gravels derived from Limestone, Alluvial deposits and bedrock subcrop/outcrop are noted. Gravels derived from Limestone intersect the CBC west of Blanchardstown Shopping Centre, at St. Brigid's Church Blanchardstown, at Talbot Court south of the N3/M50 Junction and on the eastern side of the N3/M50 Junction. There is a large pocket of Alluvium which intersects the CBC west of Nephin Road, Cabra. Moving further south towards city centre Gravels derived from Limestone are recorded along King Street North. A pocket of alluvium intercepts the CBC at Hendrick Street to Ellis Quay and the area underlying Croppies Acre Memorial Park. Urban fill is recorded from King Street North to the River Liffey.

The Geological Survey of Ireland (GSI) Quaternary map is presented in Appendix A.

2.3.2 Solid Geology

The GSI Bedrock Geology 100k map states that the rock type along the examined route is calcareous Shale of Tober Colleen Formation and Limestone of Lucan Formation (locally known as Calp Limestone). The Tober Colleen Formation is shown at two locations along the proposed route. The first location is north east of Blanchardstown Shopping Centre.

The second location extends from approximately Mill Road underpass to N3/M50 Junction. The Lucan Formation is shown to be present along the remaining part of the proposed route. The GSI Bedrock Geology 100k map shows two faults crossing the examined route.

The former is noted close to Blanchardstown Shopping Centre and the latter at M50 Junction. An anticline fold structure is shown to intersect the CBC adjacent to Talbot Court south of the Navan Road. The GSI Depth to Bedrock map presents rockhead to typically range from 0 to 10m BGL apart from the northern and southern ends of the alignment where it increases up to 15 and 20m BGL, respectively.

There are no karst features identified within Proposed Scheme in the GSI karst database.

The GSI Bedrock Geology map is presented in Appendix A.

2.4 Historical Maps and Aerial Photos

Historical maps of the site and surrounding area available from the Ordnance Survey of Ireland, have been reviewed to provide historical information for the project. The maps can be viewed online with Ordnance Survey Ireland's map viewer (http://map.geohive.ie/mapviewer.html). The following maps have been studied:

- Ordnance Survey of Ireland (OSI) 6-inch mapping series, 1:5000, 1837-1842.
- Ordnance Survey of Ireland (OSI) 25-inch mapping series, 1:5000, 1888-1913.
- Ordnance Survey of Ireland (OSI) 6-inch Cassini mapping series, 1:5000, 1830-1930.
- Ordnance Survey of Ireland (OSI) 1995 aerial photography
- Ordnance Survey of Ireland (OSI) 2000 aerial photography
- Ordnance Survey of Ireland (OSI) 2005 aerial photography

N3 Blanchardstown Junction to Snugborough Road

Historically, the OSI 6-inch mapping (between 1837 and 1842) shows agricultural land with a small number of scattered developments. Three gravel pits are located on the eastern bank of the River Tolka and to the north of Snugborough Road. Another gravel pit is located beneath the current footprint of the Snugborough Road bridge over the N3.

The OSI 25-inch mapping (between 1888 and 1913) shows no notable increase in development within the study area, however the 6-inch Cassini shows a small increase in development including the Coolmine Cottages to the north of the N3 Junction 3.

It should be noted that the 1995 OSI aerial photography is in black and white and of poor resolution.

Significant urban development is recorded in the study area with large housing estates located to the north west of the R121 (Blanchardstown Road South) and to the north east of the Tolka River. The construction of the Blanchardstown Centre is also evident.

The 2000 OSI aerial photography shows an increase in residential development to the north and west of the N3 Junction 3 as well as the constructed Blanchardstown Centre.

The 2005 OSI aerial photography imagery shows further residential development to the north and west of the N3 Junction 3.

The 2019 Google Maps aerial imagery shows no notable change in land use from the OSI 2005 aerial photography.

Snugborough Road to N3/M50 Junction

Historically, the OSI 6-inch mapping (between 1837 and 1842) shows agricultural land with scattered developments mostly in the vicinity of Blanchardstown Village. Four gravel pits are located in the River Tolka Valley Park on the northern bank of the River Tolka and south of Waterville Road. A corn mill was located on the northern bank of the River Tolka at the Mill Road. A worsted mill was located on the northern bank of the Royal Canal on the Old Navan Road. A quarry was located at Ashleigh Green and another quarry was located under the footprint of the N3/M50 Junction roundabout.

The OSI 25-inch mapping (between 1888 and 1913) shows an increase in residential development around Blanchardstown Village and an increase in industrial development around the Royal Canal. The Midland Great Western Railway runs parallel with the Royal Canal west of the N3/M50 Junction. A corn mill was located on the northern bank of the River Tolka at the Mill Road. A Margarine factory was located on the northern bank of the Royal Canal at the Old Navan Road. Disused gravel pits were located on the northern side of the River Tolka at the eastbound N3 slip road and beneath the current footprint of the N3. A gravel pit was located on the northern bank of the River Tolka south of Waterville Road. A quarry was located beneath the footprint of the N3.

It should be noted that the 1995 OSI aerial photography is in black and white and of poor resolution. Significant urban development is recorded in the study area south of the N3. The construction of the M50 is also evident.

The 2000 OSI aerial photography shows an increase in residential development to the south of the N3. A construction site is evident in the land around Tory Square. Connolly Hospital occupies a significant area of land to the north of the N3. The construction of the M50 north and southbound is completed.

The 2005 OSI aerial photography imagery shows further development to the north of the N3 north of Waterville Road and within the grounds of Connolly Hospital.

The 2019 Google Maps aerial imagery shows an increase in road infrastructure around the N3/M50 Junction. Landscaping of Waterville Park is completed with the installation of a pond.

N3/M50 Junction (Junction 6) to Navan Road/Ashtown Road Junction

Historically, the OSI 6-inch mapping (between 1837 and 1842) shows agricultural land with scattered developments. A quarry was located west of Phoenix Park Avenue. An oil mill was located on Mill Lane.

The OSI 25-inch mapping (between 1888 and 1913) shows very little increase in residential development in the study area with notable development in commercial and industrial uses. South of the Navan Road the land use changed from agricultural land to the Phoenix Park Club Racecourse. The Ashtown Oil Mills are located at Mill Lane. The Midland Great Western Railway runs along the bank of the Royal Canal which is within the study area between the N3/M50 Junction (Junction 6) and the Navan Road/Ashtown Road Junction.

The 6-inch Cassini mapping shows further industrial development west of Mill Lane with a Polish factory and Ashtown Tin Box Manufactory. A burial ground was located on River Road east of the M50.

It should be noted that the 1995 OSI aerial photography is in black and white and of poor resolution. Significant urban development is recorded in the study area south of the N3/M50 Junction. The construction of the M50 is also evident.

The 2000 OSI aerial photography shows an increase in residential development to the south of the N3 between the N3/M50 Junction and Castleknock Manor and industrial and commercial development west of Ashtown Road. The Phoenix Racecourse buildings have been demolished and the land within the study area retuned to grassland.

The 2005 OSI aerial photography imagery shows some further development in the study area the most notable of which being the construction site west of Castleknock Road on the site of the former Phoenix Racecourse.

The 2019 Google Maps aerial imagery shows an increase in road infrastructure around the N3/M50 Junction and the increase in development west of Castlenock Road.

Navan Road/Ashtown Road Junction to Navan Road/Old Cabra Road Junction

Historically, the OSI 6-inch mapping (between 1837 and 1842) shows agricultural land with scattered dwellings.

The OSI 25-inch mapping (between 1888 and 1913) shows a slight increase in mixed development throughout the study area. A graveyard was located on the Navan Road at St Joseph's School for Deaf Boys and a military cemetery was located south of Slemish Road

The 6-inch Cassini mapping shows further development particularly between Baggot Road and the Navan Road/Old Cabra Road Junction. The military cemetery is still evident south of Slemish Road.

It should be noted that the 1995 OSI aerial photography is in black and white and of poor resolution. Significant urban development is recorded in the study area. Undeveloped areas include Phoenix Park and Pope John-Paul Park as well as a number of sports grounds.

The 2000 OSI aerial photography shows an increase in residential development east of Kinvara Avenue and commercial development west of Dunard Road.

The 2005 OSI aerial photography imagery shows some no notable further development in the study area compared to the 2000 OSI aerial photography.

The 2019 Google Maps aerial imagery no notable further development in the study area compared to the 2005 OSI aerial photography.

Navan Road/Old Cabra Road Junction to Ellis Quay

Historically, the OSI 6-inch mapping (between 1837 and 1842) shows agricultural land with scattered dwellings between the Navan Road/Old Cabra Road Junction and the North Circular Road. Between the North Circular Road and Brunswick Street North there is an increase in the density of development and between Brunswick Street North and Ellis Quay the area comprises predominantly urban development.

The OSI 25-inch mapping (between 1888 and 1913) shows a significant increase in urban development in the study area, particularly to the south of the Old Cabra Road between North Circular Road and Brunswick Street. The Amiens Street & North Wall Branch railway line transects the Proposed Scheme east of the Navan Road/Old Cabra Road Junction. A tramway transects the Proposed Scheme at North Circular Road. A sawmill was located on Brunswick Street North. A Scavenging Depot and Destructor and a Malt House were located on Stanley Street. A tramway ran from the Scavenging Depot and Destructor on Stanley Street, along North Brunswick Street, Georges Lane and down Queen Street and onto Ellis Quay. A tramway also ran along Ellis Quay. A graveyard was located south of Kings Street North and another west of Ard Ri Place. A cattle market and abattoir were located on the North Circular Road

The 6-inch Cassini mapping shows significant development between the Navan Road/Old Cabra Road Junction and the North Circular Road. The cattle market and abattoir identified on North Circular Road in the OSI 25-inch mapping are also identified on the Cassini mapping.

It should be noted that the 1995 OSI aerial photography is in black and white and of poor resolution. The photo shows an increase in residential development south of the Old Cabra Road Junction and in the place of the cattle market off North Circular Road.

The 2000 OSI aerial photography shows some no notable further development in the study area compared to the 2000 OSI aerial photography.

The 2005 OSI aerial photography imagery shows some no notable further development in the study area compared to the 2000 OSI aerial photography.

The 2019 Google Maps aerial imagery no notable further development in the study area compared to the 2005 OSI aerial photography

Historical maps of the site and surrounding area is presented in Appendix A.

2.5 Records of Mines and Mineral Deposits

The GSI Bedrock Active and Historic Pits and Quarries database states that there are multiple historic quarries and pits which intersect or are near the alignment between Blanchardstown Road and the M50. There are no active quarries or pits shown near the alignment

The GSI Mineral Localities database states that there are no mineral localities within proximity to the alignment with the closest one approximately 850m offset.

GSI Mineral Localities map is presented in Appendix A.

2.6 Land Use Information

N3 Blanchardstown Junction to Snugborough Road

The Corine Land Cover 2018 classifies the land use of the study area between the N3 Blanchardstown Junction to Snugborough Road as a discontinuous urban fabric, with sections being described as industrial-commercial units and green urban areas. The green urban areas include the Tolka Valley Park and Millennium Park located within the study area and the industrial and commercial units area include for the Blanchardstown Shopping Centre. The N3 itself is classified as road and rail network.

Snugborough Road to N3/M50 Junction

The Corine Land Cover 2018 classifies the land use of the study area between Snugborough Road and the N3/M50 Junction as predominantly discontinuous urban fabric. Green urban areas include the Tolka Valley Park and the N3 itself is classified as road and rail network.

N3/M50 Junction (Junction 6) to Navan Road/Ashtown Road Junction

The Corine Land Cover 2018 classifies the land use to the south of the Navan Road between the N3/M50 Junction (Junction 6) and the Navan Road/Ashtown Road Junction as predominately discontinuous urban fabric with a large area north of Deerpark Drive classified as green urban areas. The area to the north of the Navan Road is classified as land principally occupied by agriculture with significant areas of natural vegetation

Navan Road/Ashtown Road Junction to Navan Road/Old Cabra Road Junction

The Corine Land Cover 2018 classifies the land use in the study area between Navan Road/Ashtown Road Junction and Navan Road/Old Cabra Road as predominately discontinuous urban fabric. The area to the south of Blackhorse Avenue is classified as green urban areas.

Navan Road/Old Cabra Road Junction to Ellis Quay

The Corine Land Cover 2018 classifies the land use in the study area between Navan Road/Old Cabra Road Junction and the railway line as predominately discontinuous urban fabric.

The land use between the railway line and Ellis Quay is predominately continuous urban fabric with an area of green urban fabric to the east at TU Dublin, Grangegorman Campus.

2.7 Archaeological and Historical Sites

The National Inventory of Architectural Heritage (NIAH) database states that there are

- Nine NIAH sites within 30m of the alignment north of Old Cabra Road, these include three bridges, two church/chapel, one gate lodge, one workhouse, one gates/railings/walls, one post box.
- 89 No. NIAH sites within 30m of the alignment south of Old Cabra Road

The National Monuments (DAHG) database states that there are three DAHG sites within 30m of the alignment, these include one Mill, one House – 18th/19th century and one bowling green.

2.8 Hydrology and Hydrogeology

The GSI Groundwater Aquifer map states that the proposed alignment is mainly underlain by a locally important aquifer described as bedrock which is moderately productive only in local zones. The northern part of the proposed alignment is also underlain by a poor aquifer where bedrock is generally unproductive except for local zones. A fault crosses the proposed route between Snugborough and Blanchardstown Road. According to the relevant GSI map the groundwater vulnerability varies highly. The groundwater vulnerability is classified as low at the southern section of the proposed alignment changing to moderate at approximately the corner of Cabra and Old Cabra Road. North to Ashtown Roundabout it appears as high. Extreme groundwater vulnerability is noted northwest to Phoenix Park Avenue, at M50 Roundabout, around Mill Road, close to Snugborough Road and at the northern section of the proposed route. Areas where rock at or near surface are sporadically presented at the northern part of the proposed alignment. Based on the relevant GSI map the subsoil permeability is typically classified as low. High subsoil permeability is noted in a localised area between M50 Roundabout and Snugborough Road. The GSI Wells and Springs map shows a feature (borehole) approximately 350m east of Stoneybatter. Another well, also presented as borehole, is noted around 850m south of the M50 Roundabout.

The GSI Groundwater vulnerability map, Subsoil Permeability map, Wells and Spring maps and Groundwater Aquifer map is presented in Appendix A.

2.9 Contaminated Land

The works will mostly be carried out in made ground since most of the alignment is classified as discontinuous urban fabric, with sections being described as industrial-commercial units and green urban areas.

Also, there are multiple historic quarries and pits close to the alignment and made ground is mentioned in the recent and historical boreholes.

In the recent ground investigation carried out from October 2020 to March 2021 by GII Ltd. (Project No:9754-07-20 R5, Rev D, 18.June.2021), geo-environmental testing was undertaken on 22 No. samples, in natural ground and made ground, from eight ground investigation locations. No signs of contamination were noted on borehole, trial pit and slit trench logs and all environmental test results suggest an 'Inert' Waste Acceptance Criteria (WAC) classification.

However, the ground investigations do not cover the whole alignment and contamination is a possibility. Potential sources are listed below and presented in Appendix A.

- Circle K (Blanchardstown, Ashtown, Brady's,)
- Navan road parkway station
- Phoenix industrial estate
- Gowan (Navan Road)
- Train line
- Go Station
- Maxol (Navan Road)
- MSL Motors
- Park Rite
- Tramline
- The park motor centre
- Prussia auto centre
- Polycar Ireland
- James Gas Station
- Old quarry/gravel pits
- Old Ford site
- Old worsted
- Old oil mill
- Old factories

2.10 Seismicity of the Area

Ireland lies in an area of very low tectonic activity with few seismic events in the last 30 years. From the data collected by the Irish National Seismic Network (INSN) the following number of seismic events have been registered since 1980 in Ireland and nearby areas in the UK:

2 No. Light $(4.0 < M_L \le 4.9)$;

```
32 No. Negligible (M_L \le 1.0);
50 No. Micro (1.0 < M_L \le 1.9);
24 No. Minor (2.0 < M_L \le 3.9);
```

1 No. Moderate $(5.0 < M_L \le 5.9) - M_L = 5.4$ in Lleyn Peninsula, Wales, 1984.

Where M_L is the Richter magnitude scale of the earthquake.

Based on the information above it is considered that the area presents a low risk for seismic events affecting the planned development and therefore there is no further assessment required regarding seismicity of the site.

3 Field and Laboratory Studies

3.1 Historical Ground Investigation

Historical Ground investigations have been carried out on the site between 1970 and 2006. Some historical ground investigation years are unknown.

The ground investigations available for the site are listed in the table below. 40m offset from the centreline was adopted to use select historical ground investigation data.

Table 1: Historical ground investigations (GSI)

GSI Report ID	Title	Year	Author	Location	Used GI
R67	Housing Development	1980	Irish Soils Laboratories Ltd.	Blakestown Section 2A Blanchardstown Dublin 15	1 Trial pits
R5614	River Tolka Flood Alleviation Works	Unknown	Unknown	Finglas Dublin 15	2 Cable Percussion boreholes 2 Atterberg and Moisture Content 2 PSD
R461	Greater Dublin Drainage Scheme	1968	Unknown	Grand Canal to Blanchardstown Dublin 15	2 boreholes (drilling type unspecified)
R717	North Eastern Pipeline	1984	Site investigations Ltd.	Brown's barn – Abbotstown Co. Dublin	1 Trial Pits, 2 Cable Percussion Boreholes,
R5619	Commercial Development	Unknown	Unknown	Phoenix Park Racecourse	4 Cable Percussion Boreholes and 2 Trial Pits

GSI Report ID	Title	Year	Author	Location	Used GI
					4 Atterberg and Moisture Content
					2 PSD.
R5709	Commercial Development	Unknown	Unknown	Black Hall Place Dublin 7	2 Cable Percussion Boreholes
R3743	Development	Unknown	Unknown	Black Hall Place Dublin 7	2 Cable Percussion Boreholes
R3880	Law Society Premises	Unknown	Unknown	Blackhall Place Smithfield Dublin 7	4 Cable Percussion Boreholes
R838	Lark Homes Apartments, Ellis Quay.	1990	IGSL	Ellis Quay Dublin	5 Boreholes
R2161	Proposed new Liffey bridge	1999	IGSL	River Liffey Blackhall Place Dublin	1 Percussion Borehole 1 PSD 2 UCS 2 Point Load
R745	Housing at Queen Street	1984	Site Investigations Ltd.	Queen Street Dublin 7	1 Cable Percussion Borehole and 2 Trial Pits.
R3919	Residential Development	Unknown	Unknown	Queen Street Dublin 7	5 Cable Percussion boreholes 2 Atterberg and Moisture Content
					5 PSD

GSI Report ID	Title	Year	Author	Location	Used GI
R210	Leisure Centre Blanchardstown	1996	IGSL	Blanchardstown Dublin	2 Trial Pits
R742	Redevelopment at Benburb Street	1985	Site Investigations Ltd.	Benburb Street	6 Boreholes
R2158	Arran Quay Terrace	1999	IGSL	Arran Quay Terrace, Dublin	6 Boreholes
R6617	Blanchardstown Hotel and Apartment Complex	2006	IGSL	Blanchardstown S.C	6 Boreholes 6 Atterberg and Moisture Content 3 PSD

3.2 Recent Ground Investigation

This section details the recent ground investigation carried out from October 2020 to March in 2021 by GII Ltd. (Project No:9754-07-20 R5, Rev D, 18.June.2021).

Table 2, 3, and 4 summarise the exploratory holes, in situ testing and laboratory testing for the 2021 ground investigations, respectively. A specific assessment of the results will be presented in further sections.

Table 2: Summary of exploratory holes carried out for the recent ground investigation

Exploratory Hole Type	Quantity
Trial Pit	13 no.
Cable Percussive Borehole	5 no.
Rotary Core Borehole	6 no.

^{*2} No of standpipe was installed to 1 cable percussive followed by rotary core and a rotary core borehole.

Table 3: Summary of in situ testing carried out for the recent ground investigation

In situ Testing	Quantity
Standard Penetration Test	51 no.

Table 4: Summary of laboratory testing carried out for the recent ground investigation

Laboratory Testing	Quantity
Moisture Content	9 no.
Particle Size Distribution	7 no.
Atterberg Limits	7 no.
Organic Matter	2 no.
Geo - Environmental Testing (WAC Assessment)	22 no.
Unconfined Compressive Strength	11 no
Point Load	22 no

4 Preliminary Geotechnical Design Parameters

This section provides an interpretation of the ground conditions across the alignment and outlines the methodology used to derive the different parameters. Results from previous works and published papers on Dublin Boulder Clays (Long & Menkiti, 2007a, Long & Menkiti, 2007b) and Irish Glacial soils (Hanrahan, 1977) are used to compare the obtained values and, in some cases, where the available data is limited, to derive the relevant values. Similarly, for the bedrock, published values for Limestone bedrock was researched in rock mechanics literature (Goodman 1989, Wyllie 2005) and used.

4.1 Topsoil

Topsoil is encountered in most of the exploratory locations and generally described brown to greyish brown to dark greyish brown slightly sandy slightly gravelly with occasional to frequent rootlets. The general thickness of the topsoil is 0 to 0.6m.

No interpretation is required for Topsoil. Wherever encountered within the earthworks footprint, it will be removed.

4.2 Made Ground

The made ground is encountered at 52 No. out of 78 No. ground investigation locations. From the descriptions, it is likely reworked glacial till. Waste material, such as brick, concrete and plastic, is recorded in 25 No. of the 52 No. made ground locations. Made ground that does not contain waste could potentially be reused as fill, subject to an assessment of the material properties at each area of excavation.

The thickness of the made ground except Navan Road/Old Cabra Road Junction to Ellis Quay section is variable from 0.4m to 5m but is typically 2m. Thickness of made ground at Navan Road/Old Cabra Road Junction to Ellis Quay section is variable from 4m to 7.8m but is typically 2.5m.

A general description of the made ground, except for the Navan Road/Old Cabra Road Junction to Ellis Quay section, is brown to greyish brown to brownish grey to grey, slightly sandy slightly gravelly to gravelly Clay with some angular to subangular cobbles, occasional boulders, occasional rootlets. Occasional fragments of plastic, rope, concrete, wood, cloth, tarmacadam, brick and organic matter noted in a few exploratory locations. At some locations the made ground is described as brown gravelly clayey fine to coarse Sand with occasional angular to subrounded cobbles, rootlets and occasional fragments of metal, plastic and red brick.

The description of the made ground at Navan Road/Old Cabra Road Junction to Ellis Quay, based on historical ground investigation data, is that it comprises red brick, silt and gravel.

Due to the variability of the thickness and composition of the made ground, more ground investigation is recommended for detail design.

4.2.1.1 Classification

The laboratory testing for made ground is presented in Appendix C.

The Natural Moisture Content (NMC) is determined from ten samples and Atterberg limits are determined from six samples. The NMC of the made ground ranges from 6% to 38%. The average NMC for the made ground is 14%. The average liquid limit is 37% with a minimum limit of 30% and maximum of 54%. The average plastic limit is 21% with a minimum limit of 17% and a maximum of 28%. The average plasticity index is 16% with a minimum plasticity index of 12% and a maximum of 26%. Cohesive made ground is described as low to high plasticity clay.

The PSD test was carried out for two samples. The PSD curves for the cohesive deposits have a fines content greater than 6% and 52% passing the 0.063mm sieve, with 20% to 83% gravel.

4.2.1.2 Unit Weight

In accordance with BS8002:2015, a unit weight of 17kN/m³ is above the groundwater table and 18kN/m³ below the groundwater table adopted for made ground to be conservative.

4.2.1.3 Standard Penetration Tests

In total, ten Standard Penetration Tests (SPT) were carried out on the made ground. The range of SPT 'N' values recorded are presented in Appendix B.

The SPT 'N' values typically ranged from 4 to 10, with an average of 5. SPT results of R05-CP03 are refusal due to existence of bricks. Base on this SPT values of R05-CP03 are ignored.

4.2.1.4 Undrained Shear Strength

Laboratory testing was not conducted on samples of made ground. Therefore, reference was made to Table 9 of BS5930:2015 and Stroud and Butler (1975), the undrained shear strength has been estimated based on the following:

• $c_u = f_1 \times N$ (kPa) (f_1 has conservatively been taken as 5.5kPa based on the range of plasticity index test results).

The undrained shear strength (cu) is determined as 25kPa.

4.2.1.5 Effective Stress Parameters

Laboratory testing was not conducted on samples of made ground.

To be conservative an effective angle of shearing resistance of made ground accepted as alluvium.

4.2.1.6 Soil Stiffness

The soil undrained stiffness (Eu) can be calculated based on the relationship with undrained shear strength. Jamiolkowski (1979) suggests a value of Eu between 200 cu and 1000 cu. In the examined case the Eu will be calculated as follows:

$$Eu' = 200 \times cu = 4MPa$$

The drained stiffness (E') can be approximated by taking 80% of this value which leads to a value of

E' = 3MPa

4.3 Cohesive Deposits

4.3.1 Glacial Till Deposits

Local glacial till deposits are known as Dublin Boulder Clay which is a subdivision of Till derived from Limestone. It is encountered in the majority of the exploratory locations, except some parts of the Navan Road/Old Cabra Road Junction to Ellis Quay section.

A general description of the glacial till is firm to very stiff, brown to light brown to greyish brown to light grey to grey, slightly sandy to sandy, slightly gravelly to gravelly Clay with occasional cobbles. The thickness of the glacial till is variable between 0.3 m to 10m. The typical thickness of the glacial till is 2.5m.

4.3.1.1 Classification

The laboratory testing for glacial till deposits are presented in Appendix B

The Natural Moisture Content (NMC) and Atterberg limits were determined for 15 No. samples. The NMC of the glacial till deposits ranges from 10% to 34%. The average NMC for the alluvial material is 14%. The average liquid limit is 32% with a minimum limit of 20% and maximum of 62%. The average plastic limit is 17% with a minimum limit of 10% and a maximum of 39%. The average plasticity index is 15% with a minimum plasticity index of 8% and a maximum of 25%. Cohesive material is described as high plasticity silt and low to high plasticity clay.

The PSD test was carried out for seven samples. The PSD curves for the cohesive deposits have a fines content greater than 26% and 64% passing the 0.063mm sieve, with 15% to 46% gravel.

4.3.1.2 Unit Weight

In accordance with BS8002:2015, a clay with high to very high undrained shear strength, like the one examined herein, has a weight density which typically varies from 18 to 24kN/m³. A value of 21kN/m³ is adopted.

4.3.1.3 Standard Penetration Tests

In total, 23 No. Standard Penetration Tests (SPT) were carried out on the cohesive deposits in boreholes. The range of SPT 'N' values recorded are presented in Appendix B.

The SPT 'N' values ranged from 28 to refusal, except for a value of 11 within the first 5m of a borehole at Auburn Avenue.

4.3.1.4 Undrained Shear Strength

Laboratory testing was not conducted on samples of cohesive deposits. Therefore, reference was made to Table 9 of BS5930:2015 and Stroud and Butler (1975), the undrained shear strength has been estimated based on the following:

• $c_u = f_1 \times N$ (kPa) (f_1 has conservatively been taken as 5.5kPa based on the

A general undrained shear strength (cu) for the alignment and a specific undrained shear strength (cu) for Auburn Ave are determined.

- The general undrained shear strength (c_u) for the alignment is determined as 165kPa
- The undrained shear strength (c_u) at Auburn Ave is 60kPa

4.3.1.5 Effective Stress Parameters

Laboratory testing was not conducted on samples of cohesive deposits.

Long and Menkiti (2007) report a value of 44° for the peak compressive angle of shearing resistance (ϕ'_p) for all formations of the Dublin Boulder Clay. Long and Mentiki (2007) also report a value of 36° for the critical state angle of shearing resistance (ϕ'_{cs}). This value of ϕ'_{cs} compares favourably with the findings of Lehane and Faulkner (1998) and Farrell and Wall (1990) who report values of 34°±1° and 35° respectively. In all cases a c'= 0kPa is recommended.

Taking the above into account, a value of $\phi'_p = \phi'_{cs} = 32^\circ$ is chosen for preliminary design.

4.3.1.6 Soil Stiffness

For stiff consolidated clays, the soil undrained stiffness (Eu) can be calculated based on the relationship with undrained shear strength. Jamiolkowski (1979) suggests a value of Eu between 500 cu and 1000 cu. In the examined case the Eu will be calculated as follows:

- $E_u = 500 \text{ x } c_u = 80 \text{MPa}$
- $E_u = 500 \text{ x } c_u = 30 \text{MPa}$

The drained stiffness (E') can be approximated by taking 80% of this value which leads to a value of approximately 64MPa and 24MPa.

4.3.1.7 In-situ Stress

No in situ testing or laboratory testing in which K_0 is directly or indirectly measured was carried out as part of the GI. Long & Menkiti (2007) recommended a K_0 value in the range of 1.0 to 1.5 for design. Taking the above into account a value of 1.5 is chosen.

4.3.2 Alluvial Deposits

There are alluvial deposits at the Tolka River Bridge Widening and possibly at the old Phoenix Park Racecourse.

The thickness of the alluvium is 2.8m at the Tolka River Bridge Widening and the material is described as very soft to soft, brown, slightly sandy/gravelly Clay.

Alluvium was recorded in the historical borehole logs in the old Phoenix Park Racecourse. It is described as soft to very soft, brown to dark brown, slightly peaty gravelly Clay with cobbles and boulders. The thickness of the alluvium in this area is variable between 1.5 to 1.7m. Recent ground investigations did not record any alluvium. This suggests that the alluvium was removed for the construction of the road. There may be alluvium outside of the earthworks footprint of the existing road.

4.3.2.1 Classification

The laboratory testing for alluvium deposits is presented in Appendix C

The Natural Moisture Content (NMC) and Atterberg limits were determined for one sample. The NMC of the alluvium deposits is 20%. The liquid limit is 24%. The plastic limit is 15%. The plasticity index is 9%. Alluvium deposit is described as low plasticity clay.

4.3.2.2 Unit Weight

In accordance with BS8002:2015, a unit weight of 17kN/m3 is recommended for alluvial deposits above the groundwater table and 18kN/m3 below the groundwater table.

4.3.2.3 Standard Penetration Tests

In total, two Standard Penetration Tests (SPT) were carried out on the alluvium deposits in boreholes. The range of SPT 'N' values recorded are presented in Appendix B.

The SPT 'N' values are 3 and 6.

4.3.2.4 Undrained Shear Strength

Laboratory testing was not conducted on samples of cohesive deposits. Therefore, reference was made to Table 9 of BS5930:2015 and Stroud and Butler (1975), the undrained shear strength has been estimated based on the following:

• $c_u = f_1 \times N$ (kPa) (f_1 has conservatively been taken as 5.5kPa based on the range of plasticity index test results).

The undrained shear strength (cu) is determined as 20kPa.

4.3.2.5 Effective Stress Parameters

Laboratory testing was not conducted on samples of alluvium. Therefore, reference was made to Section 4.3.1.4 of BS8002:2015.

An effective angle of shearing resistance of 27° is recommended for alluvial deposits based on the available plasticity index test results.

4.3.2.6 Soil Stiffness

The soil undrained stiffness (Eu) can be calculated based on the relationship with undrained shear strength. Jamiolkowski (1979) suggests a value of Eu between 200 cu and 1000 cu. In the examined case the Eu will be calculated as follows:

$$Eu' = 200 x c_u = 4MPa$$

The drained stiffness (E') can be approximated by taking 80% of this value which leads to a value of E' = 3MPa

4.4 Granular Deposits

Granular deposits are encountered at Blanchardstown Shopping Centre, Tolka River Bridge Widening, old Phoenix Park Racecourse and most of the Navan Road/Old Cabra Road Junction to Ellis Quay section.

Description of granular deposits at Blanchardstown Shopping Centre is Dense brownish grey sandy clayey Gravel. The thickness of the granular deposit is 0.6m.

The description of granular deposits at Tolka River Bridge Widening is grey, slightly clayey, sandy/gravelly, medium to coarse sub angular to sub rounded Gravel/Sand. The total thickness of the granular deposit is 16m. This description is based on the driller's description and these materials may include more cohesive material than is recorded.

Description of granular deposits at old Phoenix Park Racecourse is dense grey angular to subangular fine to coarse Gravel with some angular to subangular cobbles. The total thickness of the granular deposit is 0.5m.

Description of granular deposits at the Navan Road/Old Cabra Road Junction to Ellis Quay section is dense to very dense, brown to greyish brown, fine to coarse slightly sandy Gravel / gravelly Sand. Thickness of the granular deposit is variable between 1m to 11m with an average of 5m thickness.

4.4.1 Classification

The laboratory testing for granular deposits are presented in Appendix B.

The Natural Moisture Content (NMC) and Atterberg limits were determined for one sample. The NMC of the granular deposits is 10%.

The PSD test was carried out for six samples. The PSD curves for the granular deposits have a fines content less than 5% passing the 0.063mm sieve, with 75% to 95% gravel.

4.4.2 Unit Weight

Based on the available GI results, this stratum is typically described as gravel or sand below groundwater level. Most of the SPT N values are above 30 which, according to BS5930, corresponds to a dense layer. This leads to a γ value ranging between 19 to 23kN/m³ (BS8002: 2015). A value of 20kN/m³ is adopted.

4.4.3 Standard Penetration Tests

In total 34 No. Standard Penetration Tests (SPT) were carried out on the granular deposits in boreholes. The range of SPT 'N' values recorded are presented in Appendix B.

The SPT 'N' values typically ranged from 28 to refusal. In two areas SPT values are less than 28;

- Tolka River Bridge Widening. SPT values are 19 between 12mbgl and 16mbgl
- N3/M50 Junction. SPT value is 23 at 10m

4.4.4 Effective Stress Parameters

Peck *et al* established a relationship between the SPT N and critical state friction angle ($\phi'_{cv,k}$) for coarse grained soils. Following from that a graph was introduced correlating the above parameters. Several SPT tests were completed within the Granular Deposits. The results ranged from 28 to above 50 (refusal). The factual report of the site specific ground investigation mentions that the lower values occurred due to blowing conditions. Thus, they will be ignored. The remaining SPT N values vary from 28 to above 50 with the majority of them exceeding a value of 30. This value is selected for the preliminary design. An SPT N value of 30 according to the graph mentioned above, corresponds to a $\phi'_{cv,k}$ of approximately 36°.

A $\phi'_{cv,k}$ value of 32° is selected for preliminary design. Due to the nature of this layer (coarse-grained) c'= 0kPa.

4.4.5 Soil Stiffness

For the estimation of the stiffness the following empirical relationship will be used:

E' = 1.5 SPT N (in MPa) which leads to an E' of 45MPa.

4.4.6 In-situ Stress

No in situ testing or laboratory testing in which K_0 is directly or indirectly measured was carried out as part of the GI.

In situ stress is determined with the approach presented in BS EN 1997-1:2004+A1:2013

 $K_0 = 1 - \sin \phi = 0.45*$

*φ value is presented above as φ'cv,k

4.5 Bedrock

Bedrock was encountered in some of the historical ground investigations and all the recent ground investigation locations, apart from at the Tolka River Bridge Widening. The top of the bedrock is variable between 0.3m to 9.5m below ground level

The bedrock is mainly described as medium strong to strong grey/dark grey fine to medium grained laminated Limestone, locally interbedded with weak black fine grained laminated Mudstone or Clay. Some of the bedrock is described as medium strong to strong thinly laminated dark grey fine grained calcareous Mudstone with occasional specs of pyrite, locally interbedded with grey fine grained Limestone.

Depth to bedrock map presented in "GeoUrban Depth to Bedrock (GSI)" is usually consistent with the top of the bedrock determined from the borehole logs, except at the Tolka River Bridge Widening. The depth to bedrock on the GeoUrban Depth to Bedrock (GSI) map is 3m to 5m below ground level. However, the top of the rock in the borehole is deeper than 35m.

4.5.1 Rock Mass Description and Characteristics

TCR (Total Core Recovery) is variable between 93% to 100% with an average 97%. The SCR (Solid Core Recovery) ranges between 14% to 100% with an average of 66%.

The RQD (Rock Quality Designation) ranges between 7% and 100% with average of 50%.

Fracture sets were described as Closely to Very closely spaced, locally Non Intact and medium spaced. Condition of the fractures are generally described as planar smooth with variable fracture angles, generally 10° to 30° and 40° to 60°.

The Fracture Index (FI) ranges from Mostly Non Intact (>25) to 1 with an average of 10.

4.5.2 Unit Weight

11 No. Unconfined Compressive Strength (UCS) tests were carried out on rock samples and Bulk Density were measured for each sample as a part of the test. Test results are is presented in Appendix C.

Based on the available GI results, the γ value is between $25kN/m^3$ to $28kN/m^3$. A value of $26kN/m^3$ is adopted.

4.5.3 Rock Strength

11 No. Unconfined Compressive Strength tests (UCS) and 22 No. Point Load tests were carried out on rock samples.

UCS test result range is between 15MPa to 59MPa.

Point Load Testing ($I_{s(50)}$) was determined on axial and diametral samples. The relationship UCS = $f^*I_{s(50)}$ (MPa), where f = 20 (although may range between 20 and 24) is commonly used for Dublin Basin (Lucan Formation) Limestones and 23 for mudstone. To be conservative 20 is adopted for all samples. Point load test results ($I_{s(50)}$) are ranging between 0.8 to 8 (UCS=16MPa to 160MPa).

A value of 20MPa is adopted for Intact Uniaxial Compressive Strength.

Test results are is presented in Appendix C.

4.6 Stratigraphic Profile

The stratigraphic profile for the Proposed Scheme is summarised in Table 5, Table 6 and Table 7. In each profile the Cohesive Deposits and Granular Deposits are interbedded.

Table 5: Summary of stratigraphic profile for the Proposed Scheme except Navan Road/Old Cabra Road Junction to Ellis Quay and Tolka River Bridge Widening

Stratum	Typical Depth (m BGL)	Typical Thickness (m)
Topsoil	0.0	0.0 to 0.2
Made Ground	0.0 to 0.2	1 to 3
Cohesive Deposits	0.2 to 3	3 to 8
Granular Deposits	0.2 to 8	0.0 to 0.5

Stratum	Typical Depth (m BGL)	Typical Thickness (m)
Bedrock	4 to 8	N/A

Table 6: Summary of stratigraphic profile for the Navan Road/Old Cabra Road Junction to Ellis Quay

Stratum	Typical Depth (m BGL)	Typical Thickness (m)
Topsoil	0.0	0.0 to 0.4
Made Ground	0.0 to 0.2	0 to 5
Cohesive Deposits	0.2 to 5	0 to 2
Granular Deposits	2 to 7	2 to 6
Bedrock	2 to 8	N/A

Table 7: Summary of stratigraphic profile for Tolka River Bridge Widening

Stratum	Depth (m BGL)	Thickness (m)
Alluvium	0.0	2.8m
Cohesive Deposits	2.8 15.7 27.4	5.4 3 7.6
Granular Deposits	8.2 18.7 35	7.5 7.6 N/A

4.7 Groundwater

4.7.1 Summary of Groundwater Conditions

Groundwater data is presented in Table 8.

Table 8: Groundwater level data

Borehole	Date	Groundwater Level (m BGL)	Standpipe / Water strike/Observation Reading
R5-RC01	09.04.2021	5.69	Standpipe
R5-CP04	09.04.2021	3.02	Standpipe
R838/B61972	13.02.1990	3	Water Strike
R838/B61973	20.02.1990	3.8	Water Strike
R838/B61974	19.02.1990	3	Water Strike
R838/B61976	22.02.1990	3.75	Water Strike
R5614/B135148	1.05.2004	6.3	Water Strike
R5619/B135217	28.11.2003	2	Ground Water Observation
R5619/B135218	29.11.2003	1.5	Ground Water Observation
R5709/B135926	7.04.2004	11.50	Ground Water Observation
R5709/B135927	05.04.20004	13.50	Ground Water Observation
R2161/B81466	27.0.1999	3	Ground Water Observation

Based on these groundwater measures, groundwater level for preliminary design should be taken as 2m below ground level.

4.8 Summary of Preliminary Design Parameters

A summary of the interpreted characteristic parameters for each stratum is presented in Table 9.

Table 9: Summary of Interpreted Characteristic Parameters

Stratum	γ (kN/m³)	\mathbf{K}_0	c _u (kPa)	φ (°)	c' (kPa)	UCS (MPa)	E _u (MPa)	E' (MPa)
Topsoil	No geotechnical parameters will be provided for these layers							
Made Ground	17	-	20	25	0	N/A	4	3
Alluvium Deposits	17	-	20	25	0	N/A	4	3
Glacial Till Deposits	21	1.5	165	32	0	N/A	80	64
Granular Deposits	20	0.45	N/A	32	0	N/A	N/A	52.5
Limestone/Mudstone	26		N/A	-	-	20	N/A	550

5 Geotechnical Risk Register

This geotechnical risk register in Appendix F has been completed based on available existing information including that gained from compilation of this GIR.

It highlights the geotechnical risks and the consequence of those risks occurring. It contains proposed measures to mitigate the risks.

It does not cover health and safety risks unless specifically related to the geotechnical works. Risk control measures will, whenever possible, reduce all risks to an acceptable 'low' level.

The following risk ratings have been adopted:

Low Risk (LOW): No action required by Designer or Contractor

Medium Risk (MED): Action required unless good reason not to e.g. design change or construction mitigation measure

High Risk (HIGH): Action required e.g. design change

Geotechnical Risk Register is given in Appendix F.

References

Bowles, J. E. (1997). Foundation Analysis and Design – International Edition, 5th edition. The McGraw-Hill Companies, Singapore.

BS 8002:2015. Code of practice for earth retaining structures. BSI, 2015.

C504, Engineering in glacial tills. CIRIA. 1999, London.

Casey, P. and Fleming, M. (2015). An investigation of the accuracy of the use of point load index test results to predict the unconfined compressive strength of Calp limestone in Ireland. Geotechnical Engineering for Infrastructure and Development, pages 3123-3127, vol6.487.

Farrell, E.R. (2016). Geotechnical Properties of Irish Glacial and Interglacial Soils. 1st Hanrahan lecture, The Institution of Engineers of Ireland.

Farrell, E.R., Lehane, B., O'Brien, S., and Orr, T. (1995). Stiffness of Dublin black boulder clay. 11th European conference on soil mechanics and foundation engineering, Vol 1; Measurement of soil/soft rock properties; 1995; Copenhagen.

Goodman, R.E. (1989). Introduction to Rock Mechanics. John Wiley & Sons.

Long, M., and Menkiti, C.O. (2007a). Characterisation and engineering properties of Dublin Bolder Clay. Characterisation and Engineering Properties of Natural Soils. 3. Pages 2003-2045.

Long, M., and Menkiti, C.O. (2007b). Geotechnical properties of Dublin Boulder Clay. Géotechnique 57, No. 7, pages 595-611.

Stroud, M. A., and Butler, F. G (1975). The standard penetration test and the engineering properties of glacial materials. In: Proceedings of the Symposium of glacial materials, University of Birmingham, April 1975.

Stroud, M.A. (1989). The Standard Penetration Test – Its application and interpretation. Proceeding of the ICE Geotechnical Conference, 1988, pages 29-49. Thomas Telford Limited, London.

Hoek & Marinos (2000). Practical Rock Engineering – Hook Brown

EN 1997-1:2005 Eurocode 7: Geotechnical Design – Part 1: General Rules

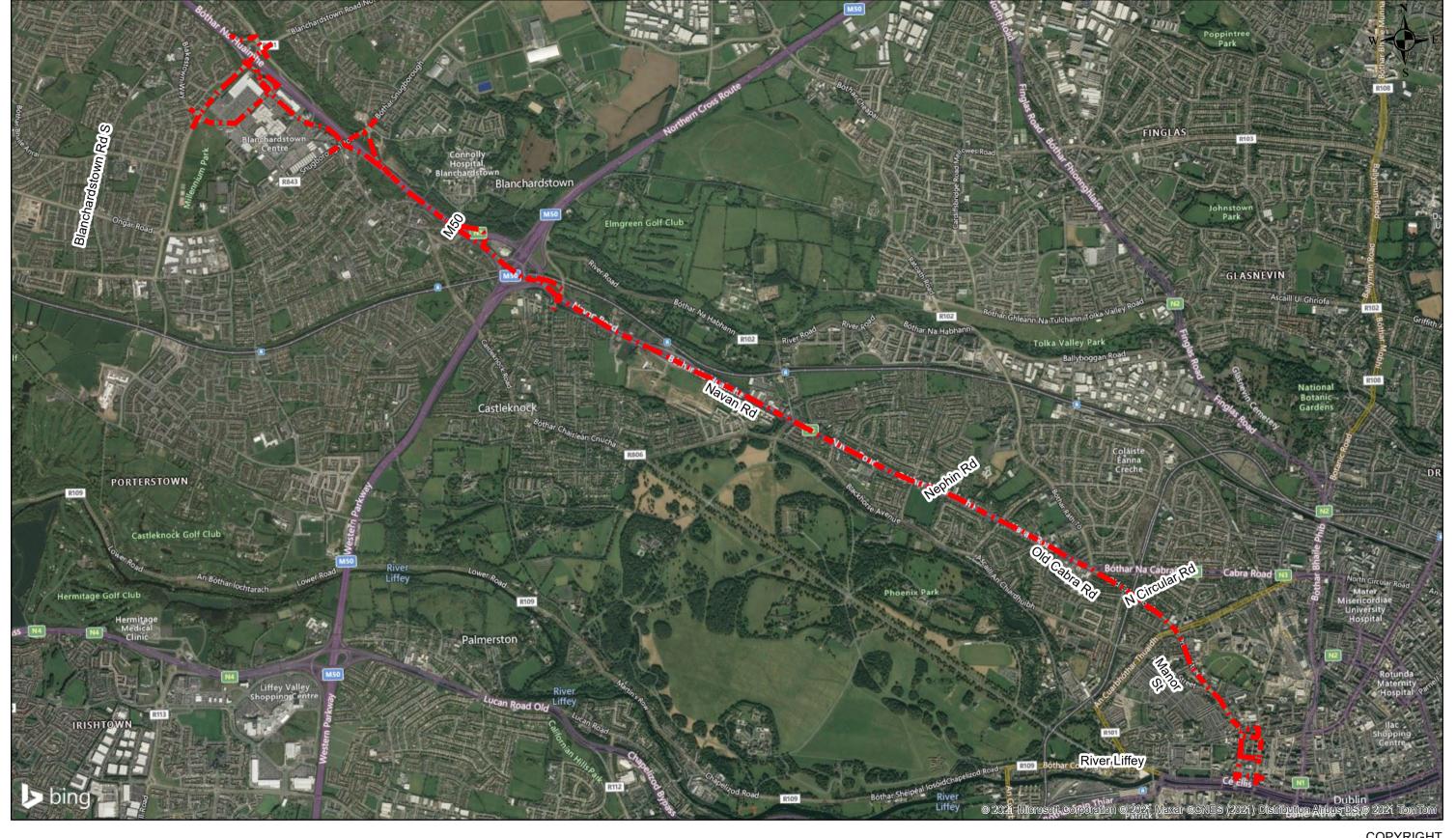
BS EN 1997-2: 2007 Euroceode 7: Geotechnical Design – Part 2 : Ground Investigation and testing

BS5930:2015. Code of Practice for Site Investigation

Hanrahan, E.T. (1977) "Irish glacial till:origin & characteristics" Foras Forbartha, Dublin. 164.

Appendix A

Ground Investigation Layout Plan and Geological Survey Ireland Maps



Legend ■ I I Alignment

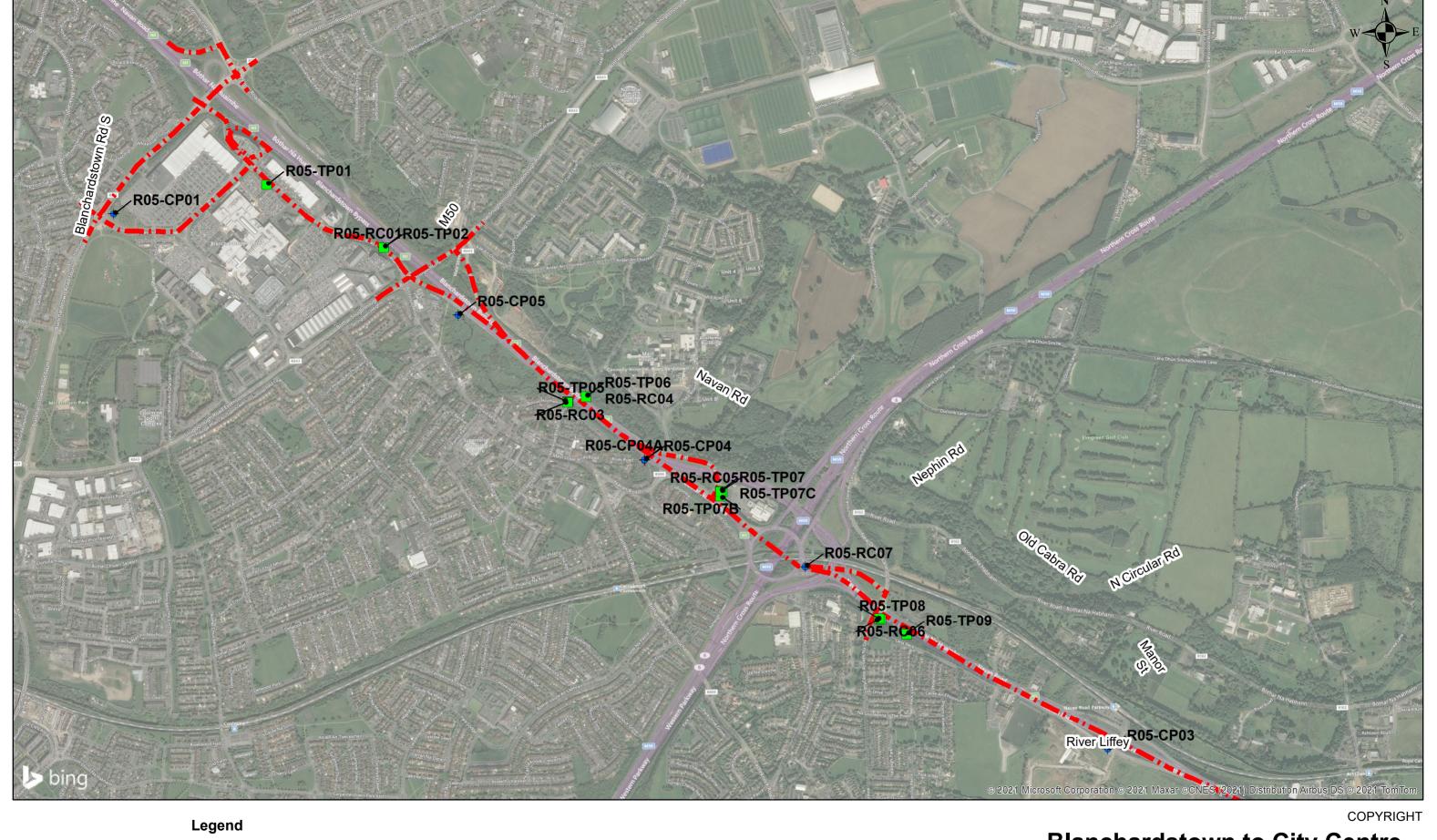
Blanchardstown to City Centre Core Bus Corridor

Aerial View (Bing Map)

ARUP

⊐ Meters 0 250 500 1,000 1,500

1:27,500



GI Type ♦ BH ■ TP ■ I I Alignment

ARUP

Blanchardstown to City Centre Core Bus Corridor

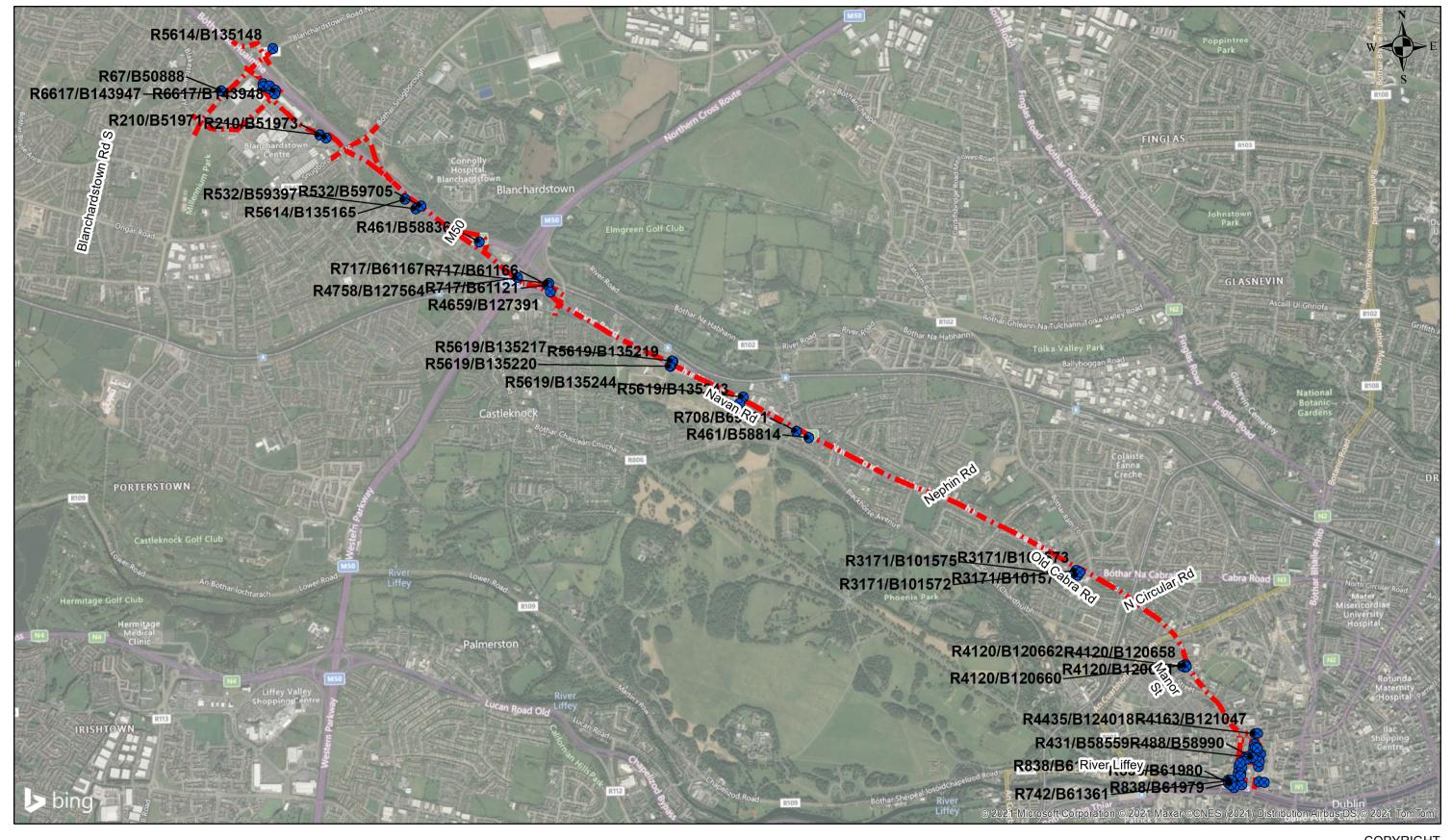
Site Specific Ground Investigation Location Plan

1:12,000

FIGURE A02



268401 250 500 1,000 1,500



l eaend

Misrorical Ground Investigtion (GSI) - 20m Offset

■ I I Alignment

ARUP

1:27,500

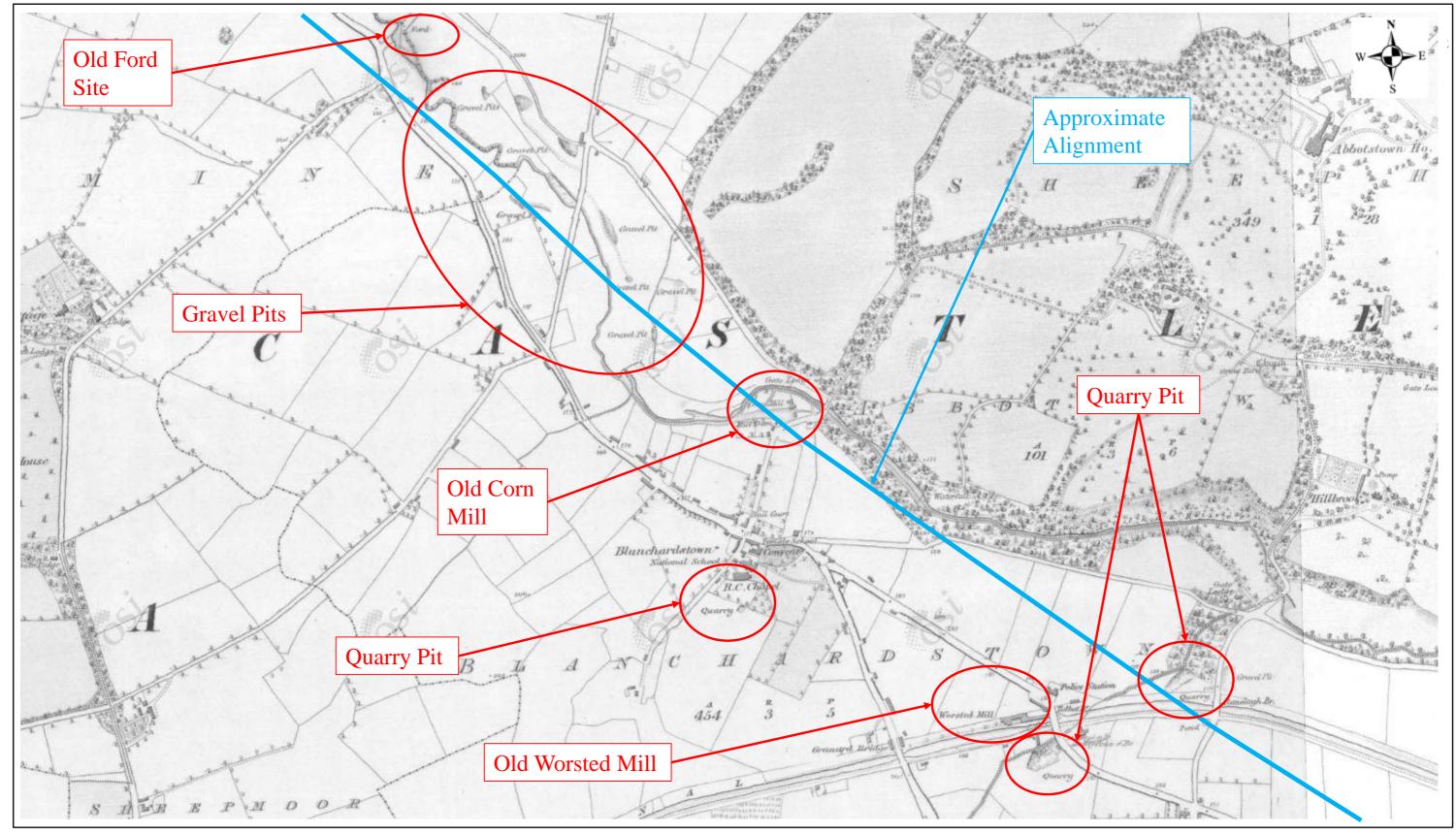
0 250 500 1,000 1,500

Blanchardstown to City Centre Core Bus Corridor

Historical Boreholes (GSI) 20m Offset from the Route 5

268401 FIGURE

A03

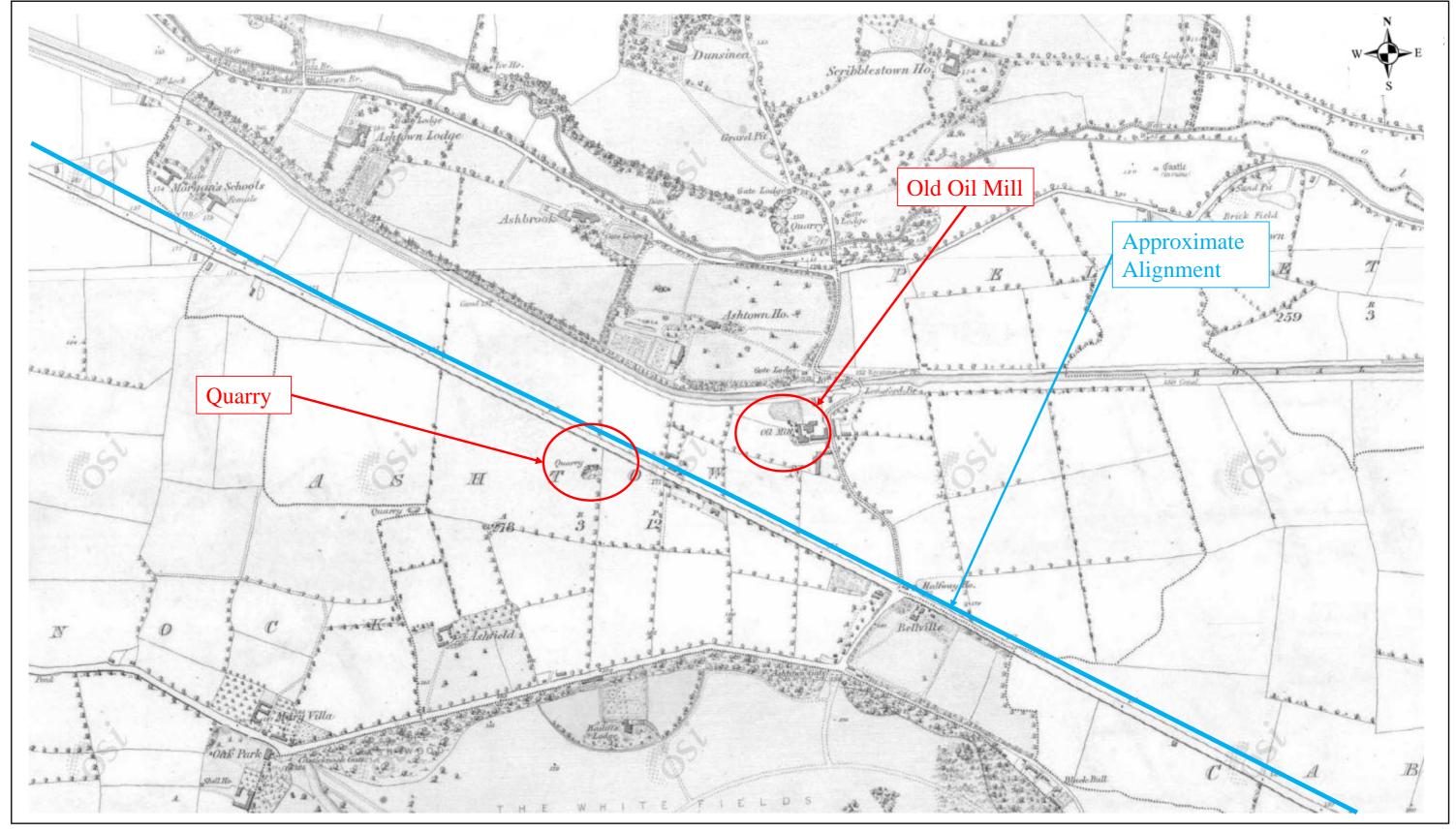


COPYRIGHT

Blanchardstown to City Centre Core Bus Corridor

Historic Map 6 Inch (1837 - 1842)

268401



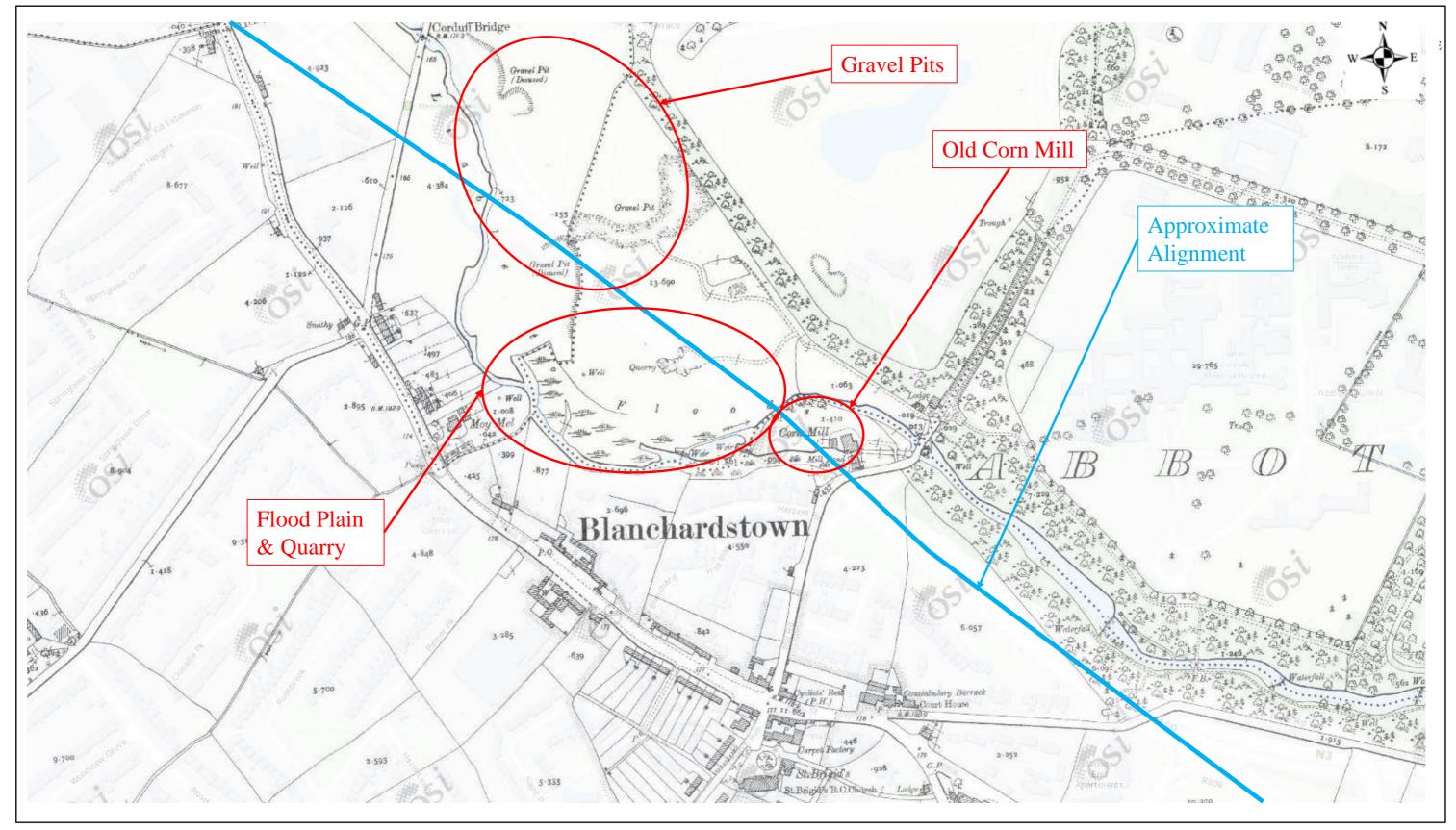
COPYRIGHT

Blanchardstown to City Centre Core Bus Corridor

Historic Map 6 Inch (1837 - 1842)

ARUP

268401



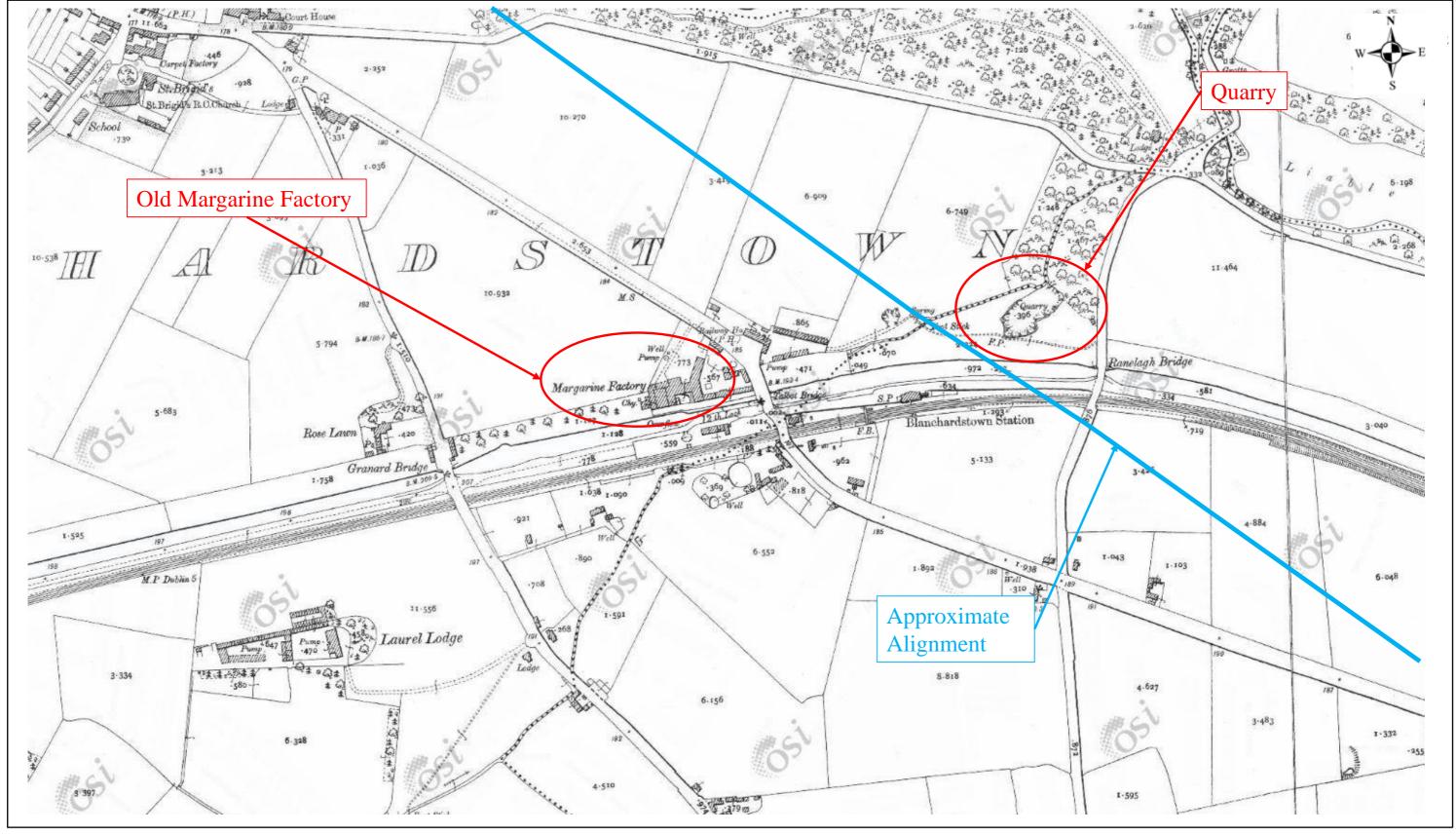
COPYRIGHT

Blanchardstown to City Centre Core Bus Corridor

Historic Map 25 Inch (1888 - 1913)

ARUP

268401



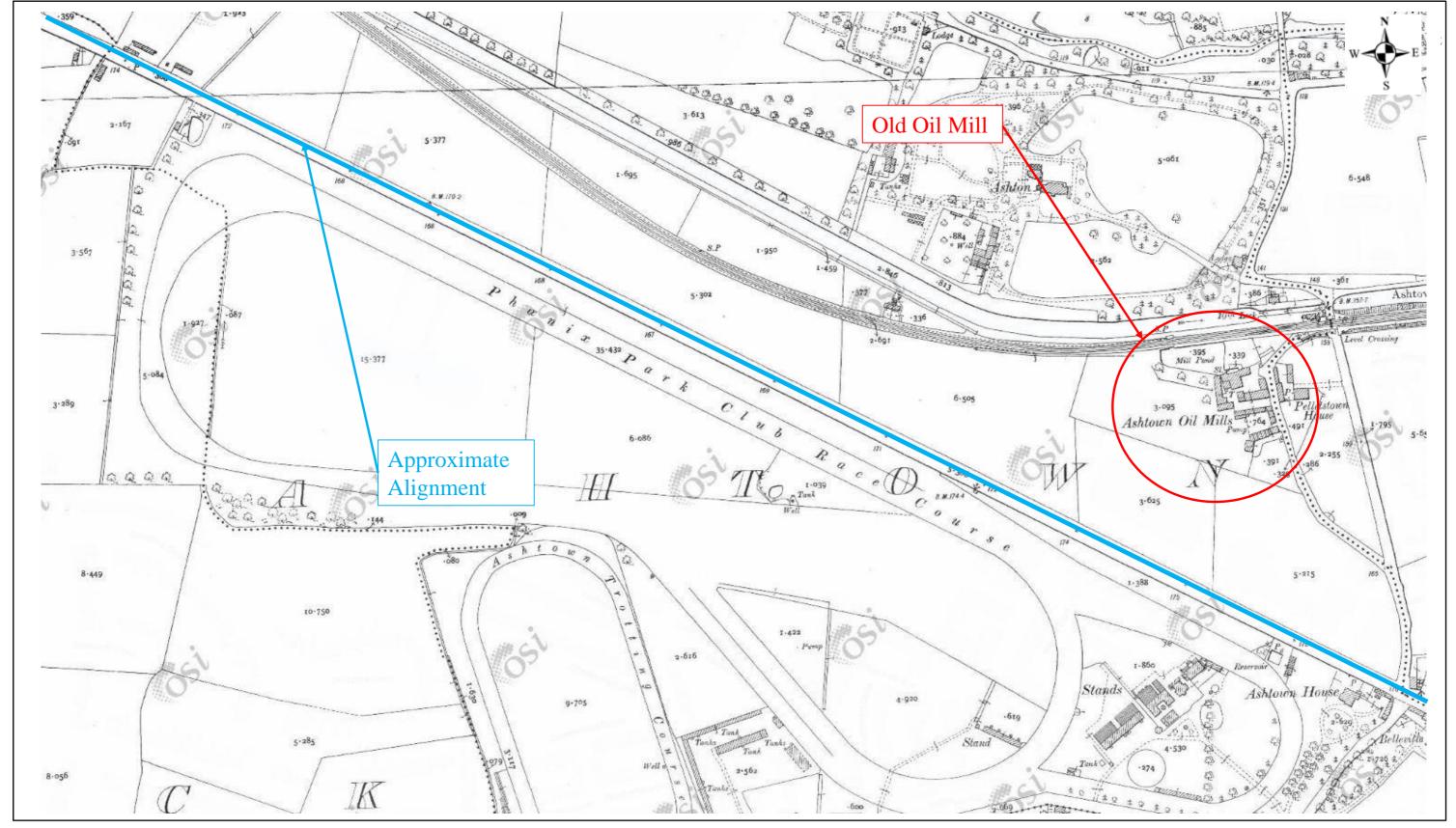
COPYRIGHT

Blanchardstown to City Centre Core Bus Corridor

Historic Map 25 Inch (1888 - 1913)

ARUP

268401



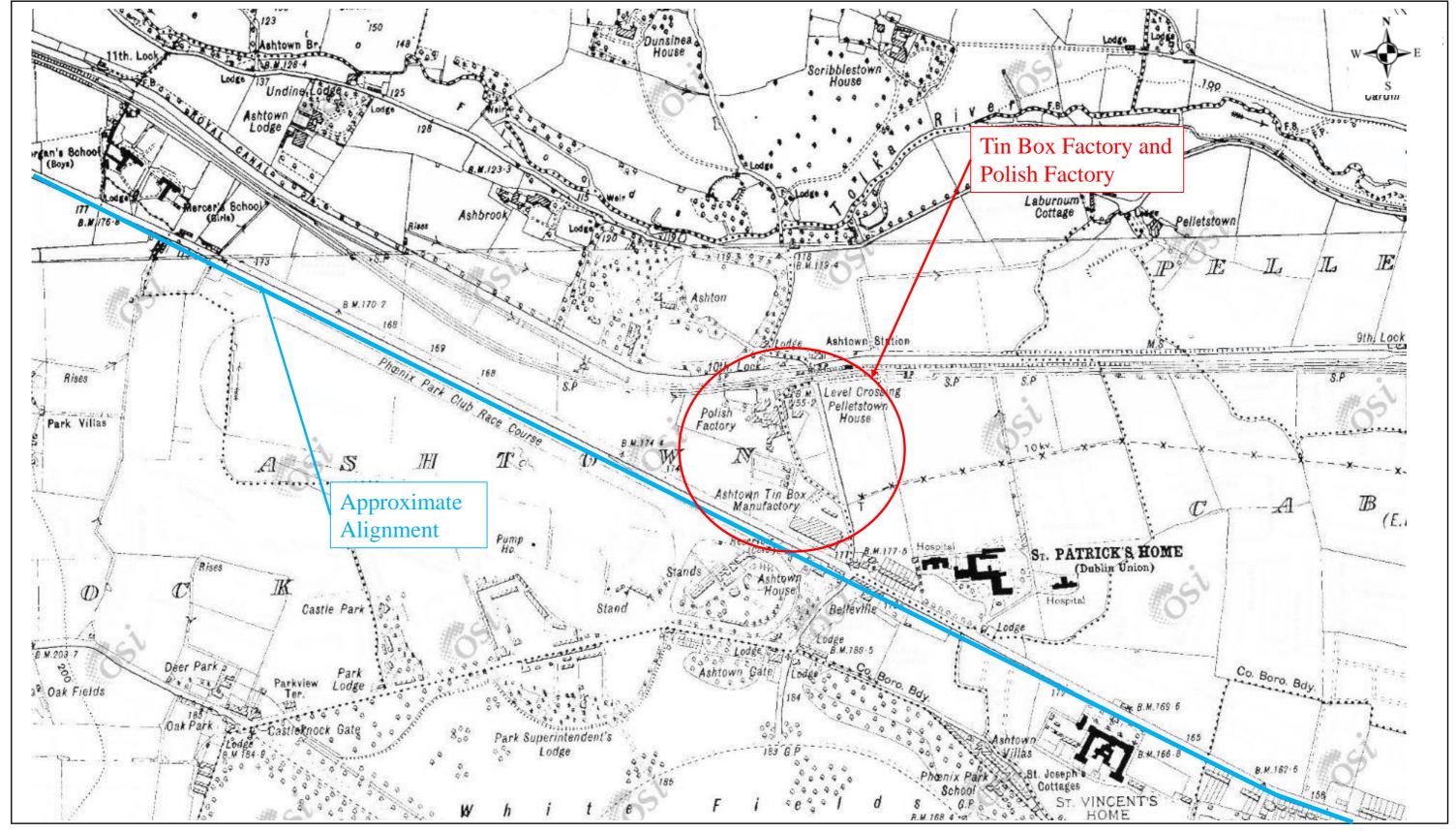
COPYRIGHT

Blanchardstown to City Centre Core Bus Corridor

Historic Map 25 Inch (1888 - 1913)

ARUP

268401



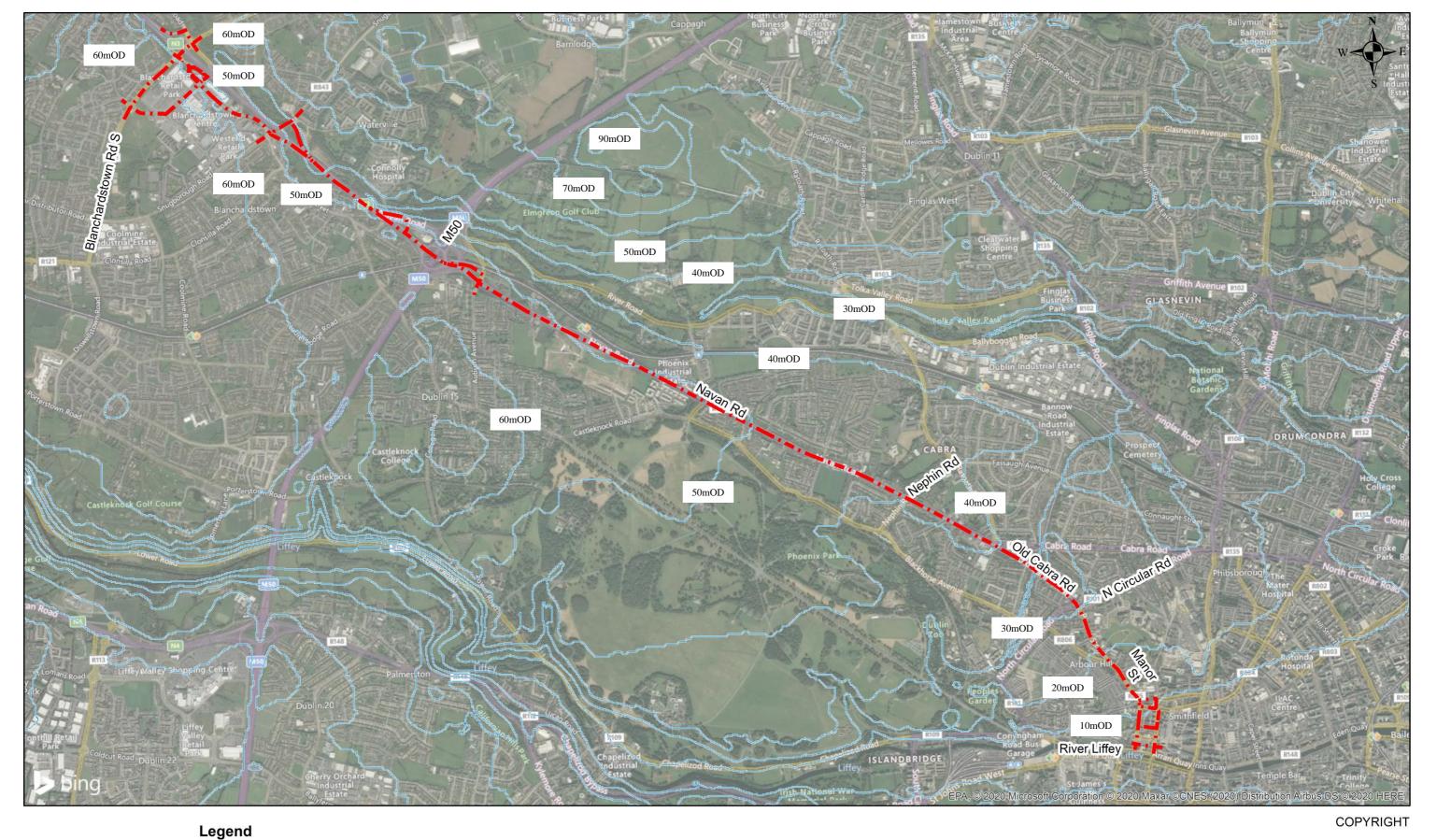
ARUP

COPYRIGHT

Blanchardstown to City Centre Core Bus Corridor

6 Inch Cassini (1830-1930)

t to Scalo 268401



Blanchardstown to City Centre Core Bus Corridor

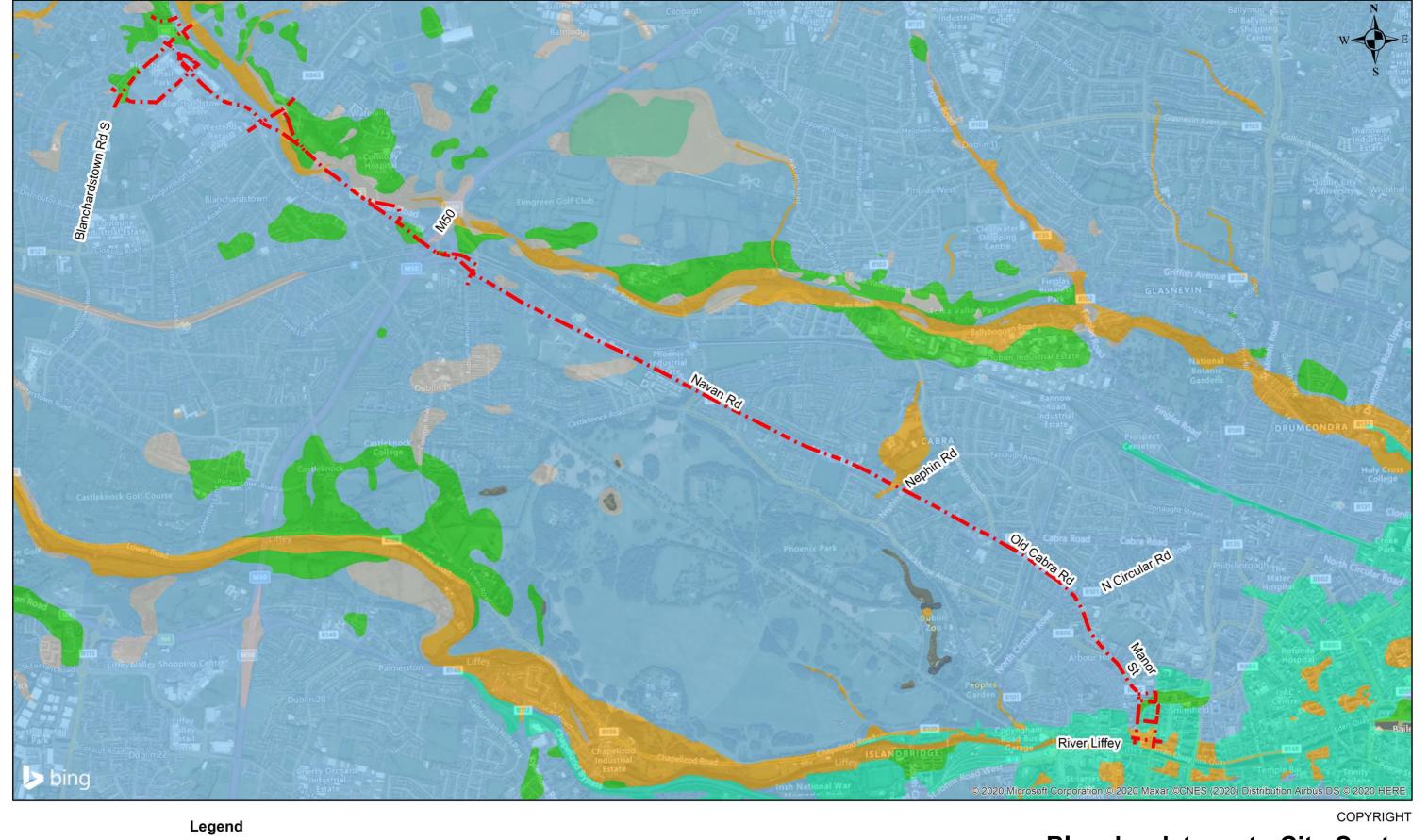
EPA 20m Contour Map

ARUP

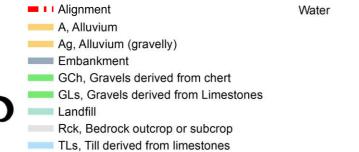
■ I I Alignment

1:27,500 0 250 500 1,500 1,000

268401



0 250 500



Urban

Blanchardstown to City Centre Core Bus Corridor

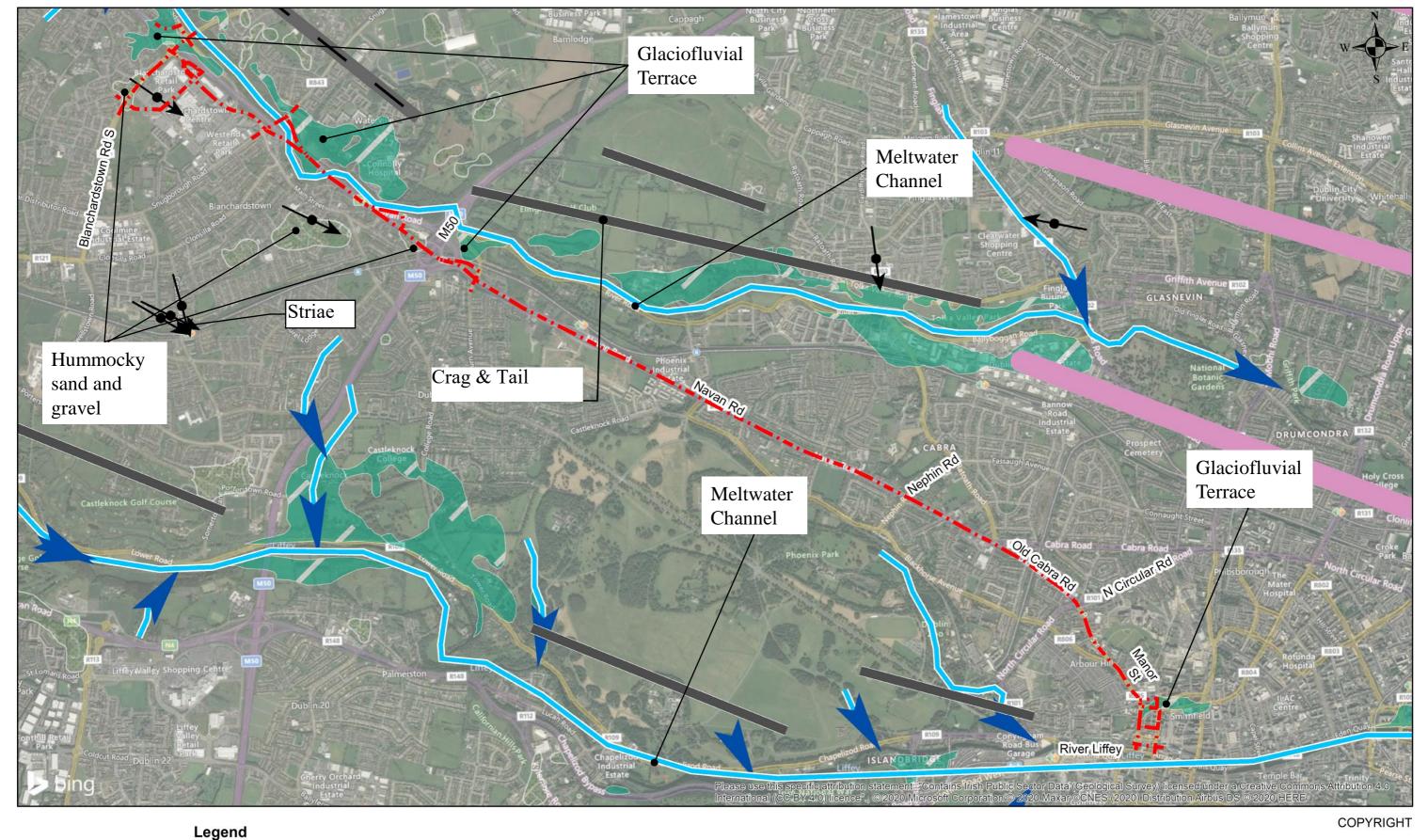
Quaternary Sediments

1:27,500

1,500

1,000

268401



Blanchardstown to City Centre Core Bus Corridor

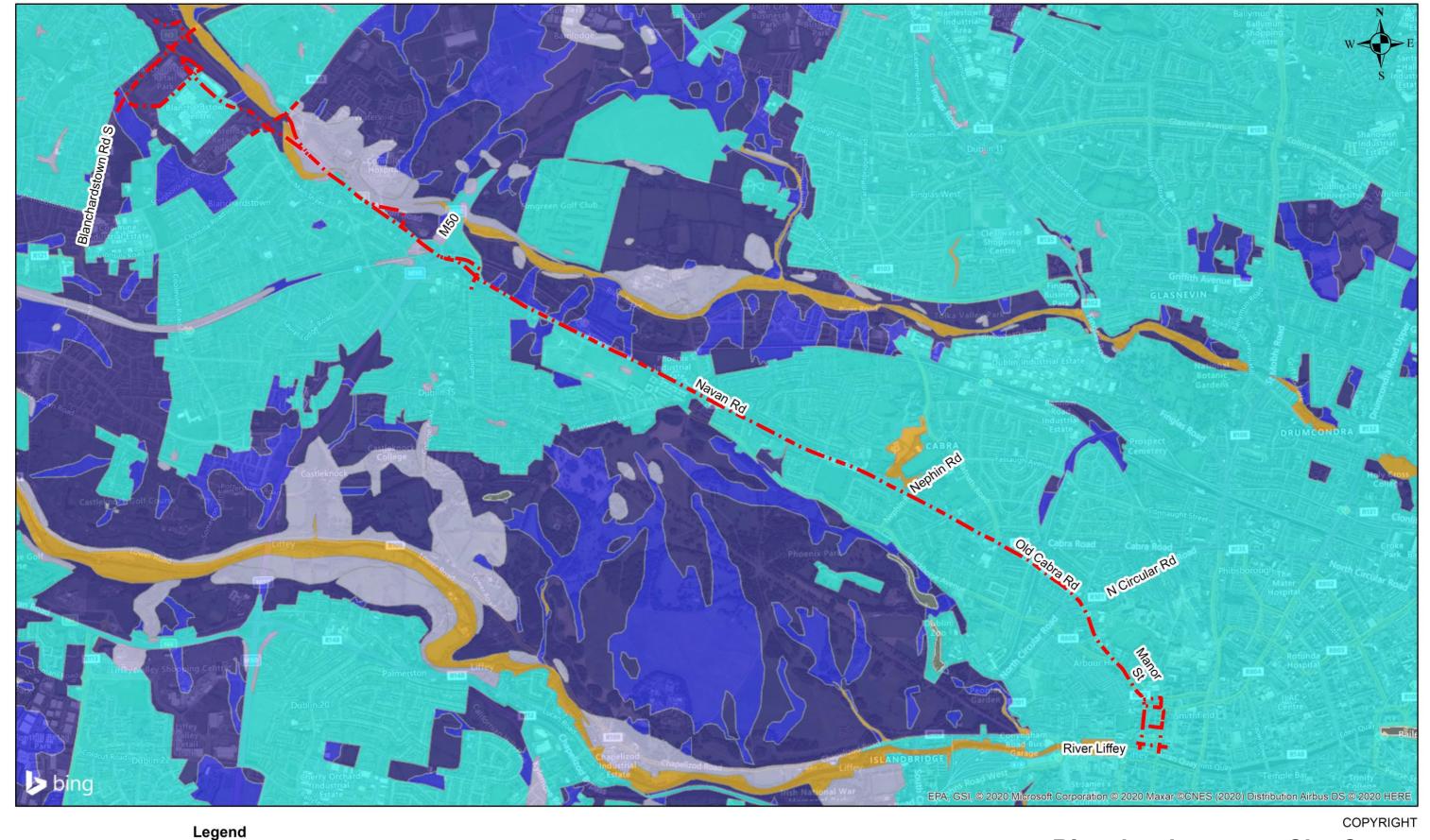
Quaternary Geomorphology

- I Alignment

ARUP

1:27,500 Meters 0 250 500 1,000 1,500

...



■ I I Alignment

Alluviun

BminDW - Till derived chiefly from limestone

BminPD - Till derived chiefly from limestone

BminSW - Bedrock at Surface - Calcareous

Made Ground

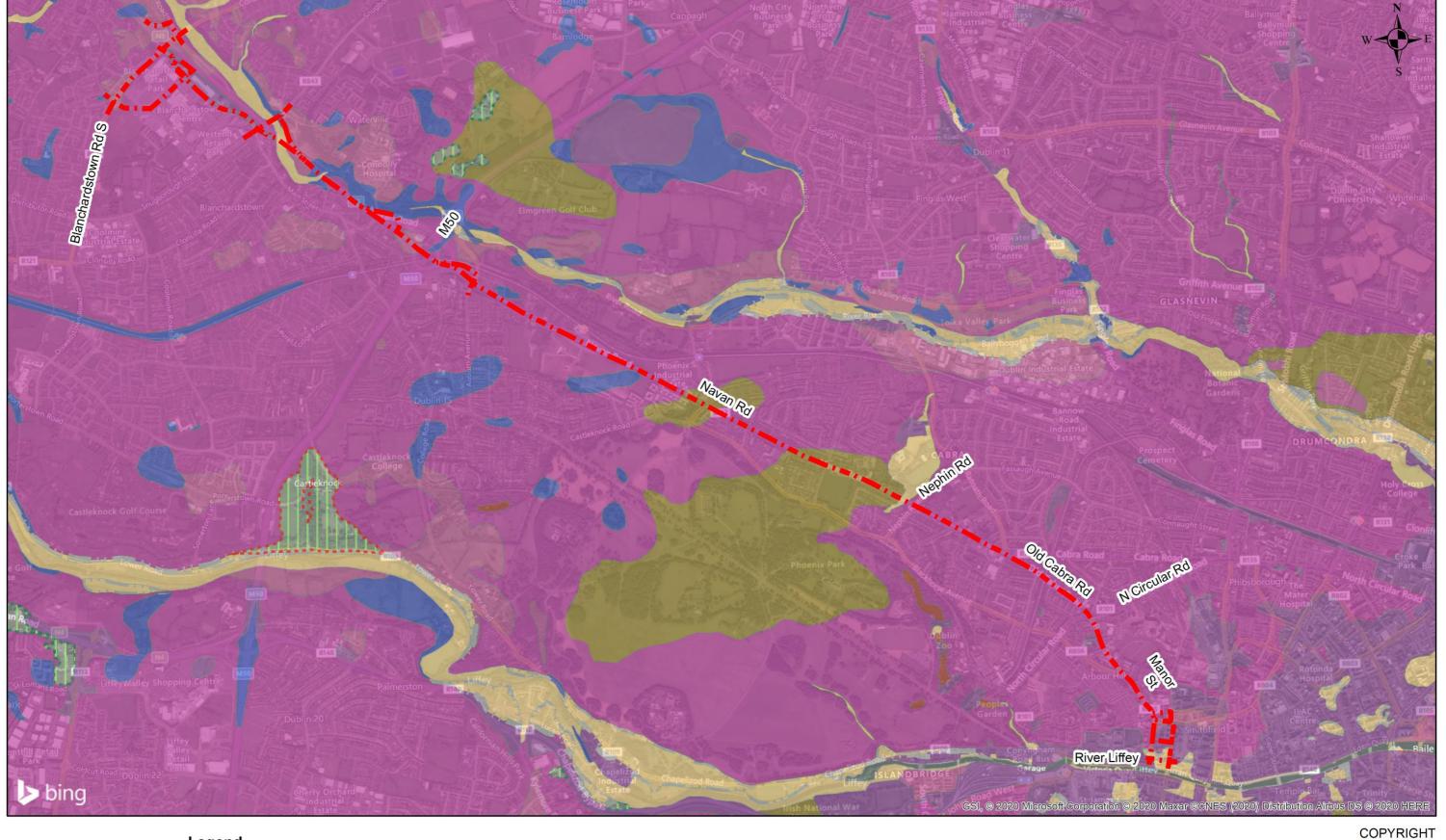
1:27,500 Meters 0 250 500 1,000 1,500

Blanchardstown to City Centre Core Bus Corridor

GSI Groundwater Subsoils (Teagasc)

268401 FIGURE **A13**

ARUP



ARUP

■ I I Alignment

A - Gravelly

TLs - Limestone till (Carboniferous)

GLs - Limestone sands and gravels (Carboniferous)

TwGLs - Interstratified till with gravel derived from Lower Carboniferous Limestone

Rck - Bedrock at surface

1:27,500

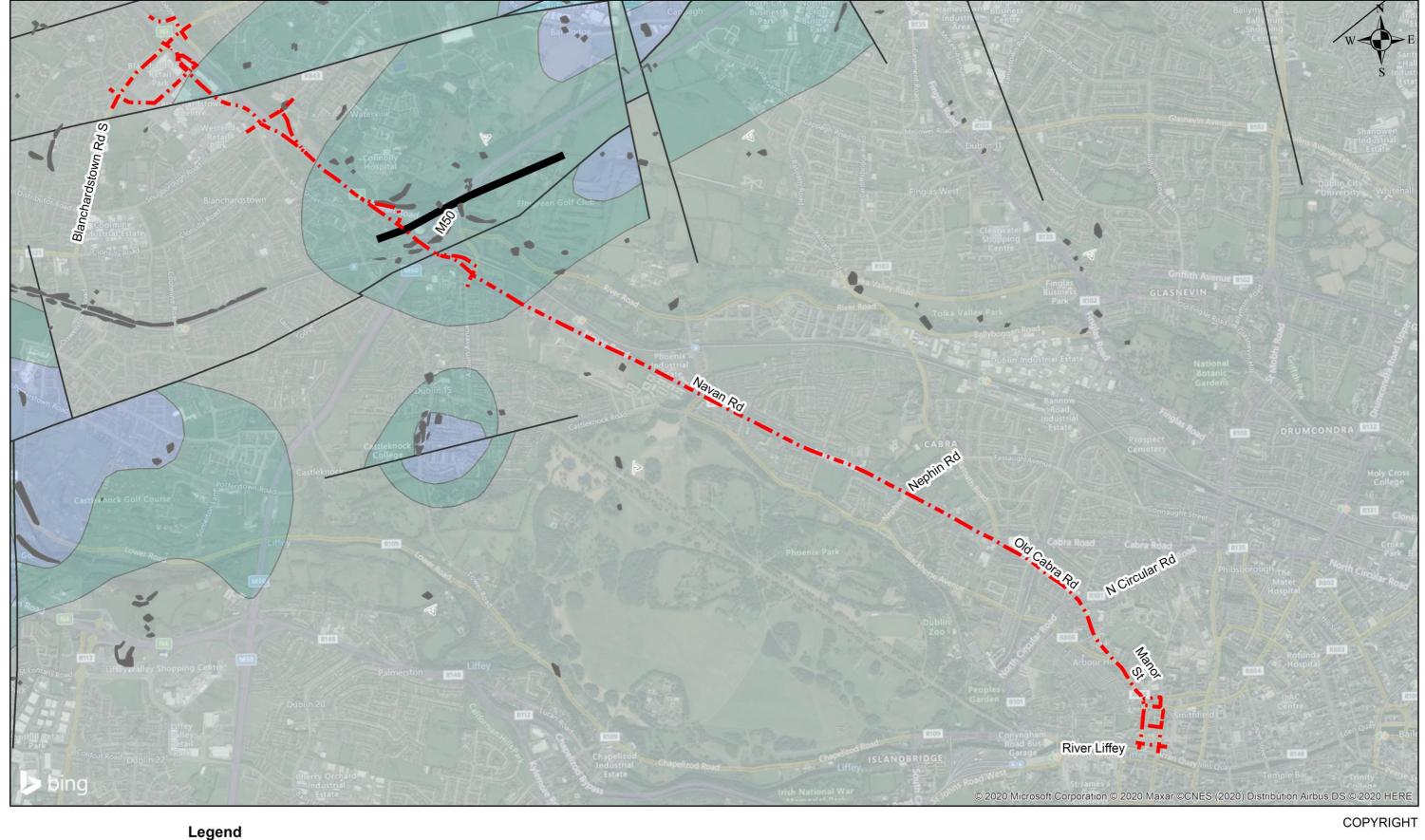
GSI GeoUrban

Unconsolidated Sediments

Blanchardstown to City Centre Core Bus Corridor

268401





Strike and dip of bedding, right way up Bedrock Outcrops 100 ITM 2018 Anticlinal Axis Synclinal Axis Tober Colleen Formation Waulsortian Limestones

1:27,500 0 250 500 1,000 1,500

Blanchardstown to City Centre Core Bus Corridor

GSI Bedrock Geology 100k

268401



0 250 500



GS Fe

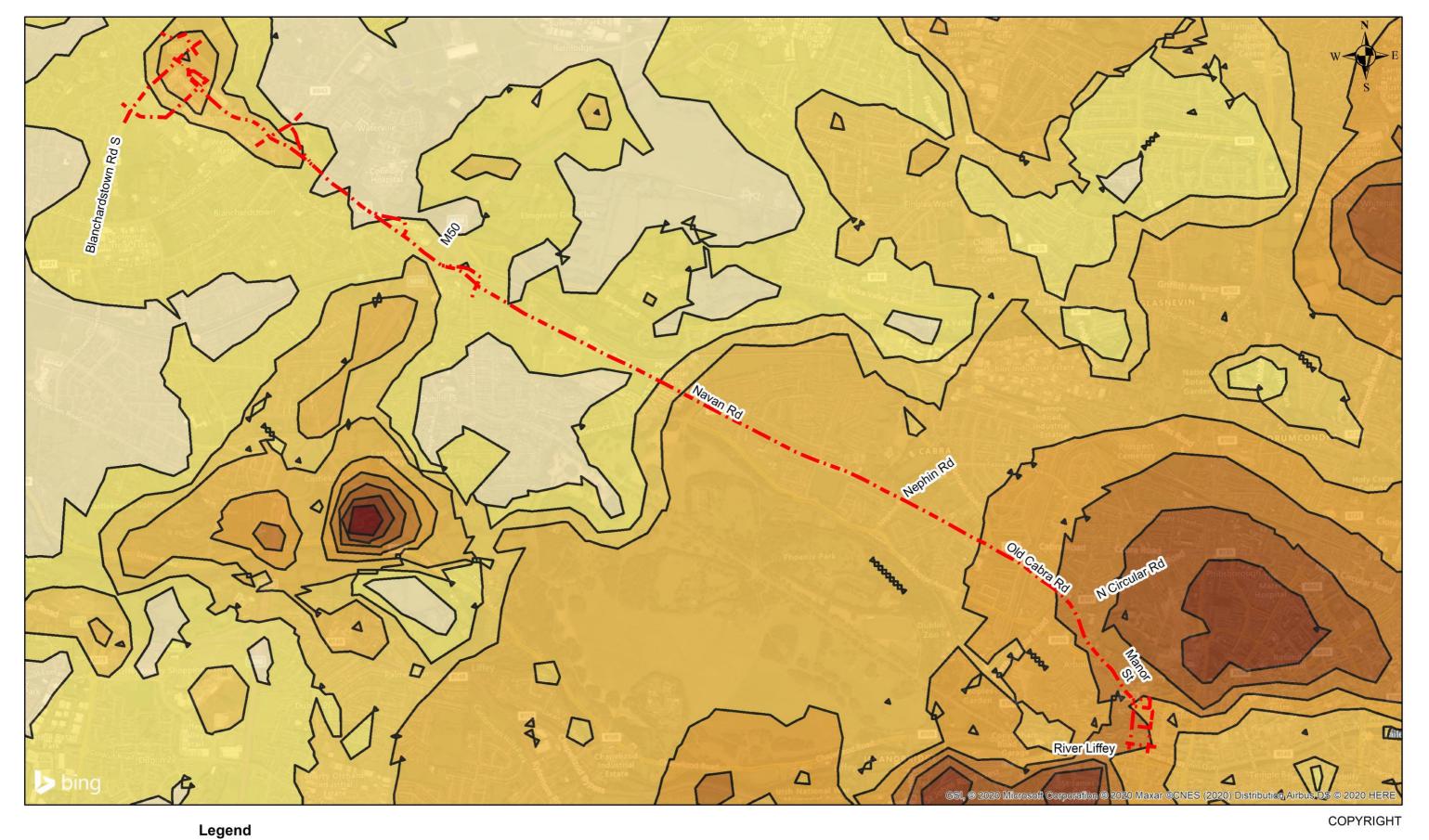
1:27,500

1,500

1,000

Blanchardstown to City Centre Core Bus Corridor GSI Karst Features

268401

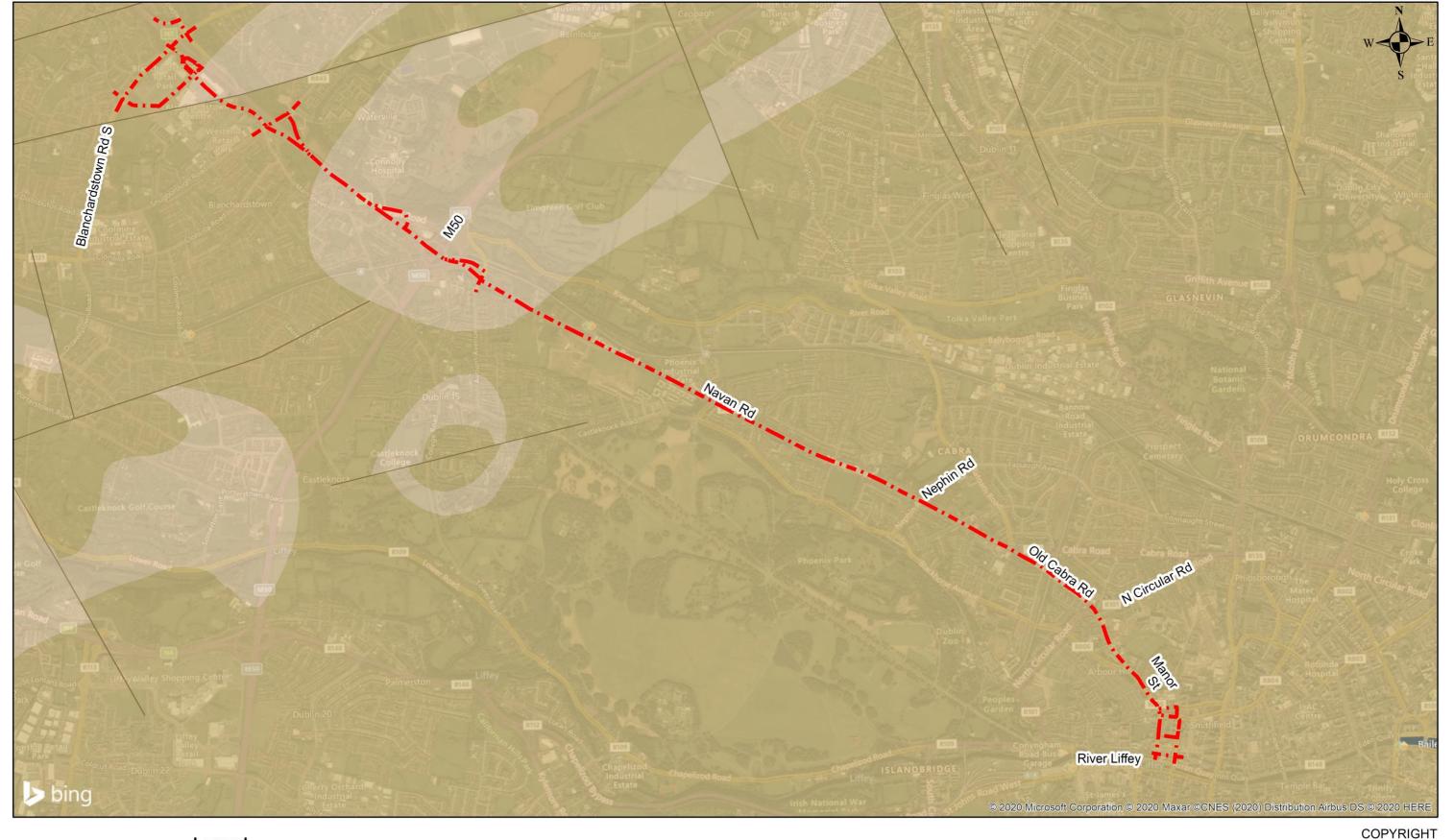


ARUP Alignment 0 to 1m 1 to 3m 3 to 5m 5 to 10m 10 to 15m 15 to 20m 20 to 25m 25 to 30m 30 to 45m

Blanchardstown to City Centre Core Bus Corridor

GSI GeoUrban1:27,500 Depth to Bedrock (Dublin County)

Meters 0 250 500 1,000 1,500



- Alignmer
- LI Locally Important Aquifer Bedrock which is Moderately Productive only in Local Zones
- PI Poor Aquifer Bedrock which is Generally Unproductive except for Local Zones
- ---- Bedrock Aquifer Faults

1:27,500

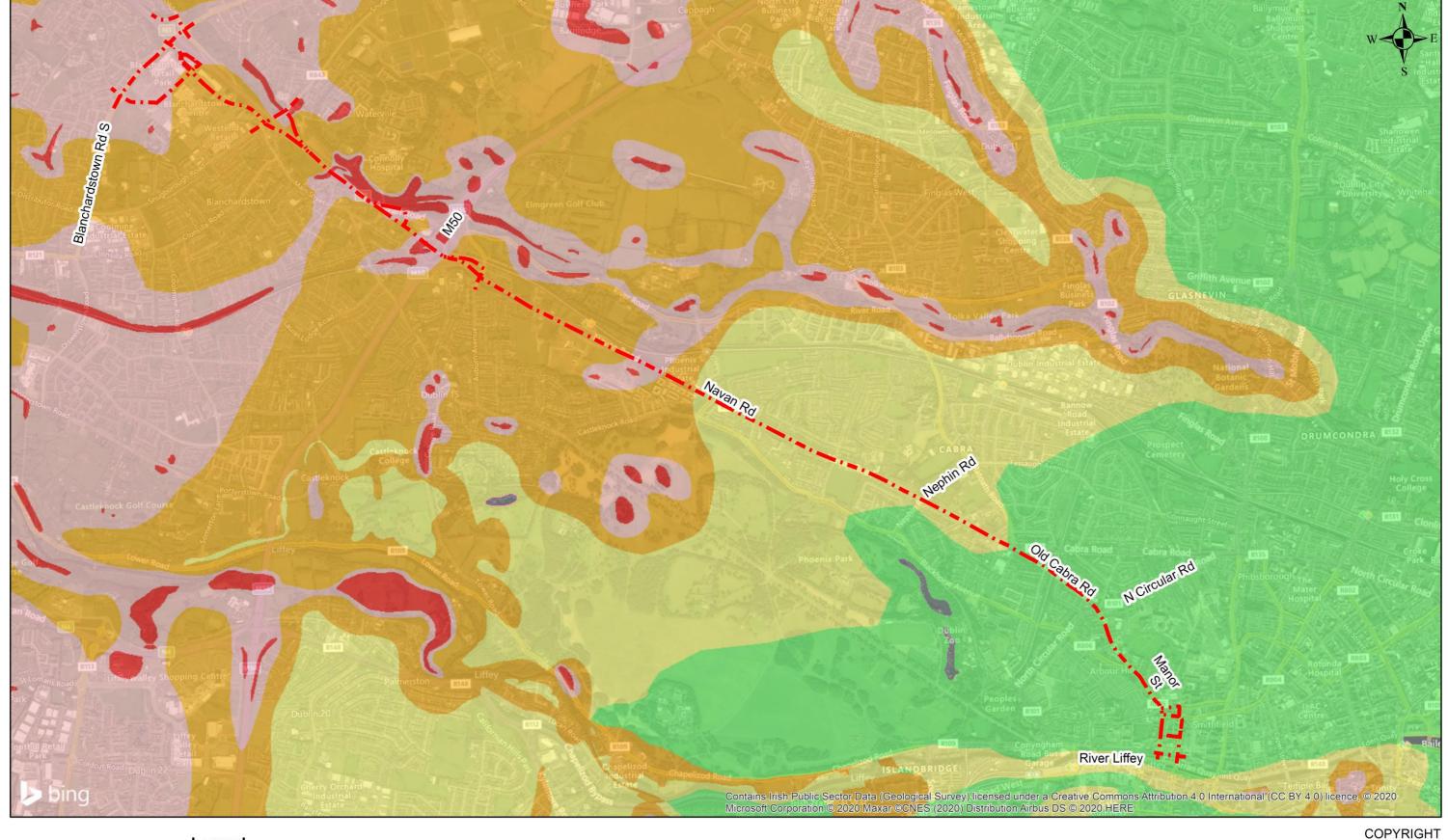
0 250 500 1,000 1,500

Blanchardstown to City Centre Core Bus Corridor

GSI Groundwater Aquifer

268401





■ I I Alignment

National Groundwater Vulnerability Ireland

Rock at or near Surface or Karst

Extreme

High

Moderate

— Low

ARUP

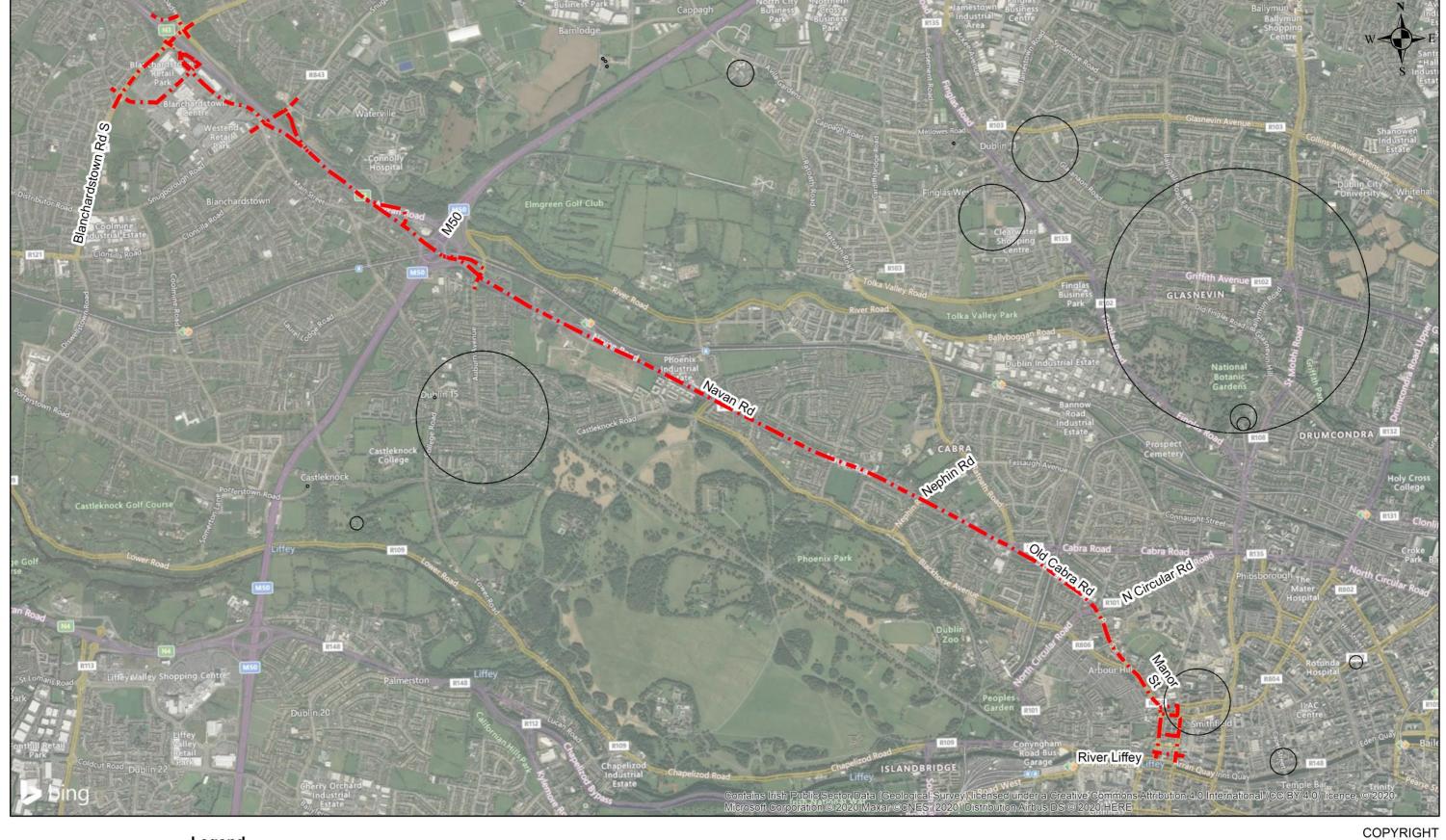
1:27,500

0 250 500 1,000 1,500

Blanchardstown to City Centre Core Bus Corridor

GSI Groundwater Vulnerability

268401



- I Alignment

Groundwater Wells and Springs



Blanchardstown to City Centre Core Bus Corridor GSI GW Wells & Springs

1:27,500

0 250 500 1,000 1,500

268401



ARUP

■ I Alignment

River Network and River Flow Direction Arrows

Lake Segments

Estimated Historic Rivers and

Estimated Historic Rivers and Streams

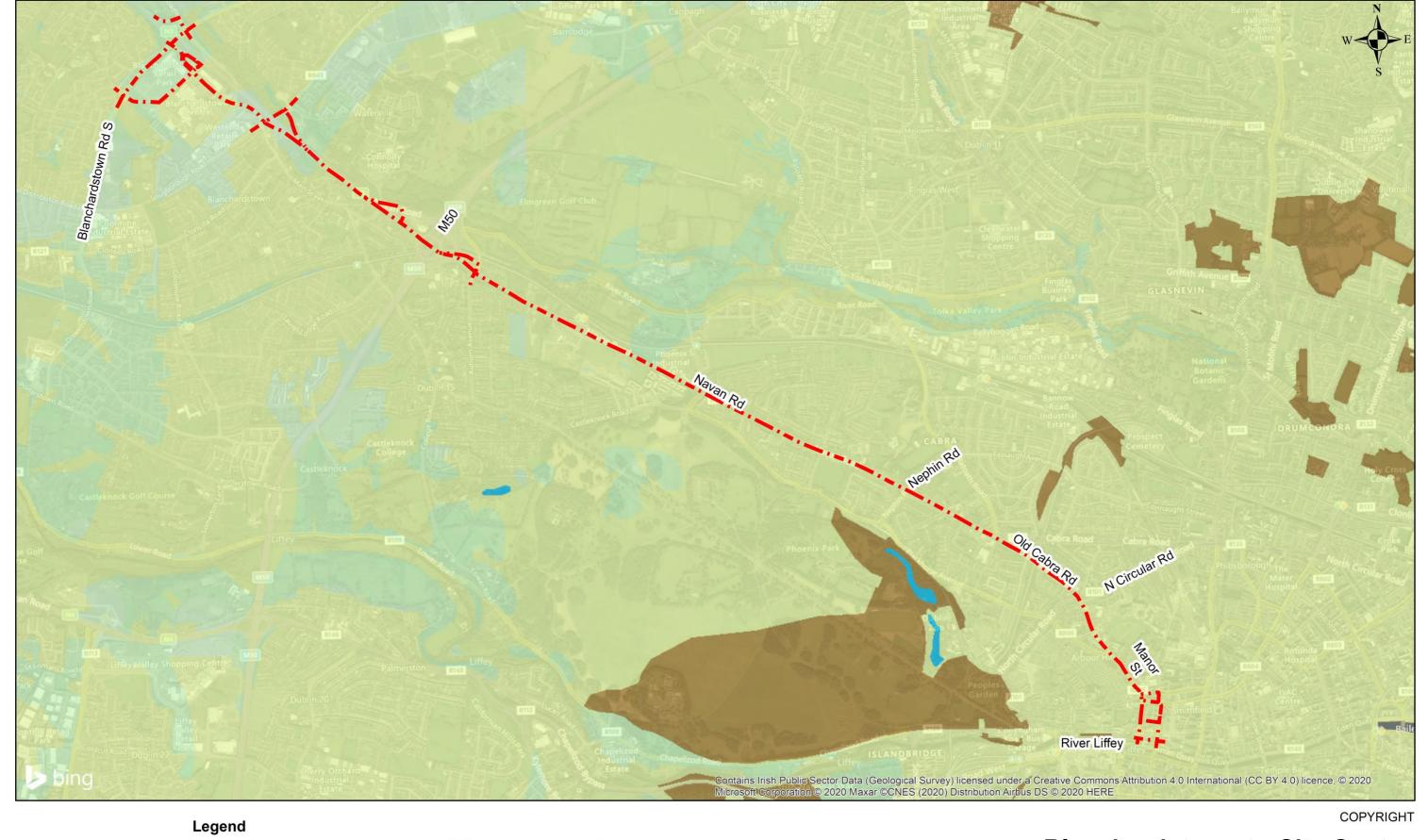
Core Bus Corridor Rivers of Dublin &

Blanchardstown to City Centre

EPA Waterbodies

268401





0 250 500



Blanchardstown to City Centre Core Bus Corridor Groundwater Recharge

1:27,500

1,500

1,000

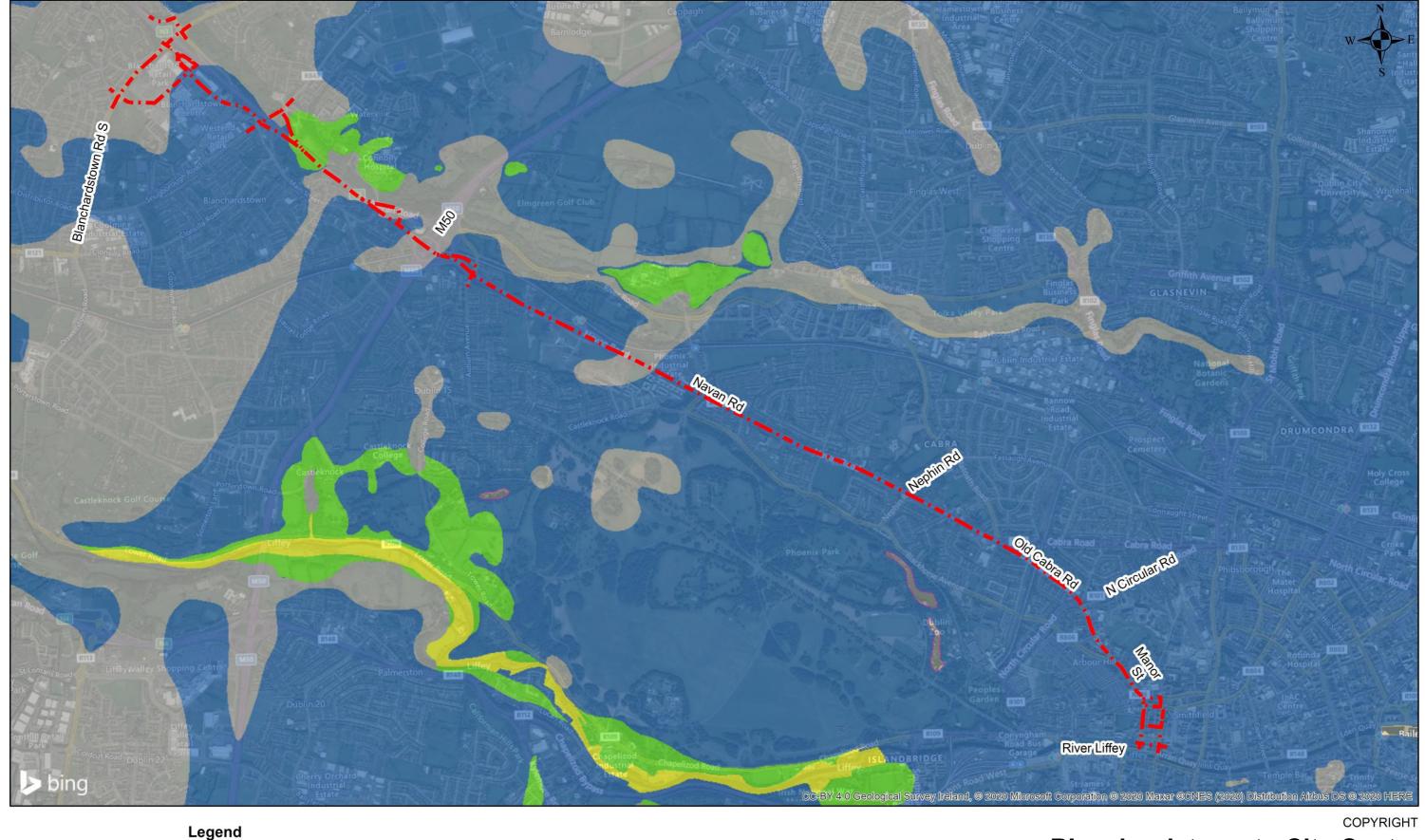
268401

FIGURE A22

701-800 mm

- 601-700 mm

151-200 mm 101-150 mm



Alignment

Subsoil Permeability

- High

Medium

ARUP

Not mapped

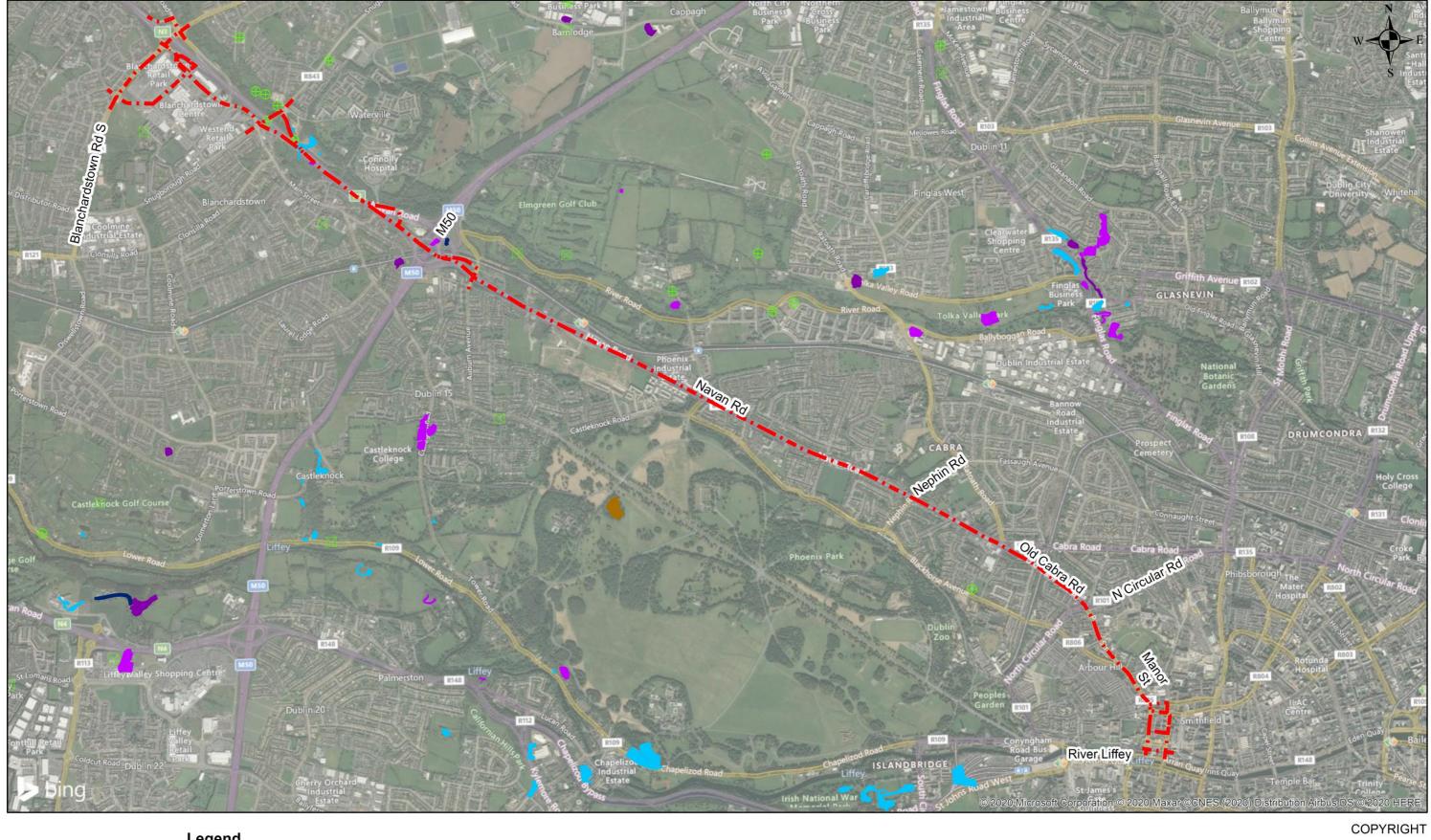
Blanchardstown to City Centre Core Bus Corridor

Subsoil Permeability

1:27,500

0 250 500 1,500 1,000

268401



■ I I Alignment Early to Mid-20thC: Pits Mid-19thC: Pits

Blanchardstown to City Centre Core Bus Corridor

GSI Active and Historic Pits & Quarries

268401

FIGURE A24

1:27,500

0 250 500 1,000 1,500



Blanchardstown to City Centre Core Bus Corridor

GSI Mineral Localities

268401

FIGURE A25

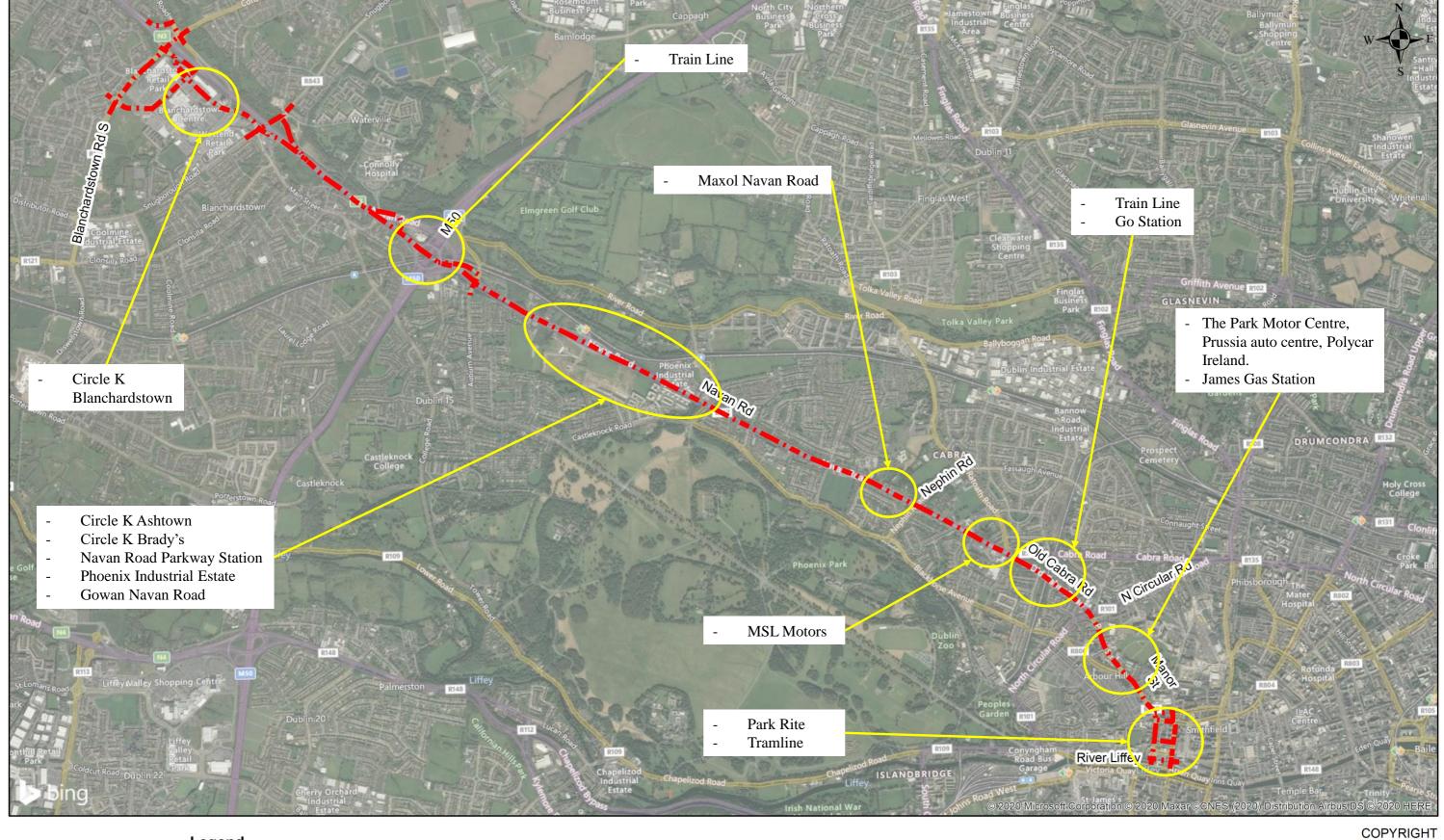
1:27,500

0 250 500 1,500 1,000

ARUP

Metallic

Non-metallic



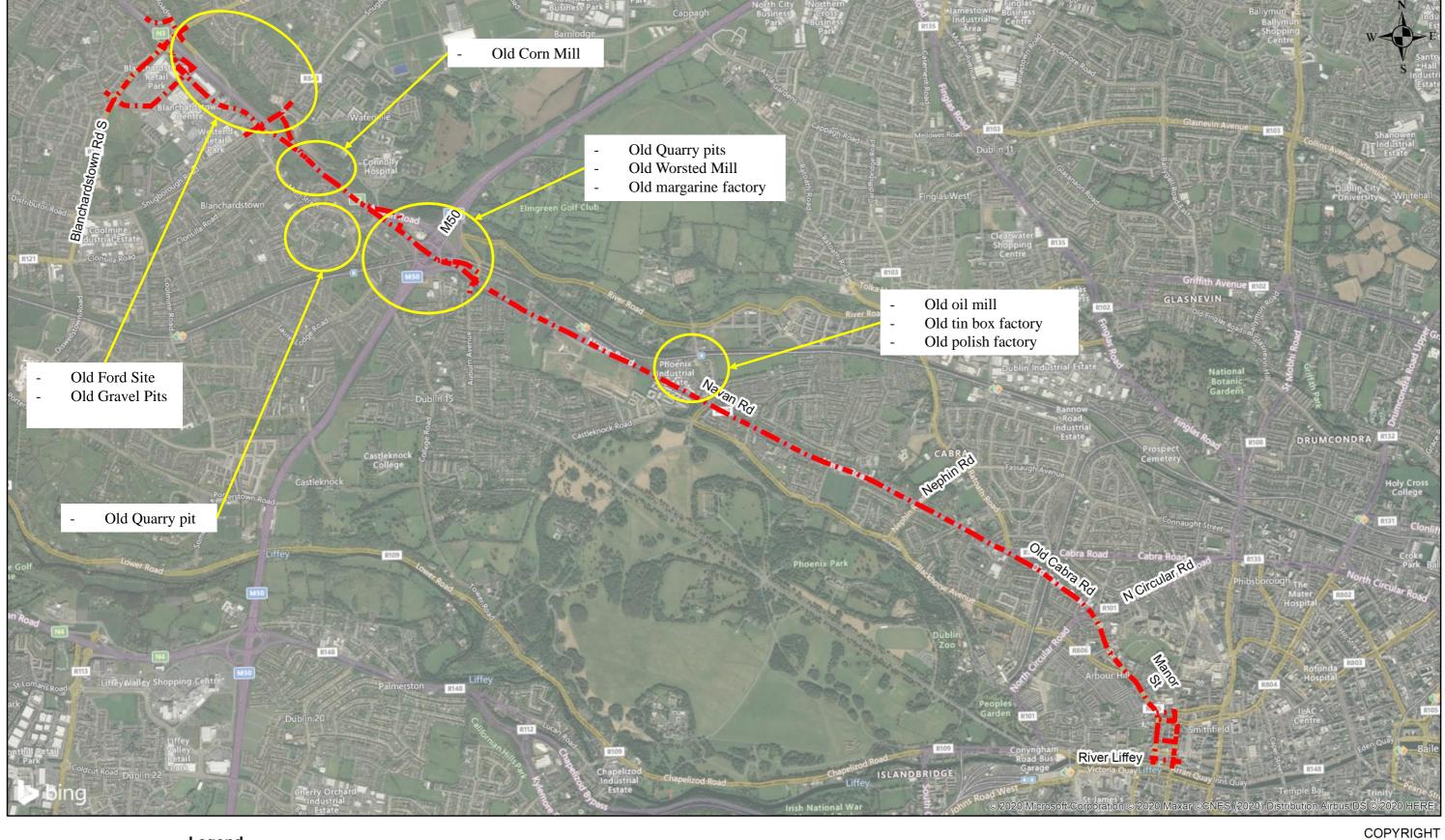
■ I I Alignment

Blanchardstown to City Centre Core Bus Corridor

Potential Sources of Contamination - 2020 Aerial Map FIGURE A26 268401

ARUP

1:27,500 0 250 500 1,500 1,000



■ I I Alignment

Blanchardstown to City Centre Core Bus Corridor

Potential Sources of Contamination - Historic

1:27,500

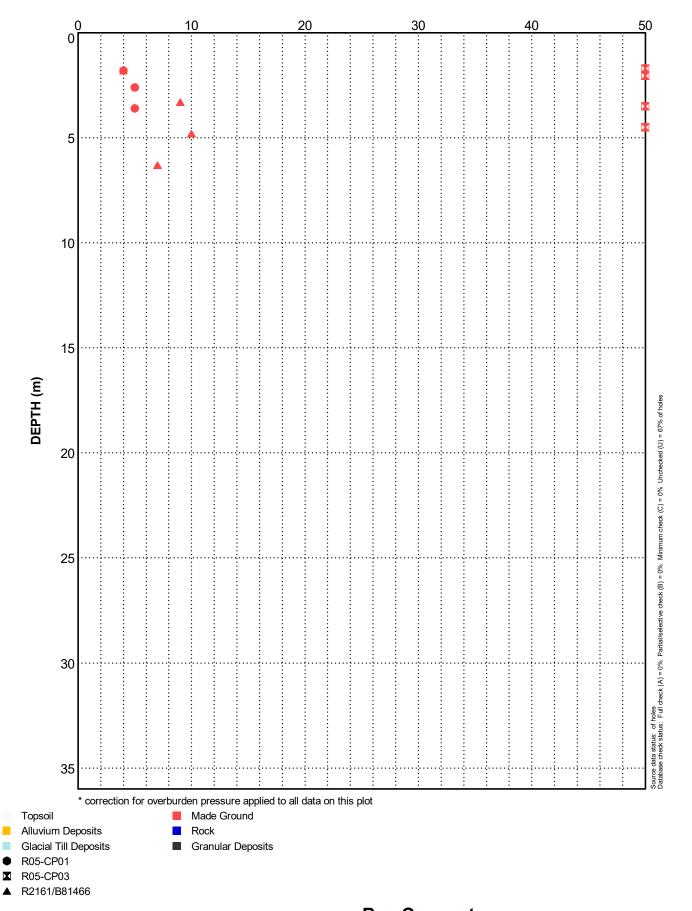
268401



Appendix B

In-Situ Testing Figures

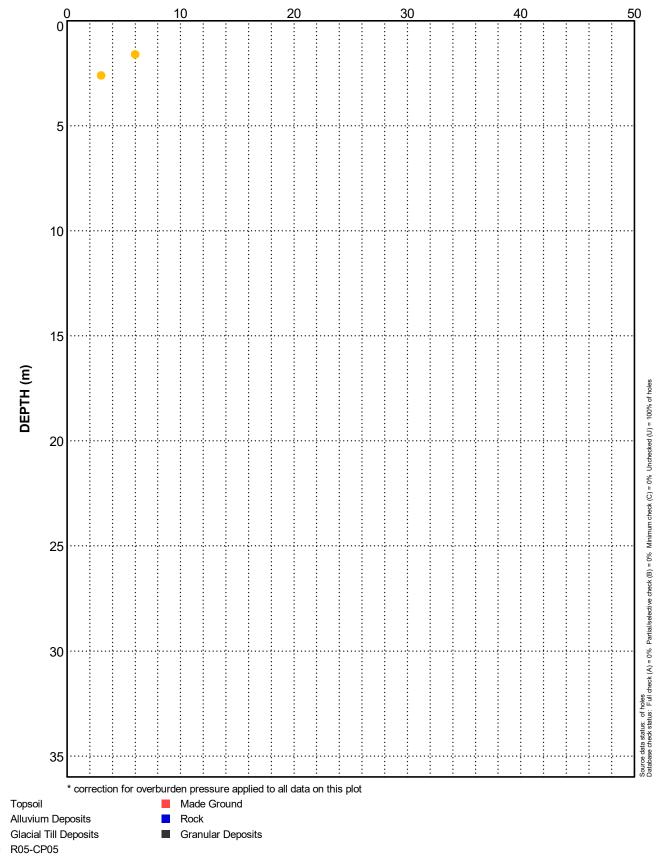
SPT N VALUE* (blows/300mm)



gINT V10.00.01.07 Licenced to Arup

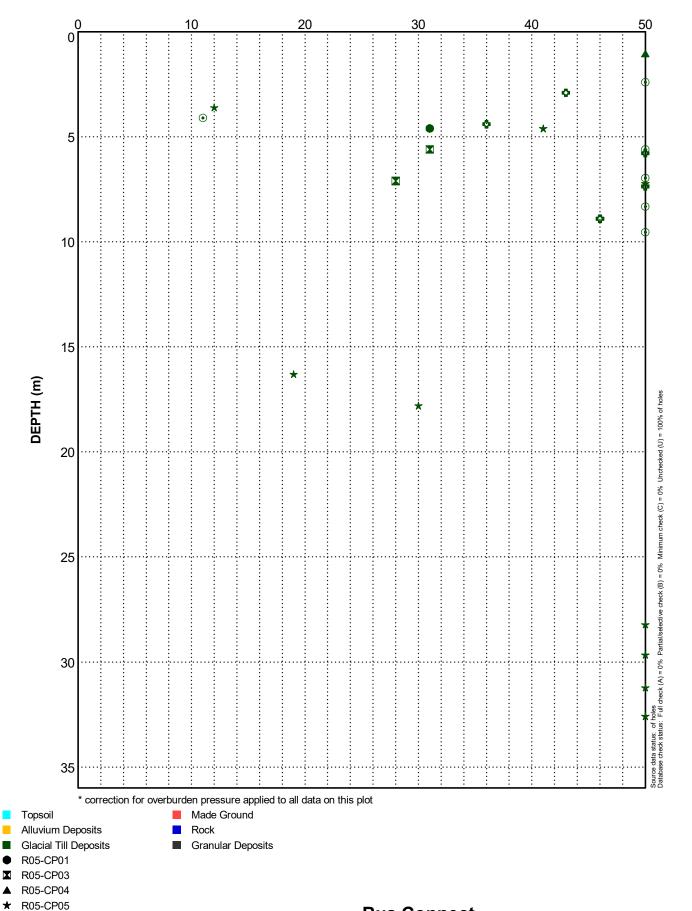
Graph: 3.09, Library: \\global\engineering\tauger\engineering\tauger\engineering\tauger\engin\engin\tauger\engin\engin\engin\engin\tauger\engin\engi

Bus Connect
STANDARD PENETRATION TESTS
Blanchardstown to City Centre Core
Bus Corridor
Made Ground
268401-00
FIGURE B01



Bus Connect
STANDARD PENETRATION TESTS
Blanchardstown to City Centre Core
Bus Corridor
Alluvium
268401-00
FIGURE **B02**

SPT N VALUE* (blows/300mm)



gINT V10.00.01.07 Licenced to Arup

Graph: C., Usus Associated and the Control of Section (1907) Section (1907)

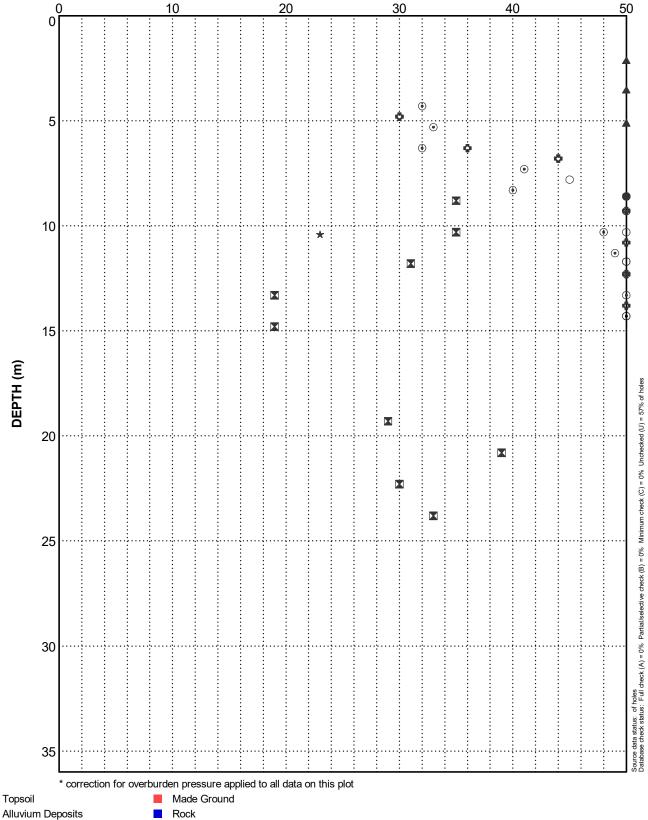
Bus Connect
STANDARD PENETRATION TESTS
Blanchardstown to City Centre Core
Bus Corridor
Glacial Till Deposits
268401-00
FIGURE B03

R05-RC06

R05-RC07

 \odot

SPT N VALUE* (blows/300mm)



Glacial Till Deposits

Granular Deposits

R05-CP03

R05-CP05

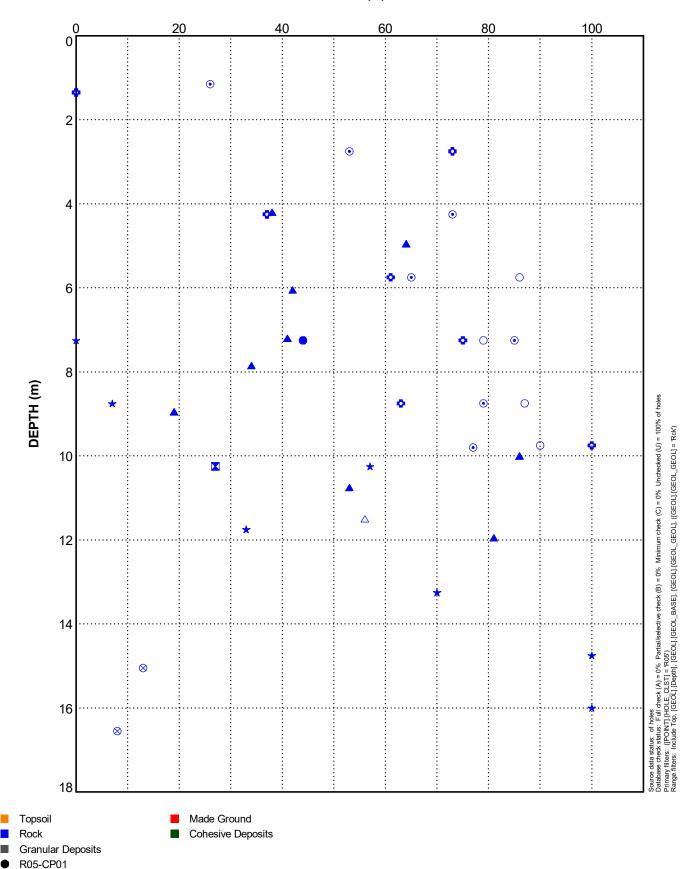
R05-RC01 R05-RC07

 \odot R2158/B81329

R2158/B81330

O R2161/B81466

Bus Connect STANDARD PENETRATION TESTS
Blanchardstown to City Centre Core **Bus Corridor Granular Deposits** FIGURE **B04** 268401-00



gINT v10.00.01.07 Licenced to Arup
Project : c. Userscat to Arup
Project : c. Userscatus plendets despessible in Template : 3.0); Library : \indicabaleuropeldublin\iobs2\toxinis\ground engineering\tau1.0 technica\personal folders\ozgur alper\gin\tau1 aper\gin\tau1 aper\gin\tau1 aper\gin\tau2 NGQU reas 31Aug1\tau1)
Graph: 3.49 CRD (reas 31Aug1\tau1)
gil\tau1 rouput page 1 of 1, Made 28May21 00.24 •

Bus Connect ROCK QUALITY DESIGNATION Blanchardstown to City Centre Core Bus Corridor

FIGURE B05

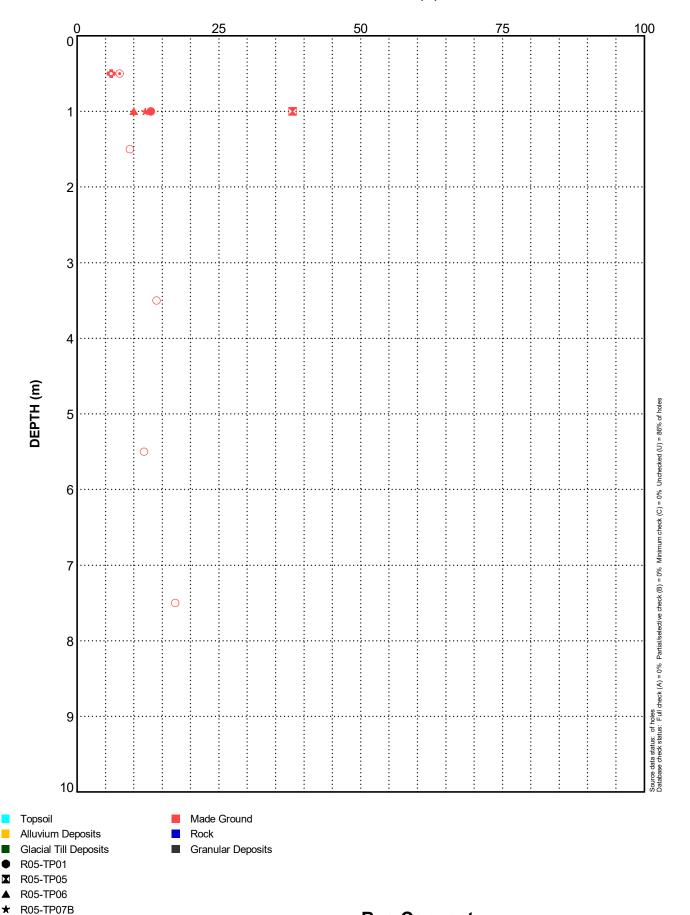
R05-CP03 R05-CP04 R05-RC01

R05-RC03

R05-RC04 R05-RC05 R05-RC06 R05-RC07

Appendix C

Laboratory Testing Figures



gINT v10.00.01.07. Licenced to Arup
Project : c. users/agging to protective and project to the project of the p

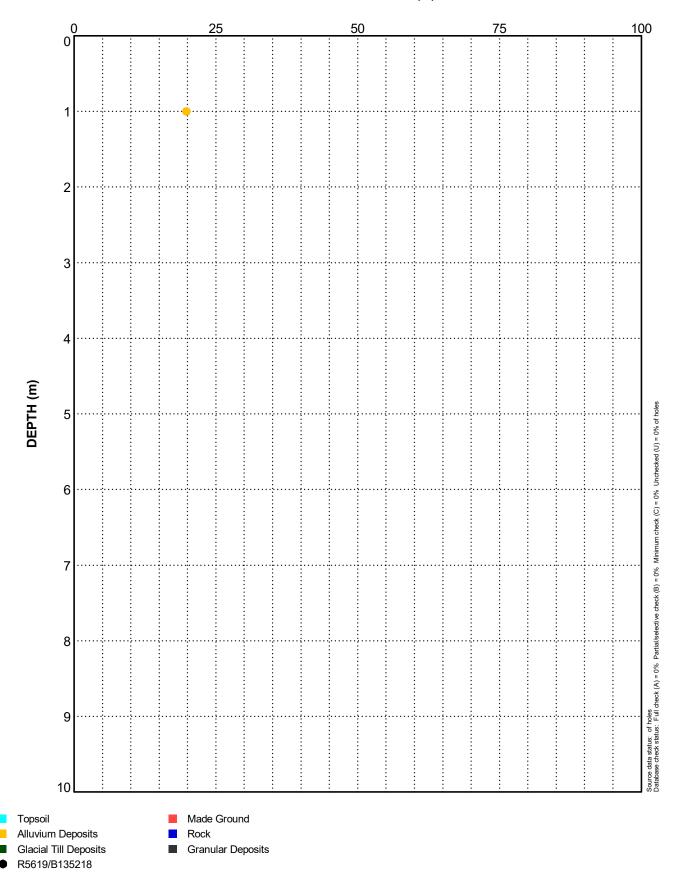
Bus Connect
MOISTURE CONTENT
Blanchardstown to City Centre Core
Bus Corridor
Made Ground

FIGURE C01

R05-TP08A

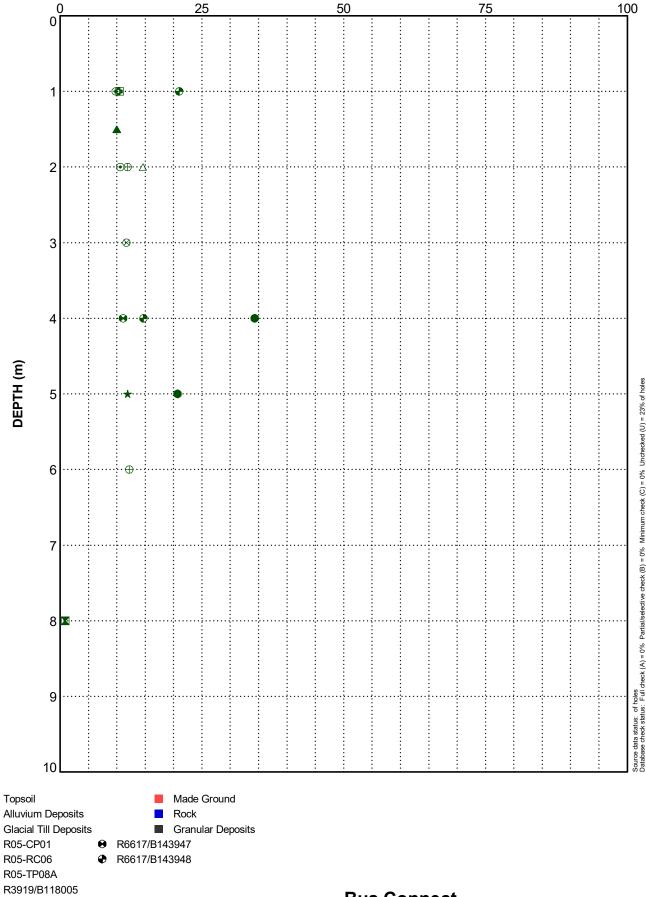
♣ R05-TP09○ R5614/B135148

 \odot



gINT v10.00.01.07. Licenced to Aup Project : c. Usersoziguri alperfolizioni piobi288401-00 bus connects\gint\05.02_gint\05.02_gint\05.05. Library : \@iobal\europe\dublin\obs2_gint\0502_qint\0502_gint\05.05. Bib Graph: 3.01.D Molist\UEDERS\(\text{(rev 9Febt1)}\) g\NT output page 1 of 1. Made 28.ung1 20:34

Bus Connect
MOISTURE CONTENT
Blanchardstown to City Centre Core
Bus Corridor
Alluvium
FIGURE C02



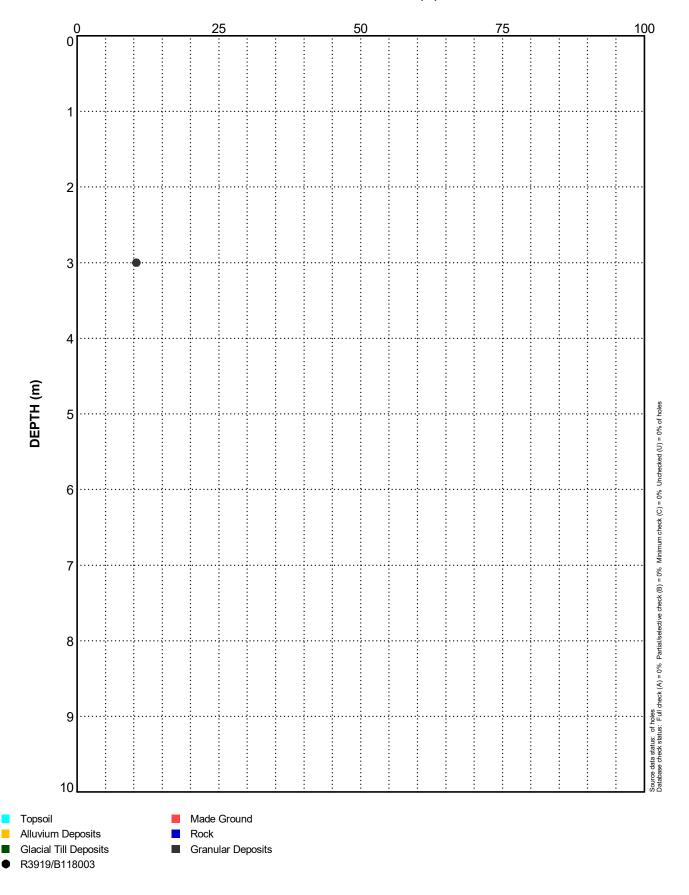
: c.Vserslozgur.alperidesktojvjob storfcuts\aunp job\269401-00. bus connects\gint\05\02_gint\05\05 gpj, (Template: 3.0); Library: \\\globalleurope\dublin\jobs\2_ovils\ground engineering\1.0 technical\personal folders\ozgur alper\gint\annup uklib_3-0-002-8.glb 33.01UB COONTEN (ALL TABLES) (rev.9Feb11)

△ R6617/B143943
 ⊗ R6617/B143944
 ⊕ R6617/B143945
 □ R6617/B143946

<<DrawingFileSpec>>

R5619/B135217

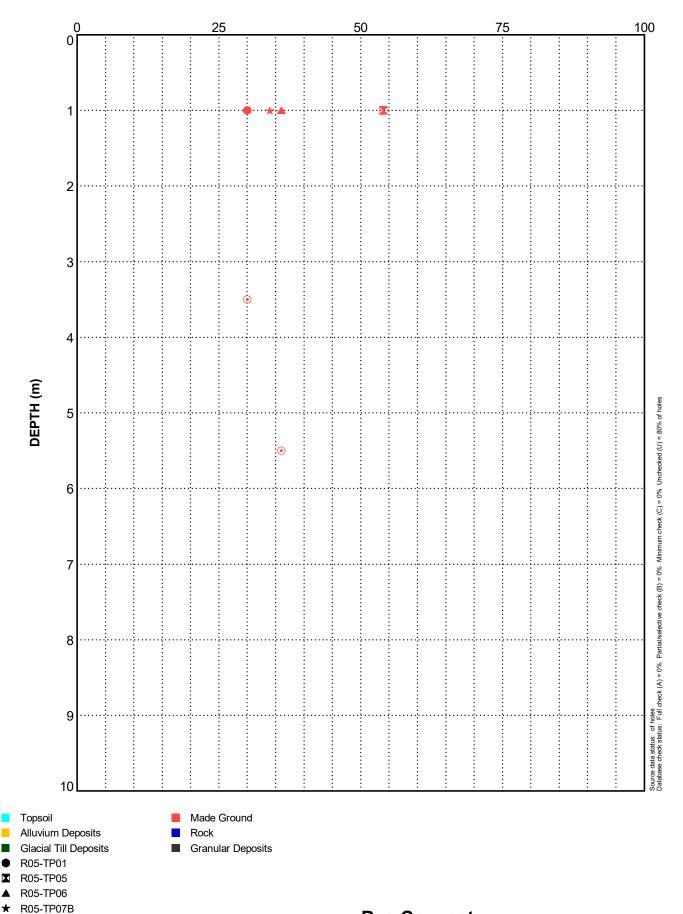
R5619/B135219 R5619/B135220 Bus Connect
MOISTURE CONTENT
Blanchardstown to City Centre Core
Bus Corridor
Glacial Till Deposits
FIGURE C03



gINT v10.00.01.07. Licenced to Arup
Project : c. usersozid to Arup
Project : c. usersozid usersozid usersozid in the project of the project o

Bus Connect MOISTURE CONTENT
Blanchardstown to City Centre Core **Bus Corridor Granular Deposits** FIGURE C04

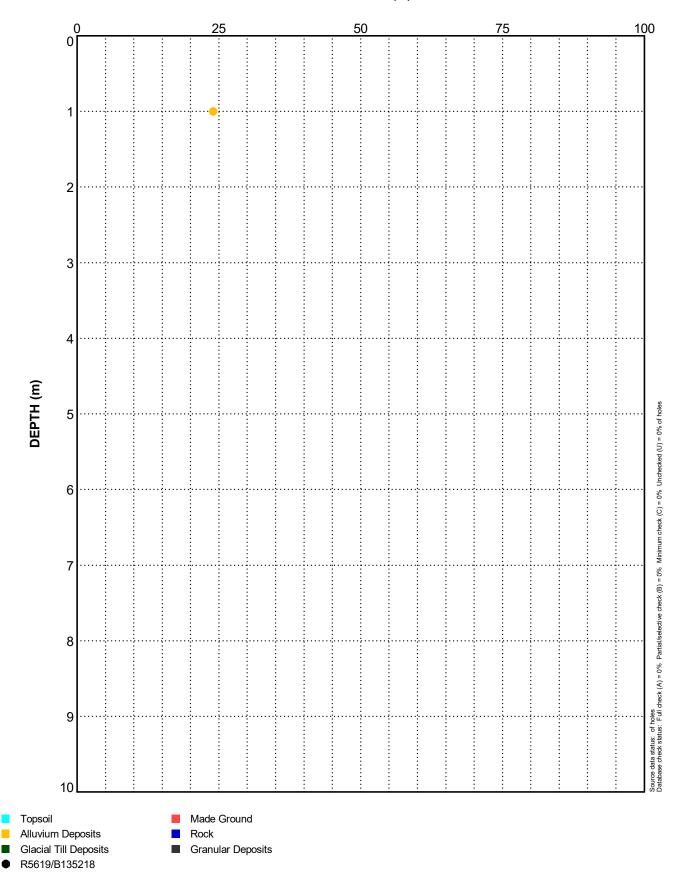
LIQUID LIMIT (%)



gINT v10.00.01.07. Licenced to Arup
Profest: c. userscated to Arup
Graph: 3.3.13D. Library: \\[\text{Global\tensored}\] (Template: 3.0); Library: \\[\text{Global\tensored}\] (All obselvention engineering): 1.0 technical\tensored folder\tensored folder\tensored alper\tensored folder\tensored alper\tensored alper\tensored

Bus Connect
LIQUID LIMIT
Blanchardstown to City Centre Core
Bus Corridor
Ground
FIGURE C05

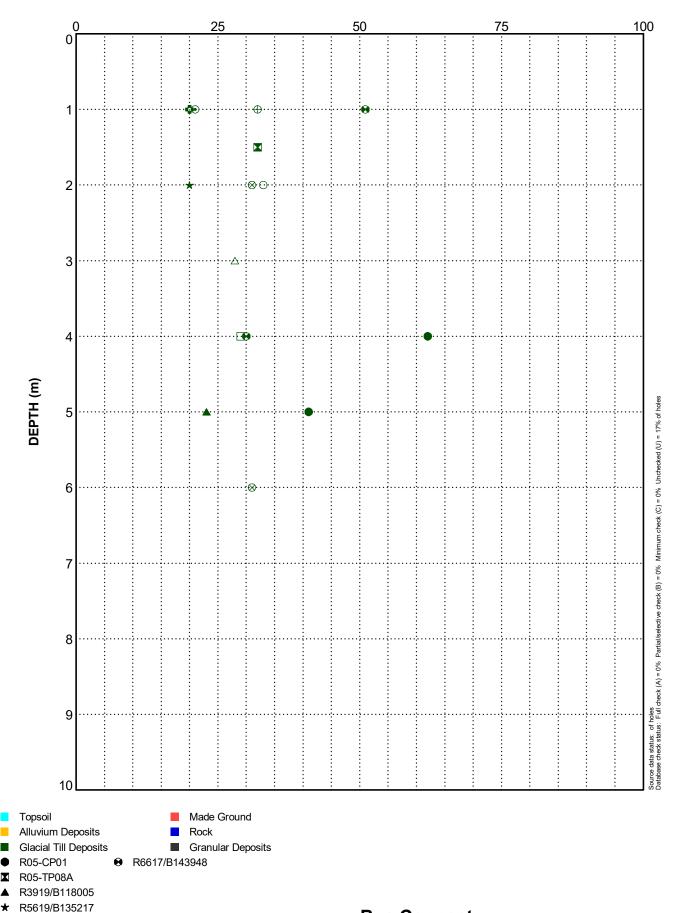
R5614/B135148



gINT v10.00.01.07. Licenced to Arup
Profest: c. userscated to Arup
Graph: 3.3.13D. Library: \\[\text{Global\tensored}\] (Template: 3.0); Library: \\[\text{Global\tensored}\] (All obselvention engineering): 1.0 technical\tensored folder\tensored folder\tensored alper\tensored folder\tensored alper\tensored alper\tensored

Bus Connect LIQUID LIMIT
Blanchardstown to City Centre Core **Bus Corridor Alluvium** FIGURE C06

LIQUID LIMIT (%)



10.00.01.07 Licenced to Arup : c:bassogu:alpersoand professoral job/288401-00_bus connects/gnin/05/02_gintin/05/02_gintin/05/09. Library:\\globalleurope\dublin\\jobs2_civils\ground engineering\ni\0 technical\personal folders\alphagur alper\grund professoral folder\alphagur alper\grund professoral folder\alphagur alper\grund professoral folder\alphagur alper\grund professoral folder\alphagur alphagur alper\grund professoral folder\alphagur alphagur alph

Bus Connect LIQUID LIMIT
Blanchardstown to City Centre Core **Bus Corridor Glacial Till Deposits**

FIGURE C07

☐ R6617/B143947 <<DrawingFileSpec>>

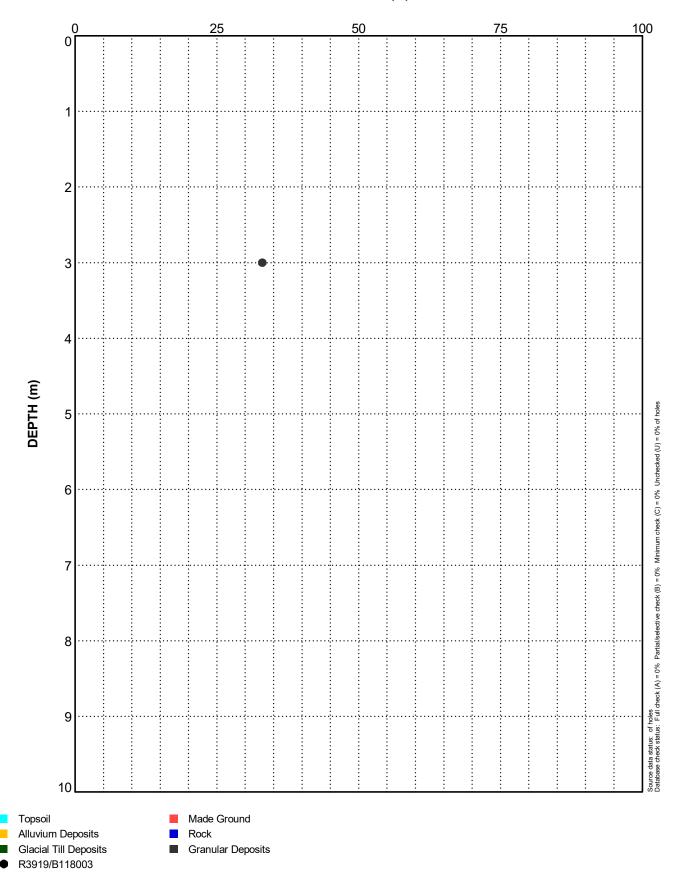
R5619/B135219

R5619/B135220 R6617/B143943 R6617/B143944

R6617/B143945

R6617/B143946

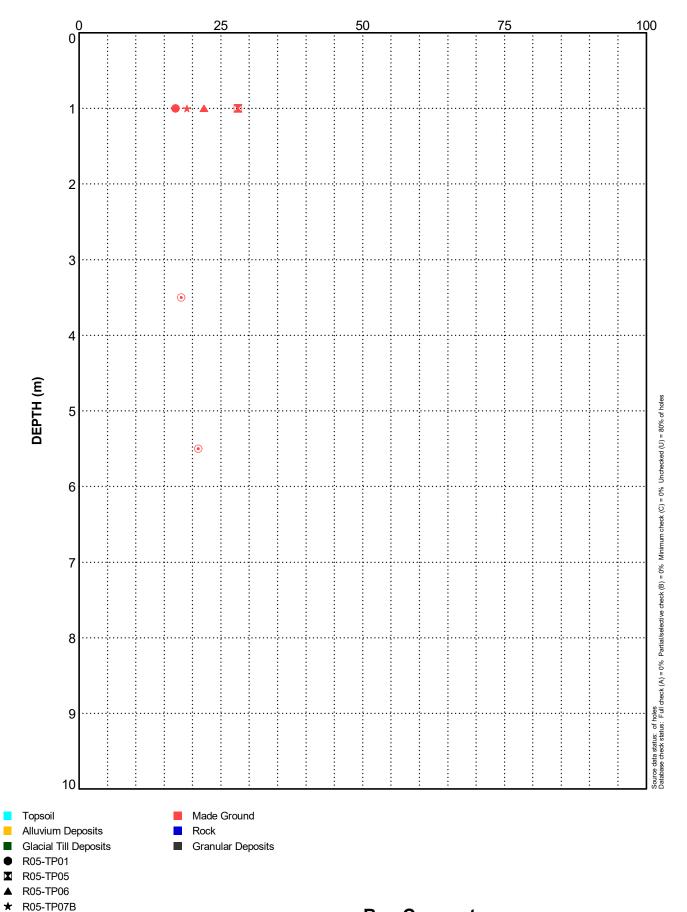
 \odot



gINT v10.00.01.07. Licenced to Arup
Profest: c. userscated to Arup
Graph: 3.3.13D. Library: \\[\text{Global\tensored}\] (Template: 3.0); Library: \\[\text{Global\tensored}\] (All obselvention engineering): 1.0 technical\tensored folder\tensored folder\tensored alper\tensored folder\tensored alper\tensored alper\tensored

Bus Connect LIQUID LIMIT
Blanchardstown to City Centre Core **Bus Corridor Granular Deposits** FIGURE C08

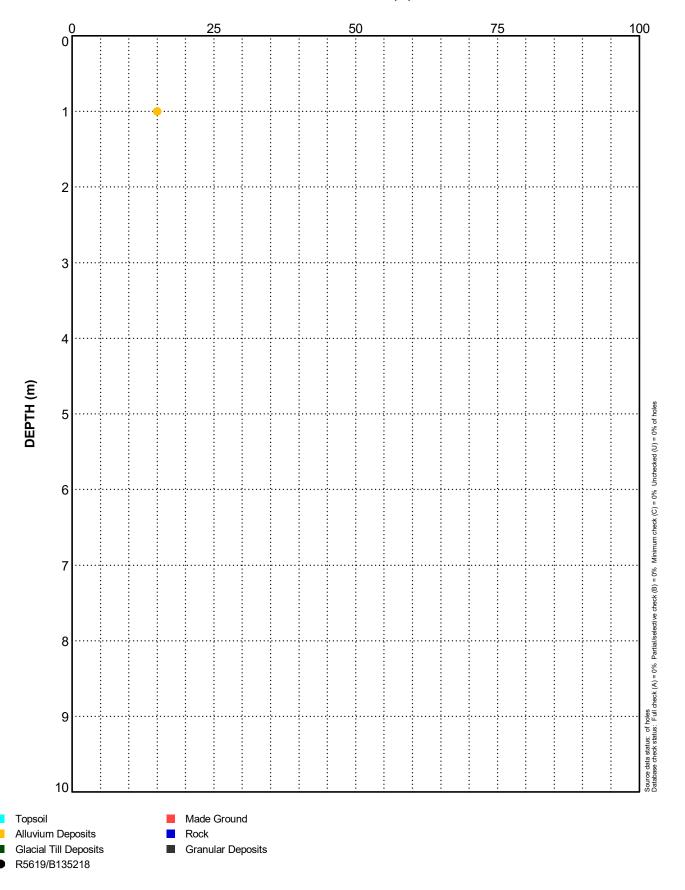
PLASTIC LIMIT (%)



gINT v10.00.01.07. Licenced to Arup
Project : c. userscated to Arup
Project : c. userscated to Arup
Graph: 3.1.2.D PLASTIC INNIT (eve Peb 11)
Graph: 3.3.1.2.D PLASTIC INNIT (eve Peb 11)

Bus Connect PLASTIC LIMIT
Blanchardstown to City Centre Core **Bus Corridor Made Ground** FIGURE C09

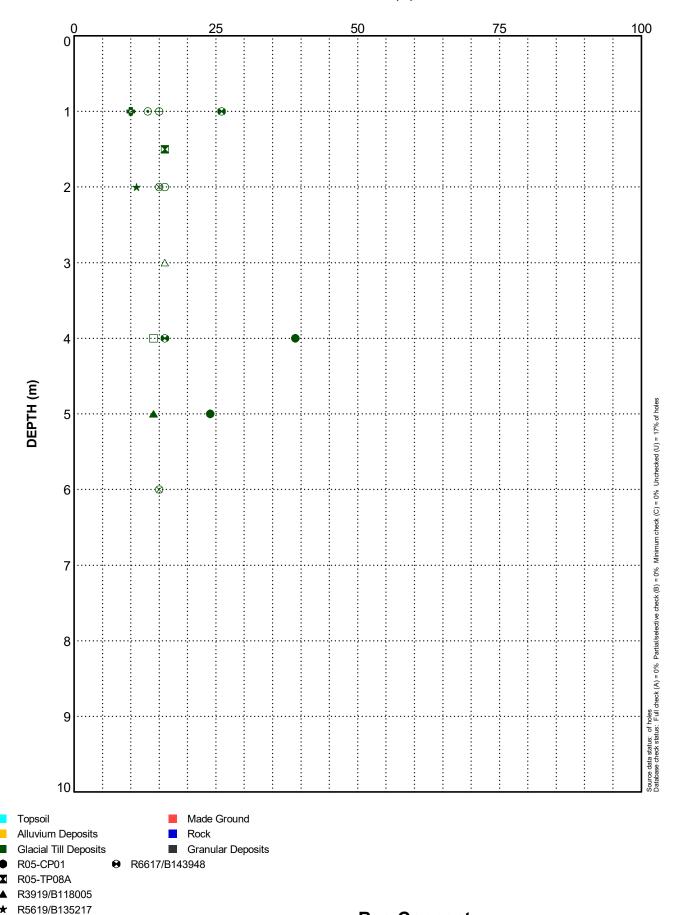
R5614/B135148



gINT v10.00.01.07. Licenced to Arup
Project : c. userscated to Arup
Project : c. userscated to Arup
Graph: 3.1.2.D PLASTIC INNIT (eve Peb 11)
Graph: 3.3.1.2.D PLASTIC INNIT (eve Peb 11)

Bus Connect
PLASTIC LIMIT
Blanchardstown to City Centre Core
Bus Corridor
Alluvium
FIGURE C10

PLASTIC LIMIT (%)



gINT v10.00.01.07 Licenced to Arup
Project : Ususcatoguical perfect (1902) and 1900 pus connects/gint/05/02_gint/105/09_gint/1

PLASTIC LIMIT
Blanchardstown to City Centre Core **Bus Corridor Glacial Till Deposits**

FIGURE C11

☐ R6617/B143947 <<DrawingFileSpec>>

R5619/B135219

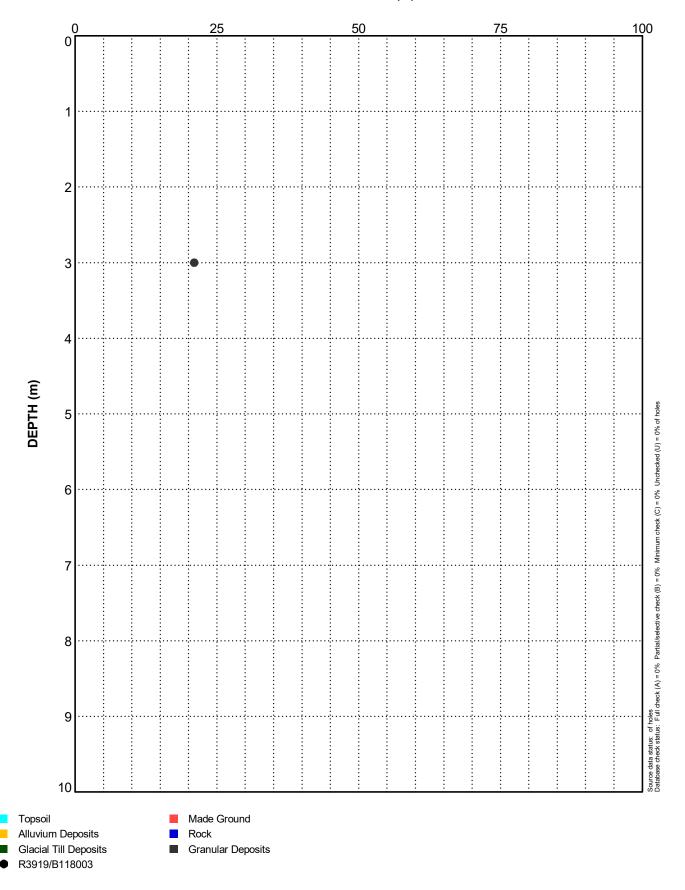
R5619/B135220 R6617/B143943 R6617/B143944

R6617/B143945

R6617/B143946

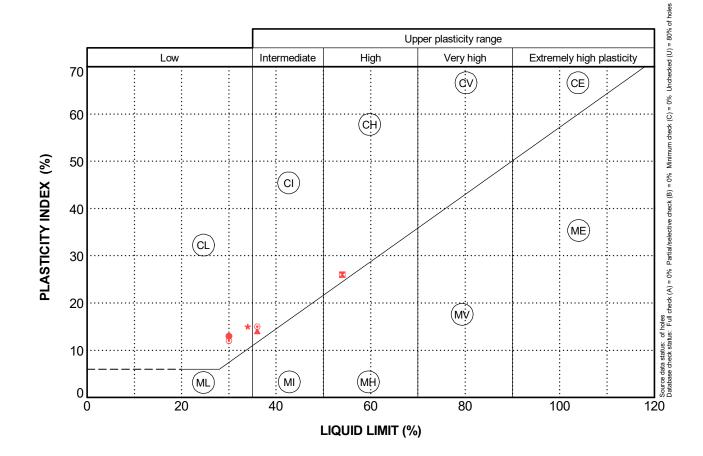
 \odot

Bus Connect



gINT v10.00.01.07. Licenced to Arup
Project : c. userscated to Arup
Project : c. userscated to Full Project : c. userscated to Arup
Graph: 3.1.2.D PLASTIC INNIT (eve Peab11)
Graph: 3.3.1.2.D PLASTIC INNIT (eve Peab12)
Graph: 3.3.1.2.D PLASTIC INNIT (eve Peab13)
Graph: 3.4.2.D PLASTIC INNIT (eve Peab14)

Bus Connect
PLASTIC LIMIT
Blanchardstown to City Centre Core
Bus Corridor
Granular Deposits
FIGURE C12





Made Ground

Granular Deposits

Rock

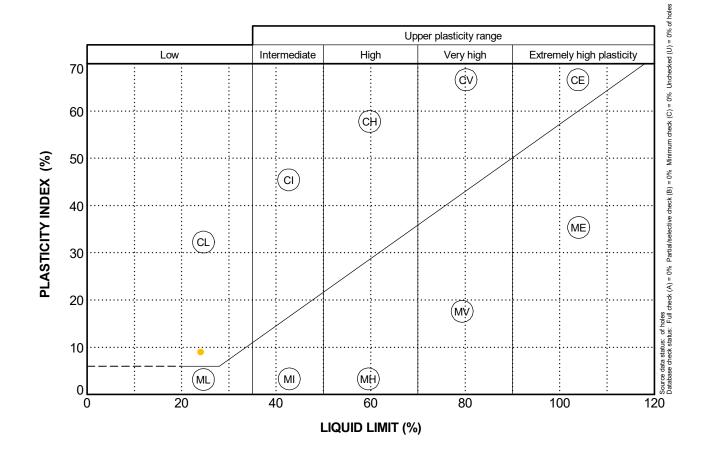
R05-TP01

R05-TP05

R05-TP06

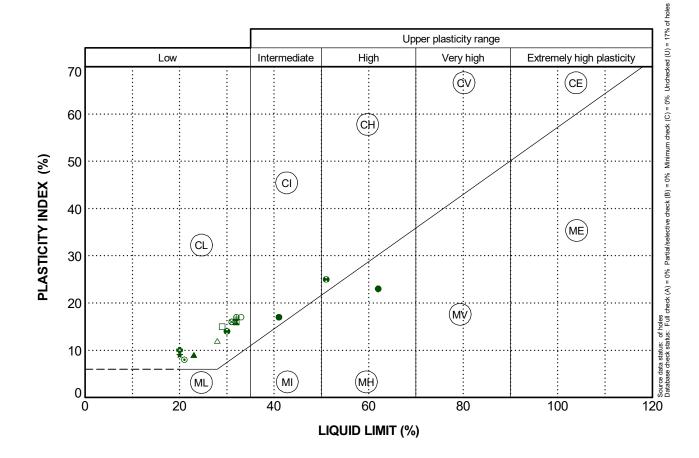
R05-TP07B R5614/B135148

Bus Connect PLASTICITY CHART
Blanchardstown to City Centre Core **Bus Corridor Made Ground** FIGURE C13





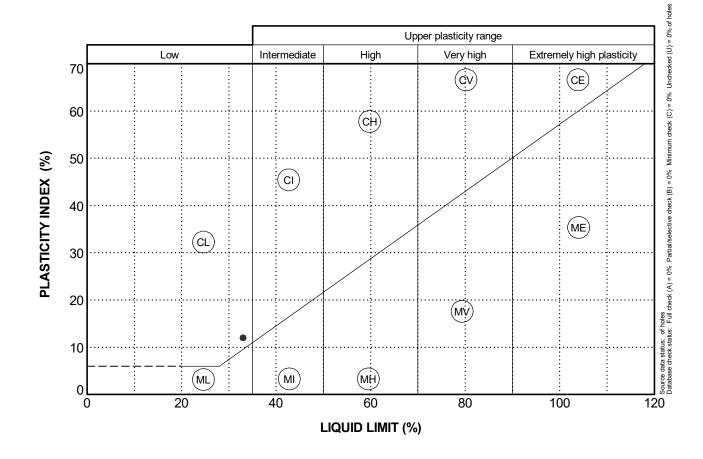
Bus Connect
PLASTICITY CHART
Blanchardstown to City Centre Core
Bus Corridor
Alluvium
FIGURE C14





- R05-TP08A
- ▲ R3919/B118005
- ★ R5619/B135217
- R5619/B135219
- ♣ R5619/B135220
- O R6617/B143943
- △ R6617/B143944 ⊗ R6617/B143945
- ⊕ R6617/B143946
- ☐ R6617/B143947

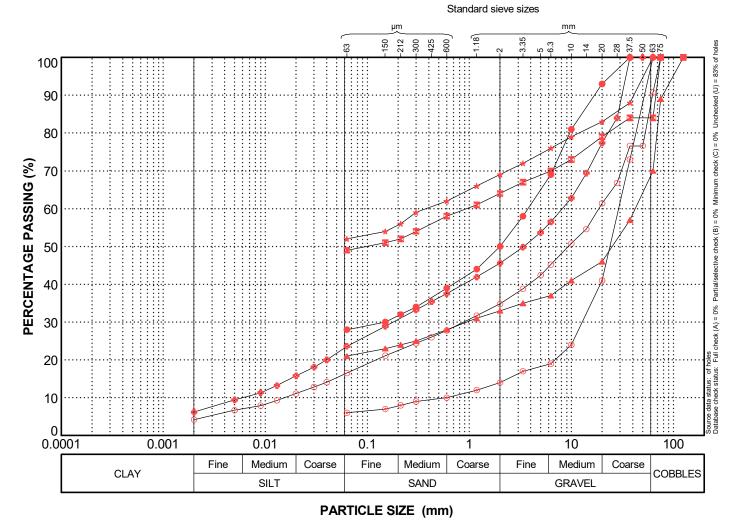
Bus Connect
PLASTICITY CHART
Blanchardstown to City Centre Core
Bus Corridor
Glacial Till Deposits
FIGURE C15





Granular Deposits

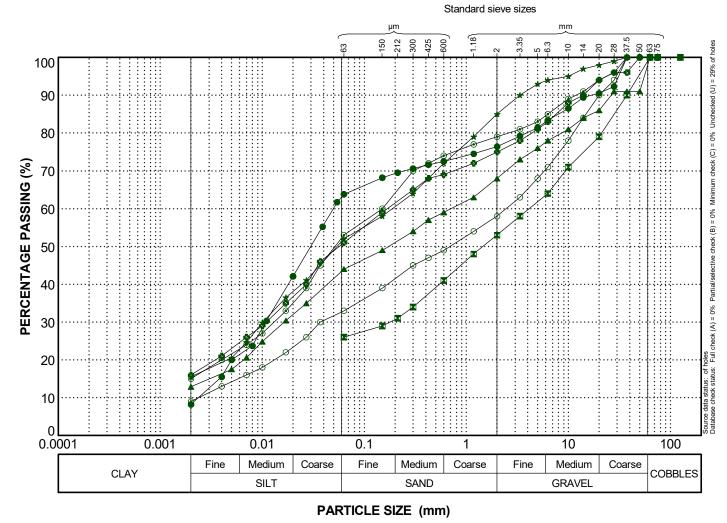
Bus Connect PLASTICITY CHART
Blanchardstown to City Centre Core **Bus Corridor Granular Deposits** FIGURE C16



- R05-TP01, 1.00m
- R05-TP05, 1.00m
- ▲ R05-TP06, 1.00m
- ★ R05-TP07B, 1.00m
- R05-TP09, 0.50m
- ♠ R5614/B135148, 1.50m
- O R5614/B135148, 7.50m

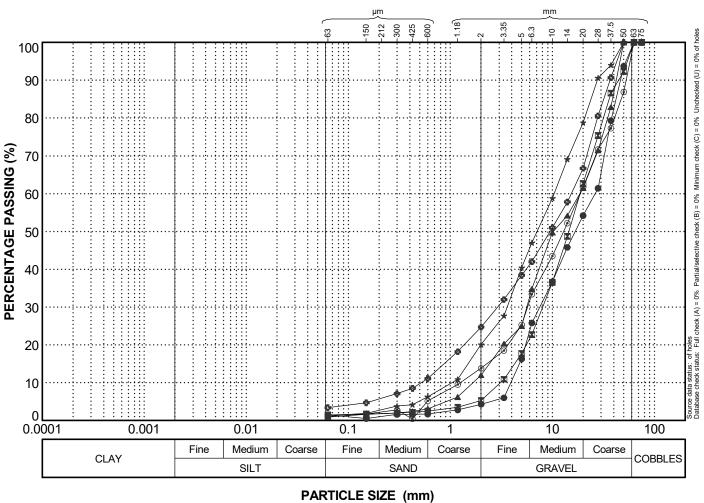
Topsoil
Made Ground
Alluvium Deposits
Rock
Glacial Till Deposits
Granular Deposits

Bus Connect
PARTICLE SIZE DISTRIBUTION
Blanchardstown to City Centre Core
Bus Corridor
Made Ground
268401-00
FIGURE C17



- R05-CP01, 4.00m
- R05-TP08A, 1.50m
- ▲ R5619/B135217, 2.00m
- ★ R5619/B135219, 1.00m
- R6617/B143943, 2.00m
- ♣ R6617/B143947, 4.00m
- O R6617/B143948, 4.00m

Bus Connect
PARTICLE SIZE DISTRIBUTION
Blanchardstown to City Centre Core
Bus Corridor
Glacial Till Deposits
268401-00
FIGURE C18



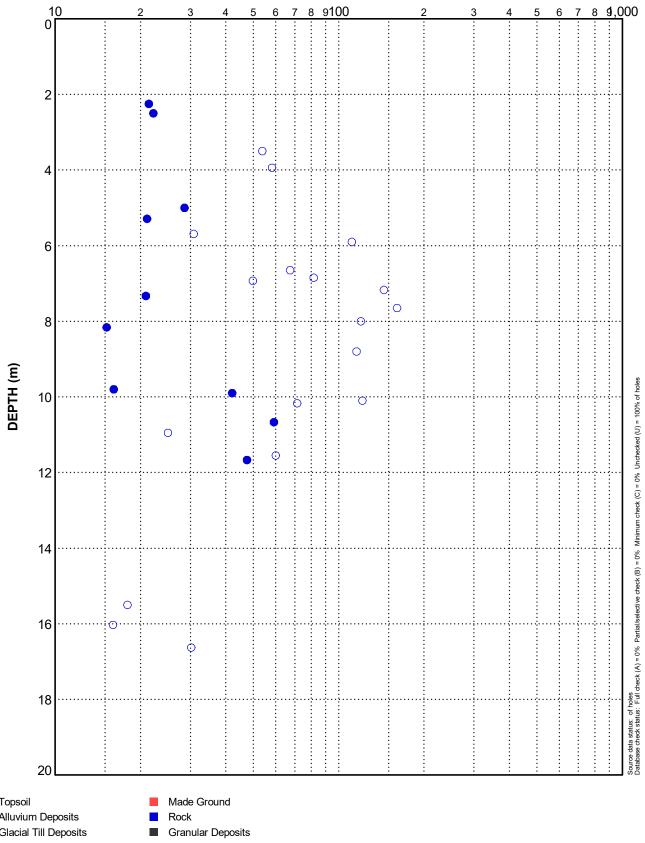
Standard sieve sizes

- R2161/B81466, 9.00m
- R3919/B118003, 3.00m
- R3919/B118004, 3.50m
- R3919/B118005, 2.50m
- R3919/B118006, 5.00m
- R3919/B118007, 4.00m

Topsoil Made Ground Alluvium Deposits Glacial Till Deposits Granular Deposits

> **Bus Connect** PARTICLE SIZE DISTRIBUTION
> Blanchardstown to City Centre Core **Bus Corridor Granular Deposits** 268401-00 FIGURE C19

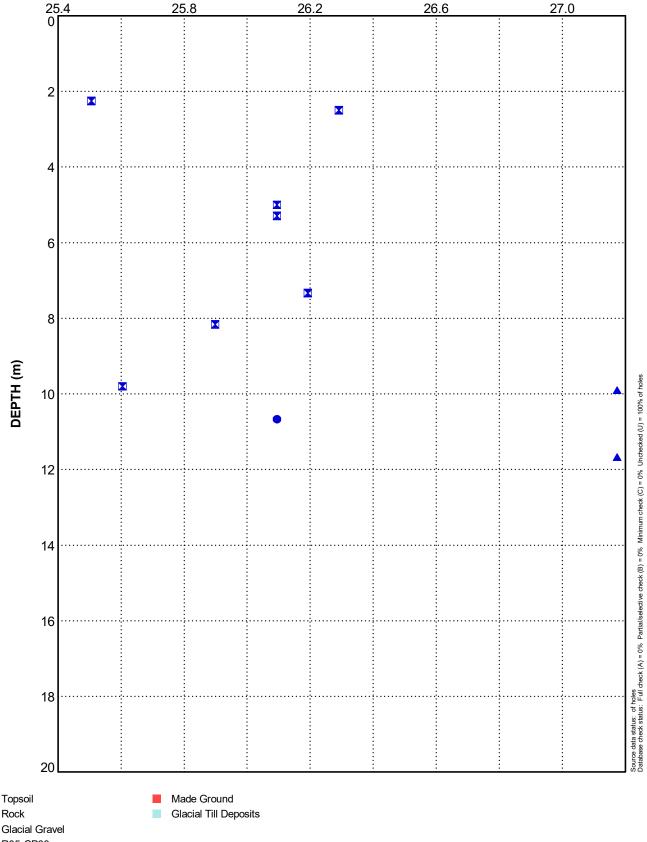
UNIAXIAL COMPRESSIVE STRENGTH (MPa)



gINT v10.00.01.07 Licenced to Arup
Project : Usersockagolicus international pob)288401-00_bus connects/gin/05/02_gin/t/05.gpj, (Template : 3.0); Library : \@jobal\europe\dublin\ope2/_gin\operational engineering1.0 technical\personal folders\ozerlangual alperguntarup_job)288401-00_bus connects\overational gin/t/05.gpj, (Template : 3.0); Library : \@jobal\europe\dublin\operational gin/toolar engineering1.0 technical\personal folders\ozerlangual gin/toolar gin/ Topsoil Alluvium Deposits Glacial Till Deposits <<DrawingFileSpec>>

Bus Connect POINT LOAD INDEX
Blanchardstown to City Centre Core **Bus Corridor Rock** FIGURE C20

BULK UNIT WEIGHT (kN/m³)



Rock Glacial Gravel R05-CP03 R05-RC04 R05-RC06

gINT v10.00.01.07 Licenced to Arup
Project : c. Usersiozgur alperideblishes ags3.gpj, (Template : 3.0); Library : \\[\text{global\europeldublin\}\] bbs2_\circ \\ \text{civils\ground engineering\}\] 1.0 technica\\\perpersonal folders\\\ \text{circl}\] personal folders\\\ \text{circl}\] 2.0-002-8.glb
Graph: 3.35.D Bulk_VURI WEIGHT (rer. 15May77)
gNT rouput page 1 of 1. Made 28May21 01:11

Bus Connect BULK UNIT WEIGHT Blanchardstown to City Centre Core **Bus Corridor Rock** FIGURE C21

Appendix D

Factual Ground Investigation Report

National Transport Authority

Blanchardstown to City Centre Core Bus Corridor Scheme

Factual Ground Investigation Report

268401-00

Issue | 21 December 2021

This report takes into account the particular instructions and requirements of our client. It is not intended for and should not be relied upon by any third party and no responsibility is undertaken to any third party.

Job number 268401-00

Ove Arup & Partners Ireland Ltd

Arup 50 Ringsend Road Dublin 4 D04 T6X0 Ireland www.arup.com





Catherinestown House, Hazelhatch Road, Newcastle, Co. Dublin. D22 YD52

Tel: 01 601 5175 / 5176

Email: info@gii.ie Web: www.gii.ie

Ground Investigations Ireland

Bus Connect Detailed Stage 1 Lot 1

Route 5

National Transport Authority

Ground Investigation Report

June 2021





Catherinestown House, Hazelhatch Road, Newcastle, Co. Dublin. D22 YD52

Tel: 01 601 5175 / 5176

Email: info@gii.ie Web: www.gii.ie

DOCUMENT CONTROL SHEET

Project Title	Bus Connect Detailed Stage 1 Lot 1 – Route 5	
Engineer	Arup	
Client	NTA	
Project No	9754-07-20 R5	
Document Title	Ground Investigation Report	

Rev.	Status	Author(s)	Reviewed By	Approved By	Office of Origin	Issue Date
Α	Draft	M Sutton	A McDonnell	A McDonnell	Dublin	29 March 2021
В	Final	M Sutton	A McDonnell	A McDonnell	Dublin	20 April 2021
С	Final	M Sutton	A McDonnell	A McDonnell	Dublin	14 May 2021
D	Final	M Sutton	A McDonnell	A McDonnell	Dublin	18 June 2021

Ground Investigations Ireland Ltd. present the results of the fieldworks and laboratory testing in accordance with the specification and related documents provided by or on behalf of the client. The possibility of variation in the ground and/or groundwater conditions between or below exploratory locations or due to the investigation techniques employed must be taken into account when this report and the appendices inform designs or decisions where such variation may be considered relevant. Ground and/or groundwater conditions may vary due to seasonal, man-made or other activities not apparent during the fieldworks and no responsibility can be taken for such variation. The data presented and the recommendations included in this report and associated appendices are intended for the use of the client and the client's geotechnical representative only and any duty of care to others is excluded unless approved in writing.





GROUND INVESTIGATIONS IRELAND

Geotechnical & Environmental

Catherinestown House, Hazelhatch Road, Newcastle, Co. Dublin. D22 YD52

Tel: 01 601 5175 / 5176

Email: info@gii.ie Web: www.gii.ie

CONTENTS

1.0	Preamble1
2.0	Overview1
2.1.	Background1
2.2.	Purpose and Scope1
3.0	Subsurface Exploration1
3.1.	General1
3.2.	Trial Pits2
3.3.	Cable Percussion Boreholes2
3.4.	Rotary Boreholes3
3.5.	Surveying3
3.6.	Groundwater Monitoring Installations4
3.7.	Laboratory Testing4
4.0	Ground Conditions4
4.1.	General4
4.2.	Groundwater6
4.3.	Laboratory Testing6
4.3.1.	Geotechnical Laboratory Testing6
4.3.2.	Environmental Laboratory Testing6
4.3.3.	Rock Laboratory Testing6

APPENDICES

Appendix 1	Site Location Plan
Appendix 2	Trial Pit Records
Appendix 3	Borehole Records
Appendix 4	Laboratory Testing
Appendix 5	Groundwater Monitoring



1.0 Preamble

On the instructions of Arup, a site investigation was carried out by Ground Investigations Ireland Ltd., between October 2020 and March 2021 at the site of the proposed bus corridor along Route 5: Blanchardstown to the City Centre.

2.0 Overview

2.1. Background

It is proposed to construct a new Bus Connects Core Bus Corridor on several commuter routes into Dublin City Centre. Route 5 is proposed to run between Blanchardstown and the City Centre.

2.2. Purpose and Scope

The purpose of the site investigation was to investigate subsurface conditions utilising a variety of investigative methods in accordance with the project specification. The scope of the work undertaken for this project included the following:

- Visit project site to observe existing conditions
- Carry out 13 No. Trial Pits to a maximum depth of 2.2m BGL
- Carry out 5 No. Cable Percussion boreholes to maximum depth of 5.2m BGL with rotary follow on to a maximum depth of 35.2m BGL
- Carry out 6 No. Rotary Core Boreholes to a maximum depth of 17.3m BGL
- Carry out 2 Window samples to take environmental samples.
- Installation of 2 No. Groundwater monitoring wells
- Geotechnical & Environmental Laboratory testing
- Factual Report

3.0 Subsurface Exploration

3.1. General

During the ground investigation a programme of intrusive investigation specified by the Consulting Engineer was undertaken to determine the sub surface conditions at the proposed site. Regular sampling and insitu testing was undertaken in the exploratory holes to facilitate the geotechnical descriptions and to enable laboratory testing to be carried out on the soil samples recovered during excavation and drilling.

The procedures used in this site investigation are in accordance with Eurocode 7 Part 2: Ground Investigation and testing (ISEN 1997 – 2:2007) and B.S. 5930:2015.

3.2. Trial Pits

The trial pits were excavated using a 3T tracked excavator at the locations shown in the exploratory hole location plan in Appendix 1. The locations were checked using a CAT scan to minimise the potential for encountering services during the excavation. The trial pits were sampled, logged and photographed by a Geotechnical Engineer/Engineering Geologist prior to backfilling with arisings. Notes were made of any services, inclusions, pit stability, groundwater encountered and the characteristics of the strata encountered and are presented on the trial pit logs which are provided in Appendix 2 of this Report. At a number of locations trial pits refused at shallow depths due to obstructions. In some locations a second, third or fourth attempt was made at a different location. These additional pits are labelled with A, B or C after the trial pit reference on the logs.

3.3. Window Sampling

The window sampling was carried out at the locations R5-CP01A and R5-CP03A shown in the location plan in Appendix 1 using a Tecopsa SPT Tec 10 percussion drilling rig. The window sample boreholes were undertaken to replace environmental samples that were previously taken from R5-CP01 and R5-CP03 and not tested. The window sampling consists of a 1m long steel tube with a cutting edge and an internal plastic liner which is mechanically driven into the ground utilising a 50kg weight falling a height of 500mm. Upon completion of the 1m sample, the tube is withdrawn and the plastic liner removed and sealed for logging and sub sampling by a Geotechnical Engineer/Engineering Geologist. The tube is replaced in the borehole and a subsequent 1m sample can be recovered. Occasionally outer casing or a reduced diameter tube is utilised to enable the window sample to progress in difficult drilling conditions. Geotechnical or environmental soil samples can be recovered from each of the liners following logging. The window sample records are provided in Appendix 3 of this Report.

3.4. Cable Percussion Boreholes

The Cable Percussion Boreholes were drilled using a Dando 2000 drilling rig with regular in-situ testing and sampling undertaken to facilitate the production of geotechnical logs and laboratory testing.

The standard method of boring in soil for site investigation is known as the Cable Percussion method. It consists of using a Shell in non cohesive soils and a clay cutter in cohesive soils, both operated on a wire cable. Very hard soils, boulders and other hard obstructions are broken up by chiselling and the fragments removed with the Shell. Where ground conditions made it necessary, the borehole was lined with 200mm diameter steel casing. While the use of the Cable Percussion method of boring gives the maximum data on soil conditions, some mixing of laminated soil is inevitable. For this reason, thin lenses of granular material may not be noticed. Disturbed samples were taken from the boring tools at suitable depths, so that there is a representative sample at the top of each change in stratum and thereafter at regular intervals down the borehole until the next stratum was encountered. The disturbed samples were then sealed and sent to the laboratory where they were visually examined to confirm the description of the relevant strata.

Standard Penetration Tests were carried out in the boreholes. The results of these tests, together with the depths at which the tests were taken are shown on the accompanying borehole records. The test consists of a thick wall sampler tube, 50mm external diameter, being driven into the soil by a monkey weighing 63.5kg and with a free drop of 760mm. For gravels and glacial till the driving shoe was replaced by a solid 60° cone. The Standard Penetration Test number referred to as the 'N' value is the number of blows required to drive the tube 300mm, after an initial penetration of 150mm. The number gives a guide to the consistency of the soil and can also be used to estimate the relative strength/density at the depth of the test and also to estimate the bearing capacity and compressibility of the soil.

At the location of R5-CP04 the cable percussion drilling refused at a shallow depth therefore another attempt was made adjacent to the first attempt and labelled CP04A.

The cable percussion borehole logs are provided in Appendix 3 of this Report.

3.5. Rotary Boreholes

The rotary coring was carried out by a track mounted T44 Beretta rig at the locations shown on the location plan in Appendix 1. The rotary boreholes were completed from the ground surface or alternatively, where noted on the individual borehole log, from the base of the cable percussion borehole where a temporary liner was installed to facilitate follow-on rotary coring.

The T44 Beretta is equipped with rubber tracks which allow for short travel on pavement surfaces avoiding any damage to the surface. The T44 Beretta utilises a triple tube core barrel system operated using a wireline drilling process. The outer barrel is rotated by the drill rods and at its lower end, carries the coring bit. The inner barrel is mounted on a swivel so that it does not rotate during the process. The third barrel or liner is placed within the second one to retain the core intact and to preserve as much as possible the fabric of the drilling stratum. The core is cut by the coring bit and passes to the inner liner. The core is brought up to the surface within the inner barrel on a small diameter wire rope or line attached to the "overshoot" recovery tool which is then placed into a core box in order of recovery. A drilling fluid, typically air mist or water flush is passed from the surface through hollow drill rods to the drill bit, and is used to cool the drill bit. Temporary casing is used in some situations to support unstable ground or to seal off fissures or voids. It should be noted that the rotary coring can only achieve limited recovery in overburden, particularly granular or weakly cemented strata due to the flushing medium washing away the cohesive fraction during coring. The recovery achieved, where required is noted on the borehole logs and core photographs are provided to allow assessment of the core recovered. The rotary borehole logs are provided in Appendix 3 of this Report.

3.6. Surveying

The exploratory hole locations have been recorded using a KQ GEO Technologies KQ-M8 System which records the coordinates and elevation of the locations to ITM or Irish National Grid as required by the project specification. The coordinates and elevations are provided on the exploratory hole logs in the appendices of this Report.

3.7. Groundwater Monitoring Installations

Groundwater Installations were installed upon the completion of the boreholes to enable sampling and the determination of the equilibrium groundwater level. The typical groundwater monitoring installation consists of a 50mm uPVC/HDPE slotted pipe with a pea gravel response zone and bentonite seal installed to the Engineers specification. The standpipe and finished with a durable steel cover fixed in place with a concrete surround. The installation details are provided on the exploratory hole logs in the appendices of this Report.

3.8. Laboratory Testing

Samples were selected from the exploratory holes for a range of geotechnical and environmental testing to assist in the classification of soils and to provide information for the proposed design.

Environmental & Chemical testing as required by the specification, including the specified by ARUP based on suite E testing and organic matter content was carried out by Element Materials Technology Laboratory in the UK.

Geotechnical testing consisting of moisture content, Atterberg limits, Particle Size Distribution (PSD), hydrometer, tests were carried out in NMTL's Geotechnical Laboratory in Carlow or Pro Soils Laboratory in the UK.

Rock strength testing including Point Load (Is₅₀) and Unconfined Compressive Strength (UCS) testing was carried out in Pro Soils Geotechnical Laboratory in the UK.

The results of the laboratory testing are included in Appendix 4 of this Report.

4.0 Ground Conditions

4.1. General

The ground conditions encountered during the investigation are summarised below with reference to insitu and laboratory test results. The full details of the strata encountered during the ground investigation are provided in the exploratory hole logs included in the appendices of this report.

The sequence of strata encountered were variable across the site and are generally comprised;

- Topsoil / Surfacing
- Made Ground
- Granular Deposits
- Cohesive Deposits
- Bedrock

TOPSOIL: Topsoil was encountered in the majority of the exploratory holes and was present to a maximum depth of 0.2m BGL. Concrete surfacing was present in R05-TP02 to a depth of 0.11m BGL

MADE GROUND: Made Ground deposits were encountered from the surface or beneath the Topsoil and were present to depths of between 0.25 and 5.0m BGL across the proposed route. It should be noted that a number of the trial pits refused within the made ground. The Made Ground deposits were described generally as *brown sandy gravelly CLAY with occasional cobbles*. The secondary sand and gravel constituents varied across the site. At some locations *occasional fragments of concrete, red brick, wood, tarmacadam and plastic were* encountered within the made ground. Also, some, occasional or frequent cobble and boulder content was encountered where noted on the exploratory hole logs.

Tarmacadam obstruction was encountered in R05-TP07 and TP07A with a concrete obstruction encountered in TP07B. Tarmacadam was also encountered in RC05-TP07C between 0.5 and 0.7m BGL with angular to sub angular Gravel fill below.

COHESIVE DEPOSITS: Cohesive deposits were encountered beneath the Made Ground or topsoil and were described typically *brown or grey sandy gravelly CLAY with occasional cobbles and boulders*. The secondary sand and gravel constituents varied across the site and with depth, with granular lenses occasionally present in the glacial till matrix. The strength of the cohesive deposits was typically firm to very stiff and generally increased with depth in the majority of the exploratory holes however R05-CP05 encountered very soft and soft deposits to a depth of 2.8m BGL. These deposits had some, occasional or frequent cobble and boulder content where noted on the exploratory hole logs.

GRANULAR DEPOSITS: Generally minimal granular deposits were encountered within some boreholes however a significant depth of granular material was found within R05-CP05. It should be noted that the rotary drilling technique can wash away finer material so this should be considered where poor recovery is noted on the borehole logs.

The granular deposits were typically described as Grey / brown sandy sub rounded to sub angular fine to coarse GRAVEL or fine to coarse SAND. The secondary sand/gravel and silt/clay constituents varied across the site and with depth while occasional or frequent cobble and boulder content also present where noted on the exploratory hole logs.

Based on the SPT N values the deposits are typically medium dense and become dense with depth. The driller noted blowing sands or gravels during drilling in R05-CP05.

BEDROCK: The rotary core boreholes recovered Medium strong to strong grey/dark grey fine to medium grained laminated LIMESTONE locally interbedded with weak black fine grained laminated Mudstone or Clay. This is typical of the Calp Formation, which is noted on the geological mapping of the proposed site. Rare visible pyrite veins were noted during logging which are typically present within the Calp Limestone. The depth to rock generally varies from 0.3m BGL in R05-RC05 to 10.6 mBGL in R05-RC07 however, rock was not encountered in R05-CP05 at a depth of 35.20m BGL where the borehole was terminated. The total core recovery is good, typically 100% with some of the uppermost runs dropping to 80 or 90%. The SCR and RQD both are relatively poor in the upper weathered zone, often recovered as non-intact, however both indices show an increase with depth in each of the boreholes.

4.2. Groundwater

No groundwater was noted during the investigation however we would point out that these exploratory holes did not remain open for sufficiently long periods of time to establish the hydrogeological regime and groundwater levels would be expected to vary with the time of year, rainfall, nearby construction and other factors. For this reason, standpipes were installed in R05-RC01 and R05-RC04 to allow the equilibrium groundwater level to be determined. The groundwater monitoring is included in Appendix 5 of this Report.

4.3. Laboratory Testing

4.3.1. Geotechnical Laboratory Testing

The geotechnical testing carried out on soil samples recovered from R05-CP01 generally confirm the descriptions on the logs with the primary constituent of the cohesive deposits found to be SILT of intermediate to high plasticity. A sample from TP08A at 1.5 m shows the primary constituent to be Gravel however the material is described as CLAY based on material behaviour encountered when on site. The Particle Size Distribution tests confirm that generally the cohesive deposits are well-graded with percentages of sands and gravels ranging between 12% and 47% generally with fines contents of 26 to 64%

The Particle Size Distribution tests carried out on the made ground deposits show they are either cohesive or granular and generally well graded. The particle size distribution tests on the cohesive made ground deposits from TP01, TP05 and TP07A generally gave percentages of sand and gravel ranging between 15% to 50%, with fines contents of 28% to 52%. The Particle Size Distribution tests carried out on the granular made ground deposits from TP06 and TP09 gave percentages of sands between 8% to 12%, gravel between 37% to 86%, with fines contents of 6% to 21%.

4.3.2. Environmental Laboratory Testing

A Total of 29 samples were analysed for a Suite of testing specified by ARUP based on suite E according to engineers Ireland.

The possibility for contamination, not revealed by the testing undertaken should be borne in mind particularly where Made Ground deposits are present, or the previous site use or location indicate a risk of environmental variation.

The results from the completed laboratory testing is included in Appendix 4 of this report.

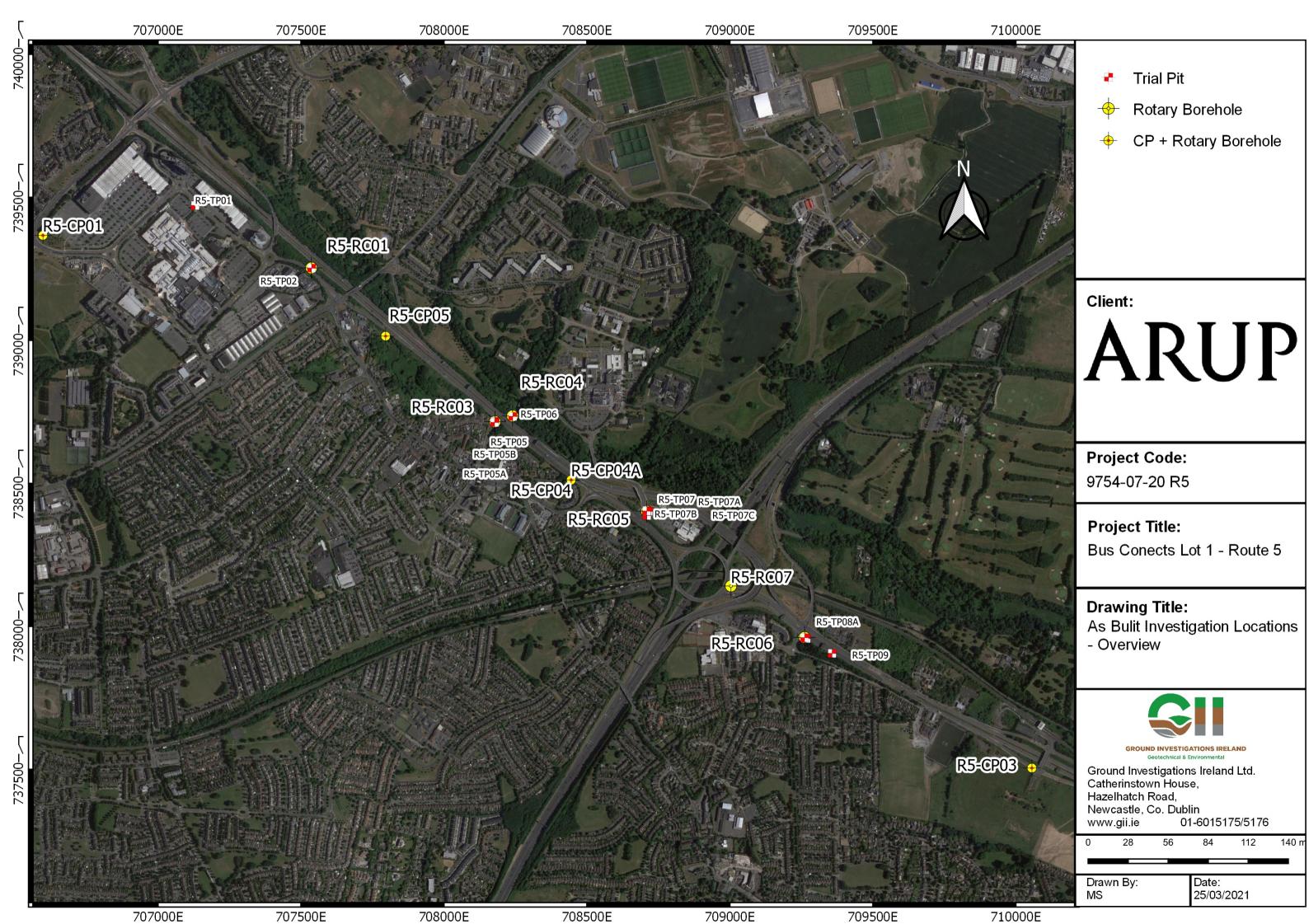
4.3.3. Rock Laboratory Testing

The rock testing carried out on samples recovered from the boreholes reported Unconfined Compressive Strength (UCS) values ranging between 16.1 and 59.1 MPa while the point load testing gave Is50 values ranging between 0.80 to 8.03 MPa. These results correlate to the strength descriptions ranging between of Weak to Strong and confirming the variability of this stratum and the descriptions on the logs.

The results from the completed laboratory testing is included in Appendix 4 of this report.

APPENDIX 1 - Site Location Plan













APPENDIX 2 – Trial Pit Records



	Groui	nd Inv	vestigations Ire www.gii.ie	Site Bus Connect Detailed Stag	ge 1 Lot 1	Trial Pit Number R05-TP01		
Machine: 3 Method: T	T Tracked Excavator rial Pit	Dimensi 1.60m (l			Level (mOD) 59.98	Client National Transport Authori	ty	Job Number 9754-07-20
		Location 707	1 130 E 739469 N	Dates 17	/11/2020	Project Contractor Ground Investigations Irela	and	Sheet 1/1
Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	D	escription	Legend ×
0.50	EN			59.58	0.40	Clay with frequent rootlets	slightly sandy slightly gravell slightly sandy gravelly Clay or ar cobbles and occasional r to subangular fine to coars	
1.00 1.00	ВТ			58.68	- - - - - - - - - - - - - - - - - - -	subangular cobbles and o	avelly CLAY with some anguccasional boulders. Gravel	ılar to
1.50	BEN			58.38	F	angular to subangular fine Obstruction: presumed b Complete at 1.60m		6.20 6.20 6.20
Plan .					-	Remarks Trial pit terminated at 1.60m	RCL due to an obstruction	on a progumed
						Trial pit earninated at 1.50m boulder Trial pit stable No groundwater encountere Trial pit backfilled upon com		<u>a p. 300m00</u>
					-			
					.	Scale (approx)	Logged By	Figure No.
						1:25	PC 9	754-07-20.R05-TP0

Ground Investigations Ireland Ltd www.gii.ie						Site Bus Connect Detailed Stage 1 Lot 1 Trial Pit Number R05-TP0			mber
Machine: 3	BT Tracked Excavator Frial Pit	Dimensi 1.25m (ons L) x 0.40m (W) x 1.10m (D)		Level (mOD) 55.94	Client National Transport Authori	ty		mber -07-20
		Location	า	Dates 23	/11/2020	Project Contractor		She	et
		707	7536.8 E 739250.1 N			Ground Investigations Irela	and		1/1
Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	D	escription	Lege	Nater bne
0.50 0.50 0.50 1.00 1.00 1.10	B EN T EN		Field Records	55.83 55.73 55.39	- (0.11) - (0.10) - (0.34) - (0.55) - (0.55) - (1.10) - (CONCRETE MADE GROUND: Grey sa coarse Gravel with occasic Stiff brown slightly sandy gangular to subangular cobangular to subangular to subang	ndy angular to subangular finonal rootlets gravelly CLAY with occasional bles and boulders. Gravel is to coarse. Possible Made andy gravelly CLAY with angular cobbles and boulders gular fine to coarse	ne to	
						boulders Trial pit stable No groundwater encountere Trial pit backfilled upon com			
						Trial pit backfilled upon com	pletion		
		•			•				
						Scale (approx)	Logged Pri	Eigure N.	
						Scale (approx) 1:25		Figure No. 754-07-20.F	₹5-TP02

	Groui	nd In	vestigations Ire www.gii.ie	eland	Ltd	Site Bus Connect Detailed Stage	Trial Pit Number R05-TP05	
Machine: 3 Method: T	T Tracked Excavator rial Pit	Dimensi 1.50m (ions L) x 0.30m (W) x 1.60m (D)		Level (mOD) 46.78	Client National Transport Authori	ty	Job Number 9754-07-20
		Location 708	n 3177.1 E 738714.5 N	Dates 16	6/11/2020	Project Contractor Ground Investigations Irela	and	Sheet 1/1
Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	D	escription	Kater Variet
				46.58	(0.20) - (0.20) - 0.20	Brown slightly sandy slight occasional rootlets MADE GROUND: Greyish gravelly Clay with some ar occasional boulders and cangular fine	brown slightly sandy slightly ngular to subangular cobbles, ocasional rootlets. Gravel is	
0.50 0.50	EN T				(0.70)	J J		
1.00	B T			45.88	0.90	MADE GROUND: Brown s Clay with occasional angu is angular to subangular fi	slightly sandy slightly gravelly lar to subangular cobbles. Gr ne to coarse	avel
1.50	EN			45.23 45.18		MADE GROUND: Grey su coarse Gravel (surroundin Trial pit terminated at 1.6 encountered Complete at 1.60m	bangular to subrounded fine g pipe) yom BGL due to service	to
Plan .						Remarks Trial pit terminated at 1.60m	BGL due to service encounte	ered
						Trial pit stable No groundwater encountere Trial pit backfilled upon com	d during excavation	-
		•		·		Scale (approx)	Logged By	Figure No.
						1:25		54-07-20.R05-TP0

	Grou	nd In	vestigations Ire www.gii.ie	eland	Site Bus Connect Detailed State	Trial Pit Number R05-TP05A		
Machine :	3T Tracked Excavato Trial Pit		ions (L) x 0.30m (W) x 0.40m (D)		Level (mOD) 46.66	Client National Transport Authori	ty	Job Number 9754-07-20
		Locatio 70	n 8178.7 E 738712.8 N	Dates 16	6/11/2020	Project Contractor Ground Investigations Irela	and	Sheet 1/1
Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	D	escription	V Safer Tegend
				46.46 46.26	- (0.20) - 0.40	Complete at 0.40m	slightly sandy gravelly Clay v Gravel is angular to subang	vith
Plan .						Remarks Trial pit terminated at 0.40m Trial pit stable	BGL due to an obstruction of	on presumed rock
				•		No groundwater encountere Trial pit backfilled upon com	d during excavation pletion	
		•		•				
						Scale (approx)	Logged By	Figure No.
						1:25		754-07-20.R05-TP05

	Groui	nd In	vestigations Ire www.gii.ie	eland	Site Bus Connect Detailed Stage 1 Lot 1		Trial Pit Number R05-TP05B	
Machine: 3	T Tracked Excavator rial Pit	Dimens 1.50m (Level (mOD) 46.70	Client National Transport Authori	ty	Job Number 9754-07-20
		Location 708	n 3176.9 E 738710.5 N	Dates 16	6/11/2020	Project Contractor Ground Investigations Irela	and	Sheet 1/1
Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	D	escription	Kegend Age
0.90	BEN			45.80	- (0.70) - 0.90	Obstruction: presumed n	r sandy gravelly CLAY with gular cobbles. Gravel is angu se	ular 6 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
Plan .		•		•		Remarks Trial pit terminated at 0.90m Trial pit stable	BGL due to an obstruction of	on presumed rock
						No groundwater encountere Trial pit backfilled upon com	d pletion	
				•				
		•			. 5	Scale (approx) 1:25		Figure No. 54-07-20.R05-TP05

	Groui	nd Inv	vestigations Ire www.gii.ie	Site Bus Connect Detailed Stage 1 Lot 1 R05				
Machine: 3 Method: T	T Tracked Excavator	Dimensi 1.50m (l			Level (mOD) 45.00	Client National Transport Authori	ty	Job Number 9754-07-20
		Location 708	1 3240.6 E 738731.7 N	Dates 16	6/11/2020	Project Contractor Ground Investigations Irela	and	Sheet 1/1
Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	D	escription	Legend Nate L
0.50 0.50	EN T			44.80	(0.20) - (0.20) - 0.20	with frequent rootlets MADE GROUND: Brown of Sand with occasional and	y sandy slightly gravelly TOI gravelly clayey fine to coarse lar to subangular cobbles, gments of metal, plastic and	9
1.00 1.00	B T				- - - - - - - - - - - - - - - - - - -			
1.50	EN			43.30	(0.30)	Brown sandy clayey angul GRAVEL with some angula (possible weathered rock)	ar to subangular fine to coa ar to subangular cobbles	rse
2.00	B T					Obstruction: boulder or p	ossible rock	
Plan .						Remarks Trial pit terminated at 2.00m	BGL due to obstruction on	a boulder or
						possible rock Trial pit stable No groundwater encountere Trial pit backfilled upon com	d during excavation	
						Scale (approx)	Logged By	Figure No.
						1:25	PC	9754-07-20.R5-TP06

	Grou	nd In	vestigations Ire www.gii.ie	eland	Site Bus Connect Detailed Stage	Trial Pit Number R05-TP07		
Machine: 3	BT Tracked Excavator Frial Pit		ions (L) x 0.30m (W) x 0.25m (D)		Level (mOD) 53.48	Client National Transport Authori	ty	Job Number 9754-07-20
		Location 708	n 8708.4 E 738402.6 N	Dates 17	//11/2020	Project Contractor Ground Investigations Irela	and	Sheet 1/1
Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	D	escription	Vater Variet Var
0.20	В			53.38 53.23		Brown slightly sandy slight MADE GROUND: Grey sli occasional angular to subr rootlets Obstruction: Tarmacadar Complete at 0.25m	ghtly sandy gravelly Clay w ounded cobbles and occas	ith
		•		•		Trial pit terminated at 0.25m Trial pit stable		
		•				No groundwater encountere be seen in pit on photograph Trial pit backfilled upon com	n) pletion	so mator full oil oall
		•						
						Scale (approx)	Logged By	Figure No.
						1:25		9754-07-20.R05-TP0

	Grou	nd In	vestigation www.gii.ie	s Irel		Site Bus Connect Detailed Stage	ge 1 Lot 1	Trial Pit Number R05-TP07A		
Machine: 3 Method: T	T Tracked Excavator		ions (L) x 0.30m (W) x 0.70	Om (D)		Level (mO 53.22	D)	Client National Transport Authori	ty	Job Number 9754-07-20
		Locatio 70	n 8715.6 E 738400 N		Dates 17	/11/2020		Project Contractor Ground Investigations Irela	and	Sheet 1/1
Depth (m)	Sample / Tests	Water Depth (m)	Field Record	Is	Level (mOD)	Depth (m) (Thicknes	ss)	D	escription	Nate Variet Vari
0.50	BT				53.02	(0.2	0 -	Obstruction: Tarmacadar Complete at 0.70m	ghtly sandy gravelly Clay wi ed cobbles, occasional root of plastic and rope	th
Plan .		•		-		•		Remarks Trial pit terminated at 0.70m Trial pit stable	BGL due to an obstruction of	on tarmacadam
				•			<u> </u>	No groundwater encountere Trial pit backfilled upon com	d during excavation pletion	
									I	
							S	cale (approx) 1:25	Logged By PC 9	Figure No. 754-07-20.R05-TP07

	Grou	nd In	vestigations Ire www.gii.ie	land	Ltd	Site Bus Connect Detailed Stage	Trial Pit Number R05-TP07B	
Machine: 3 Method: T	T Tracked Excavator rial Pit		ions (L) x 0.50m (W) x 1.65m (D)		Level (mOD) 53.56	Client National Transport Authori	ty	Job Number 9754-07-20
		Location 708	n 3709.8 E 738385.1 N	Dates 17	7/11/2020	Project Contractor Ground Investigations Irela	and	Sheet 1/1
Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	D	escription	Vate Puesend
				53.36	(0.20)	1	dy slightly gravelly TOPSOIL of the gravelly Clay with unded cobbles, occasional asional fragments of concrete	
0.50 0.50	EN T				- - - - - - - - - - - - - - - - - - -	boulders, rootlets and occ plastic, tarmacadam and v	asional fragments of concrete vood	,
1.00	B T				(1.45)			
1.50	EN			51.91	1.65	Obstruction: Concrete Complete at 1.65m		
Plan .						Remarks	DCI due to an abotenation and	
				-		Trial pit terminated at 1.55m Trial pit stable No groundwater encountere Trial pit backfilled upon com	BGL due to an obstruction on d during excavation pletion	COHORELE
		·		· ·		Scale (approx)	Logged By F	Figure No.
						1:25	PC 975	4-07-20.R05-TP07

	Groui	nd In	vestigations Ire www.gii.ie	land	Site Bus Connect Detailed Stage	ge 1 Lot 1	Trial Pit Number R05-TP07C	
Machine: 3 Method: T	T Tracked Excavator rial Pit	Dimens 2.00m (ions (L) x 0.70m (W) x 1.30m (D)		Level (mOD) 53.48	Client National Transport Authori	ty	Job Number 9754-07-20
		Locatio	n 3709.3 E 738400.6 N	Dates 23	8/11/2020	Project Contractor Ground Investigations Irela	and	Sheet 1/1
Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	D	escription	Legend Nater
0.50	В			53.28 52.98 52.78		MADE GROUND: Grey sli some angular to subround and occasional fragments		ts
1.00	Т			52.38 52.18	(0.40) - (0.10) - (0.20)	MADE GROUND: Compar subangular fine to coarse subangular cobbles		
1.30	В					Complete at 1.30m		
Plan .						Remarks Trial pit terminated at 1.30m	BGL	
		•				Trial pit stable No groundwater encountere Trial pit backfilled upon com	d during excavation pletion	
		·						
						Scale (approx)	Logged By	Figure No.
						1:25		4-07-20.R05-TP07

	Grou	nd In	vestigations Ire www.gii.ie	Site Bus Connect Detailed State	Trial Pit Number R05-TP08			
Machine : :	3T Tracked Excavator Trial Pit				Level (mOD) 53.18	Client National Transport Authori	ty	Job Number 9754-07-20
		Location 709	n 9267.3 E 737955.2 N	Dates 18	3/02/2021	Project Contractor Ground Investigations Irela	and	Sheet 1/1
Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	D	escription	Legend Age
				52.98 52.58	- (0.40) - 0.60	Services encountered at Terminated at 0.60m	own slighty gravelly sandy C nd occasional pockets of fine	e sand
Plan .		-			•	Remarks Trial pit terminated due to se Trial pit stable		n BGL
		•				No groundwater encountere Trial pit backfilled upon com	d during excavation pletion	
						Scale (approx)	Logged By	Figure No.
						1:25	JD 9	754-07-20.R05-TP0

	Groui	nd In	vestigations Ire www.gii.ie	land	Site Bus Connect Detailed Stage 1 Lot 1		Trial Pit Number R05-TP08A	
Machine: 3 Method: T	T Tracked Excavator rial Pit	Dimens 1.80m (ions (L) x 0.50m (W) x 2.20m (D)		Level (mOD 53.23) Client National Transport Author	ty	Job Number 9754-07-20
		Locatio 709	n 9261.2 E 737957.9 N	Dates 18	3/02/2021	Project Contractor Ground Investigations Irel	and	Sheet 1/1
Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness	D	escription	Vater Variet
					(0.20)		th occasional rootlets	
0.50				53.03	- 0.20 (0.60)	coarse Gravel with many	ey angular to subangular fine to angular cobbles and boulders	
0.50 0.50	B EN							
				52.43	0.80 	Stiff light brown slightly sa angular to subangular cob angular boulders	ndy gravelly CLAY with many bles of Limestone and occasior	ial 6 7 4 5
					_ _ _ _			9 5 4 . 9 6 6 4 .
1.50 1.50	B EN				(1.40)			10 10 0 0 0 0 0 0 0
1.00								0 0 0 0 0 0 0 0 0 0 0 0
								6 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
2.20	EN			51.03	2.20	Terminated at 2.20m		1, a 1, 0.
					_ 			
					- - -			
					_			
					_ _ _ _			
					<u>-</u>			
					_ - -			
					<u> </u>			
Plan .				•		Remarks Trial pit terminated at 2.20m	BGL	
				-		No g ['] roundwater encountere Trial pit stable Trial pit backfilled upon com	d during excavation	
				•				
				-		Scale (approx)	Logged By Fig	gure No.
						1:25	PC 9754	-07-20.R05-TP08

Ground Investigations Ireland Ltd www.gii.ie						Site Bus Connect Detailed Stage 1 Lot 1			Trial Pit Number R05-TP09	
Machine: 3T Tracked Excavator Method: Trial Pit		Dimensions 1.70m (L) x 0.45m (W) x 1.40m (D) Location 709357.4 E 737903.1 N		Ground Level (mOD) 52.38 Dates 18/02/2021		Client National Transport Authority Project Contractor Ground Investigations Ireland		N	Job Number 9754-07-20 Sheet	
								SI		
Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	D	escription	Leç	Mater Dues	
0.50 0.50	B EN			52.18	(0.20) -	Dark brown sandy TOPSC MADE GROUND: Brown of angular Gravel with many and occasional boulders	OIL with occasional rootlets clayey sandy angular to sub angular to subangular cobbl	es		
1.40	BEN			50.98	1.40	Services encountered at Terminated at 1.40m	1.40m BGL			
Plan .						Remarks				
· · ·						Trial pit terminated due to se Trial pit stable No groundwater encountere Trial pit backfilled upon com		n BGL		
· ·										
						Scale (approx)	Logged By JD 9	Figure No 754-07-20.		











Bus Connects Route 5 – Trial Pit Photographs
TP02

















Bus Connects Route 5 – Trial Pit Photographs

TP05B







TP06





Bus Connects Route 5 – Trial Pit Photographs R5-RC04 (Inspection Pit)



*Note: above photo taken at the location of TP06 on a subsequent day when the area was cleared to create space for the rotary core rig













Bus Connects Route 5 – Trial Pit Photographs
TP07B







Bus Connects Route 5 – Trial Pit Photographs
TP07C



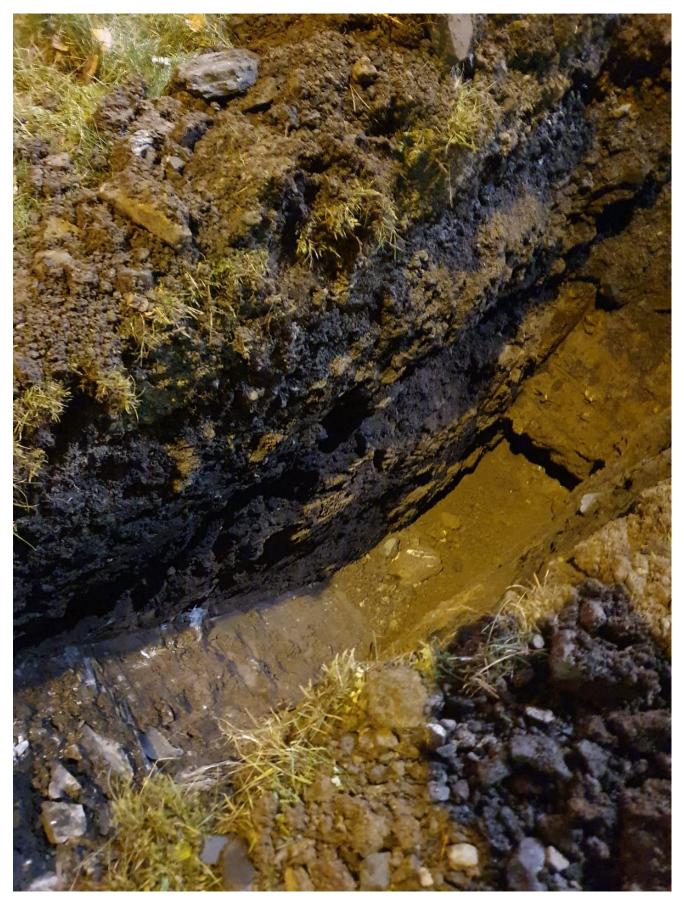




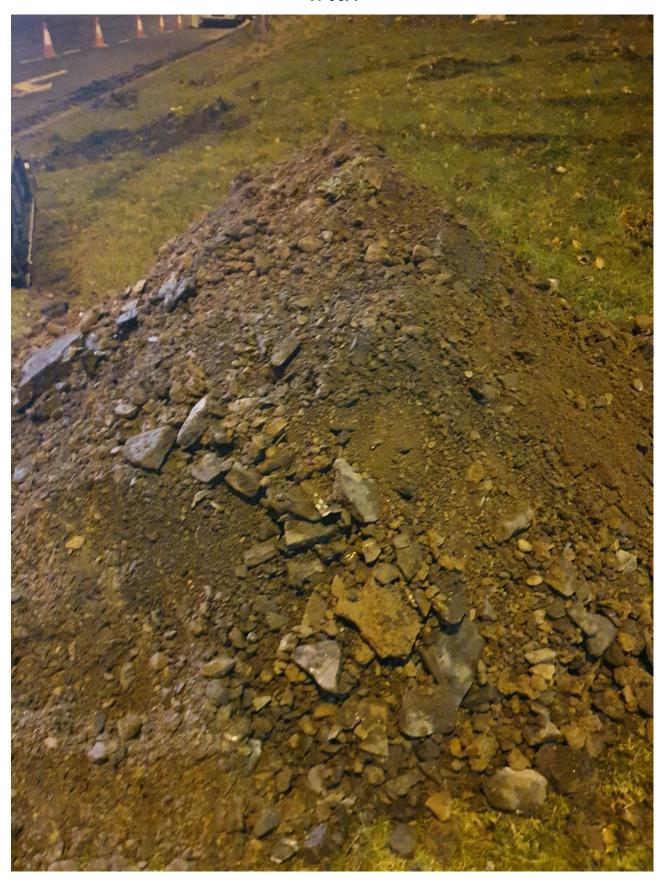
Bus Connects Route 5 – Trial Pit Photographs TP08A



Bus Connects Route 5 – Trial Pit Photographs TP08A



Bus Connects Route 5 – Trial Pit Photographs TP08A



Bus Connects Route 5 – Trial Pit Photographs

TP09



TP09



APPENDIX 3 – Borehole Records



		Groui	nd In		gations Ire w.gii.ie	land l	Ltd	Site Bus Connect Detailed Stage 1 Lot 1	Borehole Number R05-CP01
Method : C	eretta T44 able Percu	ssion		0mm cas	r ed to 5.20m d to 8.00m		Level (mOD) 65.64	Client National Transport Authority	Job Number 9754-07-20
W	ith Rotary f	ollow on	Location 700		739366.5 N	Dates 03	/11/2020	Project Contractor Ground Investigations Ireland	Sheet 1/1
Depth (m)	Sample	/ Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Kagend Nate
(m) 1.00 1.00 1.20-1.65 1.50 2.00-2.45 2.00 2.50 3.00-3.45 3.00 3.50 4.00-4.45 4.00 4.00 5.00 5.00 5.00 6.50 6.70 7.40 8.00	EN B T SPT(C) EN SPT(C) B T EN SPT(C) T T TCR 100	N=4 N=5 N=5	RQD 9	FI MNI 16	1,0/1,1,1,1 1,0/1,1,2,1 2,1/2,1,1,1 2,3/6,7,8,10 3,18/50 B SPT(C) 50/10 T	65.44 64.04 62.24 61.64 61.34 60.64 58.24 57.64	(0.20)	Brown slightly sandy slightly gravelly TOPSOIL. MADE GROUND: Brown slightly sandy slightly gravelly Clay with occasional fragments of cloth. MADE GROUND: Grey slightly sandy slightly gravelly Clay with occasional fragments of wood and organic matter. MADE GROUND: Grey slightly sandy slightly gravelly clayey SILT. Very stiff grey slightly sandy slightly gravelly clayey SILT. Very stiff light grey mottled brown slightly sandy gravelly clayey SILT. Wery stiff light grey mottled brown slightly sandy gravelly clayey SILT. Medium strong thinly to thickly laminated grey fine grained argillaceous LIMESTONE with occasional calcite veining. Distinctly weathered 5.00m-6.70m BGL - Mostly Non Intact 6.70m-7.40m BGL - Two fracture sets. F1: Very closely spaced, 10° to 20°, planar smooth. F2: Very closely to closely spaced, 50° to 70°, planar smooth Medium strong to strong thinly to thickly laminated grey fine grained argillaceous LIMESTONE with occasional calcite veining. Partially weathered 7.40m-7.80m BGL - F1: Closely spaced, 20° to 40°, planar smooth Complete at 8.00m	
	follow on f	rom 5.00m	า BGL due	e to slight	collapse at base of the	he cable p	ercussion hole	Scale (appro	Logged By
Borehole co No groundw Borehole ba Chiselling fro	ater encou ckfilled upc	ntered dur in complet	ing drilling tion	eers Inst g (Rotary	ruction drilling with water flus	sh may co	nseal water st	Figure	JS & PC P No. 7-20.R05-CP03

				WW	gations Ire w.gii.ie	land	Ltd	Site Bus Connect Detailed Stage 1 Lot 1	Borehold Number R05-CP0
Method : Ca	eretta T44 able Percu	ssion	20	Diamete 0mm cas mm case	r ed to 4.00m d to 11.00m		Level (mOD) 55.65	Client National Transport Authority	Job Number 9754-07-2
WI	th Rotary i	rollow on	Locatio 71		737504.1 N		/11/2020- /11/2020	Project Contractor Ground Investigations Ireland	Sheet 1/2
Depth (m)	Sample	/ Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend
0.50	EN					55.55		Brown slightly sandy slightly gravelly TOPSOIL. MADE GROUND: Dark grey sandy gravelly Clay with many cobbles.	
1.00 1.00 1.20-1.55 1.50	B T SPT(C) EN	50/200			8,11/11,17,22	54.65		MADE GROUND: Brownish grey sandy gravelly CLAY with some sub-angular cobbles and fragments of crushed brick.	
2.00-2.04 2.00 2.00 2.50	SPT(C) B T	50*/40			50/		(3.00)		
3.00-3.34 3.00 3.00 3.50	SPT(C) B T EN	50/190			12,13/13,23,14		(3.00)		
4.00 4.00-4.34 4.00 4.00	TCR	SCR	RQD	FI	14,11/10,21,19 B SPT(C) 50/190 T	51.65	4.00	OVERBURDEN: Poor recovery - recovery consists of dense grey subangular to subrounded fine to coarse	
5.00-5.45 5.00	35				4,4/7,7,8,9 SPT(C) N=31	50.65	(1.00)	GRAVEL with occasional cobbles. Driller's notes - Made Ground: Brown sandy gravelly Clay with some cobbles OVERBURDEN: Poor recovery - recovery consists of grey	0 <u>.02</u> 0
	23							subangular to subrounded fine to coarse Gravel with occasional cobbles. Driller's notes: Brown sandy gravelly CLAY with some cobbles	
3.50-6.95 3.50			_		3,4/4,8,8,8 SPT(C) N=28		(3.00)		
	20				12,12/8,5,7,30				
3.00-8.45 3.00					SPT(C) N=50	47.65	8.00	Dense grey angular to subangular fine to coarse GRAVEL with some angular to subangular cobbles	0.000
3.50	82	51	21			47.15	8.50 	Medium strong to strong thinly laminated grey fine grained LIMESTONE interbedded with medium strong thinly laminated dark grey fine grained calcareous MUDSTONE. Partially to distinctly weathered	
9.50				13			(2.50)	8.50m-10.40m BGL - F1: Very closely to closely spaced, 10° to 30°m planar smooth with clay staining	
Remarks Cable percus Rotary follow	sion drillir on from 4	ig refusal .00m BGL	at 4.00m	BGL.	drilling with water 0	ioh mari -	nood water	Scale (approx	Logged By
Borehole bac	kfilled upo	on comple	tion		drilling with water flu truction. g from 4.00m to 4.00			Figure	JS & PC No. -20.R05-CP

		Groui	nd In	vesti ww	gations Ire w.gii.ie	land l	Ltd	Site Bus Connect Detailed Stage 1 Lot 1		Borehole Number R05-CP03
Machine : DEFlush : Core Dia: 6	Beretta T44	+		Diamete			Level (mOD) 55.65	Client National Transport Authority		Job Number 9754-07-20
Method : C		ssion follow on	Locatio 71		737504.1 N	Dates 02 19	//11/2020- //11/2020	Project Contractor Ground Investigations Ireland		Sheet 2/2
Depth (m)	TCR (%)	SCR (%)	RQD (%)	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	L	-egend Nate
10.40 11.00	100	54	27	3		44.65	11.00	10.40m-11.00m BGL - F1: Very closely to medium spaced, 10° to 20°, planar smooth Complete at 11.00m	cale	Logged
Nemarks										Logged By JS & PC
								Fig	gure No	

		Grou	nd In		gations Ire ww.gii.ie	land	Ltd	Site Bus Connect Detailed Stage 1 Lot 1	Borehole Number R05-CP04
	eretta T44 Vater	+	20		ed to 1.00m d to 12.70m		Level (mOD 50.32	Client National Transport Authority	Job Number 9754-07-20
Method : C			Locatio 70		738509.8 N	Dates 04	/12/2020	Project Contractor Ground Investigations Ireland	Sheet 1/2
Depth (m)	TCR (%)	SCR (%)	RQD (%)	FI	Field Records	Level (mOD)	Depth (m) (Thickness	Description	Legend Fig. 1
0.00 1.00-1.04 1.00	18				50/50 SPT(C) 50*/40 50/0 B	50.12	(0.80)	Brown slightly sandy gravelly CLAY with some subangular to subrounded cobbles and boulders. Gravel is subangular to subrounded fine to coarse Poor recovery, recovery consists of: Dark grey slightly sandy gravelly CLAY with occasional cobbles and boulders. Gravel is medium to coarse, sub-angular to sub-rounded. (Drillers notes: Gravelly CLAY with boulders).	
2.20 2.40	100	41	24			47.92	2.40	weak to medium strong dark grey massive fine to medium grained LIMESTONE interbedded with firm dark grey slightly silty slightly sandy gravelly CLAY. Gravel is fine to coarse, sub-angular to sub-rounded. Distinctly weathered.	
3.70	100	53	38			46.27	4.05	Weak to medium strong dark grey massive fine to medium grained LIMESTONE with widely spaced, thin beds of firm dark grey slightly sitly slightly sandy gravelly CLAY. Gravel is fine to coarse, sub-angular to sub-rounded. Partially to distinctly weathered.	
4.70	100	90	64					2,40m - 8.40m BGL: Fracture set 1: 20-30 degrees,	
5.20	100	58	42	6			(4.35)	discontinuities are rough, undulating with clay, closely spaced. Fracture set 2: 60-65 degrees, discontinuities are rough to stepped, undulating with clay and iron staining, medium spaced.	
6.90	100	43	41						
7.50	100	61	34						
9.70 10.00	90	53	19	13		41.92	8.40 	Medium strong dark grey massive fine grained LIMESTONE with clay and iron staining on surfaces. Partially weathered.	
Remarks Borehole col Borehole ba	mpleted at	12.70m B	GL. on en	igineers i	nstruction.	1		Scale (approx)	Logged By
No groundw Chiselling fro	ater encou	ntered dur	ring drilling	g (Rotary	drilling with water flu	sh may co	nseal water	1:50 Figure I	JD/JS No. 20.R05-CP04

		Grou	nd In	vesti ww	gations Ire w.gii.ie	land	Ltd		Site Bus Connect Detailed Stage 1 Lot 1	Bore Num R05-0	
ı	Dando 2000 Beretta T44 Water	+		Diamete			Level (m 50.32	OD)	Client National Transport Authority	Job Num 9754-	
	Cable Percu	ssion follow on	Locatio 70		738509.8 N	Dates 04	l/12/2020		Project Contractor Ground Investigations Ireland		/2
Depth (m)	TCR (%)	SCR (%)	RQD (%)	FI	Field Records	Level (mOD)	Dept (m) (Thickn	h ess)	Description	Legen	Water
10.30	100	76	53					.30)	8.40m - 12.70m BGL: Fracture set 1: 0-10 degrees, discontinuities are smooth to rough, undulating, with clay and iron smearing, very closely to closely spaced. Fracture set 2: 30-40 degrees, discontinuities are stepped, undulating, with clay and iron staining, closely spaced.		
11.20	100	87	81	4							
12.70						37.62		2.70	Complete at 12.70m		
Remarks	. '		•				'		Scale (approx	Logg By	
									Figure 9754-07	No. -20.R05-	CP04

	Grou	nd In		gations Ire w.gii.ie	land	Ltd	Site Bus Connect Detailed Stage 1 Lot 1	Nun	ehole nber CP04A
Machine : D	ando 2000 Cable Percussion	1	Diamete 0mm cas	r ed to 1.00m		Level (mOD) 50.39	Client National Transport Authority		n ber -07-20
		Locatio 70		738511.3 N	Dates 04	1/12/2020	Project Contractor Ground Investigations Ireland	She	e et 1/1
Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Lege	Mater bn
1.00-1.04 1.00 Remarks Refusal at 1	SPT(C) 50*/40 50/0 B	tion, Possi	ble rock (or boulder.	49.39	(0.80)	TOPSOIL Brown slightly sandy gravelly CLAY with some subangular to subrounded cubbles and boulders. Gravel is subangular to subrounded fine to coarse Refusal at 1.00m		SIP
Borehole ba No groundw Chiselling fro	ckfilled on completio ater encountered du om 1.00m to 1.00m f	n. ring drilling or 1 hour.	g.				1:50 Figure	JD/	

		Grou	nd In		gations Ire	land	Ltd	Site Bus Connect Detailed Stage 1 Lot 1		Boreho Number R05-CP	r
Machine : D	ando 2000 44) + Bereta	Casing	Diamete	r	Ground	Level (mOD)	Client		Job	_
Method : C	able Percu				ed to 4.80m d to 35.20m		46.78	National Transport Authority		9754-07-	
W	ith Rotary i	TOHOW ON	Locatio		70004441	Dates 07	/12/2020	Project Contractor		Sheet	
					739014.4 N		T	Ground Investigations Ireland		1/4	_
Depth (m)	Sample	e / Tests	Casing Depth (m)	Water Depth (m)	Field Records	(mOD)	Depth (m) (Thickness)	Description		Legend	Water
0.50 1.00-1.45 1.00	B SPT(C) B	N=6			1,1/2,1,1,2	45.28	(1.50)	Soft greyish brown slightly sandy gravelly CLAY. (fine to coarse, sub-angular. Very soft brown slightly sandy slightly gravelly CL			
2.00-2.45 2.00	SPT(C) B	N=3			1,0/1,0,1,1		(1.30)	is fine to coarse, sub-angular.			▼ 1
3.00	B SPT(C)	N=12			Water strike(1) at 3.00m, rose to 2.70m in 20 mins. 2,2/2,3,3,4	43.98	2.80	Firm to stiff greyish brown slightly sandy gravelly Gravel is fine to coarse, sub-angular. Very stiff greyish brown slightly sandy gravelly CL occasional sub-rounded cobbles. Gravel is fine to	.AY with		∇ 1
4.00 4.00-4.45	В				4,5/6,8,13,14 SPT(C) N=41			sub-angular.		\$\frac{10.0}{0.0}\$	
4.20	TCR	SCR	RQD	FI			(1.25)			10 105 Q	
	50					42.08	4.70	Poor recovery, recovery consists of: Dark brown sandy gravelly CLAY with occasional boulders. (Enotes: Gravelly CLAY with boulders).	slightly Orillers		
5.20	33				7,7/6,8,36 SPT(C) 50/225		=				
6.70-7.08 6.70	13				SPT(C) 50/225						
8.20-8.65 8.20	30				8,7/8,6,9,12 SPT(C) N=35	38.58	8.20	Poor recovery, recovery consists of: Grey slightly medium to coarse sub-angular to sub-rounded G with occasional cobbles.	RAVEĹ		
9.70-10.15 9.70					7,6/7,8,9,11 SPT(C) N=35			Poor recovery, recovery consists of: Grey sandy to coarse, sub-rounded GRAVEL., (Driller notes Gra			
Remarks Borehole cor From 20 2 to	mpleted at	35.20m B	GL.on en	gineers ir	nstruction wing sand				Scale (approx)	Logged By	1
From 20.2 to 21.7 and 24.7 to 26.2 Driller notes blowing sand Borehole backfilled on completion. Groundwater encountered at 3.00m BGL Chiselling from 4.70m to 4.80m for 1 hour.									1:50	JS	
Jinsening IIC	2.11 - 7.7 UIII (-	o i nour.						Figure N 9754-07-2		²05

		Groui	nd In		gations Irel w.gii.ie	land l	Ltd	Site Bus Connect Detailed Stage 1 Lot 1	Borehole Number R05-CP05
Machine: Da Ta Flush : Core Dia: 64	44	+ Bereta		Diamete 0mm cas mm case	ed to 4.80m d to 35.20m		Level (mOD) 46.78	Client National Transport Authority	Job Number 9754-07-20
Method : C		ission follow on	Locatio 70		739014.4 N	Dates 07	/12/2020	Project Contractor Ground Investigations Ireland	Sheet 2/4
Depth (m)	TCR (%)	SCR (%)	RQD (%)	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend Nater
11.20-11.65	26				9,8/8,7,9,7 SPT(C) N=31	35.58	(2.20)		
11.20	20				4,5/4,4,5,6		(1.50)	Poor recovery, recovery consists of: Grey sandy fine to coarse, sub-rounded GRAVEL., (Driller notes Gravell with clay)	
12.70-13.15 12.70	13				SPT(C) N=19	34.08	12.70	Poor recovery, recovery consists of: Grey medium to coarse, sub-rounded to sub-angular GRAVEL. (Driller notes Gravell with clay)	
14.20-14.65 14.20	10				5,5/4,5,4,6 SPT(C) N=19		(3.00)		
15.70-16.15 15.70	26				6,8/4,5,4,6 SPT(C) N=19	31.08	15.70	Poor recovery, recovery consists of: Dark brown sandy CLAY. (Driller notes sandy Clay)	
17.20-17.65 17.20	23				7,9/6,8,9,7 SPT(C) N=30		(3.00)		
18.70-19.15 18.70	6				9,8/6,7,8,8 SPT(C) N=29	28.08	18.70	Poor recovery, recovery consists of: Dark brown fine to coarse SAND.(Driller notes Sand)	
Remarks	1		1	1		1	1	Scale (approx)	Logged By
								1:50	JS
								Figure 9754-07-	No. 20.R05-CP05

		Groui	nd In		gations Ire w.gii.ie	land l	Ltd	Site Bus Connect Detailed Stage 1 Lot 1	Borehole Number R05-CP05
Machine: Da T2 Flush : Core Dia: 64	44	+ Bereta		Diamete			Level (mOD) 46.78	Client National Transport Authority	Job Number 9754-07-20
Method : Ca		ssion follow on	Locatio 70		739014.4 N	Dates 07	/12/2020	Project Contractor Ground Investigations Ireland	Sheet 3/4
Depth (m)	TCR (%)	SCR (%)	RQD (%)	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Kater Margar
20.20-20.65 20.20	10				7,7/8,9,10,12 SPT(C) N=39			20.2 to 21.7 Driller notes blowing sand	
21.70-22.15 21.70			_		9,7/6,7,9,8 SPT(C) N=30		(6.30)		
23.20-23.65	26				8,8/6,9,7,11 SPT(C) N=33				
23.20	23								
24.70-25.15 24.70	30				9,7/10,11,14,12 SPT(C) N=47	21.78	25.00	24.7 to 26.2 Driller notes blowing sand Poor recovery, recovery consists of: Brown clayey grave Cobbles with occasional boulders. (Driller notes Clay wiboulders)	ally of o o
26.20	50					19.38	(2.40)	Very stiff brown slightly sandy gravelly CLAY with	, , , , , , , , , , , , , , , , , , ,
27.70-28.08 27.70	50				9,11/8,12,30 SPT(C) 50/225			occásional cobbles and boulders. Grável is fine to coars sub-angular to sub-rounded.	
29.20-29.50 29.20	13				7,9/14,36 SPT(C) 50/150				
Remarks				•		•		Sc	ale Logged brox) By
								1:: Fig	JS JS Jure No.
									I-07-20.R05-CP05

		Groui	nd In	vesti wv	gations Ire w.gii.ie	land	Ltd	Site Bus Connect Detailed Stage 1 Lot 1	Nu	rehole imber 5-CP05
Machine: Da T ² Flush : Core Dia: 64	44	+ Bereta		Diamete			Level (mOD) 46.78	Client National Transport Authority		b imber 4-07-20
Method : Ca		ission follow on	Locatio 70		739014.4 N	Dates 07	7/12/2020	Project Contractor Ground Investigations Ireland		4/4
Depth (m)	TCR (%)	SCR (%)	RQD (%)	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Leg	Mater bne
30.70-31.08 30.70	50				8,11/10,13,27 SPT(C) 50/225					
32.20-32.43 32.20					12,15/50 SPT(C) 50/75	14.58	32.20	Very stiff dark grey slightly sandy gravelly CLAY with occasional cobbles and boulders. Gravel is fine to coarse		
	50				25/50			sub-angular to sub-rounded.		
33.70-33.70 33.70	30				SPT(C) 25*/0 50/0		(2.80)			
35.20						11.78 11.58	→ (0.20)	Grey slightly clayey medium to coarse sub-angular GRAVEL. Complete at 35.20m		
Remarks			•	•		•	•	Sca (appro	le Lo	gged
									re No . 07-20.R0	JS 5-CP05

Machine : Flush : \			Casing	W\ Diamete	igations Ire ww.gii.ie ed to 16.50m	Ground	Level (mOD) 55.93	Bus Connect Detailed Stage 1 Lot 1 Client National Transport Authority		J	ob lumber 54-07-20
Core Dia: 6	64 mm Rotary Core	d	Locatio			Dates 27	//11/2020-	Project Contractor		-	heet
			70	7536.4 E	739250.3 N	30	/11/2020	Ground Investigations Ireland			1/2
Depth (m)	TCR (%)	SCR (%)	RQD (%)	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
0.00	15	0	0				(2.00)	Poor recovery, recovery consists of MADE GROUND: grey/brown clayey angular to sub-angular fine to coarse Gravel with occasiona fragments of concrete. Driller notes: Clay fill.	ı		
2.00 2.00-2.12	20	0	0		20,50/ SPT(C) 70*/115	53.93		Poor recovery,recovery consists of dark grey slightly clayey sub-angular to sub-rounded fine to coarse GRAVEL with occasional sub-angular to sub-rounded cobbles. Driller notes: Clayey sandy GRAVEL.			
3.50 3.50-3.52 5.00-5.10	35	0	0		50/ SPT(C) 50*/20 17,50/ SPT(C) 67*/95		(4.30)				
5.20	77	15	0				= = = = = = = = = = = = = = = = = = =			•	
6.20 6.50 6.80	100	30	0	11 NI	_	49.63	6.30	Weak to mediu strong dark grey thinly laminated calcareous MUDSTONE. Distinctly to partially weathered. 6.20m - 6.80m BGL Fracture set 1: 40-50 degrees, discontinuities are planar smooth with clay smearing, closely spaced. 6.80m - 7.80m Non-Intact			100 (100 (100 (100 (100 (100 (100 (100
7.80 8.00	100	63	7	25		49.63	(3.70)	7.80m - 9.50m Fracture set 1: 20-30 degrees, discontinuities are planar to undulating smooth, clean, very closely to closely spaced. Fracture set 2: 80-90 degrees, undulating rough with some oxidation along fracture surfaces.			
9.50				NI				9.50m - 10.0m Non-Intact			
Standpipe i 1.00m to G	L with a cem	aled from ent bent	16.50m to honite surr	7.00m l ound an				00m with a pea gravel surround, sealed from trike)	Scale (approx) 1:50 Figure 1 9754-07-2	No.	Tmcl

		Groui	nd In		gations Irel w.gii.ie	land l	Ltd		Site Bus Connect Detailed Stage 1 Lot 1 OD) Client		Νι	orehole umber 5-RC01
Machine : Be	ater			Diamete mm case	r d to 16.50m	Ground	Leve 55.93		Client National Transport Authority		Νι	ob umber 54-07-20
Core Dia: 64 Method : Ro		d	Locatio 70		739250.3 N	Dates 27 30	/11/20 /11/20	020- 020	Project Contractor Ground Investigations Ireland		Sh	heet 2/2
Depth (m)	TCR (%)	SCR (%)	RQD (%)	FI	Field Records	Level (mOD)	D (Thi	epth (m) ckness)	Description	Legend	Water	Instr
	100	73	57			45.93		10.00	Medium strong dark grey thinly laminated calcareous MUDSTONE. Partially weathered. 10.0m - 14.0m Fracture set 1: 0-20 degrees, undulating to stepped rough, clean, close to medium spacing. Fracture set 2: 50-60 degrees, planar smooth, clay staining, closely spaced.			
11.00	100	50	33	8				(4.00)				
12.50	100	87	70	4								
14.00	100	100	100			41.93		14.00	Medium strong to strong dark grey thinly laminated calcareous MUDSTONE. Unweathered. 14.0m - 16.50m Fracture set 1: 20-30 degrees, stepped smooth, clean.			
15.50	100	100	100	1				(2.50)				
16.50						39.43		16.50	Complete at 16.50m			
Remarks										Scale (approx) 1:50 Figure N 9754-07-2	No.	Tmcl

	Ground Investigations Iro www.gii.ie								Site Bus Connect Detailed Stage 1 Lot 1		Borehole Number R05-RC03	
Machine : E Flush : V Core Dia : 6	Water			Diamete mm case	r d to 10.10m	Ground	Leve l 46.58	, ,	Client National Transport Authority		Job Number 9754-07-20	
Method : F		d	Locatio 70		738712.8 N	Dates 17	7/11/20)20	Project Contractor Ground Investigations Ireland		Sheet 1/2	
Depth (m)	TCR (%)	SCR (%)	RQD (%)	FI	Field Records	Level (mOD)	D (Thic	epth (m) ckness)	Description		Legend Nate	
0.30				NI		46.38 46.28		(0.20) 0.20 0.30	Brown slightly sandy slightly gravelly TOPSOIL with occasional rootlets MADE GROUND: Brown slightly sandy gravelly Clafrequent angular cobbles. Gravel is angular to subaffine to coarse	ay with		
1.30	90	40	26	20		45.28		1.30	Weak to medium strong thinly laminated dark grey grained calcareous MUDSTONE. Distinctly weathe 0.30m-0.70m BGL - Mostly Non Intact 0.70m-1.30m BGL - F1: Very closely spaced, 60° 80°, undulating smooth	' to		
2.00	100	76	53	6					Medium strong to strong thinly laminated dark grey grained calcareous MUDSTONE with occasional spyrite. Partially to distinctly weathered 1.30m-3.00m BGL - F1: Very closely to closely sp 60° to 80°, undulating smooth			
3.50	100	77	73	4		45.28			3.00m-4.60m BGL - F1: Closely to medium space to 80°, undulating smooth	ed, 60°		
4.60 5.00				NI					4.60m-5.30m BGL - Mostly Non Intact			
5.30	100	79	65					(8.80)				
6.50	100	100	85	3					5.30m-10.10m BGL - F1: Closely to medium space 10° to 40°, undulating smooth to rough	ced,		
8.00	100	91	79									
9.50	100	95	77									
Borehole ba	omplete at 1 ackfilled upo vater encou	on comple	tion		structrution. drilling with water flu	ush may co	nseal	water st	rike)	Scale (approx)	Logged By	
J			J	- · · ···)	J 110	,		,	·	1:50 Figure N 9754-07-2	PC lo. 0.R05-RC03	

Michania Michania	Ground Investigations Ire							Ltd	Site Bus Connect Detailed Stage 1 Lot 1		Borehole Number R05-RC03		
Complete st 10.10m	Flush : W	eretta T44 /ater		Casing	Diamete	r	Ground	Level (mOD)			Numbe		
10.10			d			738712.8 N	Dates 17	7/11/2020					
Remarks Scale (approx) Figure No.	Depth (m)	TCR (%)	SCR (%)	RQD (%)	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description		Legend	Water	
Figure No.							36.48		Complete at 10.10m	Scale (approx)	Logge	d	
9754-07-20.R05-RC03										Figure N	lo.		

		Grou	nd In		gations Ire w.gii.ie	Ltd	Site Bus Connect Detailed Stage 1 Lot 1		Boreho Numbe R05-RC			
	Vater			Diamete mm case	r d to 10.00m		Level (mOD) 45.40	Client National Transport Authority		N	ob lumber 54-07-20	
Core Dia: 6 Method: F		d	Locatio 70		38732.9 N	Dates 17	7/11/2020	Project Contractor Ground Investigations Ireland			Sheet 1/2	
Depth (m)	TCR (%)	SCR (%)	RQD (%)	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr	
						44.70	(0.70)	Brownish grey angular to subangular fine to coarse GRAVEL with occasional angular to subangular cobbles		>		
0.70	68	0	0			44.70	<u> </u>	Weak thinly laminated dark grey fine grained calcareous MUDSTONE. Distinctly weathered				
				MNI			(1.55)	0.70m-2.25m BGL - Mostly Non Intact				
2.00	100	73	73			43.15	2.25	Medium strong to strong thinly laminated dark grafine grained calcareous MUDSTONE. Partially to distinctly weathered with occasional calcite veining	·			
3.50				3				2.25m-4.50m BGL - F1: Closely to medium spaced, 20° to 50°, undulating rough with occasional clay infilling/staining				
4.50	100	48	37				= == == == == == ==					
5.00				MNI			<u> </u>	4.50m-5.00m BGL - Mostly Non Intact				
	100	73	61									
6.50	100	92	75	3			(7.75)	5.00m-9.00m BGL - F1: Closely to medium spaced, 40° to 60°, undulating smooth to rough with occasional clay infilling/staining				
9.00	100	63	63									
9.50				MNI				9.00m-9.50m BGL - Mostly Non Intact				
10.00	100	100	100	1			<u>-</u>	9.50m-10.00m BGL - F1: Closely spaced, 10°				
with bentoni	te surround	ls and flus	sh cover		struction. 0m BGL with pea gra drilling with water flu			ndpipe installed from 1.00m BGL to ground level trike)	Scale (approx) 1:50 Figure N 9754-07-	No.	PC R5-RC04	

Ground Investigations Ire							Ltd	Site Bus Connect Detailed Stage 1 Lot 1			orehole umber 5-RC04
	Vater			Diamete			Level (mOD) 45.40	Client National Transport Authority		Νι	ob umber 54-07-20
Core Dia: 6			Locatio	n		Dates		Project Contractor Ground Investigations Ireland			heet
Method : F	T	I	70		38732.9 N	17	7/11/2020				2/2
Depth (m)	TCR (%)	SCR (%)	RQD (%)	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
						35.40		to 20°, undulating smooth to rough with occasional clay staining Complete at 10.00m			
Remarks									Scale (approx) 1:50 Figure N		ogged y
									Figure N 9754-07-2		85-RC04

		Grou	nd In		gations Ire w.gii.ie	land	Ltd	Site Bus Connect Detailed Stage 1 Lot 1	Borehole Number R05-RC05
Machine : E Flush : V Core Dia: 6	Vater			Diamete mm case	r d to 10.00m		Level (mOD) 53.43	Client National Transport Authority	Job Number 9754-07-20
Method : F		d	Locatio 70		738399.7 N	Dates 03	3/12/2020	Project Contractor Ground Investigations Ireland	Sheet 1/1
Depth (m)	TCR (%)	SCR (%)	RQD (%)	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend set
	12						(2.00)	Poor recovery, recovery consists of: MADE GROUND: slightly clayey fine to coarse angular Gravel with rare concrete fragments. (Gravel is of limestone mostly). Dri notes: Clay fill.	Grey
2.00	23					51.43	2.00	Poor recovery, recovery consists of: Grey/brown clayey angular medium to coarse Gravel. (Drillers notes: Yellor brown boulder CLAY).	w 6.0.00 6.0.00 6.0.00 6.0.00 6.0.00 6.0.00 6.0.00 6.0.00 6.0.00 6.0.00 6.0.00 6.0.00 6.0.00 6.0.00 6.0.00 6.0.00 6.0000 6.000 6.000 6.000 6.000 6.000 6.000 6.000 6.000 6.0000 6.000 6.000 6.000 6.000 6.000 6.000 6.000 6.000 6.0000 6.000 6.000 6.000 6.000 6.000 6.000 6.000 6.000 6.0000 6.000 6.000 6.000 6.000 6.000 6.000 6.000 6.000 6.0000 6.0000 6.000 6.000 6.000 6.000 6.000 6.000 6.000 6.000 6.0
3.50	73	40	33			49.93	(0.80)	Grey/brown clayey angular medium to coarse GRAVEL Possible weathered bedrock. (Drillers notes: Yellow broboulder CLAY).	
5.00				7		49.13	4.30	Medium strong to strong dark grey extremely to very cle laminated fine to medium grained LIMESTONE with so calcite rich veins and clay smearing. Partially weathere	me Hill
5.30 6.30	100	90	86	3				4.30m - 10.0m BGL: Fracture set 1: 30-40 degrees, discontinuities are rough to stepped, undulating with clay smearing, very closely to medium spaced. Fracture set 2: 5-20 degrees, discontinuities are roug to stepped, undulating, clean, closely to medium spaced.	h
6.50	93	86	79	5			(5.70)		
8.00	100	95	87						
9.10 9.40							E E E		
9.50	100	100	90	3		43.43	10.00		
Remarks Borehole co	omplete at 1	0.00m BG	L on engi	neers ins	struction.	+3.43	10.00	Sr (ap)	cale Logged prox) By
No groundw	ater encou	ntered dui	ring drillin	g (Rotary	drilling with water flu	sh may co	nseal water st	1:	50 JS
									gure No. 4-07-20.R05-RC0

		Grou	nd In		igations Ire	land l	Ltd	Site Bus Connect Detailed Stage 1 Lot 1	Borehole Number R05-RC06
Machine : E Flush : V Core Dia: 6	Vater		Casing 96		ed to 12.00m		Level (mOD) 53.12	Client National Transport Authority	Job Number 9754-07-20
Method : F		ed	Locatio 70		737958.4 N	Dates 04	/03/2021	Project Contractor Ground Investigations Ireland	Sheet 1/2
Depth (m)	TCR (%)	SCR (%)	RQD (%)	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Kater Variet
						52.92	(0.20)	Brown sandy TOPSOIL with occasional rootlets MADE GROUND: Dark grey angular to subangular fine to	
						52.32	(0.60)	coarse Gravel with many angular cobbles and boulders	
	33					32.32	- 0.00	Stiff light brown slightly gravelly sandy CLAY with many angular to subangular cobbles of Limestone and occasion angular boulders	1 6 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
							(1.40)		0 0 0 0 0 0 0 0 0
2.00 2.00-2.25					2,2/3,47 SPT(C) 50/100	50.92	2.20	Poor recovery. Recovery consists of grey slightly clayey angular to subangular fine to coarse Gravel with finer	6 - 2 0 0 - 2 0
	23							material washed away by flush (Firm) Driller's notes: Light brown boulder Clay	0000 0000 0000
3.50					3,3/2,2,3,4		(2.80)		<u>\$</u>
3.50-3.95					SPT(C) N=11		(2.00)		
	39						<u> </u>		
						48.12	5.00		
5.00 5.00-5.45					6,6/10,12,14,14 SPT(C) N=50	40.12	3.00	Very stiff greyish brown slightly sandy gravelly CLAY with frequent cobbles and occasional boulders of Limestone	
	87						<u>=</u> = = =		
6.50 6.50-6.80					10,10/15,35 SPT(C) 50/150				
	87						(4.60)		
							<u>E</u> <u>E</u> E		
8.00 8.00-8.16					7,18/50 SPT(C) 50/10				
	00						<u> </u>		
	83						<u>=</u> =- =-		
9.50 9.50-9.52					25/50 SPT(C) 25*/10	43.52	9.60	Medium strong to strong thinly laminated to thinly bedded	
9.60					50/10		<u>-</u>	dark grey fine to medium grained argillaceous LIMESTONE. Partially weathered with occasional calcite	
Borehole co	mplete at 1	12.00m BC	SL on engi	neers in	etails from 0.00m - 2 struction drilling with water flu		•	(Logged By
g aa.n	554	3	J =	J (·)	J //acc. 110	, 50		1:50	PC e No.
									7-20.R05-RC06

		Grou	nd In		gations Ire w.gii.ie	land	Ltd	Site Bus Connect Detailed Stage 1 Lot 1		Boreh Number R05-R0	er
	Vater			Diamete mm case	r d to 12.00m		Level (mOD) 53.12	Client National Transport Authority		Job Number 9754-07-20	
Core Dia: 6			Locatio	n		Dates	1/00/0004	Project Contractor		Sheet	
Method : F	totary Core	a .	70	9261.5 E	737958.4 N	04	1/03/2021	Ground Investigations Ireland		2/2	
Depth (m)	TCR (%)	SCR (%)	RQD (%)	FI	Field Records	Level (mOD)	Depth (m) (Thickness)	Description		Legend	Water
10.50 11.00 11.50 12.00	100	67	56	1 . MNI 2	Pielu Recolus	41.12	(2.40)	veining 9.60m-10.80m BGL - F1: Medium to widely space to 10°, undulating smooth with occasional clay in 10.80m-11.50m BGL - Mostly Non Intact. Recover indicates two fracture sets - F1: Closely spaced, 10°, undulating smooth with brown staining. F2: subvertical fracture, 80° to 90°, undulating smoorough with brown staining and clay infill 11.50m-12.00m BGL - F1: Medium spaced, 0° to undulating smooth with brown staining Complete at 12.00m	eed, 0° fill ery 0° to One th to	Legeliu III III III III III III III III III I	PM .
Remarks	•					*			Scale (approx)	Logge By	:d
									1:50	PC	
									Figure N 9754-07-2		C06

	Ground Investigations Irela								Site Bus Connect Detailed Stage 1 Lot 1		Borehole Number R05-RC07
Machine: B Flush: V Core Dia: 6	Vater		Casing 96	Diamete		Ground	Level (r 57.59	nOD)	Client National Transport Authority		Job Number 9754-07-20
Method : R		ed	Locatio 709		E 738138.2 N		2/03/202 4/03/202		Project Contractor Ground Investigations Ireland		Sheet 1/2
Depth (m)	TCR (%)	SCR (%)	RQD (%)	FI	Field Records	Level (mOD)	Dep (m (Thicki	oth) ness)	Description		Legend segment
	30					57.39		0.20) 0.20 2.10)	Brown slightly sandy slightly gravelly TOPSOIL Poor recovery. Recovery consists of brown/grey clayey angular to subrounded fine to coarse Gravel with occasional cobbles of mudstone and limestone with fine material washed away by flush. Driller's notes: Brown boulder Clay	y ner	
2.30 2.30-2.75	21				3,5/7,11,15,10 SPT(C) N=43	55.29		2.30	Poor recovery. Recovery consists of grey clayey subangular to subrounded fine to coarse Gravel with occasional cobbles of limestone with finer material was away by flush (very stiff). Driller's notes: Brown boulder Clay.		
3.80 3.80-4.25	44				4,6/5,8,10,13 SPT(C) N=36						
5.30 5.30-5.62	31				16,9/25,19,6 SPT(C) 50/170			7.70)			
6.80 6.80-7.20	13				12,11/15,17,12,6 SPT(C) 50/250						
8.30 8.30-8.75	19				7,8/10,9,15,12 SPT(C) N=46						
9.80 9.80-10.25					5,5/7,6,4,6 SPT(C) N=23		= = = = = =				
Remarks Borehole co No groundw	mplete at 1 ater encou	17.30m BO Intered du	GL on engi ring drilling	neers in g (Rotar	struction. y drilling with water flu	ısh may co	onseal wa	ater st	rike)	cale prox)	Logged By
									Fig	igure N	

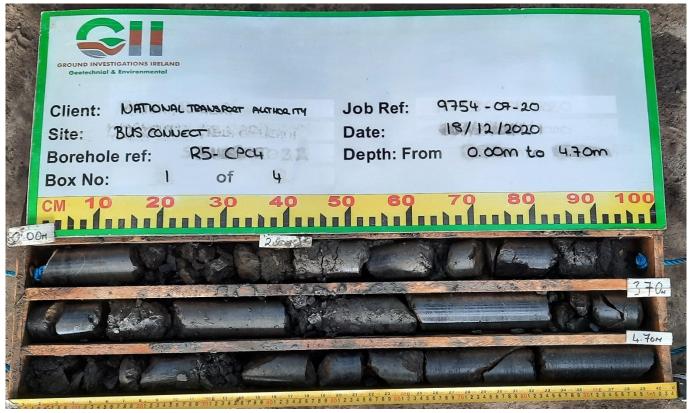
	Ground Investigations Irela								Site Bus Connect Detailed Stage 1 Lot 1	Borehol Number R05-RC0	•
	Vater			Diamete		Ground	Level ((mOD)	Client National Transport Authority	Job Number 9754-07-2	- 1
Core Dia: 6 Method: F		d	Locatio		738138.2 N		2/03/202 1/03/202		Project Contractor Ground Investigations Ireland	Sheet 2/2	
Depth (m)	TCR (%)	SCR (%)	RQD (%)	FI	Field Records	Level (mOD)	De (r (Thick	pth n) kness)	Description	Legend	Water
	100	11				47.59 46.99		10.00 (0.60) 10.60	Possible weathered rock recovered as grey angular to subangular fine to coarse Gravel of limestone and mudstone Weak to medium strong thinly laminated dark grey MUDSTONE interbedded with weak to medium strong thinly laminated to thinly bedded grey fine grained LIMESTONE. Distinctly weathered with occasional calcite veining		
12.80	100	10	NI	NI					vening		
	100	14	7					(5.10)	10.00m-15.00m BGL: Mostly Non Intact		
14.30 15.00	100	30	13								
15.80						41.89		15.70	Medium strong thinly laminated dark grey MUDSTONE. Partially to distinctly weathered with occasional calcite veining and rare specs/bands of pyrite		
	100	48	8	19				(1.60)	15.00m-17.30m BGL - F1: Very closely to closely spaced, 0° to 10°, planar smooth		
17.30						40.29		17.30	Complete at 17.30m		
Remarks							<u> </u>		Scale (approx)		
									1:50 Figure 9754-07-	PC No. 20.R05-RC0	07





























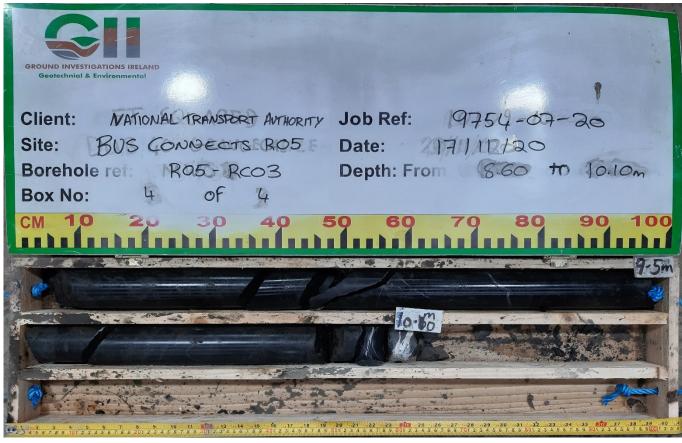














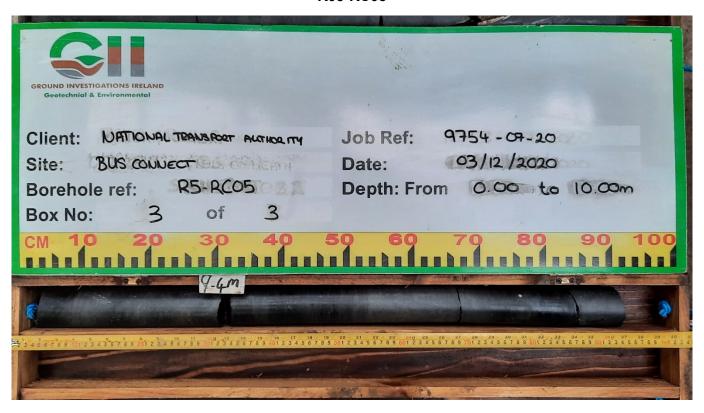








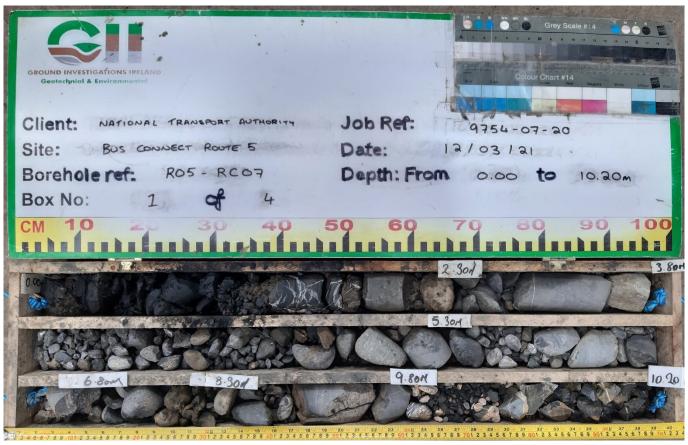






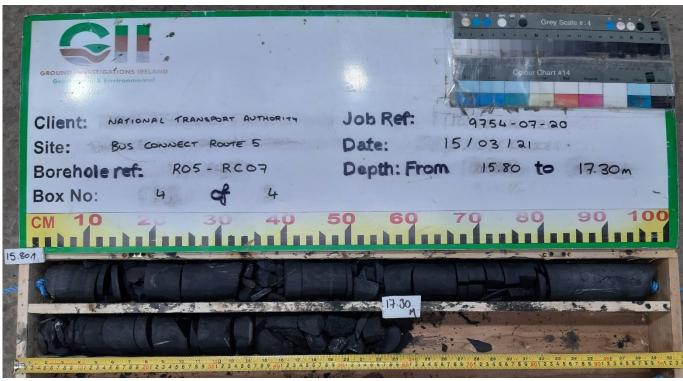












Grou	nd In	vestigations Irel www.gii.ie	land I	Ltd	Site Bus Connect Detailed Stage 1 Lot 1	Number R05-CP01A
Machine : GEOTEC 10 Method : Drive-in Windowless Sampler	Dimens			Level (mOD) 65.83	Client National Transport Authority	Job Number 9754-07-20
	Locatio	n 6607.8 E 739366.6 N	Dates 28	/05/2021	Project Contractor Ground Investigations Ireland	Sheet 1/1
Depth (m) Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend Nater
0.20-1.20 B			65.63	(0.20) - (0.20) - 0.20	Brown slightly sandy slightly gravelly TOPSOIL with occasional rootlets MADE GROUND: Greyish brown slightly sandy slightly gravelly Clay with occasional rootlets	
0.50 EN				(1.00)		
1.20-2.00 B			64.63	- - - - - - - -	MADE GROUND: Grey slightly sandy slightly gravelly Clay with occasional fragments of organic matter and wood and a rare fragment of glass	
1.50 EN 2.00-3.00 B				- - - - - - - - - - - - - - - - - - -		
2.50 EN				- - - - - - - - - - - - - - - - - - -		
3.00-4.00 B				- - - - - - -		
3.50 EN				- - - - - - - -		
			61.83	4.00	Refusal at 4.00m BGL Complete at 4.00m	
Remarks 0.00m-1.00m BGL 95% recovery 1.00m-2.00m BGL 95% recovery 2.00m-3.00m BGL 95% recovery 3.00m-4.00m BGL 95% recovery Refusal at 4.00m BGL			ı	_	Scale (approx) 1:25 Figure N	PC No.

	Groui	nd In	vestigations Irel www.gii.ie	and I	_td	Site Bus Connect Detailed Stage 1 Lot 1	Number R05-CP03A
	EOTEC 10 rive-in Windowless	Dimens			Level (mOD) 55.65	Client National Transport Authority	Job Number 9754-07-20
	·	Locatio 71	n 0056.5 E 737504.1 N	Dates 28	/05/2021	Project Contractor Ground Investigations Ireland	Sheet 1/1
Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend Nater
0.10-1.00	В			55.55	- (0.10) - 0.10	Brown slightly sandy slightly gravelly TOPSOIL with occasional rootlets MADE GROUND: Dark grey/brown slightly sandy gravelly Clay with occasional subangular cobbles and occasional fragments of concrete and red brick	
0.50	EN				- - - - - - - -		
1.00 1.00-2.00	EN B				(1.90)		
1.80	EN			53.65	2.00	Refusal at 2.00m BGL Complete at 2.00m	
					- - - - - - - - - - -		
					- - - - - - - - - - - -		
Remarks 0.00m-1.00n 1.00m-2.00n	n BGL 90% recovery					Scale (approx)	Logged By
Refusal at 2.	00m BGL					1:25 Figure 9754-07-	PC No. 20.R5-CP03A

Bus Connects Route 5 – Window Sample Photographs

R5-CP01A



Bus Connects Route 5 – Window Sample Photographs

R5-CP03A



APPENDIX 4 – Laboratory Testing



National Materials Testing Laboratory Ltd. **SUMMARY OF TEST RESULTS** Index Properties **Undrained Triaxial Tests** Particle Bulk Cell Lab <425um BH/TP Depth sample Moisture Density LL PLЫ Density Presssure Compressive Strain at Vane Remarks Mg/m3 % % % Mg/m3 kPa Stress kPa Failure % kPa No No. R05-CP01 34.3 71.6 62 39 4.0 23 R05-CP01 5.0 В 20.7 51.1 41 24 17 NMTL NMTL 3326 GII Project ID: 9754-07-20 Job ref No. Notes: **Bus Connect Routes**

Location

1. All BS tests carried out using preferred (definitive) method unless otherwise stated.

NMTL Ltd

Sieve	%
Size mm	Passing
125.000	100.0
75.000	100.0
63.000	100.0
50.000	100.0
37.500	100.0
28.000	92.3
20.000	90.5
14.000	89.4
10.000	86.5
6.300	83.4
5.000	81.4
3.350	79.2
2.000	76.4
1.180	74.5
0.600	72.5
0.425	71.6
0.300	70.6
0.212	69.5
0.150	68.2
0.063	63.8
0.054	61.7
0.039	55.2
0.020	42.1
0.011	30.3
0.008	23.7
0.005	20.0
0.004	15.5
0.002	8.2
NM	

TL

Ltd

Determination of Particle Size Distribution

BS 1377: 1990: Part 2: Clauses 9.2 & 9.5



Percentage Particle Size

Clay	Fine Medium Coarse	Fine Medium Coarse	Fine Medium Coarse	Cobbles	Boulder
	Silt	Sand	Gravel		
8.2	55.6	12.6	23.6	0.0	0.0

Sample Description Dark brown slightly sandy slightly gravelly clayey SILT.

Project No. BH/TP No.

NMTL 3326 R05-CP01

	Project
Operator	Tzr

ject Bus connect Route 5 GII Project ID-9754-07-20

Checked Nc Approved Bc Date sample tested 14/1:

07-20 Sample No. 14/12/2020 Depth

B 4.0m

NMTL Ltd

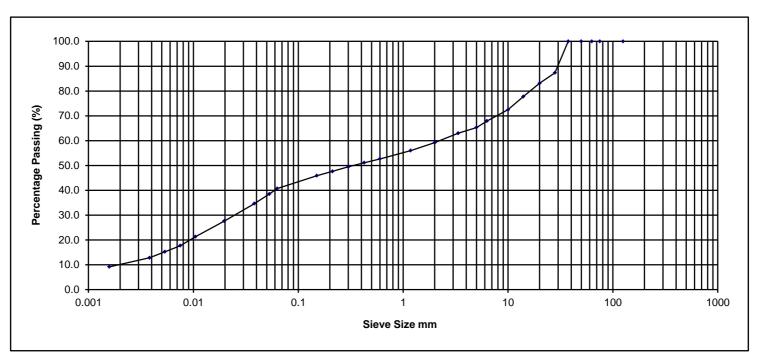
Sieve	%
Size mm	Passing
125.000	100.0
75.000	100.0
63.000	100.0
50.000	100.0
37.500	100.0
28.000	87.3
20.000	83.1
14.000	77.8
10.000	72.5
6.300	67.9
5.000	65.3
3.350	63.0
2.000	59.2
1.180	56.0
0.600	52.7
0.425	51.1
0.300	49.5
0.212	47.7
0.150	45.9
0.063	40.7
0.053	38.5
0.038	34.7
0.020	27.6
0.010	21.3
0.007	17.7
0.005	15.3
0.004	12.8
0.002	9.2
NM	

TL

Ltd

Determination of Particle Size Distribution

BS 1377: 1990: Part 2: Clauses 9.2 & 9.5



Percentage Particle Size

Clay	Fine Medium Coarse	Fine Medium Coarse	Fine Medium Coarse	Cobbles	Boulder
	Silt	Sand	Gravel		
9.2	31.5	18.5	40.8	0.0	0.0

Sample Description Dark brown slightly sandy slightly gravelly clayey SILT.

Project No. BH/TP No.

NMTL 3326 R05-CP01

	Project
Operator	Tzr

Project		Bus connect I	Route 5	
Tzr	Checked	Nc	Approved	Вс

GII Project ID-97	54-07-20
Date sample tested	14/1

07-20 Sample No. 14/12/2020 Depth

B 5.0m



LABORATORY REPORT



4043

Contract Number: PSL21/1700

Report Date: 25 March 2021

Client's Reference: 2868817

Client Name: Ground Investigations Ireland Ltd

Catherinestown House Hazelhatch Road

Newcastle Co Dublin D22 YD52

For the attention of: Patrick Cochran/John Duggan

Contract Title: Bus Connect Route 5

Date Received: 26/2/2021
Date Commenced: 26/2/2021
Date Completed: 25/3/2021

Notes: Opinions and Interpretations are outside the UKAS Accreditation

A copy of the Laboratory Schedule of accredited tests as issued by UKAS is attached to this report. 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 other than in full, without the prior written approval of the laboratory.

Checked and Approved Signatories:

A Watkins R Berriman S Royle
(Director) (Quality Manager) (Laboratory Manager)

EK#

L Knight S Eyre T Watkins (Senior Technician) (Senior Technician) (Senior Technician)

Page 1 of

5 – 7 Hexthorpe Road, Hexthorpe,

Doncaster DN4 0AR tel: +44 (0)844 815 6641

fax: +44 (0)844 815 6642

e-mail: rberriman@prosoils.co.uk awatkins@prosoils.co.uk

SUMMARY OF LABORATORY SOIL DESCRIPTIONS

Hole Number	Sample Number	Sample Type	Top Depth m	Base Depth m	Description of Sample
R5-TP01		В	1.00		Brown very sandy very clayey GRAVEL.
R5-TP05		В	1.00		Brown gravelly slightly sandy CLAY with cobbles.
R5-TP06		T	1.00		Brown highly weathered MUDSTONE.
R5-TP07B		В	1.00		Brown slightly gravelly slightly sandy CLAY with cobbles.



Contract No:
PSL21/1700
Client Ref:
2868817

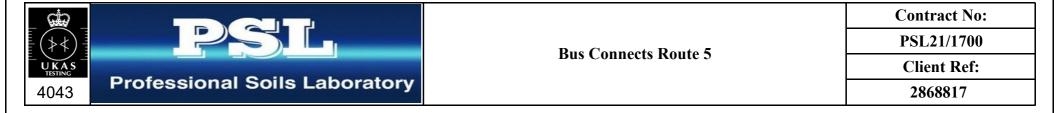
SUMMARY OF SOIL CLASSIFICATION TESTS

(BS1377: PART 2: 1990)

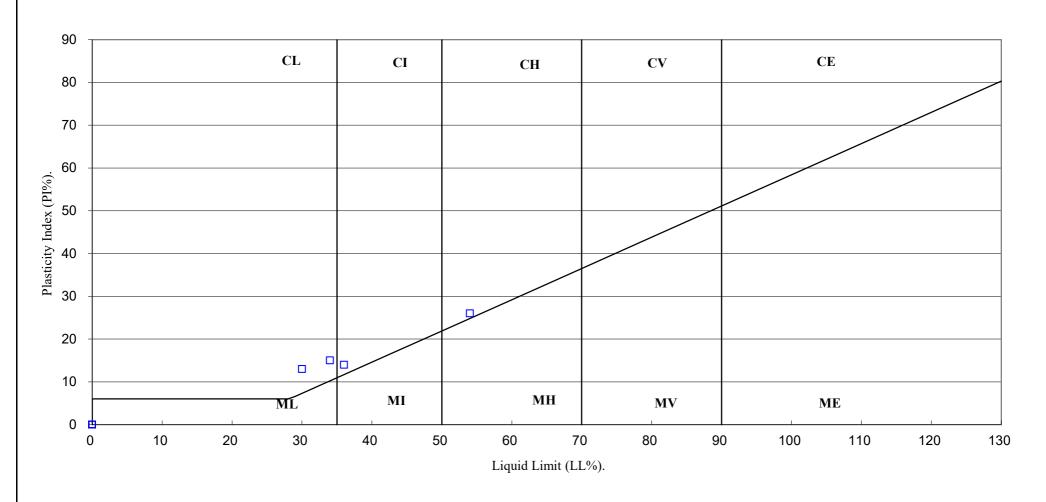
					Moisture	Linear	Particle	Liquid	Plastic	Plasticity	Passing	
Hole	Sample	Sample	Top	Base	Content	Shrinkage	Density	Limit	Limit	Index	.425mm	Remarks
Number	Number	Type	Depth	Depth	%	%	Mg/m^3	%	%	%	%	
			m	m	Clause 3.2	Clause 6.5	Clause 8.2	Clause 4.3/4	Clause 5.3	Clause 5.4		
R5-TP01		В	1.00		13			30	17	13	34	Low Plasticity CL
R5-TP05		В	1.00		38			54	28	26	56	High Plasticity CH
R5-TP06		T	1.00		10			36	22	14	27	Intermediate Plasticity CI
R5-TP07B		В	1.00		12			34	19	15	61	Low Plasticity CL

SYMBOLS: NP: Non Plastic

^{*:} Liquid Limit and Plastic Limit Wet Sieved.



PLASTICITY CHART FOR CASAGRANDE CLASSIFICATION.





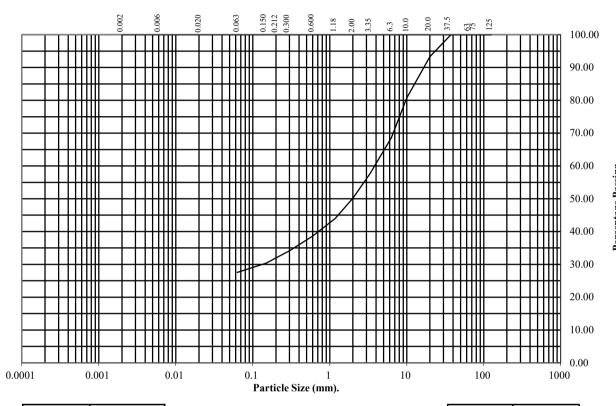
Contract No:
PSL21/1700
Client Ref:
2868817

BS1377 : Part 2 : 1990 Wet Sieve, Clause 9.2

Hole Number: R5-TP01 Top Depth (m): 1.00

Sample Number: Base Depth(m):

Sample Type: B



BS Test	Percentage
Sieve (mm)	Passing
125	100
75	100
63	100
37.5	100
20	93
10	81
6.3	69
3.35	58
2	50
1.18	44
0.6	39
0.3	34
0.212	32
0.15	30
0.063	28

Soil	Total
Fraction	Percentage
Cobbles Gravel Sand Silt/Clay	0 50 22 28

Remarks:

See Summary of Soil Descriptions





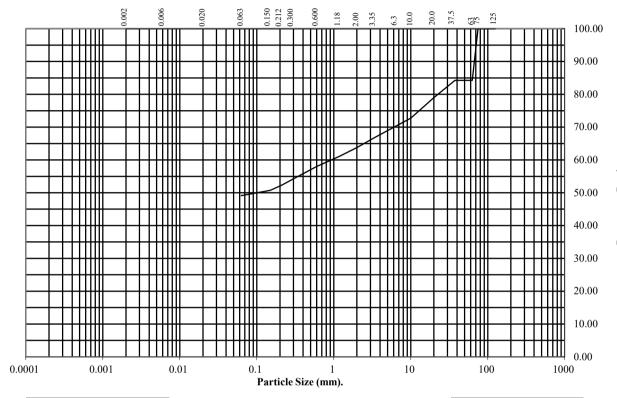
Contract No:
PSL21/1700
Client Ref:
2868817

BS1377 : Part 2 : 1990 Wet Sieve, Clause 9.2

Hole Number: R5-TP05 Top Depth (m): 1.00

Sample Number: Base Depth(m):

Sample Type: B



BS Test	Percentage
Sieve (mm)	Passing
125	100
75	100
63	84
37.5	84
20	79
10	73
6.3	70
3.35	67
2	64
1.18	61
0.6	58
0.3	54
0.212	52
0.15	51
0.063	49

Soil	Total
Fraction	Percentage
Cobbles Gravel Sand Silt/Clay	16 20 15 49

Remarks:

See Summary of Soil Descriptions





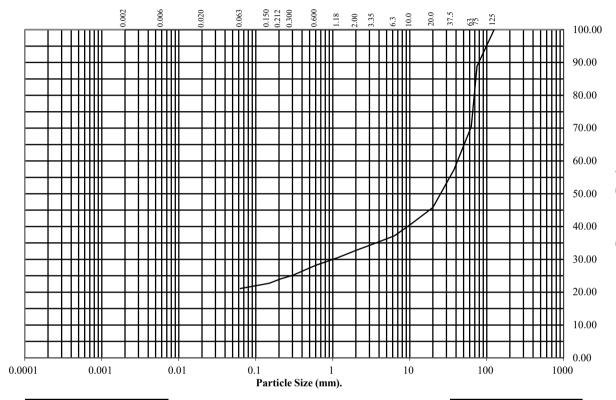
Contract No:
PSL21/1700
Client Ref:
2868817

BS1377 : Part 2 : 1990 Wet Sieve, Clause 9.2

Hole Number: R5-TP06 Top Depth (m): 1.00

Sample Number: Base Depth(m):

Sample Type: T



BS Test	Percentage
Sieve (mm)	Passing
125	100
75	89
63	70
37.5	57
20	46
10	41
6.3	37
3.35	35
2	33
1.18	31
0.6	28
0.3	25
0.212	24
0.15	23
0.063	21

Soil	Total
Fraction	Percentage
Cobbles Gravel Sand Silt/Clay	30 37 12 21

Remarks:

See Summary of Soil Descriptions





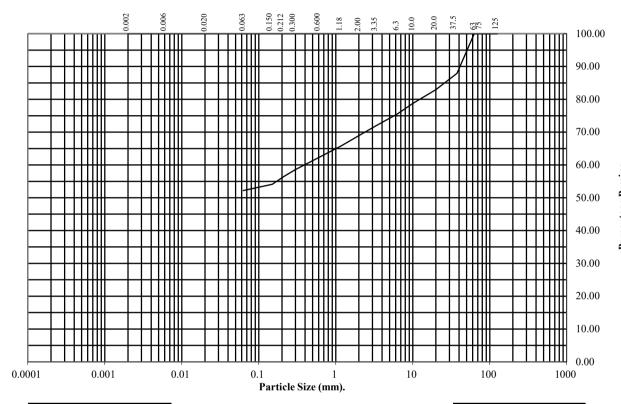
Contract No:
PSL21/1700
Client Ref:
2868817

BS1377 : Part 2 : 1990 Wet Sieve, Clause 9.2

Hole Number: R5-TP07B Top Depth (m): 1.00

Sample Number: Base Depth(m):

Sample Type: B



BS Test	Percentage
Sieve (mm)	Passing
125	100
75	100
63	100
37.5	88
20	83
10	79
6.3	76
3.35	72
2	69
1.18	66
0.6	62
0.3	59
0.212	56
0.15	54
0.063	52

Soil	Total
Fraction	Percentage
Cobbles Gravel Sand Silt/Clay	0 31 17 52

Remarks:

See Summary of Soil Descriptions





Contract No:
PSL21/1700
Client Ref:
2868817



LABORATORY **REPORT**



Contract Number: PSL21/1802

29 March 2021 Report Date:

Client's Reference: 9754-07-20

Client Name: Ground Investigations Ireland Ltd

> Catherinestown House Hazelhatch Road

Newcastle Co Dublin D22 YD52

For the attention of: Patrick Cochran/John Duggan

Contract Title: Bus Connect Route 5

Date Received: 1/3/2021 Date Commenced: 1/3/2021 Date Completed: 29/3/2021

Notes: Opinions and Interpretations are outside the UKAS Accreditation

A copy of the Laboratory Schedule of accredited tests as issued by UKAS is attached to this report. 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 other than in full, without the prior written approval of the laboratory.

Checked and Approved Signatories:

A Watkins R Berriman S Royle

(Director) (Quality Manager) (Laboratory Manager)

T Watkins L Knight S Eyre (Senior Technician) (Senior Technician) (Senior Technician)

Page 1 of

8/

5 – 7 Hexthorpe Road, Hexthorpe,

Doncaster DN4 0AR

tel: +44 (0)844 815 6641 fax: +44 (0)844 815 6642

e-mail: rberriman@prosoils.co.uk awatkins@prosoils.co.uk

SUMMARY OF LABORATORY SOIL DESCRIPTIONS

Hole Number	Sample Number	Sample Type	Top Depth m	Base Depth m	Description of Sample
R05-TP08A		В	0.50		Grey slightly clayey very sandy GRAVEL.
R05-TP08A		В	1.50		Brownish grey slightly sandy gravelly CLAY.
R05-TP09		В	0.50		Brown clayey slightly sandy GRAVEL.
R05-TP09		В	1.40		Brown clayey sandy GRAVEL.



Contract No:	
PSL21/1802	
Client Ref:	
2868817	

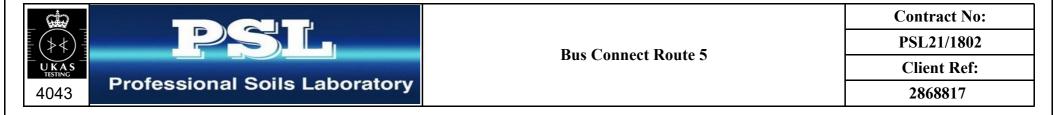
SUMMARY OF SOIL CLASSIFICATION TESTS

(BS1377: PART 2: 1990)

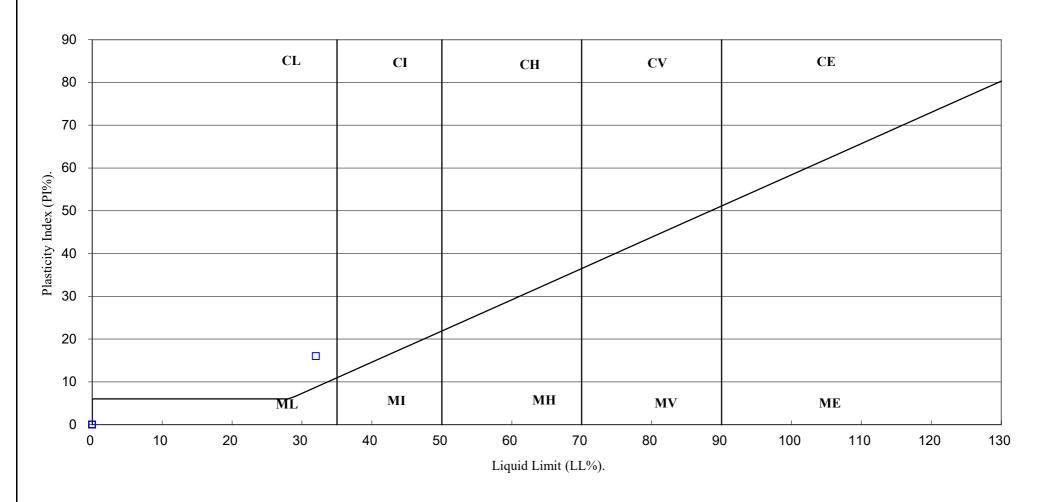
Hole Number	Sample Number	Sample Type	Top Depth m	Base Depth m	Moisture Content % Clause 3.2	Particle Density Mg/m ³ Clause 8.2	Liquid Limit % Clause 4.3/4	Plastic Limit % Clause 5.3	Plasticity Index % Clause 5.4	Passing .425mm %	Remarks
R05-TP08A		В	0.50		7.5			NP			
R05-TP08A		В	1.50		10		32	16	16	38	Low Plasticity CL
R05-TP09		В	0.50		6.0			NP			
R05-TP09		В	1.40		10						
			•	•							

SYMBOLS: NP: Non Plastic

^{*:} Liquid Limit and Plastic Limit Wet Sieved.



PLASTICITY CHART FOR CASAGRANDE CLASSIFICATION.





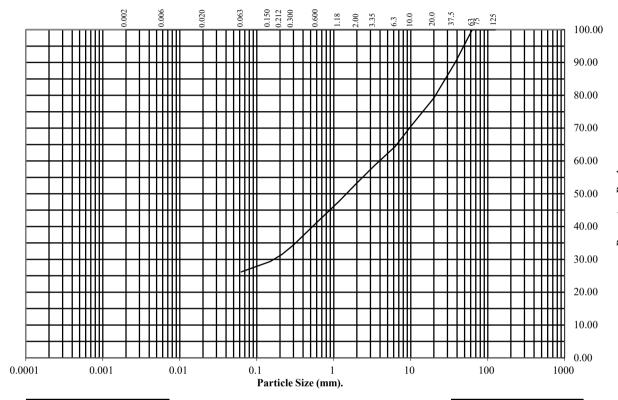
Contract No:
PSL21/1802
Client Ref:
2868817

BS1377 : Part 2 : 1990 Wet Sieve, Clause 9.2

Hole Number: R05-TP08A Top Depth (m): 1.50

Sample Number: Base Depth(m):

Sample Type: B



BS Test	Percentage
Sieve (mm)	Passing
125	100
75	100
63	100
37.5	90
20	79
10	71
6.3	64
3.35	58
2	53
1.18	48
0.6	41
0.3	34
0.212	31
0.15	29
0.063	26

Soil	Total
Fraction	Percentage
Cobbles Gravel Sand Silt/Clay	0 47 27 26

Remarks:

See Summary of Soil Descriptions





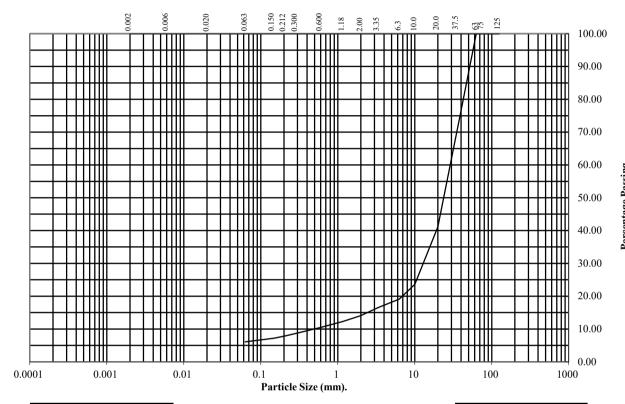
Contract No:
PSL21/1802
Client Ref:
2868817

BS1377 : Part 2 : 1990 Wet Sieve, Clause 9.2

Hole Number: R05-TP09 Top Depth (m): 0.50

Sample Number: Base Depth(m):

Sample Type: B



BS Test	Percentage
Sieve (mm)	Passing
125	100
75	100
63	100
37.5	73
20	41
10	24
6.3	19
3.35	17
2	14
1.18	12
0.6	10
0.3	9
0.212	8
0.15	7
0.063	6

Soil	Total
Fraction	Percentage
Cobbles Gravel Sand Silt/Clay	0 86 8 6

Remarks:

See Summary of Soil Descriptions





Contract No:
PSL21/1802
Client Ref:
2868817





ANALYTICAL TEST REPORT

Contract no: 94161

Contract name: Bus Connect Route 5

Client reference: PSL21/1802

Clients name: Professional Soils Laboratory

Clients address: 5/7 Hexthorpe Road

Doncaster DN4 0AR

Samples received: 08 March 2021

Analysis started: 08 March 2021

Analysis completed: 10 March 2021

Report issued: 11 March 2021

Notes: Opinions and interpretations expressed herein are outside the UKAS accreditation scope.

Unless otherwise stated, Chemtech Environmental Ltd was not responsible for sampling.

All testing carried out at Unit 6 Parkhead, Stanley, DH9 7YB, except for subcontracted testing.

Methods, procedures and performance data are available on request.

Results reported herein relate only to the material supplied to the laboratory. This report shall not be reproduced except in full, without prior written approval. Samples will be disposed of 6 weeks from initial receipt unless otherwise instructed.

Key: U UKAS accredited test

M MCERTS & UKAS accredited test

\$ Test carried out by an approved subcontractor

I/S Insufficient sample to carry out test N/S Sample not suitable for testing

Approved by:

Rachael Burton

Customer Support Squad Leader

Chemtech Environmental Limited

SOILS

Lab number	94161-1	94161-2	94161-3		
Sample id	R05-TP08A	R05-TP08A	R05-TP09		
Depth (m)	0.50	1.50	0.50		
Date sampled	25/02/2021	25/02/2021	25/02/2021		
Test	Method	Units			
Total Organic Carbon (TOC)	CE197	% w/w C	1.1	1.0	0.5
Estimate of OMC (calculated from TOC)	CE197	% w/w	1.8	1.8	8.0

Chemtech Environmental Limited

METHOD DETAILS

METHOD	SOILS	METHOD SUMMARY	SAMPLE	STATUS	LOD	UNITS
CE197	Total Organic Carbon (TOC)	Carbon Analyser	Dry		0.1	% w/w C
CE197	Estimate of OMC (calculated from TOC)	Calculation from Total Organic Carbon	Dry		0.1	% w/w

Chemtech Environmental Limited

DEVIATING SAMPLE INFORMATION

Comments

Sample deviation is determined in accordance with the UKAS note "Guidance on Deviating Samples" and based on reference standards and laboratory trials.

For samples identified as deviating, test result(s) may be compromised and may not be representative of the sample at the time of sampling.

Chemtech Environmental Ltd cannot be held responsible for the integrity of sample(s) received if Chemtech Environmental Ltd did not undertake the sampling. Such samples may be deviating.

Key

N No (not deviating sample)
Y Yes (deviating sample)
NSD Sampling date not provided

NST Sampling time not provided (waters only)

EHT Sample exceeded holding time(s)

IC Sample not received in appropriate containers
HP Headspace present in sample container

NCF Sample not chemically fixed (where appropriate)

OR Other (specify)

Lab ref	Sample id	Depth (m)	Deviating	Tests (Reason for deviation)
94161-1	R05-TP08A	0.50	N	
94161-2	R05-TP08A	1.50	N	
94161-3	R05-TP09	0.50	N	



Element Materials Technology

Unit 3 Deeside Point

Zone 3

Deeside Industrial Park

Deeside CH5 2UA P: +44 (0) 1244 833780

F: +44 (0) 1244 833781

W: www.element.com

Ground Investigations Ireland Catherinestown House Hazelhatch Road Newcastle Co. Dublin Ireland





Attention: John Duggan

Date: 8th December, 2020

Your reference: 9754-07-20

Our reference : Test Report 20/16588 Batch 1

1

Location : BusConnects Route 5

Date samples received : 26th November, 2020

Status: Final report

Issue:

Two samples were received for analysis on 26th November, 2020 of which two were scheduled for analysis. Please find attached our Test Report which should be read with notes at the end of the report and should include all sections if reproduced. Interpretations and opinions are outside the scope of any accreditation, and all results relate only to samples supplied.

All analysis is carried out on as received samples and reported on a dry weight basis unless stated otherwise. Results are not surrogate corrected.

Authorised By:

Bruce Leslie Project Manager

p luce

Please include all sections of this report if it is reproduced $% \left(1\right) =\left(1\right) \left(1$

Client Name: Ground Investigations Ireland

Reference: 9754-07-20

Location: BusConnects Route 5

Contact: John Duggan EMT Joh No: 20/16588

Report : Solid

EMT Job No:	20/16588								
EMT Sample No.	1-3	4-6					l		
Sample ID	R5 TP02	R5 TP02							
Depth	0.50	1.10					Please se	e attached n	otes for all
COC No / misc								ations and a	
Containers	VJT	VJT							
Sample Date									
Sample Type	Soil	Soil							
Batch Number	1	1					LOD/LOR	Units	Method No.
Date of Receipt									
Antimony	2	<1					<1	mg/kg	TM30/PM15
Arsenic [#]	9.5	7.9					<0.5	mg/kg	TM30/PM15
Barium #	69	120					<1	mg/kg	TM30/PM15
Cadmium#	1.6	1.5					<0.1	mg/kg	TM30/PM15
Chromium #	33.6 22	39.1					<0.5	mg/kg	TM30/PM15 TM30/PM15
Copper# Lead#	12	18 11					<1 <5	mg/kg	TM30/PM15
Lead Mercury [#]	<0.1	<0.1					<0.1	mg/kg mg/kg	TM30/PM15
Molybdenum #	4.0	3.4					<0.1	mg/kg	TM30/PM15
Nickel [#]	31.5	26.4					<0.7	mg/kg	TM30/PM15
Selenium #	2	20.4					<1	mg/kg	TM30/PM15
Zinc#	74	56					<5	mg/kg	TM30/PM15
ZIIIC	7.7	00					-	mg/kg	THIOGH HITO
PAH MS									
Naphthalene #	<0.04	<0.04					<0.04	mg/kg	TM4/PM8
Acenaphthylene	<0.03	<0.03					<0.03	mg/kg	TM4/PM8
Acenaphthene #	<0.05	<0.05					<0.05	mg/kg	TM4/PM8
Fluorene #	<0.04	<0.04					<0.04	mg/kg	TM4/PM8
Phenanthrene #	<0.03	<0.03					<0.03	mg/kg	TM4/PM8
Anthracene #	<0.04	<0.04					<0.04	mg/kg	TM4/PM8
Fluoranthene #	<0.03	<0.03					<0.03	mg/kg	TM4/PM8
Pyrene#	<0.03	<0.03					<0.03	mg/kg	TM4/PM8
Benzo(a)anthracene#	<0.06	<0.06					<0.06	mg/kg	TM4/PM8
Chrysene #	<0.02	<0.02					<0.02	mg/kg	TM4/PM8
Benzo(bk)fluoranthene#	<0.07	<0.07					<0.07	mg/kg	TM4/PM8
Benzo(a)pyrene #	<0.04	<0.04					<0.04	mg/kg	TM4/PM8
Indeno(123cd)pyrene	<0.04	<0.04					<0.04	mg/kg	TM4/PM8
Dibenzo(ah)anthracene #	<0.04	<0.04					<0.04	mg/kg	TM4/PM8
Benzo(ghi)perylene #	<0.04	<0.04					<0.04	mg/kg	TM4/PM8
Coronene	<0.04	<0.04					<0.04	mg/kg	TM4/PM8
PAH 17 Total	<0.64	<0.64					<0.64	mg/kg	TM4/PM8
Benzo(b)fluoranthene	<0.05	<0.05					<0.05	mg/kg	TM4/PM8
Benzo(k)fluoranthene	<0.02	<0.02					<0.02	mg/kg	TM4/PM8
PAH Surrogate % Recovery	79	80					<0	%	TM4/PM8
Mineral Oil (C10-C40) (EH_CU_1D_Total)	<30	<30					<30	mg/kg	TM5/PM8/PM16
(2.12 2.13) (211_00_18_10tal)	-50	-50					-50	mg/kg	

Client Name: Ground Investigations Ireland

Reference: 9754-07-20

Location: BusConnects Route 5

Contact: John Duggan EMT Job No: 20/16588

Report : Solid

EMT Job No:	20/16588		 	 	 	 	•						
EMT Sample No.	1-3	4-6											
Sample ID	R5 TP02	R5 TP02											
Depth	0.50	1.10											
COC No / misc	0.00							Please see attached notes for abbreviations and acronyms					
Containers	VJT	VJT											
Sample Date													
Sample Type	Soil	Soil											
Batch Number	1	1					LOD/LOR	Units	Method				
Date of Receipt	26/11/2020	26/11/2020					203/2011	O.I.I.S	No.				
TPH CWG													
Aliphatics													
>C5-C6 (HS_1D_AL)#	<0.1	<0.1					<0.1	mg/kg	TM36/PM12				
>C6-C8 (HS_1D_AL)#	<0.1	<0.1					<0.1	mg/kg	TM36/PM12				
>C8-C10 (HS_1D_AL)	<0.1	<0.1					<0.1	mg/kg	TM36/PM12				
>C10-C12 (EH_1D_AL)#	<0.2	<0.2					<0.2	mg/kg	TM5/PM8/PM16				
>C12-C16 (EH_1D_AL)#	<4	<4					<4	mg/kg	TM5/PM8/PM16				
>C16-C21 (EH_1D_AL)# >C21-C35 (EH_1D_AL)#	<7 <7	<7 <7					<7 <7	mg/kg mg/kg	TM5/PM8/PM16 TM5/PM8/PM16				
>C21-C35 (EH_1D_AL) >C35-C40 (EH_1D_AL)	<7	<7					<7	mg/kg	TM5/PM8/PM16				
Total aliphatics C5-40 (EH+HS_1D_AL)	<26	<26					<26	mg/kg	TM5/TM36/PM8/PM12/PM1				
>C6-C10 (HS_1D_AL)	<0.1	<0.1					<0.1	mg/kg	TM36/PM12				
>C10-C25 (EH_1D_AL)	<10	<10					<10	mg/kg	TM5/PM8/PM16				
>C25-C35 (EH_1D_AL)	<10	<10					<10	mg/kg	TM5/PM8/PM16				
Aromatics													
>C5-EC7 (HS_1D_AR)#	<0.1	<0.1					<0.1	mg/kg	TM36/PM12				
>EC7-EC8 (HS_1D_AR)#	<0.1	<0.1					<0.1	mg/kg	TM36/PM12				
>EC8-EC10 (HS_1D_AR)#	<0.1	<0.1					<0.1	mg/kg	TM36/PM12				
>EC10-EC12 (EH_1D_AR)#	<0.2	<0.2					<0.2	mg/kg	TM5/PM8/PM16				
>EC12-EC16 (EH_1D_AR)#	<4	<4					<4	mg/kg	TM5/PM8/PM16				
>EC16-EC21 (EH_1D_AR)#	<7	<7					<7	mg/kg	TM5/PM8/PM16				
>EC21-EC35 (EH_1D_AR)#	<7	<7					<7	mg/kg	TM5/PM8/PM16				
>EC35-EC40 (EH_1D_AR)	<7	<7					<7	mg/kg	TM5/PM8/PM16				
Total aromatics C5-40 (EH+HS_1D_AR) Total aliphatics and aromatics(C5-40) (EH+HS_CU_1D_Total)	<26 <52	<26 <52					<26 <52	mg/kg	TM5/TM36/PM6/PM12/PM1				
>EC6-EC10 (HS_1D_AR)#	<0.1	<0.1					<0.1	mg/kg mg/kg	TM36/PM12				
>EC10-EC25 (EH_1D_AR)	<10	<10					<10	mg/kg	TM5/PM8/PM16				
>EC25-EC35 (EH_1D_AR)	<10	<10					<10	mg/kg	TM5/PM8/PM16				
, ,													
MTBE#	<5	<5					<5	ug/kg	TM36/PM12				
Benzene #	<5	<5					<5	ug/kg	TM36/PM12				
Toluene #	<5	<5					<5	ug/kg	TM36/PM12				
Ethylbenzene #	<5	<5					<5	ug/kg	TM36/PM12				
m/p-Xylene #	<5	<5					<5	ug/kg	TM36/PM12				
o-Xylene [#]	<5	<5					<5	ug/kg	TM36/PM12				
PCB 28#	<5	<5					<5	ug/kg	TM17/PM8				
PCB 52#	<5 <5	<5 <5					<5 <5	ug/kg ug/kg	TM17/PM8				
PCB 101 #	<5	<5 <5					<5	ug/kg	TM17/1 M8				
PCB 118#	<5	<5					<5	ug/kg	TM17/PM8				
PCB 138#	<5	<5					<5	ug/kg	TM17/PM8				
PCB 153#	<5	<5					<5	ug/kg	TM17/PM8				
PCB 180#	<5	<5					<5	ug/kg	TM17/PM8				
Total 7 PCBs #	<35	<35					<35	ug/kg	TM17/PM8				

Client Name: Ground Investigations Ireland

Reference: 9754-07-20

Location: BusConnects Route 5

Contact: John Duggan EMT Job No: 20/16588

Report : Solid

EMT Job No:	20/16588								
EMT Sample No.	1-3	4-6							
Sample ID	R5 TP02	R5 TP02							
Depth	0.50	1.10					Please se	e attached n	otes for all
COC No / misc								ations and a	
Containers	VJT	VJT							
Sample Date	23/11/2020	23/11/2020							
Sample Type	Soil	Soil							
Batch Number	1	1							Method
Date of Receipt	26/11/2020	26/11/2020					LOD/LOR	Units	No.
Natural Moisture Content	7.3	5.9					<0.1	%	PM4/PM0
Moisture Content (% Wet Weight)	6.8	5.6					<0.1	%	PM4/PM0
Hexavalent Chromium #	<0.3	<0.3					<0.3	mg/kg	TM38/PM20
Chromium III	33.6	39.1					<0.5	mg/kg	NONE/NONE
T #	.0 =						.0.=		TM00/DM44
Total Cyanide #	<0.5	<0.5					<0.5	mg/kg	TM89/PM45
Total Organic Carbon #	0.34	0.29					<0.02	%	TM21/PM24
Loss on Ignition # pH #	1.6 8.54	1.2 8.94					<1.0 <0.01	% pH units	TM22/PM0 TM73/PM11
pπ	0.54	0.54					40.01	priumo	11117 071 11111
Mass of raw test portion	0.0974	0.0969						kg	NONE/PM17
Mass of dried test portion	0.09	0.09						kg	NONE/PM17
			•						

Client Name: Ground Investigations Ireland

Reference: 9754-07-20

Location: BusConnects Route 5

Contact: John Duggan EMT Job No: 20/16588

Report: CEN 10:1 1 Batch

EWI JOD NO:	20/10000		 	 	 	 							
EMT Sample No.	1-3	4-6											
Sample ID	R5 TP02	R5 TP02											
Depth	0.50	1.10					Diagon	e attached n	otoo for all				
COC No / misc								ations and a					
Containers	VJT	VJT											
Sample Date	23/11/2020	23/11/2020											
Sample Type	Soil	Soil											
Batch Number	1	1											
Date of Receipt							LOD/LOR	Units	Method No.				
Dissolved Antimony#	<0.002	<0.002					<0.002	mg/l	TM30/PM17				
Dissolved Antimony (A10) #	<0.02	<0.02					<0.02	mg/kg	TM30/PM17				
Dissolved Arsenic#	<0.0025	<0.0025					<0.0025	mg/l	TM30/PM17				
Dissolved Arsenic (A10) #	<0.025	<0.025					<0.025	mg/kg	TM30/PM17				
Dissolved Barium #	0.009	0.003					<0.003	mg/l	TM30/PM17				
Dissolved Barium (A10)#	0.009	0.003					<0.03	mg/kg	TM30/PM17				
Dissolved Cadmium #	<0.0005	<0.0005					<0.005	mg/l	TM30/PM17				
Dissolved Cadmium (A10) #	<0.005	<0.005					<0.005	mg/kg	TM30/PM17				
Dissolved Chromium #	<0.0015	<0.0015					<0.0015	mg/l	TM30/PM17				
Dissolved Chromium (A10)#	<0.015	<0.015					<0.015	mg/kg	TM30/PM17				
Dissolved Copper#	<0.007	<0.007					<0.007	mg/l	TM30/PM17				
Dissolved Copper (A10) #	<0.07	<0.07					<0.07	mg/kg	TM30/PM17				
Dissolved Lead #	<0.005	<0.005					<0.005	mg/l	TM30/PM17				
Dissolved Lead (A10)#	<0.05	<0.05					<0.05	mg/kg	TM30/PM17				
Dissolved Molybdenum #	0.016	0.012					<0.002	mg/l	TM30/PM17				
Dissolved Molybdenum (A10)#	0.16	0.12					<0.02	mg/kg	TM30/PM17				
Dissolved Nickel #	<0.002	<0.002					<0.002	mg/l	TM30/PM17				
Dissolved Nickel (A10)#	<0.02	<0.02					<0.02	mg/kg	TM30/PM17				
Dissolved Selenium#	<0.003	<0.003					<0.003	mg/l	TM30/PM17				
Dissolved Selenium (A10)#	<0.03	<0.03					<0.03	mg/kg	TM30/PM17				
Dissolved Zinc#	<0.003	0.003					<0.003	mg/l	TM30/PM17				
Dissolved Zinc (A10)#	<0.03	0.03					<0.03	mg/kg	TM30/PM17				
Mercury Dissolved by CVAF#	<0.00001	<0.00001					<0.00001	mg/l	TM61/PM0				
Mercury Dissolved by CVAF#	<0.0001	<0.0001					<0.0001	mg/kg	TM61/PM0				
Total Phenols HPLC	<0.05	<0.05					<0.05	mg/l	TM26/PM0				
Total Phenols HPLC	<0.5	<0.5					<0.5	mg/kg	TM26/PM0				
Fluoride	<0.3	<0.3					<0.3	mg/l	TM173/PM0				
Fluoride	<3	<3					<3	mg/kg	TM173/PM0				
Sulphate as SO4#	21.7	7.5					<0.5	mg/l	TM38/PM0				
Sulphate as SO4 #	217	75					<5	mg/kg	TM38/PM0				
Chloride #	<0.3	<0.3					<0.3	mg/l	TM38/PM0				
Chloride #	<3	<3					<3	mg/kg	TM38/PM0				
Dissolved Organic Carbon	2	3					<2	mg/l	TM60/PM0				
Dissolved Organic Carbon	20	30					<20	mg/kg	TM60/PM0				
Total Dissolved Solids #	64	47					<35	mg/l	TM20/PM0				
Total Dissolved Solids #	640	470					<350	mg/kg	TM20/PM0				

Client Name: Ground Investigations Ireland

Reference: 9754-07-20 Location: BusConnects Route 5 Contact: EMT Job No: John Duggan 20/16588

Report: EN12457_2

EMI JOD NO:	20/16588					
EMT Sample No.	1-3	4-6				
Sample ID	R5 TP02	R5 TP02				
Depth	0.50	1.10				
COC No / misc						
Containers	VJT	VJT				
Sample Date	23/11/2020	23/11/2020				
Sample Type	Soil	Soil				
Batch Number	1	1				

Depth	0.50	1.10								Please se	e attached n	otes for all
COC No / misc										abbrevi	ations and a	ronyms
Containers	VJT	VJT										
Sample Date	23/11/2020	23/11/2020										
Sample Type	Soil	Soil										
Batch Number	1	1					Inert	Stable Non- reactive	Hazardous	LOD LOR	Units	Method No.
Date of Receipt	26/11/2020	26/11/2020						reactive				INO.
Solid Waste Analysis												
Total Organic Carbon#	0.34	0.29					3	5	6	<0.02	%	TM21/PM24
Sum of BTEX	<0.025	<0.025					6	-	-	<0.025	mg/kg	TM36/PM12
Sum of 7 PCBs#	<0.035	<0.035					1	-	-	<0.035	mg/kg	TM17/PM8
Mineral Oil	<30	<30					500	-	-	<30	mg/kg	TM5/PM8/PM16
PAH Sum of 17	<0.64	<0.64					100	-	-	<0.64	mg/kg	TM4/PM8
CEN 10:1 Leachate												
Arsenic#	<0.025	<0.025					0.5	2	25	<0.025	mg/kg	TM30/PM17
Barium #	0.09	0.03					20	100	300	<0.03	mg/kg	TM30/PM17
Cadmium #	<0.005	<0.005					0.04	1	5	<0.005	mg/kg	TM30/PM17
Chromium #	<0.015	<0.015					0.5	10	70	<0.015	mg/kg	TM30/PM17
Copper#	<0.07	<0.07					2	50	100	<0.07	mg/kg	TM30/PM17
Mercury #	<0.0001	<0.0001					0.01	0.2	2	<0.0001	mg/kg	TM61/PM0
Molybdenum #	0.16	0.12					0.5	10	30	<0.02	mg/kg	TM30/PM17
Nickel#	<0.02	<0.02					0.4	10	40	<0.02	mg/kg	TM30/PM17
Lead#	<0.05	<0.05					0.5	10	50	<0.05	mg/kg	TM30/PM17
Antimony#	<0.02	<0.02					0.06	0.7	5	<0.02	mg/kg	TM30/PM17
Selenium #	<0.03	<0.03					0.1	0.5	7	<0.03	mg/kg	TM30/PM17
Zinc#	<0.03	0.03					4	50	200	<0.03	mg/kg	TM30/PM17
Total Dissolved Solids #	640	470					4000	60000	100000	<350	mg/kg	TM20/PM0
Dissolved Organic Carbon	20	30					500	800	1000	<20	mg/kg	TM60/PM0
Mass of raw test portion	0.0974	0.0969					-	-	-		kg	NONE/PM17
Dry Matter Content Ratio	92.7	93.4					-	-	-	<0.1	%	NONE/PM4
Leachant Volume	0.893	0.894					-	-	-		I	NONE/PM17
Eluate Volume	0.85	0.8					-	-	-		I	NONE/PM17
pH#	8.54	8.94					-	-	-	<0.01	pH units	TM73/PM11
Fluoride	<3	<3					-	-	-	<3	mg/kg	TM173/PM0
Sulphate as SO4 #	217	75					1000	20000	50000	<5	mg/kg	TM38/PM0
Chloride #	<3	<3					800	15000	25000	<3	mg/kg	TM38/PM0
						1						1

Client Name: Ground Investigations Ireland

Reference: 20/07/9754

Location: BusConnects Route 5

Contact: John Duggan

Note:

Asbestos Screen analysis is carried out in accordance with our documented in-house methods PM042 and TM065 and HSG 248 by Stereo and Polarised Light Microscopy using Dispersion Staining Techniques and is covered by our UKAS accreditation. Detailed Gravimetric Quantification and PCOM Fibre Analysis is carried out in accordance with our documented in-house methods PM042 and TM131 and HSG 248 using Stereo and Polarised Light Microscopy and Phase Contrast Optical Microscopy (PCOM). Samples are retained for not less than 6 months from the date of analysis unless specifically requested.

Opinions, including ACM type and Asbestos level less than 0.1%, lie outside the scope of our UKAS accreditation.

Where the sample is not taken by a Element Materials Technology consultant, Element Materials Technology cannot be responsible for inaccurate or unrepresentative sampling.

EMT Job No.	Batch	Sample ID	Depth	EMT Sample No.	Date Of Analysis	Analysis	Result
20/16588	1	R5 TP02	0.50	2	03/12/2020	General Description (Bulk Analysis)	Soil/Stones
					03/12/2020	Asbestos Fibres	NAD
					03/12/2020	Asbestos ACM	NAD
					03/12/2020	Asbestos Type	NAD
					03/12/2020	Asbestos Level Screen	NAD
20/16588	1	R5 TP02	1.10	5	03/12/2020	General Description (Bulk Analysis)	Soil/Stones
					03/12/2020	Asbestos Fibres	NAD
					03/12/2020	Asbestos ACM	NAD
					03/12/2020	Asbestos Type	NAD
					03/12/2020	Asbestos Level Screen	NAD

Client Name: Ground Investigations Ireland

Reference: 9754-07-20

Location: BusConnects Route 5

Contact: John Duggan

EMT Job No.	Batch	Sample ID	Depth	EMT Sample No.	Analysis	Reason
					No deviating sample report results for job 20/16588	

Please note that only samples that are deviating are mentioned in this report. If no samples are listed it is because none were deviating. Only analyses which are accredited are recorded as deviating if set criteria are not met.

NOTES TO ACCOMPANY ALL SCHEDULES AND REPORTS

EMT Job No.: 20/16588

SOILS

Please note we are only MCERTS accredited (UK soils only) for sand, loam and clay and any other matrix is outside our scope of accreditation.

Where an MCERTS report has been requested, you will be notified within 48 hours of any samples that have been identified as being outside our MCERTS scope. As validation has been performed on clay, sand and loam, only samples that are predominantly these matrices, or combinations of them will be within our MCERTS scope. If samples are not one of a combination of the above matrices they will not be marked as MCERTS accredited.

It is assumed that you have taken representative samples on site and require analysis on a representative subsample. Stones will generally be included unless we are requested to remove them.

All samples will be discarded one month after the date of reporting, unless we are instructed to the contrary.

If you have not already done so, please send us a purchase order if this is required by your company.

Where appropriate please make sure that our detection limits are suitable for your needs, if they are not, please notify us immediately.

All analysis is reported on a dry weight basis unless stated otherwise. Limits of detection for analyses carried out on as received samples are not moisture content corrected. Results are not surrogate corrected. Samples are dried at 35°C ±5°C unless otherwise stated. Moisture content for CEN Leachate tests are dried at 105°C ±5°C.

Where Mineral Oil or Fats, Oils and Grease is quoted, this refers to Total Aliphatics C10-C40.

Where a CEN 10:1 ZERO Headspace VOC test has been carried out, a 10:1 ratio of water to wet (as received) soil has been used.

% Asbestos in Asbestos Containing Materials (ACMs) is determined by reference to HSG 264 The Survey Guide - Appendix 2 : ACMs in buildings listed in order of ease of fibre release.

Sufficient amount of sample must be received to carry out the testing specified. Where an insufficient amount of sample has been received the testing may not meet the requirements of our accredited methods, as such accreditation may be removed.

Negative Neutralization Potential (NP) values are obtained when the volume of NaOH (0.1N) titrated (pH 8.3) is greater than the volume of HCI (1N) to reduce the pH of the sample to 2.0 - 2.5. Any negative NP values are corrected to 0.

The calculation of Pyrite content assumes that all oxidisable sulphides present in the sample are pyrite. This may not be the case. The calculation may be an overesitimate when other sulphides such as Barite (Barium Sulphate) are present.

WATERS

Please note we are not a UK Drinking Water Inspectorate (DWI) Approved Laboratory .

ISO17025 accreditation applies to surface water and groundwater and usually one other matrix which is analysis specific, any other liquids are outside our scope of accreditation.

As surface waters require different sample preparation to groundwaters the laboratory must be informed of the water type when submitting samples.

Where Mineral Oil or Fats, Oils and Grease is guoted, this refers to Total Aliphatics C10-C40.

DEVIATING SAMPLES

All samples should be submitted to the laboratory in suitable containers with sufficient ice packs to sustain an appropriate temperature for the requested analysis. The temperature of sample receipt is recorded on the confirmation schedules in order that the client can make an informed decision as to whether testing should still be undertaken.

SURROGATES

Surrogate compounds are added during the preparation process to monitor recovery of analytes. However low recovery in soils is often due to peat, clay or other organic rich matrices. For waters this can be due to oxidants, surfactants, organic rich sediments or remediation fluids. Acceptable limits for most organic methods are 70 - 130% and for VOCs are 50 - 150%. When surrogate recoveries are outside the performance criteria but the associated AQC passes this is assumed to be due to matrix effect. Results are not surrogate corrected.

DILUTIONS

A dilution suffix indicates a dilution has been performed and the reported result takes this into account. No further calculation is required.

BLANKS

Where analytes have been found in the blank, the sample will be treated in accordance with our laboratory procedure for dealing with contaminated blanks.

NOTE

Data is only reported if the laboratory is confident that the data is a true reflection of the samples analysed. Data is only reported as accredited when all the requirements of our Quality System have been met. In certain circumstances where all the requirements of the Quality System have not been met, for instance if the associated AQC has failed, the reason is fully investigated and documented. The sample data is then evaluated alongside the other quality control checks performed during analysis to determine its suitability. Following this evaluation, provided the sample results have not been effected, the data is reported but accreditation is removed. It is a UKAS requirement for data not reported as accredited to be considered indicative only, but this does not mean the data is not valid.

Where possible, and if requested, samples will be re-extracted and a revised report issued with accredited results. Please do not hesitate to contact the laboratory if further details are required of the circumstances which have led to the removal of accreditation.

EMT Job No.: 20/16588

REPORTS FROM THE SOUTH AFRICA LABORATORY

Any method number not prefixed with SA has been undertaken in our UK laboratory unless reported as subcontracted.

Measurement Uncertainty

Measurement uncertainty defines the range of values that could reasonably be attributed to the measured quantity. This range of values has not been included within the reported results. Uncertainty expressed as a percentage can be provided upon request.

ABBREVIATIONS and ACRONYMS USED

#	ISO17025 (UKAS Ref No. 4225) accredited - UK.
SA	ISO17025 (SANAS Ref No.T0729) accredited - South Africa
В	Indicates analyte found in associated method blank.
DR	Dilution required.
М	MCERTS accredited.
NA	Not applicable
NAD	No Asbestos Detected.
ND	None Detected (usually refers to VOC and/SVOC TICs).
NDP	No Determination Possible
SS	Calibrated against a single substance
SV	Surrogate recovery outside performance criteria. This may be due to a matrix effect.
W	Results expressed on as received basis.
+	AQC failure, accreditation has been removed from this result, if appropriate, see 'Note' on previous page.
>>	Results above calibration range, the result should be considered the minimum value. The actual result could be significantly higher, this result is not accredited.
*	Analysis subcontracted to an Element Materials Technology approved laboratory.
AD	Samples are dried at 35°C ±5°C
СО	Suspected carry over
LOD/LOR	Limit of Detection (Limit of Reporting) in line with ISO 17025 and MCERTS
ME	Matrix Effect
NFD	No Fibres Detected
BS	AQC Sample
LB	Blank Sample
N	Client Sample
ТВ	Trip Blank Sample
ОС	Outside Calibration Range
_	

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/S ANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
PM4	Gravimetric measurement of Natural Moisture Content and % Moisture Content at either 35°C or 105°C. Calculation based on ISO 11465:1993(E) and BS1377-2:1990.	PM0	No preparation is required.			AR	
TM4	Modified USEPA 8270D v5:2014 method for the solvent extraction and determination of PAHs by GC-MS.	PM8	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required.			AR	Yes
TM4	Modified USEPA 8270D v5:2014 method for the solvent extraction and determination of PAHs by GC-MS.	PM8	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required.	Yes		AR	Yes
TM5	Modified 8015B v2:1996 method for the determination of solvent Extractable Petroleum Hydrocarbons (EPH) within the range C8-C40 by GCFID. For waters the solvent extracts dissolved phase plus a sheen if present.	PM8/PM16	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required/Fractionation into aliphatic and aromatic fractions using a Rapid Trace SPE.			AR	Yes
TM5	Modified 8015B v2:1996 method for the determination of solvent Extractable Petroleum Hydrocarbons (EPH) within the range C8-C40 by GCFID. For waters the solvent extracts dissolved phase plus a sheen if present.	PM8/PM16	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required/Fractionation into aliphatic and aromatic fractions using a Rapid Trace SPE.	Yes		AR	Yes
TM5/TM36	please refer to TM5 and TM36 for method details	PM8/PM12/PM16	please refer to PM8/PM16 and PM12 for method details			AR	Yes
TM17	Modified US EPA method 8270D v5:2014. Determination of specific Polychlorinated Biphenyl congeners by GC-MS.	PM8	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required.	Yes		AR	Yes
TM20	Modified BS 1377-3:1990/USEPA 160.1/3 (TDS/TS: 1971) Gravimetric determination of Total Dissolved Solids/Total Solids	PM0	No preparation is required.	Yes		AR	Yes
TM21	Modified BS 7755-3:1995, ISO10694:1995 Determination of Total Organic Carbon or Total Carbon by combustion in an Eltra TOC furnace/analyser in the presence of oxygen. The CO2 generated is quantified using infra-red detection. Organic Matter (SOM) calculated as per EA MCERTS Chemical Testing of Soil, March 2012 v4.	PM24	Dried and ground solid samples are washed with hydrochloric acid, then rinsed with deionised water to remove the mineral carbon before TOC analysis.	Yes		AD	Yes
TM22	Modified BS1377-3:1990 Gravimetric determination of Loss on Ignition by temperature controlled Muffle Furnace (35C-440C). On request modified ASTM D2974-00 LOI (105C-440C)	- PM0	No preparation is required.	Yes		AD	Yes

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/S ANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
TM26	Determination of phenols by Reversed Phased High Performance Liquid Chromatography and Electro-Chemical Detection.	PM0	No preparation is required.			AR	Yes
ТМ30	Determination of Trace Metals by ICP-OES (Inductively Coupled Plasma – Optical Emission Spectrometry): WATERS by Modified USEPA Method 200.7, Rev. 4.4, 1994; Modified EPA Method 6010B, Rev.2, Dec 1996; Modified BS EN ISO 11885:2009: SOILS by Modified USEP	PM15	Acid digestion of dried and ground solid samples using Aqua Regia refluxed at 112.5 °C. Samples containing asbestos are not dried and ground.			AD	Yes
TM30	Determination of Trace Metals by ICP-OES (Inductively Coupled Plasma – Optical Emission Spectrometry): WATERS by Modified USEPA Method 200.7, Rev. 4.4, 1994; Modified EPA Method 6010B, Rev.2, Dec 1996; Modified BS EN ISO 11885:2009: SOILS by Modified USEP	PM15	Acid digestion of dried and ground solid samples using Aqua Regia refluxed at 112.5 °C. Samples containing asbestos are not dried and ground.	Yes		AD	Yes
TM30	Determination of Trace Metals by ICP-OES (Inductively Coupled Plasma – Optical Emission Spectrometry): WATERS by Modified USEPA Method 200.7, Rev. 4.4, 1994; Modified EPA Method 6010B, Rev.2, Dec 1996; Modified BS EN ISO 11885:2009: SOILS by Modified USEP	PM17	Modified method BS EN12457-2:2002 As received solid samples are leached with water in a 10:1 water to soil ratio for 24 hours, the moisture content of the sample is included in the ratio.	Yes		AR	Yes
TM36	Modified US EPA method 8015B v2:1996. Determination of Gasoline Range Organics (GRO) in the carbon chain range of C4-12 by headspace GC-FID. MTBE by GCFID coelutes with 3-methylpentane if present and therefore can give a false positive. Positive MTBE results will be re-run using GC-MS to double check, when requested.	PM12	Modified US EPA method 5021A v2:2014. Preparation of solid and liquid samples for GC headspace analysis.			AR	Yes
TM36	Modified US EPA method 8015B v2:1996. Determination of Gasoline Range Organics (GRO) in the carbon chain range of C4-12 by headspace GC-FID. MTBE by GCFID coelutes with 3-methylpentane if present and therefore can give a false positive. Positive MTBE results will be re-run using GC-MS to double check, when requested.	PM12	Modified US EPA method 5021A v2:2014. Preparation of solid and liquid samples for GC headspace analysis.	Yes		AR	Yes
TM38	Soluble Ion analysis using Discrete Analyser. Modified US EPA methods: Chloride 325.2 (1978), Sulphate 375.4 (Rev.2 1993), o-Phosphate 365.2 (Rev.2 1993), TON 353.1 (Rev.2 1993), Nitrite 354.1 (1971), Hex Cr 7196A (1992), NH4+ 350.1 (Rev.2 1993 (comparabl	PM0	No preparation is required.	Yes		AR	Yes
TM38	Soluble Ion analysis using Discrete Analyser. Modified US EPA methods: Chloride 325.2 (1978), Sulphate 375.4 (Rev.2 1993), o-Phosphate 365.2 (Rev.2 1993), TON 353.1 (Rev.2 1993), Nitrite 354.1 (1971), Hex Cr 7196A (1992), NH4+ 350.1 (Rev.2 1993 (comparabl	PM20	Extraction of dried and ground or as received samples with deionised water in a 2:1 water to solid ratio using a reciprocal shaker for all analytes except hexavalent chromium. Extraction of as received sample using 10:1 ratio of 0.2M sodium hydroxide to soil for hexavalent chromium using a reciprocal shaker.	Yes		AR	Yes
TM60	TC/TOC analysis of Waters by High Temperature Combustion followed by NDIR detection. Based on the following modified standard methods: USEPA 9060A (2002), APHA SMEWW 5310B:1999 22nd Edition, ASTM D 7573, and USEPA 415.1.	PM0	No preparation is required.			AR	Yes
TM61	Determination of Mercury by Cold Vapour Atomic Fluorescence - WATERS: Modified USEPA Method 245.7, Rev 2, Feb 2005. SOILS: Modified USEPA Method 7471B, Rev.2, Feb 2007	PM0	No preparation is required.	Yes		AR	Yes

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/S ANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
TM65	Asbestos Bulk Identification method based on HSG 248 First edition (2006)	PM42	Modified SCA Blue Book V.12 draft 2017 and WM3 1st Edition v1.1:2018. Solid samples undergo a thorough visual inspection for asbestos fibres prior to asbestos identification using TM065.	Yes		AR	
TM73	Modified US EPA methods 150.1 (1982) and 9045D Rev. 4 - 2004) and BS1377-3:1990. Determination of pH by Metrohm automated probe analyser.	PM11	Extraction of as received solid samples using one part solid to 2.5 parts deionised water.	Yes		AR	No
TM89	Modified USEPA method OIA-1667 (1999). Determination of cyanide by Flow Injection Analyser. Where WAD cyanides are required a Ligand displacement step is carried out before analysis.	PM45	As received solid samples are extracted with 1M NaOH by orbital shaker for Cyanide, Sulphide and Thiocyanate analysis.	Yes		AR	Yes
TM173	Analysis of fluoride by ISE (Ion Selective Electrode) using modified ISE method 9214 - 340.2 (EPA 1998)	PM0	No preparation is required.			AR	Yes
NONE	No Method Code	NONE	No Method Code			AD	Yes
NONE	No Method Code	PM17	Modified method BS EN12457-2:2002 As received solid samples are leached with water in a 10:1 water to soil ratio for 24 hours, the moisture content of the sample is included in the ratio.				
NONE	No Method Code	PM17	Modified method BS EN12457-2:2002 As received solid samples are leached with water in a 10:1 water to soil ratio for 24 hours, the moisture content of the sample is included in the ratio.			AR	
NONE	No Method Code	PM4	Gravimetric measurement of Natural Moisture Content and % Moisture Content at either 35°C or 105°C. Calculation based on ISO 11465:1993(E) and BS1377-2:1990.			AR	



Unit 3 Deeside Point

Zone 3

Deeside Industrial Park

Deeside CH5 2UA P: +44 (0) 1244 833780

F: +44 (0) 1244 833781

W: www.element.com

Ground Investigations Ireland Catherinestown House Hazelhatch Road Newcastle Co. Dublin Ireland





Attention: John Duggan

Date: 16th December, 2020

Your reference: 9754-07-20

Our reference : Test Report 20/17312 Batch 1

Location: BusConnects Route 5

Date samples received : 8th December, 2020

Status: Final report

Issue:

One sample was received for analysis on 8th December, 2020 of which one was scheduled for analysis. Please find attached our Test Report which should be read with notes at the end of the report and should include all sections if reproduced. Interpretations and opinions are outside the scope of any accreditation, and all results relate only to samples supplied.

All analysis is carried out on as received samples and reported on a dry weight basis unless stated otherwise. Results are not surrogate corrected.

Authorised By:

Bruce Leslie

p luce

Project Manager

Please include all sections of this report if it is reproduced

Client Name: Ground Investigations Ireland

Reference: 9754-07-20

Location: BusConnects Route 5

Contact: John Duggan EMT Job No: 20/17312

Report : Solid

EMI JOD NO:	20/1/312									
EMT Sample No.	1-3									
Sample ID	R5-CP05									
Depth	0.50									
						Please see attached notes for abbreviations and acronyms				
COC No / misc								,		
Containers	VJT									
Sample Date	04/12/2020									
Sample Type	Soil									
Batch Number	1							Mathad		
Date of Receipt						LOD/LOR	Units	Method No.		
Antimony	2					<1	ma/ka	TM30/PM15		
Arsenic #	14.4					<0.5	mg/kg mg/kg	TM30/PM15		
Barium #	96					<1	mg/kg	TM30/PM15		
Cadmium#	1.3					<0.1	mg/kg	TM30/PM15		
Chromium #	49.6					<0.5	mg/kg	TM30/PM15		
Copper#	43					<1	mg/kg	TM30/PM15		
Lead [#]	45					<5	mg/kg	TM30/PM15		
Mercury#	<0.1					<0.1	mg/kg	TM30/PM15		
Molybdenum #	3.2					<0.1	mg/kg	TM30/PM15		
Nickel#	43.7					<0.7	mg/kg	TM30/PM15		
Selenium #	2					<1	mg/kg	TM30/PM15		
Zinc [#]	111					<5	mg/kg	TM30/PM15		
								ļ		
PAH MS										
Naphthalene [#]	<0.04					<0.04	mg/kg	TM4/PM8		
Acenaphthylene	0.06					<0.03	mg/kg	TM4/PM8		
Acenaphthene #	<0.05					<0.05	mg/kg	TM4/PM8		
Fluorene #	<0.04					<0.04	mg/kg	TM4/PM8		
Phenanthrene #	0.28					<0.03	mg/kg	TM4/PM8		
Anthracene #	0.12					<0.04	mg/kg	TM4/PM8		
Fluoranthene #	1.01					<0.03	mg/kg	TM4/PM8		
Pyrene #	0.92					<0.03	mg/kg	TM4/PM8		
Benzo(a)anthracene#	0.59 0.62					<0.06 <0.02	mg/kg	TM4/PM8 TM4/PM8		
Chrysene [#] Benzo(bk)fluoranthene [#]	1.43					<0.02	mg/kg mg/kg	TM4/PM8		
Benzo(a)pyrene #	0.68					<0.04	mg/kg	TM4/PM8		
Indeno(123cd)pyrene	0.52					<0.04	mg/kg	TM4/PM8		
Dibenzo(ah)anthracene #	0.08					<0.04	mg/kg	TM4/PM8		
Benzo(ghi)perylene#	0.52					<0.04	mg/kg	TM4/PM8		
Coronene	0.08					<0.04	mg/kg	TM4/PM8		
PAH 17 Total	6.91					<0.64	mg/kg	TM4/PM8		
Benzo(b)fluoranthene	1.03					<0.05	mg/kg	TM4/PM8		
Benzo(k)fluoranthene	0.40					<0.02	mg/kg	TM4/PM8		
PAH Surrogate % Recovery	98					<0	%	TM4/PM8		
Mineral Oil (C10-C40) (EH_CU_1D_Total)	<30					<30	mg/kg	TM5/PM8/PM16		
								[
								[
								ļ		
								<u>l</u>		

Client Name: Ground Investigations Ireland

Reference: 9754-07-20

Location: BusConnects Route 5

Contact: John Duggan EMT Job No: 20/17312

Report : Solid

EMT Job No:	20/17312	 	 	 	 	_							
EMT Sample No.	1-3												
Sample ID	R5-CP05												
Depth	0.50												
COC No / misc							Please see attached notes for a abbreviations and acronyms						
Containers	VJT												
Sample Date	04/12/2020												
Sample Type	Soil												
Batch Number	1							Method					
Date of Receipt	08/12/2020					LOD/LOR	Units	No.					
TPH CWG													
Aliphatics													
>C5-C6 (HS_1D_AL)#	<0.1					<0.1	mg/kg	TM36/PM12					
>C6-C8 (HS_1D_AL)#	<0.1					<0.1	mg/kg	TM36/PM12					
>C8-C10 (HS_1D_AL)	<0.1					<0.1	mg/kg	TM36/PM12					
>C10-C12 (EH_CU_1D_AL)#	<0.2					<0.2	mg/kg	TM5/PM8/PM16					
>C12-C16 (EH_CU_1D_AL)#	<4					<4	mg/kg	TM5/PM8/PM16					
>C16-C21 (EH_CU_1D_AL)#	<7					<7	mg/kg	TM5/PM8/PM16					
>C21-C35 (EH_CU_1D_AL)*	<7 <7					<7 <7	mg/kg	TM5/PM8/PM16 TM5/PM8/PM16					
>C35-C40 (EH_1D_AL) Total aliphatics C5-40 (EH+HS_1D_AL)	<26					<26	mg/kg mg/kg	TM5/TM36/PM8/PM12/PM16					
>C6-C10 (HS_1D_AL)	<0.1					<0.1	mg/kg	TM36/PM12					
>C10-C25 (EH_1D_AL)	<10					<10	mg/kg	TM5/PM8/PM16					
>C25-C35 (EH_1D_AL)	<10					<10	mg/kg	TM5/PM8/PM16					
Aromatics													
>C5-EC7 (HS_1D_AR)#	<0.1					<0.1	mg/kg	TM36/PM12					
>EC7-EC8 (HS_1D_AR)#	<0.1					<0.1	mg/kg	TM36/PM12					
>EC8-EC10 (HS_1D_AR)#	<0.1					<0.1	mg/kg	TM36/PM12					
>EC10-EC12 (EH_CU_1D_AR)#	<0.2					<0.2	mg/kg	TM5/PM8/PM16					
>EC12-EC16 (EH_CU_1D_AR)#	<4					<4	mg/kg	TM5/PM8/PM16					
>EC16-EC21 (EH_CU_1D_AR)#	<7					<7	mg/kg	TM5/PM8/PM16					
>EC21-EC35 (EH_CU_1D_AR)#	77					<7	mg/kg	TM5/PM8/PM16					
>EC35-EC40 (EH_1D_AR)	20 97					<7	mg/kg	TM5/PM8/PM16					
Total aromatics C5-40 (EH+HS_1D_AR) Total aliphatics and aromatics(C5-40) (EH+HS_CU_1D_Total)	97					<26 <52	mg/kg mg/kg	TMS/TM36/PM8/PM12/PM16					
>EC6-EC10 (HS_1D_AR)#	<0.1					<0.1	mg/kg	TM36/PM12					
>EC10-EC25 (EH_1D_AR)	20					<10	mg/kg	TM5/PM8/PM16					
>EC25-EC35 (EH_1D_AR)	71					<10	mg/kg	TM5/PM8/PM16					
, ,													
MTBE#	<5					<5	ug/kg	TM36/PM12					
Benzene#	<5					<5	ug/kg	TM36/PM12					
Toluene #	<5					<5	ug/kg	TM36/PM12					
Ethylbenzene #	<5					<5	ug/kg	TM36/PM12					
m/p-Xylene #	<5					<5	ug/kg	TM36/PM12					
o-Xylene [#]	<5					<5	ug/kg	TM36/PM12					
PCB 28#	<5					<5	ug/kg	TM17/PM8					
PCB 52 #	<5					<5 <5	ug/kg	TM17/PM8					
PCB 101#	<5					<5	ug/kg	TM17/PM8					
PCB 118#	<5					<5	ug/kg	TM17/PM8					
PCB 138#	<5					<5	ug/kg	TM17/PM8					
PCB 153#	<5					<5	ug/kg	TM17/PM8					
PCB 180 #	<5					<5	ug/kg	TM17/PM8					
Total 7 PCBs#	<35					<35	ug/kg	TM17/PM8					

Client Name: Ground Investigations Ireland

Reference: 9754-07-20

Location: BusConnects Route 5

Contact: John Duggan EMT Job No: 20/17312

Report : Solid

EMT Sample No.	1-3														
Sample ID	R5-CP05														
Depth	0.50									Please se	e attached n	otes for all			
COC No / misc										abbreviations and acronyms					
Containers	VJT														
Sample Date	04/12/2020														
Sample Type	Soil														
Batch Number	1								j	LOD/LOR	Units	Method			
Date of Receipt	08/12/2020									LOD/LOR	Offics	No.			
Natural Moisture Content	17.9									<0.1	%	PM4/PM0			
Moisture Content (% Wet Weight)	15.2									<0.1	%	PM4/PM0			
Hexavalent Chromium #	<0.3									<0.3	mg/kg	TM38/PM20			
Chromium III	49.6									<0.5	mg/kg	NONE/NONE			
Total Cyanide [#]	<0.5									-O.F	ma#	TM89/PM45			
rotal Cyanide	<0.5									<0.5	mg/kg	I WOS/PW45			
Total Organic Carbon #	1.31									<0.02	%	TM21/PM24			
Loss on Ignition #	3.7									<1.0	%	TM22/PM0			
pH [#]	8.41									<0.01		TM73/PM11			
Mass of raw test portion	0.1064										kg	NONE/PM17			
Mass of dried test portion	0.09										kg	NONE/PM17			
		'	'	'	i .	'	i .	'							

Client Name: Ground Investigations Ireland

Reference: 9754-07-20

Location: BusConnects Route 5

Contact: John Duggan EMT Job No: 20/17312

Report: CEN 10:1 1 Batch

										_					
EMT Sample No.	1-3														
Sample ID	R5-CP05														
Depth	0.50									Please se	e attached n	otes for all			
COC No / misc										Please see attached notes for a abbreviations and acronyms					
Containers	VJT														
Sample Date	04/12/2020														
Sample Type	Soil														
Batch Number	1											Method			
Date of Receipt	08/12/2020									LOD/LOR	Units	No.			
Dissolved Antimony#	<0.002									<0.002	mg/l	TM30/PM17			
Dissolved Antimony (A10) #	<0.02									<0.02	mg/kg	TM30/PM17			
Dissolved Arsenic#	<0.0025									<0.0025	mg/l	TM30/PM17			
Dissolved Arsenic (A10)#	<0.025									<0.025	mg/kg	TM30/PM17			
Dissolved Barium#	0.009									<0.003	mg/l	TM30/PM17			
Dissolved Barium (A10) #	0.09									<0.03	mg/kg	TM30/PM17			
Dissolved Cadmium #	<0.0005									<0.0005	mg/l	TM30/PM17			
Dissolved Cadmium (A10)#	<0.005									<0.005	mg/kg	TM30/PM17			
Dissolved Chromium #	0.0017									<0.0015	mg/l	TM30/PM17			
Dissolved Chromium (A10) #	0.017									<0.015	mg/kg	TM30/PM17			
Dissolved Copper#	<0.007									<0.007	mg/l	TM30/PM17			
Dissolved Copper (A10)#	<0.07									<0.07	mg/kg	TM30/PM17			
Dissolved Lead #	<0.005									<0.005	mg/l	TM30/PM17			
Dissolved Lead (A10)#	<0.05									<0.05	mg/kg	TM30/PM17			
Dissolved Molybdenum #	0.008									<0.002	mg/l	TM30/PM17			
Dissolved Molybdenum (A10)#	0.08									<0.02	mg/kg	TM30/PM17			
Dissolved Nickel #	<0.002									<0.002	mg/l	TM30/PM17			
Dissolved Nickel (A10)#	<0.02									<0.02	mg/kg	TM30/PM17			
Dissolved Nickel (A10) Dissolved Selenium #	<0.003									<0.003	mg/l	TM30/PM17			
Dissolved Selenium (A10)#	<0.003									<0.03	mg/kg	TM30/PM17			
Dissolved Zinc#	0.004									<0.003	mg/l	TM30/PM17			
Dissolved Zinc (A10) #	0.04									<0.03	mg/kg	TM30/PM17			
Mercury Dissolved by CVAF#	<0.00001									<0.0001	mg/l	TM61/PM0			
Mercury Dissolved by CVAF	<0.0001									<0.0001	mg/kg	TM61/PM0			
Mercury Dissolved by CVAI	40.0001									40.0001	mg/kg	TIVIO 1/1 IVIO			
Total Phenols HPLC	<0.05									<0.05	mg/l	TM26/PM0			
Total Phenols HPLC	<0.5									<0.5	mg/kg	TM26/PM0			
											0 0				
Fluoride	0.3									<0.3	mg/l	TM173/PM0			
Fluoride	<3									<3	mg/kg	TM173/PM0			
	-										3.3				
Sulphate as SO4 #	6.0									<0.5	mg/l	TM38/PM0			
Sulphate as SO4#	60									<5	mg/kg	TM38/PM0			
Chloride #	0.8									<0.3	mg/l	TM38/PM0			
Chloride #	8									<3	mg/kg	TM38/PM0			
	-										55				
Dissolved Organic Carbon	3									<2	mg/l	TM60/PM0			
Dissolved Organic Carbon	30									<20	mg/kg	TM60/PM0			
Total Dissolved Solids #	86									<35	mg/l	TM20/PM0			
Total Dissolved Solids	860									<350	mg/kg	TM20/PM0			
. S.a. Diodolfod Golida	- 30									300	פיייש				
		I	1	1	1	1	I	I		I		l .			

Client Name: Ground Investigations Ireland

Reference: 9754-07-20 Location: BusConnects Route 5 Contact: John Duggan EMT Job No:

Report: EN12457_2

Solids: V=60g VOC jar, J=250g glass jar, T=plastic tub

20/17312 EMT Sample No.

Sample ID	R5-CP05													
Depth	0.50											Please se	e attached n	notes for all
COC No / misc												abbrevi	ations and a	cronyms
Containers	VJT													
Sample Date														
Sample Type	Soil													
Batch Number	1								Inert	Stable Non-	Hazardous	LOD LOR	Units	Method
Date of Receipt	08/12/2020								men	reactive	Hazardous	LOD LOR	Offics	No.
Solid Waste Analysis														
Total Organic Carbon #	1.31								3	5	6	<0.02	%	TM21/PM24
Sum of BTEX	<0.025								6	-	-	<0.025	mg/kg	TM36/PM12
Sum of 7 PCBs#	<0.035								1	-	-	<0.035	mg/kg	TM17/PM8
Mineral Oil	<30								500	-	-	<30	mg/kg	TM5/PM8/PM16
PAH Sum of 17	6.91								100	-	-	<0.64	mg/kg	TM4/PM8
CEN 10:1 Leachate														
Arsenic#	<0.025								0.5	2	25	<0.025	mg/kg	TM30/PM17
Barium #	0.09								20	100	300	<0.03	mg/kg	TM30/PM17
Cadmium #	<0.005								0.04	1	5	<0.005	mg/kg	TM30/PM17
Chromium #	0.017								0.5	10	70	<0.015	mg/kg	TM30/PM17
Copper#	<0.07 <0.0001								2	50	100 2	<0.07 <0.0001	mg/kg	TM30/PM17 TM61/PM0
Mercury#	0.08								0.01	0.2 10	30	<0.001	mg/kg mg/kg	TM30/PM17
Molybdenum # Nickel #	<0.02								0.4	10	40	<0.02	mg/kg	TM30/PM17
Lead #	<0.02								0.5	10	50	<0.02	mg/kg	TM30/PM17
Antimony#	<0.02								0.06	0.7	5	<0.02	mg/kg	TM30/PM17
Selenium #	<0.03								0.1	0.5	7	<0.03	mg/kg	TM30/PM17
Zinc#	0.04								4	50	200	<0.03	mg/kg	TM30/PM17
Total Dissolved Solids #	860								4000	60000	100000	<350	mg/kg	TM20/PM0
Dissolved Organic Carbon	30								500	800	1000	<20	mg/kg	TM60/PM0
Dry Matter Content Ratio	84.3								-	-	-	<0.1	%	NONE/PM4
pH#	8.41								-	-	-	<0.01	pH units	TM73/PM11
Fluoride	<3								-	-	-	<3	mg/kg	TM173/PM0
Sulphate as SO4 #	60								1000	20000	50000	<5	mg/kg	TM38/PM0
Chloride #	8								800	15000	25000	<3	mg/kg	TM38/PM0
														1
	·	 	1	·	1	·	1	1		·				

Client Name: Ground Investigations Ireland

Reference: 20/07/9754

Location: BusConnects Route 5

Contact: John Duggan

Note:

Asbestos Screen analysis is carried out in accordance with our documented in-house methods PM042 and TM065 and HSG 248 by Stereo and Polarised Light Microscopy using Dispersion Staining Techniques and is covered by our UKAS accreditation. Detailed Gravimetric Quantification and PCOM Fibre Analysis is carried out in accordance with our documented in-house methods PM042 and TM131 and HSG 248 using Stereo and Polarised Light Microscopy and Phase Contrast Optical Microscopy (PCOM). Samples are retained for not less than 6 months from the date of analysis unless specifically requested.

Opinions, including ACM type and Asbestos level less than 0.1%, lie outside the scope of our UKAS accreditation.

Where the sample is not taken by a Element Materials Technology consultant, Element Materials Technology cannot be responsible for inaccurate or unrepresentative sampling.

EMT Job No.	Batch	Sample ID	Depth	EMT Sample No.	Date Of Analysis	Analysis	Result
20/17312	1	R5-CP05	0.50	2	12/12/2020	General Description (Bulk Analysis)	soil.stones
					12/12/2020	Asbestos Fibres	NAD
					12/12/2020	Asbestos ACM	NAD
					12/12/2020	Asbestos Type	NAD
					12/12/2020	Asbestos Level Screen	NAD

Client Name: Ground Investigations Ireland

Reference: 9754-07-20

Location: BusConnects Route 5

Contact: John Duggan

EMT Job No.	Batch	Sample ID	Depth	EMT Sample No.	Analysis	Reason
					No deviating sample report results for job 20/17312	

Please note that only samples that are deviating are mentioned in this report. If no samples are listed it is because none were deviating. Only analyses which are accredited are recorded as deviating if set criteria are not met.

NOTES TO ACCOMPANY ALL SCHEDULES AND REPORTS

EMT Job No.: 20/17312

SOILS

Please note we are only MCERTS accredited (UK soils only) for sand, loam and clay and any other matrix is outside our scope of accreditation.

Where an MCERTS report has been requested, you will be notified within 48 hours of any samples that have been identified as being outside our MCERTS scope. As validation has been performed on clay, sand and loam, only samples that are predominantly these matrices, or combinations of them will be within our MCERTS scope. If samples are not one of a combination of the above matrices they will not be marked as MCERTS accredited.

It is assumed that you have taken representative samples on site and require analysis on a representative subsample. Stones will generally be included unless we are requested to remove them.

All samples will be discarded one month after the date of reporting, unless we are instructed to the contrary.

If you have not already done so, please send us a purchase order if this is required by your company.

Where appropriate please make sure that our detection limits are suitable for your needs, if they are not, please notify us immediately.

All analysis is reported on a dry weight basis unless stated otherwise. Limits of detection for analyses carried out on as received samples are not moisture content corrected. Results are not surrogate corrected. Samples are dried at 35°C ±5°C unless otherwise stated. Moisture content for CEN Leachate tests are dried at 105°C ±5°C.

Where Mineral Oil or Fats, Oils and Grease is quoted, this refers to Total Aliphatics C10-C40.

Where a CEN 10:1 ZERO Headspace VOC test has been carried out, a 10:1 ratio of water to wet (as received) soil has been used.

% Asbestos in Asbestos Containing Materials (ACMs) is determined by reference to HSG 264 The Survey Guide - Appendix 2 : ACMs in buildings listed in order of ease of fibre release.

Sufficient amount of sample must be received to carry out the testing specified. Where an insufficient amount of sample has been received the testing may not meet the requirements of our accredited methods, as such accreditation may be removed.

Negative Neutralization Potential (NP) values are obtained when the volume of NaOH (0.1N) titrated (pH 8.3) is greater than the volume of HCI (1N) to reduce the pH of the sample to 2.0 - 2.5. Any negative NP values are corrected to 0.

The calculation of Pyrite content assumes that all oxidisable sulphides present in the sample are pyrite. This may not be the case. The calculation may be an overesitimate when other sulphides such as Barite (Barium Sulphate) are present.

WATERS

Please note we are not a UK Drinking Water Inspectorate (DWI) Approved Laboratory .

ISO17025 accreditation applies to surface water and groundwater and usually one other matrix which is analysis specific, any other liquids are outside our scope of accreditation.

As surface waters require different sample preparation to groundwaters the laboratory must be informed of the water type when submitting samples.

Where Mineral Oil or Fats, Oils and Grease is guoted, this refers to Total Aliphatics C10-C40.

DEVIATING SAMPLES

All samples should be submitted to the laboratory in suitable containers with sufficient ice packs to sustain an appropriate temperature for the requested analysis. The temperature of sample receipt is recorded on the confirmation schedules in order that the client can make an informed decision as to whether testing should still be undertaken.

SURROGATES

Surrogate compounds are added during the preparation process to monitor recovery of analytes. However low recovery in soils is often due to peat, clay or other organic rich matrices. For waters this can be due to oxidants, surfactants, organic rich sediments or remediation fluids. Acceptable limits for most organic methods are 70 - 130% and for VOCs are 50 - 150%. When surrogate recoveries are outside the performance criteria but the associated AQC passes this is assumed to be due to matrix effect. Results are not surrogate corrected.

DILUTIONS

A dilution suffix indicates a dilution has been performed and the reported result takes this into account. No further calculation is required.

BLANKS

Where analytes have been found in the blank, the sample will be treated in accordance with our laboratory procedure for dealing with contaminated blanks.

NOTE

Data is only reported if the laboratory is confident that the data is a true reflection of the samples analysed. Data is only reported as accredited when all the requirements of our Quality System have been met. In certain circumstances where all the requirements of the Quality System have not been met, for instance if the associated AQC has failed, the reason is fully investigated and documented. The sample data is then evaluated alongside the other quality control checks performed during analysis to determine its suitability. Following this evaluation, provided the sample results have not been effected, the data is reported but accreditation is removed. It is a UKAS requirement for data not reported as accredited to be considered indicative only, but this does not mean the data is not valid.

Where possible, and if requested, samples will be re-extracted and a revised report issued with accredited results. Please do not hesitate to contact the laboratory if further details are required of the circumstances which have led to the removal of accreditation.

EMT Job No.: 20/17312

REPORTS FROM THE SOUTH AFRICA LABORATORY

Any method number not prefixed with SA has been undertaken in our UK laboratory unless reported as subcontracted.

Measurement Uncertainty

Measurement uncertainty defines the range of values that could reasonably be attributed to the measured quantity. This range of values has not been included within the reported results. Uncertainty expressed as a percentage can be provided upon request.

ABBREVIATIONS and ACRONYMS USED

#	ISO17025 (UKAS Ref No. 4225) accredited - UK.
SA	ISO17025 (SANAS Ref No.T0729) accredited - South Africa
В	Indicates analyte found in associated method blank.
DR	Dilution required.
М	MCERTS accredited.
NA	Not applicable
NAD	No Asbestos Detected.
ND	None Detected (usually refers to VOC and/SVOC TICs).
NDP	No Determination Possible
SS	Calibrated against a single substance
SV	Surrogate recovery outside performance criteria. This may be due to a matrix effect.
W	Results expressed on as received basis.
+	AQC failure, accreditation has been removed from this result, if appropriate, see 'Note' on previous page.
>>	Results above calibration range, the result should be considered the minimum value. The actual result could be significantly higher, this result is not accredited.
*	Analysis subcontracted to an Element Materials Technology approved laboratory.
AD	Samples are dried at 35°C ±5°C
СО	Suspected carry over
LOD/LOR	Limit of Detection (Limit of Reporting) in line with ISO 17025 and MCERTS
ME	Matrix Effect
NFD	No Fibres Detected
BS	AQC Sample
LB	Blank Sample
N	Client Sample
ТВ	Trip Blank Sample
ОС	Outside Calibration Range
_	

HWOL ACRONYMS AND OPERATORS USED

HS	Headspace Analysis.
EH	Extractable Hydrocarbons - i.e. everything extracted by the solvent.
CU	Clean-up - e.g. by florisil, silica gel.
1D	GC - Single coil gas chromatography.
Total	Aliphatics & Aromatics.
AL	Aliphatics only.
AR	Aromatics only.
2D	GC-GC - Double coil gas chromatography.
#1	EH_Total but with humics extracted.
#2	EU_Total but with fatty acids extracted.
_	Operator - underscore to separate acronyms (exception for +).
+	Operator to indicate cumulative e.g. EH+HS_Total or EH_CU+HS_Total
MS	Mass Spectrometry.

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/S ANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
PM4	Gravimetric measurement of Natural Moisture Content and % Moisture Content at either 35°C or 105°C. Calculation based on ISO 11465:1993(E) and BS1377-2:1990.	PM0	No preparation is required.			AR	
TM4	Modified USEPA 8270D v5:2014 method for the solvent extraction and determination of PAHs by GC-MS.	PM8	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required.			AR	Yes
TM4	Modified USEPA 8270D v5:2014 method for the solvent extraction and determination of PAHs by GC-MS.	PM8	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required.	Yes		AR	Yes
TM5	Modified 8015B v2:1996 method for the determination of solvent Extractable Petroleum Hydrocarbons (EPH) within the range C8-C40 by GCFID. For waters the solvent extracts dissolved phase plus a sheen if present.	PM8/PM16	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required/Fractionation into aliphatic and aromatic fractions using a Rapid Trace SPE.			AR	Yes
TM5	Modified 8015B v2:1996 method for the determination of solvent Extractable Petroleum Hydrocarbons (EPH) within the range C8-C40 by GCFID. For waters the solvent extracts dissolved phase plus a sheen if present.	PM8/PM16	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required/Fractionation into aliphatic and aromatic fractions using a Rapid Trace SPE.	Yes		AR	Yes
TM5/TM36	please refer to TM5 and TM36 for method details	PM8/PM12/PM16	please refer to PM8/PM16 and PM12 for method details			AR	Yes
TM17	Modified US EPA method 8270D v5:2014. Determination of specific Polychlorinated Biphenyl congeners by GC-MS.	PM8	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required.	Yes		AR	Yes
TM20	Modified BS 1377-3:1990/USEPA 160.1/3 (TDS/TS: 1971) Gravimetric determination of Total Dissolved Solids/Total Solids	PM0	No preparation is required.	Yes		AR	Yes
TM21	Modified BS 7755-3:1995, ISO10694:1995 Determination of Total Organic Carbon or Total Carbon by combustion in an Eltra TOC furnace/analyser in the presence of oxygen. The CO2 generated is quantified using infra-red detection. Organic Matter (SOM) calculated as per EA MCERTS Chemical Testing of Soil, March 2012 v4.	PM24	Dried and ground solid samples are washed with hydrochloric acid, then rinsed with deionised water to remove the mineral carbon before TOC analysis.	Yes		AD	Yes
TM22	Modified BS1377-3:1990 Gravimetric determination of Loss on Ignition by temperature controlled Muffle Furnace (35C-440C). On request modified ASTM D2974-00 LOI (105C-440C)	- PM0	No preparation is required.	Yes		AD	Yes

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/S ANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
TM26	Determination of phenols by Reversed Phased High Performance Liquid Chromatography and Electro-Chemical Detection.	PM0	No preparation is required.			AR	Yes
ТМ30	Determination of Trace Metals by ICP-OES (Inductively Coupled Plasma – Optical Emission Spectrometry): WATERS by Modified USEPA Method 200.7, Rev. 4.4, 1994; Modified EPA Method 6010B, Rev.2, Dec 1996; Modified BS EN ISO 11885:2009: SOILS by Modified USEP	PM15	Acid digestion of dried and ground solid samples using Aqua Regia refluxed at 112.5 °C. Samples containing asbestos are not dried and ground.			AD	Yes
TM30	Determination of Trace Metals by ICP-OES (Inductively Coupled Plasma – Optical Emission Spectrometry): WATERS by Modified USEPA Method 200.7, Rev. 4.4, 1994; Modified EPA Method 6010B, Rev.2, Dec 1996; Modified BS EN ISO 11885:2009: SOILS by Modified USEP	PM15	Acid digestion of dried and ground solid samples using Aqua Regia refluxed at 112.5 °C. Samples containing asbestos are not dried and ground.	Yes		AD	Yes
TM30	Determination of Trace Metals by ICP-OES (Inductively Coupled Plasma – Optical Emission Spectrometry): WATERS by Modified USEPA Method 200.7, Rev. 4.4, 1994; Modified EPA Method 6010B, Rev.2, Dec 1996; Modified BS EN ISO 11885:2009: SOILS by Modified USEP	PM17	Modified method BS EN12457-2:2002 As received solid samples are leached with water in a 10:1 water to soil ratio for 24 hours, the moisture content of the sample is included in the ratio.	Yes		AR	Yes
TM36	Modified US EPA method 8015B v2:1996. Determination of Gasoline Range Organics (GRO) in the carbon chain range of C4-12 by headspace GC-FID. MTBE by GCFID coelutes with 3-methylpentane if present and therefore can give a false positive. Positive MTBE results will be re-run using GC-MS to double check, when requested.	PM12	Modified US EPA method 5021A v2:2014. Preparation of solid and liquid samples for GC headspace analysis.			AR	Yes
TM36	Modified US EPA method 8015B v2:1996. Determination of Gasoline Range Organics (GRO) in the carbon chain range of C4-12 by headspace GC-FID. MTBE by GCFID coelutes with 3-methylpentane if present and therefore can give a false positive. Positive MTBE results will be re-run using GC-MS to double check, when requested.	PM12	Modified US EPA method 5021A v2:2014. Preparation of solid and liquid samples for GC headspace analysis.	Yes		AR	Yes
TM38	Soluble Ion analysis using Discrete Analyser. Modified US EPA methods: Chloride 325.2 (1978), Sulphate 375.4 (Rev.2 1993), o-Phosphate 365.2 (Rev.2 1993), TON 353.1 (Rev.2 1993), Nitrite 354.1 (1971), Hex Cr 7196A (1992), NH4+ 350.1 (Rev.2 1993 (comparabl	PM0	No preparation is required.	Yes		AR	Yes
TM38	Soluble Ion analysis using Discrete Analyser. Modified US EPA methods: Chloride 325.2 (1978), Sulphate 375.4 (Rev.2 1993), o-Phosphate 365.2 (Rev.2 1993), TON 353.1 (Rev.2 1993), Nitrite 354.1 (1971), Hex Cr 7196A (1992), NH4+ 350.1 (Rev.2 1993 (comparabl	PM20	Extraction of dried and ground or as received samples with deionised water in a 2:1 water to solid ratio using a reciprocal shaker for all analytes except hexavalent chromium. Extraction of as received sample using 10:1 ratio of 0.2M sodium hydroxide to soil for hexavalent chromium using a reciprocal shaker.	Yes		AR	Yes
TM60	TC/TOC analysis of Waters by High Temperature Combustion followed by NDIR detection. Based on the following modified standard methods: USEPA 9060A (2002), APHA SMEWW 5310B:1999 22nd Edition, ASTM D 7573, and USEPA 415.1.	PM0	No preparation is required.			AR	Yes
TM61	Determination of Mercury by Cold Vapour Atomic Fluorescence - WATERS: Modified USEPA Method 245.7, Rev 2, Feb 2005. SOILS: Modified USEPA Method 7471B, Rev.2, Feb 2007	PM0	No preparation is required.	Yes		AR	Yes

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/S ANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
TM65	Asbestos Bulk Identification method based on HSG 248 First edition (2006)	PM42	Modified SCA Blue Book V.12 draft 2017 and WM3 1st Edition v1.1:2018. Solid samples undergo a thorough visual inspection for asbestos fibres prior to asbestos identification using TM065.	Yes		AR	
TM73	Modified US EPA methods 150.1 (1982) and 9045D Rev. 4 - 2004) and BS1377-3:1990. Determination of pH by Metrohm automated probe analyser.	PM11	Extraction of as received solid samples using one part solid to 2.5 parts deionised water.	Yes		AR	No
TM89	Modified USEPA method OIA-1667 (1999). Determination of cyanide by Flow Injection Analyser. Where WAD cyanides are required a Ligand displacement step is carried out before analysis.	PM45	As received solid samples are extracted with 1M NaOH by orbital shaker for Cyanide, Sulphide and Thiocyanate analysis.	Yes		AR	Yes
TM173	Analysis of fluoride by ISE (Ion Selective Electrode) using modified ISE method 9214 - 340.2 (EPA 1998)	PM0	No preparation is required.			AR	Yes
NONE	No Method Code	NONE	No Method Code			AD	Yes
NONE	No Method Code	PM17	Modified method BS EN12457-2:2002 As received solid samples are leached with water in a 10:1 water to soil ratio for 24 hours, the moisture content of the sample is included in the ratio.			AR	
NONE	No Method Code	PM4	Gravimetric measurement of Natural Moisture Content and % Moisture Content at either 35°C or 105°C. Calculation based on ISO 11465:1993(E) and BS1377-2:1990.			AR	



Unit 3 Deeside Point

Zone 3

Deeside Industrial Park

Deeside CH5 2UA P: +44 (0) 1244 833780

F: +44 (0) 1244 833781

W: www.element.com

Ground Investigations Ireland Catherinestown House Hazelhatch Road Newcastle Co. Dublin Ireland





Attention: John Duggan

Date: 21st December, 2020

Your reference: 9754-07-20

Our reference: Test Report 20/17435 Batch 1

Location: Bus Connects Route 5

Date samples received : 9th December, 2020

Status: Final report

Issue: 1

Five samples were received for analysis on 9th December, 2020 of which five were scheduled for analysis. Please find attached our Test Report which should be read with notes at the end of the report and should include all sections if reproduced. Interpretations and opinions are outside the scope of any accreditation, and all results relate only to samples supplied.

All analysis is carried out on as received samples and reported on a dry weight basis unless stated otherwise. Results are not surrogate corrected.

Authorised By:

Lucas Halliwell

islaumed.

Project Co-ordinator

Please include all sections of this report if it is reproduced

Client Name: Ground Investigations Ireland

Reference: 9754-07-20

Location: Bus Connects Route 5

Contact: John Duggan EMT Joh No: 20/17435

Report : Solid

EMT Job No:	20/17435									
EMT Sample No.	1-3	4-6	7-9	10-12	13-15					
Sample ID	R5-CP05	R5-CP05	R5-CP05	R5-CP05	R5-CP05					
Depth	0.50	1.50	2.50	3.50	4.50			Please se	e attached n	otes for all
COC No / misc									ations and a	
Containers		VJT	VJT	VJT	VJT					
	-									
Sample Date				07/12/2020						
Sample Type	Soil	Soil	Soil	Soil	Soil					
Batch Number	1	1	1	1	1			LOD/LOR	Units	Method
Date of Receipt	09/12/2020	09/12/2020	09/12/2020	09/12/2020	09/12/2020					No.
Antimony	1	2	2	2	2			<1	mg/kg	TM30/PM15
Arsenic#	7.1	13.7	11.8	12.7	8.9			<0.5	mg/kg	TM30/PM15
Barium #	73	366	289	299	237			<1	mg/kg	TM30/PM15
Cadmium#	1.6	5.0	3.9	4.1	2.9			<0.1	mg/kg	TM30/PM15
Copper#	36.7 20	64.1 31	58.9 32	67.2 32	53.3 25			<0.5 <1	mg/kg	TM30/PM15
Copper [#] Lead [#]	13	25	24	26	25 15			<5	mg/kg mg/kg	TM30/PM15
Mercury#	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1	mg/kg	TM30/PM15
Molybdenum#	3.1	4.5	4.9	4.2	5.3			<0.1	mg/kg	TM30/PM15
Nickel [#]	27.2	59.2	54.8	51.8	47.5			<0.7	mg/kg	TM30/PM15
Selenium#	1	4	4	3	3			<1	mg/kg	TM30/PM15
Zinc [#]	76	171	163	209	109			<5	mg/kg	TM30/PM15
PAH MS										
Naphthalene [#]	<0.04	<0.04	<0.04	<0.04	<0.04			<0.04	mg/kg	TM4/PM8
Acenaphthylene	<0.03	<0.03	<0.03	<0.03	<0.03			<0.03	mg/kg	TM4/PM8
Acenaphthene #	<0.05	<0.05	<0.05	<0.05	<0.05			<0.05	mg/kg	TM4/PM8
Fluorene #	<0.04	<0.04	<0.04	<0.04	<0.04			<0.04	mg/kg	TM4/PM8
Phenanthrene #	0.05	<0.03	<0.03	<0.03	<0.03			<0.03	mg/kg	TM4/PM8
Anthracene #	<0.04	<0.04	<0.04	<0.04	<0.04			<0.04	mg/kg	TM4/PM8
Fluoranthene #	0.07	<0.03	<0.03	<0.03	0.04			<0.03	mg/kg	TM4/PM8
Pyrene#	0.06	<0.03	<0.03	<0.03	0.04			<0.03	mg/kg	TM4/PM8
Benzo(a)anthracene #	0.07	<0.06	<0.06	<0.06	<0.06			<0.06	mg/kg	TM4/PM8
Chrysene # Benzo(bk)fluoranthene #	0.04 <0.07	<0.02 <0.07	<0.02 <0.07	<0.02 <0.07	0.02 <0.07			<0.02 <0.07	mg/kg	TM4/PM8 TM4/PM8
Benzo(bk)fluorantnene Benzo(a)pyrene #	<0.07	<0.07	<0.07	<0.07	<0.07			<0.07	mg/kg mg/kg	TM4/PM8
Indeno(123cd)pyrene	<0.04	<0.04	<0.04	<0.04	<0.04			<0.04	mg/kg	TM4/PM8
Dibenzo(ah)anthracene#	<0.04	<0.04	<0.04	<0.04	<0.04			<0.04	mg/kg	TM4/PM8
Benzo(ghi)perylene #	<0.04	<0.04	<0.04	<0.04	<0.04			<0.04	mg/kg	TM4/PM8
Coronene	<0.04	<0.04	<0.04	<0.04	<0.04			<0.04	mg/kg	TM4/PM8
PAH 17 Total	<0.64	<0.64	<0.64	<0.64	<0.64			<0.64	mg/kg	TM4/PM8
Benzo(b)fluoranthene	<0.05	<0.05	<0.05	<0.05	<0.05			<0.05	mg/kg	TM4/PM8
Benzo(k)fluoranthene	<0.02	<0.02	<0.02	<0.02	<0.02			<0.02	mg/kg	TM4/PM8
PAH Surrogate % Recovery	101	98	102	72	87			<0	%	TM4/PM8
Mineral Oil (C10-C40) (EH_CU_1D_Total)	<30	<30	<30	<30	<30			<30	mg/kg	TM5/PM8/PM16
,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,									59	

Client Name: Ground Investigations Ireland

Reference: 9754-07-20

Location: Bus Connects Route 5

Contact: John Duggan EMT Job No: 20/17435

Report : Solid

EMT Job No:	20/17435					 	 	 _		
EMT Sample No.	1-3	4-6	7-9	10-12	13-15]		
Sample ID	R5-CP05	R5-CP05	R5-CP05	R5-CP05	R5-CP05					
Depth	0.50	1.50	2.50	3.50	4.50			Disc	44.0 -10 -1	-4 6: " "
COC No / misc									e attached n ations and a	
Containers		V 1 T	\/ I.T	V 1 T	V 1 T					
	VJT	VJT	VJT	VJT	VJT					
Sample Date	07/12/2020	07/12/2020	07/12/2020	07/12/2020	07/12/2020					
Sample Type	Soil	Soil	Soil	Soil	Soil					
Batch Number	1	1	1	1	1			LOD/LOR	Units	Method
Date of Receipt	09/12/2020	09/12/2020	09/12/2020	09/12/2020	09/12/2020					No.
TPH CWG										
Aliphatics "									,	
>C5-C6 (HS_1D_AL)#	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1	mg/kg	TM36/PM12
>C6-C8 (HS_1D_AL)* >C8-C10 (HS_1D_AL)	<0.1 <0.1	<0.1 0.1	<0.1 <0.1	<0.1 <0.1	<0.1 <0.1			<0.1 <0.1	mg/kg mg/kg	TM36/PM12
>C10-C12 (EH_CU_1D_AL)#	<0.1	<0.2	<0.1	<0.1	<0.1			<0.1	mg/kg	TM5/PM8/PM16
>C12-C16 (EH CU 1D AL)#	<4	<4	<4	<4	<4			<4	mg/kg	TM5/PM8/PM16
>C16-C21 (EH_CU_1D_AL)#	<7	<7	<7	<7	<7			<7	mg/kg	TM5/PM8/PM16
>C21-C35 (EH_CU_1D_AL)#	<7	<7	<7	<7	<7			<7	mg/kg	TM5/PM8/PM16
>C35-C40 (EH_1D_AL)	<7	<7	<7	<7	<7			<7	mg/kg	TM5/PM8/PM16
Total aliphatics C5-40 (EH+HS_1D_AL)	<26	<26	<26	<26	<26			<26	mg/kg	TM5/TM36/PM8/PM12/PM16
>C6-C10 (HS_1D_AL)	<0.1	0.1	<0.1	<0.1	<0.1			<0.1	mg/kg	TM36/PM12
>C10-C25 (EH_1D_AL)	<10	<10	<10	<10	<10			<10	mg/kg	TM5/PM8/PM16
>C25-C35 (EH_1D_AL) Aromatics	<10	<10	<10	<10	<10			<10	mg/kg	TM5/PM8/PM16
>C5-EC7 (HS_1D_AR)#	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1	mg/kg	TM36/PM12
>EC7-EC8 (HS_1D_AR)#	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1	mg/kg	TM36/PM12
>EC8-EC10 (HS_1D_AR)#	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1	mg/kg	TM36/PM12
>EC10-EC12 (EH_CU_1D_AR)#	<0.2	<0.2	<0.2	<0.2	<0.2			<0.2	mg/kg	TM5/PM8/PM16
>EC12-EC16 (EH_CU_1D_AR)#	<4	<4	<4	<4	<4			<4	mg/kg	TM5/PM8/PM16
>EC16-EC21 (EH_CU_1D_AR)#	<7	<7	<7	<7	<7			<7	mg/kg	TM5/PM8/PM16
>EC21-EC35 (EH_CU_1D_AR)#	<7	<7	<7	<7	<7			<7	mg/kg	TM5/PM8/PM16
>EC35-EC40 (EH_1D_AR)	<7	<7	<7	<7	<7			<7	mg/kg	TM5/PM8/PM16
Total aromatics C5-40 (EH+HS_1D_AR)	<26	<26	<26	<26	<26			<26	mg/kg	TM5/TM36/PM8/PM12/PM16
Total aliphatics and aromatics(C5-40) (EH+HS_CU_1D_Total) >EC6-EC10 (HS 1D AR)#	<52 <0.1	<52 <0.1	<52 <0.1	<52 <0.1	<52 <0.1			<52 <0.1	mg/kg	тмэгмэөрмөрм12/Рм16
>EC10-EC25 (EH_1D_AR)	<10	<10	<10	<10	<10			<10	mg/kg mg/kg	TM5/PM8/PM16
>EC25-EC35 (EH_1D_AR)	<10	<10	<10	<10	<10			<10	mg/kg	TM5/PM8/PM16
, ,	-	-	-	-	-			-	3 3	
MTBE#	<5	<5	<5	<5	<5			<5	ug/kg	TM36/PM12
Benzene#	<5	<5	<5	<5	<5			<5	ug/kg	TM36/PM12
Toluene #	<5	12	<5	<5	<5			<5	ug/kg	TM36/PM12
Ethylbenzene #	<5	<5	<5	<5	<5			<5	ug/kg	TM36/PM12
m/p-Xylene #	<5	<5	<5	<5	<5			<5	ug/kg	TM36/PM12
o-Xylene#	<5	<5	<5	<5	<5			<5	ug/kg	TM36/PM12
PCB 28 #	<5	<5	<5	<5	<5			<5	ug/kg	TM17/PM8
PCB 52#	<5	<5	<5	<5	<5			<5	ug/kg	TM17/PM8
PCB 101 #	<5	<5	<5	<5	<5			<5	ug/kg	TM17/PM8
PCB 118#	<5	<5	<5	<5	<5			<5	ug/kg	TM17/PM8
PCB 138#	<5	<5	<5	<5	<5			<5	ug/kg	TM17/PM8
PCB 153#	<5	<5	<5	<5	<5			<5	ug/kg	TM17/PM8
PCB 180 #	<5	<5	<5	<5	<5			<5	ug/kg	TM17/PM8
Total 7 PCBs#	<35	<35	<35	<35	<35			<35	ug/kg	TM17/PM8

Client Name: Ground Investigations Ireland

Reference: 9754-07-20

Location: Bus Connects Route 5

Contact: John Duggan EMT Job No: 20/17435

Report : Solid

							 		 i		
EMT Sample No.	1-3	4-6	7-9	10-12	13-15						
Sample ID	R5-CP05	R5-CP05	R5-CP05	R5-CP05	R5-CP05						
Depth	0.50	1.50	2.50	3.50	4.50				Please se	e attached n	otes for all
COC No / misc										ations and a	
Containers	VJT	VJT	VJT	VJT	VJT						
Sample Date	07/12/2020	07/12/2020	07/12/2020	07/12/2020	07/12/2020						
Sample Type	Soil	Soil	Soil	Soil	Soil						
Batch Number	1	1	1	1	1						Method
Date of Receipt	09/12/2020	09/12/2020	09/12/2020	09/12/2020	09/12/2020				LOD/LOR	Units	No.
Natural Moisture Content	17.7	22.6	30.9	35.5	24.4				<0.1	%	PM4/PM0
Moisture Content (% Wet Weight)	15.0	18.5	23.6	26.2	19.6				<0.1	%	PM4/PM0
Hexavalent Chromium#	<0.3	<0.3	<0.3	<0.3	<0.3				<0.3	mg/kg	TM38/PM20
Chromium III	36.7	64.1	58.9	67.2	53.3				<0.5	mg/kg	NONE/NONE
Total Cyanide #	<0.5	<0.5	<0.5	<0.5	<0.5				<0.5	mg/kg	TM89/PM45
Total Organic Carbon [#]	0.60	0.91	0.93	0.84	0.62				<0.02	%	TM21/PM24
Loss on Ignition #	2.4	6.3	6.5	6.2	3.2				<1.0	%	TM22/PM0
pH #	7.88	7.77	7.50	7.62	8.05				<0.01	pH units	TM73/PM11
Mass of raw test portion	0.1034	0.1128	0.1215	0.1251	0.1144					kg	NONE/PM17
Mass of dried test portion	0.09	0.09	0.09	0.09	0.09					kg	NONE/PM17
				•		•	•	•			

Client Name: Ground Investigations Ireland

Reference: 9754-07-20

Location: Bus Connects Route 5

Contact: John Duggan EMT Job No: 20/17435

Report: CEN 10:1 1 Batch

EMI JOD NO:	20/1/435									
EMT Sample No.	1-3	4-6	7-9	10-12	13-15					
Sample ID	R5-CP05	R5-CP05	R5-CP05	R5-CP05	R5-CP05					
Depth	0.50	1.50	2.50	3.50	4.50			Division		
COC No / misc									e attached n ations and a	
				=						
Containers	VJT	VJT	VJT	VJT	VJT					
Sample Date	07/12/2020	07/12/2020	07/12/2020	07/12/2020	07/12/2020					
Sample Type	Soil	Soil	Soil	Soil	Soil					
Batch Number	1	1	1	1	1					Method
Date of Receipt	09/12/2020	09/12/2020	09/12/2020	09/12/2020	09/12/2020			LOD/LOR	Units	No.
Dissolved Antimony#	<0.002	<0.002	<0.002	0.002	<0.002			<0.002	mg/l	TM30/PM17
Dissolved Antimony (A10)#	<0.02	<0.02	<0.02	<0.02	<0.02			<0.02	mg/kg	TM30/PM17
Dissolved Arsenic#	<0.0025	<0.0025	0.0031	<0.0025	<0.0025			<0.0025	mg/l	TM30/PM17
Dissolved Arsenic (A10)#	<0.025	<0.025	0.031	<0.025	<0.025			<0.025	mg/kg	TM30/PM17
Dissolved Barium#	0.016	0.017	0.039	0.007	0.006			<0.003	mg/l	TM30/PM17
Dissolved Barium (A10)#	0.16	0.17	0.39	0.07	0.06			<0.03	mg/kg	TM30/PM17
Dissolved Cadmium #	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005			<0.0005	mg/l	TM30/PM17
Dissolved Cadmium (A10)#	<0.005	<0.005	<0.005	<0.005	<0.005			<0.005	mg/kg	TM30/PM17
Dissolved Chromium#	<0.0015	<0.0015	<0.0015	<0.0015	<0.0015			<0.0015	mg/l	TM30/PM17
Dissolved Chromium (A10)#	<0.015	<0.015	<0.015	<0.015	<0.015			<0.015	mg/kg	TM30/PM17
Dissolved Copper#	<0.007	<0.007	<0.007	<0.007	<0.007			<0.007	mg/l	TM30/PM17
Dissolved Copper (A10)#	<0.07	<0.07	<0.07	<0.07	<0.07			<0.07	mg/kg	TM30/PM17
Dissolved Lead #	<0.005	<0.005	<0.005	<0.005	<0.005			<0.005	mg/l	TM30/PM17
Dissolved Lead (A10)#	<0.05	<0.05	<0.05	<0.05	<0.05			<0.05	mg/kg	TM30/PM17
Dissolved Molybdenum #	0.008	0.003	0.003	<0.002	0.014			<0.002	mg/l	TM30/PM17
Dissolved Molybdenum (A10)#	0.08	0.03	0.03	<0.02	0.14			<0.02	mg/kg	TM30/PM17
Dissolved Nickel #	<0.002	<0.002	0.003	0.002	<0.002			<0.002	mg/l	TM30/PM17 TM30/PM17
Dissolved Nickel (A10) # Dissolved Selenium #	<0.02 <0.003	<0.02 <0.003	0.03 <0.003	<0.02 <0.003	<0.02 <0.003			<0.02 <0.003	mg/kg	TM30/PM17
Dissolved Selenium Dissolved Selenium (A10)#	<0.003	<0.003	<0.003	<0.003	<0.003			<0.003	mg/l mg/kg	TM30/PM17
Dissolved Zinc#	<0.003	0.004	0.005	0.004	<0.03			<0.03	mg/l	TM30/PM17
Dissolved Zinc (A10)#	<0.03	0.04	0.05	0.04	<0.03			<0.03	mg/kg	TM30/PM17
Mercury Dissolved by CVAF #	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001			<0.00001	mg/l	TM61/PM0
Mercury Dissolved by CVAF #	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001			<0.0001	mg/kg	TM61/PM0
, ,										
Total Phenols HPLC	<0.05	<0.05	<0.05	<0.05	<0.05			<0.05	mg/l	TM26/PM0
Total Phenols HPLC	<0.5	<0.5	<0.5	<0.5	<0.5			<0.5	mg/kg	TM26/PM0
Fluoride	0.4	0.5	<0.3	<0.3	<0.3			<0.3	mg/l	TM173/PM0
Fluoride	4	5	<3	<3	<3			<3	mg/kg	TM173/PM0
Sulphate as SO4 #	23.2	38.9	9.3	12.1	13.3			<0.5	mg/l	TM38/PM0
Sulphate as SO4 #	232	389	93	121	133			<5	mg/kg	TM38/PM0
Chloride#	<0.3	0.7	5.2	1.7	1.2			<0.3	mg/l	TM38/PM0
Chloride #	<3	7	52	17	12			<3	mg/kg	TM38/PM0
Discoluted Occurs in Contract	-0		-							TMCC/DAGS
Dissolved Organic Carbon Dissolved Organic Carbon	<2 <20	5 50	7 70	<2 <20	2 <20			<2 <20	mg/l mg/kg	TM60/PM0 TM60/PM0
Total Dissolved Solids #	96	158	133	126	99			<20 <35	mg/l	TM20/PM0
Total Dissolved Solids Total Dissolved Solids #	960	1579	1330	1260	990			<350	mg/kg	TM20/PM0
Total Dissolved Solids	550	1070	1330	1200	330			-550	9/19	110125/1 1010
										ı

Client Name: Ground Investigations Ireland

Reference: 9754-07-20
Location: Bus Connects Route 5
Contact: John Duggan

Report: EN12457_2

Solids: V=60g VOC jar, J=250g glass jar, T=plastic tub

EMT Job No: 20/17435 EMT Sample No. 10-12 13-15 4-6 7-9 R5-CP05 R5-CP05 R5-CP05 R5-CP05 R5-CP05 Sample ID Depth 0.50 1.50 2.50 3.50 4.50

Please see attached notes for all

COC No / misc											abbrevia	ations and a	cronyms
Containers	VJT	VJT	VJT	VJT	VJT								
Sample Date	07/12/2020	07/12/2020	07/12/2020	07/12/2020	07/12/2020								
Sample Type	Soil	Soil	Soil	Soil	Soil								
Batch Number	1	1	1	1	1								
	09/12/2020	09/12/2020	09/12/2020	09/12/2020	09/12/2020			Inert	Stable Non- reactive	Hazardous	LOD LOR	Units	Method No.
Date of Receipt	09/12/2020	09/12/2020	09/12/2020	09/12/2020	09/12/2020								
Solid Waste Analysis	0.60	0.91	0.93	0.84	0.62			3	5	6	<0.02	%	TM21/PM24
Total Organic Carbon * Sum of BTEX	<0.025	<0.025	<0.025	<0.025	<0.025			6	-	-	<0.02		TM36/PM12
	<0.025	<0.025	<0.025	<0.025	<0.025			1			<0.025	mg/kg	TM17/PM8
Sum of 7 PCBs # Mineral Oil									-	-		mg/kg	
	<30	<30	<30	<30	<30			500	-	-	<30	mg/kg	TM5/PM8/PM16
PAH Sum of 17	<0.64	<0.64	<0.64	<0.64	<0.64			100	-	-	<0.64	mg/kg	TM4/PM8
CEN 10:1 Leachate													
	<0.025	<0.025	0.031	<0.025	<0.025			0.5	2	25	<0.025	mg/kg	TM30/PM17
Arsenic#	0.16	0.17	0.031	0.025	0.025			20	100	300	<0.025		TM30/PM17
Barium #	<0.005	<0.005	<0.005	<0.005	<0.005			0.04	100	5	<0.03	mg/kg mg/kg	TM30/PM17
Cadmium#	<0.005	<0.005	<0.005	<0.005	<0.005			0.04	10	70	<0.005		TM30/PM17
Chromium #												mg/kg	TM30/PM17
Copper#	<0.07	<0.07 <0.0001	<0.07 <0.0001	<0.07	<0.07			2	50	100	<0.07	mg/kg	TM61/PM0
Mercury#	<0.0001			<0.0001	<0.0001			0.01	0.2	2	<0.0001	mg/kg	
Molybdenum #	0.08	0.03	0.03	<0.02	0.14			0.5	10	30	<0.02	mg/kg	TM30/PM17
Nickel #	<0.02	<0.02	0.03	<0.02	<0.02			0.4	10	40	<0.02	mg/kg	TM30/PM17
Lead #	<0.05	<0.05	<0.05	<0.05	<0.05			0.5	10	50	<0.05	mg/kg	TM30/PM17
Antimony#	<0.02	<0.02	<0.02	<0.02	<0.02			0.06	0.7	5	<0.02	mg/kg	TM30/PM17
Selenium #	<0.03	<0.03	<0.03	<0.03	<0.03			0.1	0.5	7	<0.03	mg/kg	TM30/PM17
Zinc#	<0.03	0.04	0.05	0.04	<0.03			4	50	200	<0.03	mg/kg	TM30/PM17
Total Dissolved Solids#	960	1579	1330	1260	990			4000	60000	100000	<350	mg/kg	TM20/PM0
Dissolved Organic Carbon	<20	50	70	<20	<20			500	800	1000	<20	mg/kg	TM60/PM0
Dry Matter Content Ratio	87.3	79.8	73.8	72.2	78.4			-	-	-	<0.1	%	NONE/PM4
_													
pH#	7.88	7.77	7.50	7.62	8.05			-	-	-	<0.01	pH units	TM73/PM11
Fluoride	4	5	<3	<3	<3			-	-	-	<3	mg/kg	TM173/PM0
Sulphate as SO4#	232	389	93	121	133			1000	20000	50000	<5	mg/kg	TM38/PM0
Chloride #	<3	7	52	17	12			800	15000	25000	<3	mg/kg	TM38/PM0

Client Name: Ground Investigations Ireland

Reference: 20/07/9754

Location: Bus Connects Route 5

Contact: John Duggan

Note:

Asbestos Screen analysis is carried out in accordance with our documented in-house methods PM042 and TM065 and HSG 248 by Stereo and Polarised Light Microscopy using Dispersion Staining Techniques and is covered by our UKAS accreditation. Detailed Gravimetric Quantification and PCOM Fibre Analysis is carried out in accordance with our documented in-house methods PM042 and TM131 and HSG 248 using Stereo and Polarised Light Microscopy and Phase Contrast Optical Microscopy (PCOM). Samples are retained for not less than 6 months from the date of analysis unless specifically requested.

Opinions, including ACM type and Asbestos level less than 0.1%, lie outside the scope of our UKAS accreditation.

Where the sample is not taken by a Element Materials Technology consultant, Element Materials Technology cannot be responsible for inaccurate or unrepresentative sampling.

EMT				EMT			
Job	Batch	Sample ID	Depth	Sample	Date Of Analysis	Analysis	Result
No.				No.	,		
20/17435	1	R5-CP05	0.50	2	15/12/2020	General Description (Bulk Analysis)	Soil/Stones
					15/12/2020	Asbestos Fibres	NAD
					15/12/2020	Asbestos ACM	NAD
					15/12/2020	Asbestos Type	NAD
					15/12/2020	Asbestos Level Screen	NAD
20/17435	1	R5-CP05	1.50	5	15/12/2020	General Description (Bulk Analysis)	Soil/Stones
					15/12/2020	Asbestos Fibres	NAD
					15/12/2020	Asbestos ACM	NAD
					15/12/2020	Asbestos Type	NAD
					15/12/2020	Asbestos Level Screen	NAD
20/17435	1	R5-CP05	2.50	8	15/12/2020	General Description (Bulk Analysis)	Soil/Stone
					15/12/2020	Asbestos Fibres	NAD
					15/12/2020	Asbestos ACM	NAD
					15/12/2020	Asbestos Type	NAD
					15/12/2020	Asbestos Level Screen	NAD
20/17435	1	R5-CP05	3.50	11	15/12/2020	General Description (Bulk Analysis)	Soil/Stone
					15/12/2020	Asbestos Fibres	NAD
					15/12/2020	Asbestos ACM	NAD
					15/12/2020	Asbestos Type	NAD
					15/12/2020	Asbestos Level Screen	NAD
20/17435	1	R5-CP05	4.50	14	15/12/2020	General Description (Bulk Analysis)	Soil/Stone
					15/12/2020	Asbestos Fibres	NAD
					15/12/2020	Asbestos ACM	NAD
					15/12/2020	Asbestos Type	NAD
					15/12/2020	Asbestos Level Screen	NAD
						1	1

Client Name: Ground Investigations Ireland

Reference: 9754-07-20

Location: Bus Connects Route 5

Contact: John Duggan

EMT Job No.	Batch	Sample ID	Depth	EMT Sample No.	Analysis	Reason
					No deviating sample report results for job 20/17435	

Please note that only samples that are deviating are mentioned in this report. If no samples are listed it is because none were deviating. Only analyses which are accredited are recorded as deviating if set criteria are not met.

NOTES TO ACCOMPANY ALL SCHEDULES AND REPORTS

EMT Job No.: 20/17435

SOILS

Please note we are only MCERTS accredited (UK soils only) for sand, loam and clay and any other matrix is outside our scope of accreditation.

Where an MCERTS report has been requested, you will be notified within 48 hours of any samples that have been identified as being outside our MCERTS scope. As validation has been performed on clay, sand and loam, only samples that are predominantly these matrices, or combinations of them will be within our MCERTS scope. If samples are not one of a combination of the above matrices they will not be marked as MCERTS accredited.

It is assumed that you have taken representative samples on site and require analysis on a representative subsample. Stones will generally be included unless we are requested to remove them.

All samples will be discarded one month after the date of reporting, unless we are instructed to the contrary.

If you have not already done so, please send us a purchase order if this is required by your company.

Where appropriate please make sure that our detection limits are suitable for your needs, if they are not, please notify us immediately.

All analysis is reported on a dry weight basis unless stated otherwise. Limits of detection for analyses carried out on as received samples are not moisture content corrected. Results are not surrogate corrected. Samples are dried at 35°C ±5°C unless otherwise stated. Moisture content for CEN Leachate tests are dried at 105°C ±5°C.

Where Mineral Oil or Fats, Oils and Grease is quoted, this refers to Total Aliphatics C10-C40.

Where a CEN 10:1 ZERO Headspace VOC test has been carried out, a 10:1 ratio of water to wet (as received) soil has been used.

% Asbestos in Asbestos Containing Materials (ACMs) is determined by reference to HSG 264 The Survey Guide - Appendix 2 : ACMs in buildings listed in order of ease of fibre release.

Sufficient amount of sample must be received to carry out the testing specified. Where an insufficient amount of sample has been received the testing may not meet the requirements of our accredited methods, as such accreditation may be removed.

Negative Neutralization Potential (NP) values are obtained when the volume of NaOH (0.1N) titrated (pH 8.3) is greater than the volume of HCI (1N) to reduce the pH of the sample to 2.0 - 2.5. Any negative NP values are corrected to 0.

The calculation of Pyrite content assumes that all oxidisable sulphides present in the sample are pyrite. This may not be the case. The calculation may be an overesitimate when other sulphides such as Barite (Barium Sulphate) are present.

WATERS

Please note we are not a UK Drinking Water Inspectorate (DWI) Approved Laboratory .

ISO17025 accreditation applies to surface water and groundwater and usually one other matrix which is analysis specific, any other liquids are outside our scope of accreditation.

As surface waters require different sample preparation to groundwaters the laboratory must be informed of the water type when submitting samples.

Where Mineral Oil or Fats, Oils and Grease is guoted, this refers to Total Aliphatics C10-C40.

DEVIATING SAMPLES

All samples should be submitted to the laboratory in suitable containers with sufficient ice packs to sustain an appropriate temperature for the requested analysis. The temperature of sample receipt is recorded on the confirmation schedules in order that the client can make an informed decision as to whether testing should still be undertaken.

SURROGATES

Surrogate compounds are added during the preparation process to monitor recovery of analytes. However low recovery in soils is often due to peat, clay or other organic rich matrices. For waters this can be due to oxidants, surfactants, organic rich sediments or remediation fluids. Acceptable limits for most organic methods are 70 - 130% and for VOCs are 50 - 150%. When surrogate recoveries are outside the performance criteria but the associated AQC passes this is assumed to be due to matrix effect. Results are not surrogate corrected.

DILUTIONS

A dilution suffix indicates a dilution has been performed and the reported result takes this into account. No further calculation is required.

BLANKS

Where analytes have been found in the blank, the sample will be treated in accordance with our laboratory procedure for dealing with contaminated blanks.

NOTE

Data is only reported if the laboratory is confident that the data is a true reflection of the samples analysed. Data is only reported as accredited when all the requirements of our Quality System have been met. In certain circumstances where all the requirements of the Quality System have not been met, for instance if the associated AQC has failed, the reason is fully investigated and documented. The sample data is then evaluated alongside the other quality control checks performed during analysis to determine its suitability. Following this evaluation, provided the sample results have not been effected, the data is reported but accreditation is removed. It is a UKAS requirement for data not reported as accredited to be considered indicative only, but this does not mean the data is not valid.

Where possible, and if requested, samples will be re-extracted and a revised report issued with accredited results. Please do not hesitate to contact the laboratory if further details are required of the circumstances which have led to the removal of accreditation.

EMT Job No.: 20/17435

REPORTS FROM THE SOUTH AFRICA LABORATORY

Any method number not prefixed with SA has been undertaken in our UK laboratory unless reported as subcontracted.

Measurement Uncertainty

Measurement uncertainty defines the range of values that could reasonably be attributed to the measured quantity. This range of values has not been included within the reported results. Uncertainty expressed as a percentage can be provided upon request.

ABBREVIATIONS and ACRONYMS USED

#	ISO17025 (UKAS Ref No. 4225) accredited - UK.
SA	ISO17025 (SANAS Ref No.T0729) accredited - South Africa
В	Indicates analyte found in associated method blank.
DR	Dilution required.
М	MCERTS accredited.
NA	Not applicable
NAD	No Asbestos Detected.
ND	None Detected (usually refers to VOC and/SVOC TICs).
NDP	No Determination Possible
SS	Calibrated against a single substance
SV	Surrogate recovery outside performance criteria. This may be due to a matrix effect.
W	Results expressed on as received basis.
+	AQC failure, accreditation has been removed from this result, if appropriate, see 'Note' on previous page.
>>	Results above calibration range, the result should be considered the minimum value. The actual result could be significantly higher, this result is not accredited.
*	Analysis subcontracted to an Element Materials Technology approved laboratory.
AD	Samples are dried at 35°C ±5°C
СО	Suspected carry over
LOD/LOR	Limit of Detection (Limit of Reporting) in line with ISO 17025 and MCERTS
ME	Matrix Effect
NFD	No Fibres Detected
BS	AQC Sample
LB	Blank Sample
N	Client Sample
ТВ	Trip Blank Sample
ОС	Outside Calibration Range

HWOL ACRONYMS AND OPERATORS USED

HS	Headspace Analysis.
EH	Extractable Hydrocarbons - i.e. everything extracted by the solvent.
CU	Clean-up - e.g. by florisil, silica gel.
1D	GC - Single coil gas chromatography.
Total	Aliphatics & Aromatics.
AL	Aliphatics only.
AR	Aromatics only.
2D	GC-GC - Double coil gas chromatography.
#1	EH_Total but with humics extracted.
#2	EU_Total but with fatty acids extracted.
_	Operator - underscore to separate acronyms (exception for +).
+	Operator to indicate cumulative e.g. EH+HS_Total or EH_CU+HS_Total
MS	Mass Spectrometry.

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/S ANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
PM4	Gravimetric measurement of Natural Moisture Content and % Moisture Content at either 35°C or 105°C. Calculation based on ISO 11465:1993(E) and BS1377-2:1990.	PM0	No preparation is required.			AR	
TM4	Modified USEPA 8270D v5:2014 method for the solvent extraction and determination of PAHs by GC-MS.	PM8	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required.			AR	Yes
TM4	Modified USEPA 8270D v5:2014 method for the solvent extraction and determination of PAHs by GC-MS.	PM8	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required.	Yes		AR	Yes
TM5	Modified 8015B v2:1996 method for the determination of solvent Extractable Petroleum Hydrocarbons (EPH) within the range C8-C40 by GCFID. For waters the solvent extracts dissolved phase plus a sheen if present.	PM8/PM16	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required/Fractionation into aliphatic and aromatic fractions using a Rapid Trace SPE.			AR	Yes
TM5	Modified 8015B v2:1996 method for the determination of solvent Extractable Petroleum Hydrocarbons (EPH) within the range C8-C40 by GCFID. For waters the solvent extracts dissolved phase plus a sheen if present.	PM8/PM16	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required/Fractionation into aliphatic and aromatic fractions using a Rapid Trace SPE.	Yes		AR	Yes
TM5/TM36	please refer to TM5 and TM36 for method details	PM8/PM12/PM16	please refer to PM8/PM16 and PM12 for method details			AR	Yes
TM17	Modified US EPA method 8270D v5:2014. Determination of specific Polychlorinated Biphenyl congeners by GC-MS.	PM8	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required.	Yes		AR	Yes
TM20	Modified BS 1377-3:1990/USEPA 160.1/3 (TDS/TS: 1971) Gravimetric determination of Total Dissolved Solids/Total Solids	PM0	No preparation is required.	Yes		AR	Yes
TM21	Modified BS 7755-3:1995, ISO10694:1995 Determination of Total Organic Carbon or Total Carbon by combustion in an Eltra TOC furnace/analyser in the presence of oxygen. The CO2 generated is quantified using infra-red detection. Organic Matter (SOM) calculated as per EA MCERTS Chemical Testing of Soil, March 2012 v4.	PM24	Dried and ground solid samples are washed with hydrochloric acid, then rinsed with deionised water to remove the mineral carbon before TOC analysis.	Yes		AD	Yes
TM22	Modified BS1377-3:1990 Gravimetric determination of Loss on Ignition by temperature controlled Muffle Furnace (35C-440C). On request modified ASTM D2974-00 LOI (105C-440C)	- PM0	No preparation is required.	Yes		AD	Yes

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/S ANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
TM26	Determination of phenols by Reversed Phased High Performance Liquid Chromatography and Electro-Chemical Detection.	PM0	No preparation is required.			AR	Yes
TM30	Determination of Trace Metals by ICP-OES (Inductively Coupled Plasma – Optical Emission Spectrometry): WATERS by Modified USEPA Method 200.7, Rev. 4.4, 1994; Modified EPA Method 6010B, Rev.2, Dec 1996; Modified BS EN ISO 11885:2009: SOILS by Modified USEP	PM15	Acid digestion of dried and ground solid samples using Aqua Regia refluxed at 112.5 °C. Samples containing asbestos are not dried and ground.			AD	Yes
TM30	Determination of Trace Metals by ICP-OES (Inductively Coupled Plasma – Optical Emission Spectrometry): WATERS by Modified USEPA Method 200.7, Rev. 4.4, 1994; Modified EPA Method 6010B, Rev.2, Dec 1996; Modified BS EN ISO 11885:2009: SOILS by Modified USEP	PM15	Acid digestion of dried and ground solid samples using Aqua Regia refluxed at 112.5 °C. Samples containing asbestos are not dried and ground.	Yes		AD	Yes
TM30	Determination of Trace Metals by ICP-OES (Inductively Coupled Plasma – Optical Emission Spectrometry): WATERS by Modified USEPA Method 200.7, Rev. 4.4, 1994; Modified EPA Method 6010B, Rev.2, Dec 1996; Modified BS EN ISO 11885:2009: SOILS by Modified USEP	PM17	Modified method BS EN12457-2:2002 As received solid samples are leached with water in a 10:1 water to soil ratio for 24 hours, the moisture content of the sample is included in the ratio.	Yes		AR	Yes
TM36	Modified US EPA method 8015B v2:1996. Determination of Gasoline Range Organics (GRO) in the carbon chain range of C4-12 by headspace GC-FID. MTBE by GCFID coelutes with 3-methylpentane if present and therefore can give a false positive. Positive MTBE results will be re-run using GC-MS to double check, when requested.	PM12	Modified US EPA method 5021A v2:2014. Preparation of solid and liquid samples for GC headspace analysis.			AR	Yes
TM36	Modified US EPA method 8015B v2:1996. Determination of Gasoline Range Organics (GRO) in the carbon chain range of C4-12 by headspace GC-FID. MTBE by GCFID coelutes with 3-methylpentane if present and therefore can give a false positive. Positive MTBE results will be re-run using GC-MS to double check, when requested.	PM12	Modified US EPA method 5021A v2:2014. Preparation of solid and liquid samples for GC headspace analysis.	Yes		AR	Yes
TM38	Soluble Ion analysis using Discrete Analyser. Modified US EPA methods: Chloride 325.2 (1978), Sulphate 375.4 (Rev.2 1993), o-Phosphate 365.2 (Rev.2 1993), TON 353.1 (Rev.2 1993), Nitrite 354.1 (1971), Hex Cr 7196A (1992), NH4+ 350.1 (Rev.2 1993 (comparabl	PM0	No preparation is required.	Yes		AR	Yes
TM38	Soluble Ion analysis using Discrete Analyser. Modified US EPA methods: Chloride 325.2 (1978), Sulphate 375.4 (Rev.2 1993), o-Phosphate 365.2 (Rev.2 1993), TON 353.1 (Rev.2 1993), Nitrite 354.1 (1971), Hex Cr 7196A (1992), NH4+ 350.1 (Rev.2 1993 (comparabl	PM20	Extraction of dried and ground or as received samples with deionised water in a 2:1 water to solid ratio using a reciprocal shaker for all analytes except hexavalent chromium. Extraction of as received sample using 10:1 ratio of 0.2M sodium hydroxide to soil for hexavalent chromium using a reciprocal shaker.	Yes		AR	Yes
TM60	TC/TOC analysis of Waters by High Temperature Combustion followed by NDIR detection. Based on the following modified standard methods: USEPA 9060A (2002), APHA SMEWW 5310B:1999 22nd Edition, ASTM D 7573, and USEPA 415.1.	PM0	No preparation is required.			AR	Yes
TM61	Determination of Mercury by Cold Vapour Atomic Fluorescence - WATERS: Modified USEPA Method 245.7, Rev 2, Feb 2005. SOILS: Modified USEPA Method 7471B, Rev.2, Feb 2007	PM0	No preparation is required.	Yes		AR	Yes

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/S ANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
TM65	Asbestos Bulk Identification method based on HSG 248 First edition (2006)	PM42	Modified SCA Blue Book V.12 draft 2017 and WM3 1st Edition v1.1:2018. Solid samples undergo a thorough visual inspection for asbestos fibres prior to asbestos identification using TM065.	Yes		AR	
TM73	Modified US EPA methods 150.1 (1982) and 9045D Rev. 4 - 2004) and BS1377-3:1990. Determination of pH by Metrohm automated probe analyser.	PM11	Extraction of as received solid samples using one part solid to 2.5 parts deionised water.	Yes		AR	No
TM89	Modified USEPA method OIA-1667 (1999). Determination of cyanide by Flow Injection Analyser. Where WAD cyanides are required a Ligand displacement step is carried out before analysis.	PM45	As received solid samples are extracted with 1M NaOH by orbital shaker for Cyanide, Sulphide and Thiocyanate analysis.	Yes		AR	Yes
TM173	Analysis of fluoride by ISE (Ion Selective Electrode) using modified ISE method 9214 - 340.2 (EPA 1998)	PM0	No preparation is required.			AR	Yes
NONE	No Method Code	NONE	No Method Code			AD	Yes
NONE	No Method Code	PM17	Modified method BS EN12457-2:2002 As received solid samples are leached with water in a 10:1 water to soil ratio for 24 hours, the moisture content of the sample is included in the ratio.			AR	
NONE	No Method Code	PM4	Gravimetric measurement of Natural Moisture Content and % Moisture Content at either 35°C or 105°C. Calculation based on ISO 11465:1993(E) and BS1377-2:1990.			AR	



Unit 3 Deeside Point

Zone 3

Deeside Industrial Park

Deeside CH5 2UA P: +44 (0) 1244 833780

F: +44 (0) 1244 833781

W: www.element.com

Ground Investigations Ireland Catherinestown House Hazelhatch Road Newcastle Co. Dublin Ireland





Attention: Mike Sutton

Date: 11th March, 2021

Your reference: 9754-07-20

Our reference : Test Report 21/2952 Batch 1

Location: Busconnects Route 5

Date samples received : 25th February, 2021

Status: Final report

Issue: 1

Five samples were received for analysis on 25th February, 2021 of which five were scheduled for analysis. Please find attached our Test Report which should be read with notes at the end of the report and should include all sections if reproduced. Interpretations and opinions are outside the scope of any accreditation, and all results relate only to samples supplied.

All analysis is carried out on as received samples and reported on a dry weight basis unless stated otherwise. Results are not surrogate corrected.

Authorised By:

Phil Sommerton BSc

Senior Project Manager

Please include all sections of this report if it is reproduced

Client Name: Ground Investigations Ireland

Reference: 9754-07-20

Location: Busconnects Route 5

Contact: Mike Sutton EMT Job No: 21/2952

Report : Solid

EMT Sample No.	1-3	4-6	7-9	10-12	13-15						
Sample ID	R5 - TP09	R5 - TP09	R5 - TP08A	R5 - TP08A	R5 - TP08A						
Depth	0.50	1.40	0.50	1.50	2.20						
COC No / misc	0.00		0.00	1.00	2.20					e attached n ations and a	
					=						
Containers	VJT	VJT	VJT	VJT	VJT						
Sample Date	18/02/2021	18/02/2021	18/02/2021	18/02/2021	18/02/2021						
Sample Type	Soil	Soil	Soil	Soil	Soil						
Batch Number	1	1	1	1	1				LOD/LOR	Units	Method
Date of Receipt	25/02/2021	25/02/2021	25/02/2021	25/02/2021	25/02/2021				LOD/LOR	Office	No.
Antimony	1	2	1	<1	1				<1	mg/kg	TM30/PM15
Arsenic #	25.3	15.6	9.3	10.6	18.1				<0.5	mg/kg	TM30/PM15
Barium #	52	62	177	159	92				<1	mg/kg	TM30/PM15
Cadmium#	0.2	0.7	1.3	0.6	0.5				<0.1	mg/kg	TM30/PM15
Chromium # Copper #	46.1 22	64.8	28.3 18	17.4 16	18.2 15				<0.5 <1	mg/kg mg/kg	TM30/PM15 TM30/PM15
Copper** Lead#	15	11	31	22	24				<1 <5	mg/kg	TM30/PM15
Mercury#	<0.1	<0.1	<0.1	<0.1	<0.1				<0.1	mg/kg	TM30/PM15
Molybdenum #	1.4	3.6	2.2	1.1	1.7				<0.1	mg/kg	TM30/PM15
Nickel #	29.3	34.9	16.6	11.4	19.2				<0.7	mg/kg	TM30/PM15
Selenium #	<1	1	<1	<1	<1				<1	mg/kg	TM30/PM15
Zinc [#]	79	79	90	56	78				<5	mg/kg	TM30/PM15
PAH MS											T144/T140
Naphthalene #	<0.04	<0.04	<0.04	<0.04 <0.03	<0.04				<0.04	mg/kg	TM4/PM8 TM4/PM8
Acenaphthylene Acenaphthene #	<0.03	<0.03 <0.05	<0.03 <0.05	<0.03	<0.03				<0.03	mg/kg mg/kg	TM4/PM8
Fluorene #	<0.04	<0.04	<0.04	<0.04	<0.04				<0.04	mg/kg	TM4/PM8
Phenanthrene #	<0.03	<0.03	0.04	<0.03	<0.03				<0.03	mg/kg	TM4/PM8
Anthracene #	<0.04	<0.04	<0.04	<0.04	<0.04				<0.04	mg/kg	TM4/PM8
Fluoranthene #	<0.03	<0.03	0.04	<0.03	<0.03				<0.03	mg/kg	TM4/PM8
Pyrene #	<0.03	<0.03	0.04	<0.03	<0.03				<0.03	mg/kg	TM4/PM8
Benzo(a)anthracene #	<0.06	<0.06	<0.06	<0.06	<0.06				<0.06	mg/kg	TM4/PM8
Chrysene #	<0.02	<0.02	0.03	<0.02	<0.02				<0.02	mg/kg	TM4/PM8
Benzo(bk)fluoranthene #	<0.07 <0.04	<0.07 <0.04	<0.07 <0.04	<0.07 <0.04	<0.07 <0.04				<0.07 <0.04	mg/kg	TM4/PM8 TM4/PM8
Benzo(a)pyrene # Indeno(123cd)pyrene #	<0.04	<0.04	<0.04	<0.04	<0.04				<0.04	mg/kg mg/kg	TM4/PM8
Dibenzo(ah)anthracene #	<0.04	<0.04	<0.04	<0.04	<0.04				<0.04	mg/kg	TM4/PM8
Benzo(ghi)perylene #	<0.04	<0.04	<0.04	<0.04	<0.04				<0.04	mg/kg	TM4/PM8
Coronene	<0.04	<0.04	<0.04	<0.04	<0.04				<0.04	mg/kg	TM4/PM8
PAH 17 Total	<0.64	<0.64	<0.64	<0.64	<0.64				<0.64	mg/kg	TM4/PM8
Benzo(b)fluoranthene	<0.05	<0.05	<0.05	<0.05	<0.05				<0.05	mg/kg	TM4/PM8
Benzo(k)fluoranthene	<0.02	<0.02	<0.02	<0.02	<0.02				<0.02	mg/kg	TM4/PM8
PAH Surrogate % Recovery	91	92	90	87	86				<0	%	TM4/PM8
Mineral Oil (C10-C40) (EH_CU_1D_AL)	<30	<30	<30	<30	<30				<30	mg/kg	TM5/PM8/PM16
(, , , , , , , , , , , , , , , , , , ,	-50	-50	-50	-50	-50				-50	9/1/9	
		<u> </u>		<u> </u>		<u> </u>					

Client Name: Ground Investigations Ireland

Reference: 9754-07-20

Location: Busconnects Route 5

Contact: Mike Sutton EMT Job No: 21/2952

Report : Solid

LIVIT SOB IVO.								_		
EMT Sample No.	1-3	4-6	7-9	10-12	13-15					
Sample ID	R5 - TP09	R5 - TP09	R5 - TP08A	R5 - TP08A	R5 - TP08A					
Depth	0.50	1.40	0.50	1.50	2.20				e attached n	
COC No / misc								abbrevi	ations and a	cronyms
Containers	VJT	VJT	VJT	VJT	VJT					
Sample Date	18/02/2021	18/02/2021	18/02/2021	18/02/2021	18/02/2021					
Sample Type	Soil	Soil	Soil	Soil	Soil					
	1									
Batch Number		1	1	1	1			LOD/LOR	Units	Method No.
Date of Receipt	25/02/2021	25/02/2021	25/02/2021	25/02/2021	25/02/2021					
TPH CWG										
Aliphatics	0.4	0.4	SV	0.4	<0.1 sv			0.4		TM00/DM40
>C5-C6 (HS_1D_AL) #	<0.1 <0.1	<0.1 <0.1	<0.1 ^{sv}	<0.1 <0.1	<0.1 sv			<0.1 <0.1	mg/kg mg/kg	TM36/PM12 TM36/PM12
>C6-C8 (HS_1D_AL) * >C8-C10 (HS_1D_AL)	<0.1	<0.1	<0.1 sv	<0.1	<0.1 <0.1			<0.1	mg/kg	TM36/PM12
>C0-C10 (HS_1D_AL) >C10-C12 (EH_CU_1D_AL)#	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1	mg/kg	TM5/PM8/PM16
>C10-C12 (EH_CU_1D_AL)*	<4	<4	<4	<4	<4			<4	mg/kg	TM5/PM8/PM16
>C16-C21 (EH_CU_1D_AL) #	<7	<7	<7	<7	<7			<7	mg/kg	TM5/PM8/PM16
>C21-C35 (EH_CU_1D_AL) #	<7	<7	11	<7	<7			<7	mg/kg	TM5/PM8/PM16
>C35-C40 (EH_1D_AL)	<7	<7	<7	<7	<7			<7	mg/kg	TM5/PM8/PM16
Total aliphatics C5-40 (EH+HS_1D_AL)	<26	<26	<26	<26	<26			<26	mg/kg	TM5/TM36/PM8/PM12/PM16
>C6-C10 (HS_1D_AL)	<0.1	<0.1	<0.1 ^{SV}	<0.1	<0.1 sv			<0.1	mg/kg	TM36/PM12
>C10-C25 (EH_1D_AL)	<10	<10	<10	<10	<10			<10	mg/kg	TM5/PM8/PM16
>C25-C35 (EH_1D_AL)	<10	<10	12	<10	<10			<10	mg/kg	TM5/PM8/PM16
Aromatics										
>C5-EC7 (HS_1D_AR) #	<0.1	<0.1	<0.1 ^{SV}	<0.1	<0.1 sv			<0.1	mg/kg	TM36/PM12
>EC7-EC8 (HS_1D_AR) #	<0.1	<0.1	<0.1 ^{SV}	<0.1	<0.1 ^{SV}			<0.1	mg/kg	TM36/PM12
>EC8-EC10 (HS_1D_AR) #	<0.1	<0.1	<0.1 ^{SV}	<0.1	<0.1 sv			<0.1	mg/kg	TM36/PM12
>EC10-EC12 (EH_CU_1D_AR) #	<0.2	<0.2	<0.2	<0.2	<0.2			<0.2	mg/kg	TM5/PM8/PM16
>EC12-EC16 (EH_CU_1D_AR) #	<4	<4	<4	<4	<4			<4	mg/kg	TM5/PM8/PM16
>EC16-EC21 (EH_CU_1D_AR) #	<7	<7	<7	<7	<7			<7	mg/kg	TM5/PM8/PM16
>EC21-EC35 (EH_CU_1D_AR) *	<7	<7	30	19	<7			<7	mg/kg	TM5/PM8/PM16
>EC35-EC40 (EH_1D_AR)	<7	<7	13	12	<7			<7	mg/kg	TM5/PM8/PM16
Total aromatics C5-40 (EH+HS_1D_AR)	<26	<26	43	31	<26			<26	mg/kg	TM5/TM38/PM8/PM12/PM16
Total aliphatics and aromatics(C5-40) (EH+HS_CU_1D_Total)	<52	<52	<52	<52	<52			<52	mg/kg	TM5/TM38/PM8/PM12/PM16
>EC6-EC10 (HS_1D_AR) * >EC10-EC25 (EH_1D_AR)	<0.1	<0.1	<0.1 sv	<0.1	<0.1 sv			<0.1	mg/kg	TM36/PM12 TM5/PM8/PM16
>EC10-EC25 (EH_1D_AR) >EC25-EC35 (EH_1D_AR)	<10 <10	<10 <10	<10 36	<10 31	<10 <10			<10 <10	mg/kg mg/kg	TM5/PM8/PM16
>LO23-LO33 (LII_ID_AR)	<10	<10	30	31	<10			<10	ilig/kg	TWOT WOT WITO
MTBE#	<5	<5	<5sv	<5	<5 ^{sv}			<5	ug/kg	TM36/PM12
Benzene #	<5	<5	<5 <5	<5	<5 <5			<5	ug/kg	TM36/PM12
Toluene #	<5	<5	<5 <5	<5	<5 <5			<5	ug/kg	TM36/PM12
Ethylbenzene #	<5	<5	<5sv	<5	<5			<5	ug/kg	TM36/PM12
m/p-Xylene #	<5	<5	<5 ^{SV}	<5	<5 ^{SV}			<5	ug/kg	TM36/PM12
o-Xylene #	<5	<5	<5 ^{sv}	<5	<5 ^{SV}			<5	ug/kg	TM36/PM12
PCB 28#	<5	<5	<5	<5	<5			<5	ug/kg	TM17/PM8
PCB 52#	<5	<5	<5	<5	<5			<5	ug/kg	TM17/PM8
PCB 101 #	<5	<5	<5	<5	<5			<5	ug/kg	TM17/PM8
PCB 118#	<5	<5	<5	<5	<5			<5	ug/kg	TM17/PM8
PCB 138#	<5	<5	<5	<5	<5			<5	ug/kg	TM17/PM8
PCB 153#	<5	<5	<5	<5	<5			<5	ug/kg	TM17/PM8
PCB 180 #	<5	<5	<5	<5	<5			<5	ug/kg	TM17/PM8
Total 7 PCBs#	<35	<35	<35	<35	<35			<35	ug/kg	TM17/PM8

Client Name: Ground Investigations Ireland

Reference: 9754-07-20

Location: Busconnects Route 5

Contact: Mike Sutton EMT Job No: 21/2952

Report : Solid

						 	 	 i.		
EMT Sample No.	1-3	4-6	7-9	10-12	13-15					
Sample ID	R5 - TP09	R5 - TP09	R5 - TP08A	R5 - TP08A	R5 - TP08A					
Depth	0.50	1.40	0.50	1.50	2.20			Please se	e attached n	otes for all
COC No / misc									ations and a	
Containers	VJT	VJT	VJT	VJT	VJT					
Sample Date	18/02/2021	18/02/2021	18/02/2021	18/02/2021	18/02/2021					
Sample Type	Soil	Soil	Soil	Soil	Soil					
Batch Number	1	1	1	1	1					Method
Date of Receipt	25/02/2021	25/02/2021	25/02/2021	25/02/2021	25/02/2021			LOD/LOR	Units	No.
Natural Moisture Content	10.2	13.7	10.2	11.2	7.9			<0.1	%	PM4/PM0
Moisture Content (% Wet Weight)	9.3	12.1	9.2	10.1	7.3			<0.1	%	PM4/PM0
Hexavalent Chromium #	<0.3	<0.3	<0.3	<0.3	<0.3			<0.3	mg/kg	TM38/PM20
Chromium III	46.1	64.8	28.3	17.4	18.2			<0.5	mg/kg	NONE/NONE
Total Cyanide #	<0.5	<0.5	<0.5	<0.5	<0.5			<0.5	mg/kg	TM89/PM45
Total Organic Carbon #	0.07	0.20	0.32	0.50	0.53			<0.02	%	TM21/PM24
Loss on Ignition #	<1.0	1.4	1.3	1.2	1.0			<1.0	%	TM22/PM0
pH#	9.12	8.89	8.43	8.52	8.43			<0.01	pH units	TM73/PM11
Mass of raw test portion	0.1004	0.1081	0.1035 0.09	0.098	0.0991				kg	NONE/PM17 NONE/PM17
Mass of dried test portion	0.09	0.09	0.09	0.09	0.09				kg	NONE/PWI7
										<u> </u>
										
										}
P										

Client Name: Ground Investigations Ireland

Reference: 9754-07-20

Location: Busconnects Route 5

Contact: Mike Sutton EMT Job No: 21/2952

Report: CEN 10:1 1 Batch

	21/2952										
EMT Sample No.	1-3	4-6	7-9	10-12	13-15						
Sample ID	R5 - TP09	R5 - TP09	R5 - TP08A	R5 - TP08A	R5 - TP08A						
Depth	0.50	1.40	0.50	1.50	2.20						
•		1.40	0.00	1.00	2.20					e attached n ations and a	
COC No / misc											
Containers	VJT	VJT	VJT	VJT	VJT						
Sample Date	18/02/2021	18/02/2021	18/02/2021	18/02/2021	18/02/2021						
Sample Type	Soil	Soil	Soil	Soil	Soil						
Batch Number	1	1	1	1	1						Method
Date of Receipt	25/02/2021	25/02/2021	25/02/2021	25/02/2021	25/02/2021				LOD/LOR	Units	No.
Dissolved Antimony#	<0.002	<0.002	<0.002	<0.002	<0.002				<0.002	mg/l	TM30/PM17
Dissolved Antimony (A10) #	<0.02	<0.02	<0.02	<0.02	<0.02				<0.02	mg/kg	TM30/PM17
Dissolved Arsenic#	0.0107	<0.0025	<0.0025	<0.0025	<0.0025				<0.0025	mg/l	TM30/PM17
Dissolved Arsenic (A10) #	0.107	<0.025	<0.025	<0.025	<0.025				<0.025	mg/kg	TM30/PM17
Dissolved Barium #	0.003	0.008	0.058	0.069	0.008				<0.003	mg/l	TM30/PM17
Dissolved Barium (A10) #	<0.03	0.08	0.58	0.69	0.08				<0.03	mg/kg	TM30/PM17
Dissolved Cadmium #	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005				<0.0005	mg/l	TM30/PM17
Dissolved Cadmium (A10) #	<0.005	<0.005	<0.005	<0.005	<0.005				<0.005	mg/kg	TM30/PM17
Dissolved Chromium #	<0.0015	<0.0015	<0.0015	<0.0015	0.0015				<0.0015	mg/l	TM30/PM17
Dissolved Chromium (A10) #	<0.015	<0.015	<0.015	<0.015	0.015				<0.015	mg/kg	TM30/PM17
Dissolved Copper #	<0.007	<0.007	<0.007	<0.007	<0.007				<0.007	mg/l	TM30/PM17
Dissolved Copper (A10)#	<0.07	<0.07	<0.07	<0.07	<0.07				<0.07	mg/kg	TM30/PM17
Dissolved Lead #	<0.005	<0.005	<0.005	<0.005	<0.005				<0.005	mg/l	TM30/PM17
Dissolved Lead (A10) #	<0.05	<0.05	<0.05	<0.05	<0.05				<0.05	mg/kg	TM30/PM17
Dissolved Molybdenum #	0.003	0.009	0.006	0.006	0.009				<0.002	mg/l	TM30/PM17
Dissolved Molybdenum (A10) #	0.03	0.09	0.06	0.06	0.09				<0.02	mg/kg	TM30/PM17
Dissolved Nickel #	<0.002	<0.002	<0.002	<0.002	<0.002				<0.002	mg/l	TM30/PM17
Dissolved Nickel (A10) #	<0.02	<0.02	<0.02	<0.02	<0.02				<0.02	mg/kg	TM30/PM17
Dissolved Selenium#	<0.003	<0.003	<0.003	<0.003	<0.003				<0.003	mg/l	TM30/PM17
Dissolved Selenium (A10) *	<0.03	<0.03	<0.03	<0.03	<0.03				<0.03	mg/kg	TM30/PM17 TM30/PM17
Dissolved Zinc *	<0.003 <0.03	<0.003	<0.003	<0.003	<0.003 <0.03				<0.003	mg/l	TM30/PM17
Dissolved Zinc (A10) * Mercury Dissolved by CVAF *	<0.0001	<0.0001	<0.0001	<0.00001	<0.0001				<0.0001	mg/kg mg/l	TM61/PM0
Mercury Dissolved by CVAF	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001				<0.0001	mg/kg	TM61/PM0
Mercury Dissolved by CVAI	<0.0001	40.0001	<0.0001	VO.0001	VO.0001				40.0001	mg/kg	TIVIO 1/1 IVIO
Total Phenols HPLC	<0.05	<0.05	<0.05	<0.05	<0.05				<0.05	mg/l	TM26/PM0
Total Phenols HPLC	<0.5	<0.5	<0.5	<0.5	<0.5				<0.5	mg/kg	TM26/PM0
-										3 3	
Fluoride	<0.3	<0.3	<0.3	<0.3	<0.3				<0.3	mg/l	TM173/PM0
Fluoride	<3	<3	<3	<3	<3				<3	mg/kg	TM173/PM0
Sulphate as SO4#	1.6	6.2	13.9	12.6	24.7				<0.5	mg/l	TM38/PM0
Sulphate as SO4 #	16	62	139	126	247				<5	mg/kg	TM38/PM0
Chloride #	1.3	3.0	0.5	0.6	0.5				<0.3	mg/l	TM38/PM0
Chloride #	13	30	5	6	5				<3	mg/kg	TM38/PM0
Dissolved Organic Carbon	2	3	2	<2	<2				<2	mg/l	TM60/PM0
Dissolved Organic Carbon	<20	30	20	<20	<20				<20	mg/kg	TM60/PM0
Total Dissolved Solids #	40	61	54	51	82				<35	mg/l	TM20/PM0
Total Dissolved Solids #	400	610	540	510	820				<350	mg/kg	TM20/PM0
											-
	<u> </u>	<u> </u>	<u> </u>	<u> </u>	<u> </u>		<u> </u>	<u> </u>	<u> </u>		<u> </u>

Client Name: Ground Investigations Ireland

Reference: 9754-07-20 Location: Busconnects Route 5 Contact: Mike Sutton EMT Job No: 21/2952

Report : EN12457_2

Solids: V=60g VOC jar, J=250g glass jar, T=plastic tub

EMT Sample No. 4-6 10-12 13-15 R5 - TP09 R5 - TP09 R5 - TP08A R5 - TP08A R5 - TP08A Sample ID

Depth	0.50	1.40	0.50	1.50	2.20								Please se	e attached n	otes for all
COC No / misc														ations and a	
Containers	VJT	VJT	VJT	VJT	VJT										
Sample Date	18/02/2021	18/02/2021	18/02/2021	18/02/2021	18/02/2021										
Sample Type	Soil	Soil	Soil	Soil	Soil										
Batch Number	1	1	1	1	1						Stable Non-				Method
Date of Receipt	25/02/2021	25/02/2021	25/02/2021	25/02/2021	25/02/2021					Inert	reactive	Hazardous	LOD LOR	Units	No.
Solid Waste Analysis															
Total Organic Carbon #	0.07	0.20	0.32	0.50	0.53					3	5	6	<0.02	%	TM21/PM24
Sum of BTEX	<0.025	<0.025	<0.025 ^{sv}	<0.025	<0.025 ^{sv}					6	-	-	<0.025	mg/kg	TM36/PM12
Sum of 7 PCBs "	<0.035	<0.035	<0.035	<0.035	<0.035					1	-	-	<0.035	mg/kg	TM17/PM8
Mineral Oil	<30	<30	<30	<30	<30					500	-	_	<30	mg/kg	TM5/PM8/PM16
PAH Sum of 17	<0.64	<0.64	<0.64	<0.64	<0.64					100	-	-	<0.64	mg/kg	TM4/PM8
														99	
CEN 10:1 Leachate															
Arsenic #	0.107	<0.025	<0.025	<0.025	<0.025					0.5	2	25	<0.025	mg/kg	TM30/PM17
Barium #	<0.03	0.08	0.58	0.69	0.08					20	100	300	<0.03	mg/kg	TM30/PM17
Cadmium #	<0.005	<0.005	<0.005	<0.005	<0.005					0.04	1	5	<0.005	mg/kg	TM30/PM17
Chromium #	<0.015	<0.015	<0.015	<0.015	0.015					0.5	10	70	<0.015	mg/kg	TM30/PM17
Copper #	<0.07	<0.07	<0.07	<0.07	<0.07					2	50	100	<0.07	mg/kg	TM30/PM17
Mercury #	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001					0.01	0.2	2	<0.0001	mg/kg	TM61/PM0
Molybdenum #	0.03	0.09	0.06	0.06	0.09					0.5	10	30	<0.02	mg/kg	TM30/PM17
Nickel #	<0.02	<0.02	<0.02	<0.02	<0.02					0.4	10	40	<0.02	mg/kg	TM30/PM17
Lead "	<0.05	<0.05	<0.05	<0.05	<0.05					0.5	10	50	<0.05	mg/kg	TM30/PM17
Antimony #	<0.02	<0.02	<0.02	<0.02	<0.02					0.06	0.7	5	<0.02	mg/kg	TM30/PM17
Selenium #	< 0.03	<0.03	< 0.03	< 0.03	<0.03					0.1	0.5	7	<0.03	mg/kg	TM30/PM17
Zinc #	<0.03	<0.03	<0.03	<0.03	<0.03					4	50	200	<0.03	mg/kg	TM30/PM17
Total Dissolved Solids #	400	610	540	510	820					4000	60000	100000	<350	mg/kg	TM20/PM0
Dissolved Organic Carbon	<20	30	20	<20	<20					500	800	1000	<20	mg/kg	TM60/PM0
Dry Matter Content Ratio	89.2	83.0	86.5	92.1	90.6					-	-	-	<0.1	%	NONE/PM4
pH#	9.12	8.89	8.43	8.52	8.43						-	_	<0.01	pH units	TM73/PM11
p	-														
Fluoride	<3	<3	<3	<3	<3					-	-	-	<3	mg/kg	TM173/PM0
Sulphate as SO4 #	16	62	139	126	247					1000	20000	50000	<5	mg/kg	TM38/PM0
Chloride #	13	30	5	6	5					800	15000	25000	<3		TM38/PM0
Chloride	13	30	3	0	3					000	13000	23000	\ 3	mg/kg	TIVISO/F IVIO
															1
															1
		l	l	l	l	l		l	1		l	l .			

Reference: 20/07/9754

Location: Busconnects Route 5

Contact: Mike Sutton

Note:

Asbestos Screen analysis is carried out in accordance with our documented in-house methods PM042 and TM065 and HSG 248 by Stereo and Polarised Light Microscopy using Dispersion Staining Techniques and is covered by our UKAS accreditation. Detailed Gravimetric Quantification and PCOM Fibre Analysis is carried out in accordance with our documented in-house methods PM042 and TM131 and HSG 248 using Stereo and Polarised Light Microscopy and Phase Contrast Optical Microscopy (PCOM). Samples are retained for not less than 6 months from the date of analysis unless specifically requested.

Opinions, including ACM type and Asbestos level less than 0.1%, lie outside the scope of our UKAS accreditation.

Where the sample is not taken by a Element Materials Technology consultant, Element Materials Technology cannot be responsible for inaccurate or unrepresentative sampling.

EMT Job No.	Batch	Sample ID	Depth	EMT Sample No.	Date Of Analysis	Analysis	Result
21/2952	1	R5 - TP09	0.50	2	04/03/2021	General Description (Bulk Analysis)	soil/stones
					04/03/2021	Asbestos Fibres	NAD
					04/03/2021	Asbestos ACM	NAD
					04/03/2021	Asbestos Type	NAD
					04/03/2021	Asbestos Level Screen	NAD
21/2952	1	R5 - TP09	1.40	5	04/03/2021	General Description (Bulk Analysis)	Soil/Stones
					04/03/2021	Asbestos Fibres	NAD
					04/03/2021	Asbestos ACM	NAD
					04/03/2021	Asbestos Type	NAD
					04/03/2021	Asbestos Level Screen	NAD
21/2952	1	R5 - TP08A	0.50	8	05/03/2021	General Description (Bulk Analysis)	Soil/Stones
					05/03/2021	Asbestos Fibres	NAD
					05/03/2021	Asbestos ACM	NAD
					05/03/2021	Asbestos Type	NAD
					05/03/2021	Asbestos Level Screen	NAD
21/2952	1	R5 - TP08A	1.50	11	04/03/2021	General Description (Bulk Analysis)	Soil/Stones
					04/03/2021	Asbestos Fibres	NAD
					04/03/2021	Asbestos ACM	NAD
					04/03/2021	Asbestos Type	NAD
					04/03/2021	Asbestos Level Screen	NAD
21/2952	1	R5 - TP08A	2.20	14	05/03/2021	General Description (Bulk Analysis)	Soil/Stones
					05/03/2021	Asbestos Fibres	NAD
					05/03/2021	Asbestos ACM	NAD
					05/03/2021	Asbestos Type	NAD
					05/03/2021	Asbestos Level Screen	NAD

Reference: 9754-07-20

Location: Busconnects Route 5

Contact: Mike Sutton

EMT Job No.	Batch	Sample ID	Depth	EMT Sample No.	Analysis	Reason
					No deviating sample report results for job 21/2952	

Please note that only samples that are deviating are mentioned in this report. If no samples are listed it is because none were deviating. Only analyses which are accredited are recorded as deviating if set criteria are not met.

NOTES TO ACCOMPANY ALL SCHEDULES AND REPORTS

EMT Job No.: 21/2952

SOILS

Please note we are only MCERTS accredited (UK soils only) for sand, loam and clay and any other matrix is outside our scope of accreditation.

Where an MCERTS report has been requested, you will be notified within 48 hours of any samples that have been identified as being outside our MCERTS scope. As validation has been performed on clay, sand and loam, only samples that are predominantly these matrices, or combinations of them will be within our MCERTS scope. If samples are not one of a combination of the above matrices they will not be marked as MCERTS accredited.

It is assumed that you have taken representative samples on site and require analysis on a representative subsample. Stones will generally be included unless we are requested to remove them.

All samples will be discarded one month after the date of reporting, unless we are instructed to the contrary.

If you have not already done so, please send us a purchase order if this is required by your company.

Where appropriate please make sure that our detection limits are suitable for your needs, if they are not, please notify us immediately.

All analysis is reported on a dry weight basis unless stated otherwise. Limits of detection for analyses carried out on as received samples are not moisture content corrected. Results are not surrogate corrected. Samples are dried at 35°C ±5°C unless otherwise stated. Moisture content for CEN Leachate tests are dried at 105°C ±5°C.

Where Mineral Oil or Fats, Oils and Grease is quoted, this refers to Total Aliphatics C10-C40.

Where a CEN 10:1 ZERO Headspace VOC test has been carried out, a 10:1 ratio of water to wet (as received) soil has been used.

% Asbestos in Asbestos Containing Materials (ACMs) is determined by reference to HSG 264 The Survey Guide - Appendix 2 : ACMs in buildings listed in order of ease of fibre release.

Sufficient amount of sample must be received to carry out the testing specified. Where an insufficient amount of sample has been received the testing may not meet the requirements of our accredited methods, as such accreditation may be removed.

Negative Neutralization Potential (NP) values are obtained when the volume of NaOH (0.1N) titrated (pH 8.3) is greater than the volume of HCI (1N) to reduce the pH of the sample to 2.0 - 2.5. Any negative NP values are corrected to 0.

The calculation of Pyrite content assumes that all oxidisable sulphides present in the sample are pyrite. This may not be the case. The calculation may be an overesitimate when other sulphides such as Barite (Barium Sulphate) are present.

WATERS

Please note we are not a UK Drinking Water Inspectorate (DWI) Approved Laboratory .

ISO17025 accreditation applies to surface water and groundwater and usually one other matrix which is analysis specific, any other liquids are outside our scope of accreditation.

As surface waters require different sample preparation to groundwaters the laboratory must be informed of the water type when submitting samples.

Where Mineral Oil or Fats, Oils and Grease is guoted, this refers to Total Aliphatics C10-C40.

DEVIATING SAMPLES

All samples should be submitted to the laboratory in suitable containers with sufficient ice packs to sustain an appropriate temperature for the requested analysis. The temperature of sample receipt is recorded on the confirmation schedules in order that the client can make an informed decision as to whether testing should still be undertaken.

SURROGATES

Surrogate compounds are added during the preparation process to monitor recovery of analytes. However low recovery in soils is often due to peat, clay or other organic rich matrices. For waters this can be due to oxidants, surfactants, organic rich sediments or remediation fluids. Acceptable limits for most organic methods are 70 - 130% and for VOCs are 50 - 150%. When surrogate recoveries are outside the performance criteria but the associated AQC passes this is assumed to be due to matrix effect. Results are not surrogate corrected.

DILUTIONS

A dilution suffix indicates a dilution has been performed and the reported result takes this into account. No further calculation is required.

BLANKS

Where analytes have been found in the blank, the sample will be treated in accordance with our laboratory procedure for dealing with contaminated blanks.

NOTE

Data is only reported if the laboratory is confident that the data is a true reflection of the samples analysed. Data is only reported as accredited when all the requirements of our Quality System have been met. In certain circumstances where all the requirements of the Quality System have not been met, for instance if the associated AQC has failed, the reason is fully investigated and documented. The sample data is then evaluated alongside the other quality control checks performed during analysis to determine its suitability. Following this evaluation, provided the sample results have not been effected, the data is reported but accreditation is removed. It is a UKAS requirement for data not reported as accredited to be considered indicative only, but this does not mean the data is not valid.

Where possible, and if requested, samples will be re-extracted and a revised report issued with accredited results. Please do not hesitate to contact the laboratory if further details are required of the circumstances which have led to the removal of accreditation.

EMT Job No.: 21/2952

REPORTS FROM THE SOUTH AFRICA LABORATORY

Any method number not prefixed with SA has been undertaken in our UK laboratory unless reported as subcontracted.

Measurement Uncertainty

Measurement uncertainty defines the range of values that could reasonably be attributed to the measured quantity. This range of values has not been included within the reported results. Uncertainty expressed as a percentage can be provided upon request.

ABBREVIATIONS and ACRONYMS USED

#	ISO17025 (UKAS Ref No. 4225) accredited - UK.
SA	ISO17025 (SANAS Ref No.T0729) accredited - South Africa
В	Indicates analyte found in associated method blank.
DR	Dilution required.
М	MCERTS accredited.
NA	Not applicable
NAD	No Asbestos Detected.
ND	None Detected (usually refers to VOC and/SVOC TICs).
NDP	No Determination Possible
SS	Calibrated against a single substance
SV	Surrogate recovery outside performance criteria. This may be due to a matrix effect.
W	Results expressed on as received basis.
+	AQC failure, accreditation has been removed from this result, if appropriate, see 'Note' on previous page.
>>	Results above calibration range, the result should be considered the minimum value. The actual result could be significantly higher, this result is not accredited.
*	Analysis subcontracted to an Element Materials Technology approved laboratory.
AD	Samples are dried at 35°C ±5°C
СО	Suspected carry over
LOD/LOR	Limit of Detection (Limit of Reporting) in line with ISO 17025 and MCERTS
ME	Matrix Effect
NFD	No Fibres Detected
BS	AQC Sample
LB	Blank Sample
N	Client Sample
ТВ	Trip Blank Sample
ОС	Outside Calibration Range

HWOL ACRONYMS AND OPERATORS USED

HS	Headspace Analysis.
EH	Extractable Hydrocarbons - i.e. everything extracted by the solvent.
CU	Clean-up - e.g. by florisil, silica gel.
1D	GC - Single coil gas chromatography.
Total	Aliphatics & Aromatics.
AL	Aliphatics only.
AR	Aromatics only.
2D	GC-GC - Double coil gas chromatography.
#1	EH_Total but with humics extracted.
#2	EU_Total but with fatty acids extracted.
-	Operator - underscore to separate acronyms (exception for +).
+	Operator to indicate cumulative e.g. EH+HS_Total or EH_CU+HS_Total
MS	Mass Spectrometry.

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/S ANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
PM4	Gravimetric measurement of Natural Moisture Content and % Moisture Content at either 35°C or 105°C. Calculation based on ISO 11465:1993(E) and BS1377-2:1990.	PM0	No preparation is required.			AR	
TM4	Modified USEPA 8270D v5:2014 method for the solvent extraction and determination of PAHs by GC-MS.	PM8	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required.			AR	Yes
TM4	Modified USEPA 8270D v5:2014 method for the solvent extraction and determination of PAHs by GC-MS.	PM8	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required.	Yes		AR	Yes
TM5	Modified 8015B v2:1996 method for the determination of solvent Extractable Petroleum Hydrocarbons (EPH) within the range C8-C40 by GCFID. For waters the solvent extracts dissolved phase plus a sheen if present.	PM8/PM16	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required/Fractionation into aliphatic and aromatic fractions using a Rapid Trace SPE.			AR	Yes
TM5	Modified 8015B v2:1996 method for the determination of solvent Extractable Petroleum Hydrocarbons (EPH) within the range C8-C40 by GCFID. For waters the solvent extracts dissolved phase plus a sheen if present.	PM8/PM16	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required/Fractionation into aliphatic and aromatic fractions using a Rapid Trace SPE.	Yes		AR	Yes
TM5/TM36	please refer to TM5 and TM36 for method details	PM8/PM12/PM16	please refer to PM8/PM16 and PM12 for method details			AR	Yes
TM17	Modified US EPA method 8270D v5:2014. Determination of specific Polychlorinated Biphenyl congeners by GC-MS.	PM8	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required.	Yes		AR	Yes
TM20	Modified BS 1377-3:1990/USEPA 160.1/3 (TDS/TS: 1971) Gravimetric determination of Total Dissolved Solids/Total Solids	PM0	No preparation is required.	Yes		AR	Yes
TM21	Modified BS 7755-3:1995, ISO10694:1995 Determination of Total Organic Carbon or Total Carbon by combustion in an Eltra TOC furnace/analyser in the presence of oxygen. The CO2 generated is quantified using infra-red detection. Organic Matter (SOM) calculated as per EA MCERTS Chemical Testing of Soil, March 2012 v4.	PM24	Dried and ground solid samples are washed with hydrochloric acid, then rinsed with deionised water to remove the mineral carbon before TOC analysis.	Yes		AD	Yes
TM22	Modified BS1377-3:1990 Gravimetric determination of Loss on Ignition by temperature controlled Muffle Furnace (35C-440C). On request modified ASTM D2974-00 LOI (105C-440C)	- PM0	No preparation is required.	Yes		AD	Yes

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/S ANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
TM26	Determination of phenols by Reversed Phased High Performance Liquid Chromatography and Electro-Chemical Detection.	PM0	No preparation is required.			AR	Yes
TM30	Determination of Trace Metals by ICP-OES (Inductively Coupled Plasma – Optical Emission Spectrometry): WATERS by Modified USEPA Method 200.7, Rev. 4.4, 1994; Modified EPA Method 6010B, Rev.2, Dec 1996; Modified BS EN ISO 11885:2009: SOILS by Modified USEP	PM15	Acid digestion of dried and ground solid samples using Aqua Regia refluxed at 112.5 °C. Samples containing asbestos are not dried and ground.			AD	Yes
TM30	Determination of Trace Metals by ICP-OES (Inductively Coupled Plasma – Optical Emission Spectrometry): WATERS by Modified USEPA Method 200.7, Rev. 4.4, 1994; Modified EPA Method 6010B, Rev.2, Dec 1996; Modified BS EN ISO 11885:2009: SOILS by Modified USEP	PM15	Acid digestion of dried and ground solid samples using Aqua Regia refluxed at 112.5 °C. Samples containing asbestos are not dried and ground.	Yes		AD	Yes
TM30	Determination of Trace Metals by ICP-OES (Inductively Coupled Plasma – Optical Emission Spectrometry): WATERS by Modified USEPA Method 200.7, Rev. 4.4, 1994; Modified EPA Method 6010B, Rev.2, Dec 1996; Modified BS EN ISO 11885:2009: SOILS by Modified USEP	PM17	Modified method BS EN12457-2:2002 As received solid samples are leached with water in a 10:1 water to soil ratio for 24 hours, the moisture content of the sample is included in the ratio.	Yes		AR	Yes
TM36	Modified US EPA method 8015B v2:1996. Determination of Gasoline Range Organics (GRO) in the carbon chain range of C4-12 by headspace GC-FID. MTBE by GCFID coelutes with 3-methylpentane if present and therefore can give a false positive. Positive MTBE results will be re-run using GC-MS to double check, when requested.	PM12	Modified US EPA method 5021A v2:2014. Preparation of solid and liquid samples for GC headspace analysis.			AR	Yes
TM36	Modified US EPA method 8015B v2:1996. Determination of Gasoline Range Organics (GRO) in the carbon chain range of C4-12 by headspace GC-FID. MTBE by GCFID coelutes with 3-methylpentane if present and therefore can give a false positive. Positive MTBE results will be re-run using GC-MS to double check, when requested.	PM12	Modified US EPA method 5021A v2:2014. Preparation of solid and liquid samples for GC headspace analysis.	Yes		AR	Yes
TM38	Soluble Ion analysis using Discrete Analyser. Modified US EPA methods: Chloride 325.2 (1978), Sulphate 375.4 (Rev.2 1993), O-Phosphate 365.2 (Rev.2 1993), TON 353.1 (Rev.2 1993), Nitrite 354.1 (1971), Hex Cr 7196A (1992), NH4+ 350.1 (Rev.2 1993) – All anions comparable to BS ISO 15923-1: 2013I	PM0	No preparation is required.	Yes		AR	Yes
TM38	Soluble Ion analysis using Discrete Analyser. Modified US EPA methods: Chloride 325.2 (1978), Sulphate 375.4 (Rev.2 1993), o-Phosphate 365.2 (Rev.2 1993), TON 353.1 (Rev.2 1993), Nitrite 354.1 (1971), Hex Cr 7196A (1992), NH4+ 350.1 (Rev.2 1993) – All anions comparable to BS ISO 15923-1: 2013I	PM20	Extraction of dried and ground or as received samples with deionised water in a 2:1 water to solid ratio using a reciprocal shaker for all analytes except hexavalent chromium. Extraction of as received sample using 10:1 ratio of 0.2M sodium hydroxide to soil for hexavalent chromium using a reciprocal shaker.	Yes		AR	Yes
TM60	TC/TOC analysis of Waters by High Temperature Combustion followed by NDIR detection. Based on the following modified standard methods: USEPA 9060A (2002), APHA SMEWW 5310B:1999 22nd Edition, ASTM D 7573, and USEPA 415.1.	PM0	No preparation is required.			AR	Yes
TM61	Determination of Mercury by Cold Vapour Atomic Fluorescence - WATERS: Modified USEPA Method 245.7, Rev 2, Feb 2005. SOILS: Modified USEPA Method 7471B, Rev.2, Feb 2007	PM0	No preparation is required.	Yes		AR	Yes

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/S ANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
TM65	Asbestos Bulk Identification method based on HSG 248 First edition (2006)	PM42	Modified SCA Blue Book V.12 draft 2017 and WM3 1st Edition v1.1:2018. Solid samples undergo a thorough visual inspection for asbestos fibres prior to asbestos identification using TM065.	Yes		AR	
TM73	Modified US EPA methods 150.1 (1982) and 9045D Rev. 4 - 2004) and BS1377-3:1990. Determination of pH by Metrohm automated probe analyser.	PM11	Extraction of as received solid samples using one part solid to 2.5 parts deionised water.	Yes		AR	No
TM89	Modified USEPA method OIA-1667 (1999). Determination of cyanide by Flow Injection Analyser. Where WAD cyanides are required a Ligand displacement step is carried out before analysis.	PM45	As received solid samples are extracted with 1M NaOH by orbital shaker for Cyanide, Sulphide and Thiocyanate analysis.	Yes		AR	Yes
TM173	Analysis of fluoride by ISE (Ion Selective Electrode) using modified ISE method 9214 - 340.2 (EPA 1998)	PM0	No preparation is required.			AR	Yes
NONE	No Method Code	NONE	No Method Code			AD	Yes
NONE	No Method Code	PM17	Modified method BS EN12457-2:2002 As received solid samples are leached with water in a 10:1 water to soil ratio for 24 hours, the moisture content of the sample is included in the ratio.			AR	
NONE	No Method Code	PM4	Gravimetric measurement of Natural Moisture Content and % Moisture Content at either 35°C or 105°C. Calculation based on ISO 11465:1993(E) and BS1377-2:1990.			AR	



Unit 3 Deeside Point

Zone 3

Deeside Industrial Park

Deeside CH5 2UA P: +44 (0) 1244 833780

F: +44 (0) 1244 833781

W: www.element.com

Ground Investigations Ireland Catherinestown House Hazelhatch Road Newcastle Co. Dublin Ireland





Attention: John Duggan

Date: 3rd December, 2020

Your reference: 9754-07-20

Our reference : Test Report 20/16404 Batch 1

Location : BusConnects Route 5

Status: Final report

Issue:

Date samples received :

Nine samples were received for analysis on 23rd November, 2020 of which nine were scheduled for analysis. Please find attached our Test Report which should be read with notes at the end of the report and should include all sections if reproduced. Interpretations and opinions are outside the scope of any accreditation, and all results relate only to samples supplied.

23rd November, 2020

All analysis is carried out on as received samples and reported on a dry weight basis unless stated otherwise. Results are not surrogate corrected.

Authorised By:

Bruce Leslie

p lune

Project Manager

Please include all sections of this report if it is reproduced

Client Name: Ground Investigations Ireland

Reference: 9754-07-20

Location: BusConnects Route 5 **Solids:** V=60g VOC jar, J=250g glass jar, T=plastic tub

Report : Solid

Contact: John Duggan
EMT Joh No: 20/16404

EMT Job No:	20/16404											
EMT Sample No.	1-3	4-6	7-9	10-12	13-15	16-18	19-21	22-24	25-27			
Sample ID	R5 TP01	R5 TP01	R5 TP05	R5 TP05	R5 TP05B	R5 TP06	R5 TP06	R5 TP07B	R5 TP07B			
Depth	0.50	1.50	0.50	1.50	0.90	0.50	1.50	0.50	1.50	Please se	e attached n	otes for all
COC No / misc											ations and a	
Containers	VJT											
Sample Date	-				16/11/2020		16/11/2020		16/11/2020			
Sample Type	Soil											
Batch Number	1	1	1	1	1	1	1	1	1	LOD/LOR	Units	Method No.
Date of Receipt	23/11/2020	23/11/2020	23/11/2020	23/11/2020	23/11/2020	23/11/2020	23/11/2020	23/11/2020	23/11/2020			NO.
Antimony	2	2	1	<1	<1	<1	1	<1	1	<1	mg/kg	TM30/PM15
Arsenic #	12.4	11.3	9.2	4.7	3.6	7.8	8.5	4.9	13.0	<0.5	mg/kg	TM30/PM15
Barium#	75	73	98	70	46	53	64	65	104	<1	mg/kg	TM30/PM15
Cadmium#	2.5	2.7	0.9	0.9	0.2	0.3	0.8	0.8	1.1	<0.1	mg/kg	TM30/PM15
Chromium # Copper #	39.8 37	34.0 31	53.4 34	71.4 15	40.8	43.4 24	47.0 27	36.4 15	48.0 23	<0.5 <1	mg/kg mg/kg	TM30/PM15 TM30/PM15
Lead #	19	16	33	14	10	20	27	47	25	<5	mg/kg	TM30/PM15
Mercury#	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	mg/kg	TM30/PM15
Molybdenum #	4.7	5.4	2.2	3.2	0.6	0.8	2.4	2.2	3.0	<0.1	mg/kg	TM30/PM15
Nickel #	44.7	42.1	64.6	45.5	60.7	70.2	49.2	30.6	42.4	<0.7	mg/kg	TM30/PM15
Selenium#	2	4	2	<1	<1	1	<1	<1	<1	<1	mg/kg	TM30/PM15
Zinc#	101	95	140	109	127	119	84	60	135	<5	mg/kg	TM30/PM15
PAH MS												
Naphthalene #	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	mg/kg	TM4/PM8
Acenaphthylene #	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	mg/kg	TM4/PM8
Acenaphthene * Fluorene *	<0.05 <0.04	mg/kg mg/kg	TM4/PM8 TM4/PM8									
Phenanthrene #	<0.04	<0.04	0.11	<0.04	<0.04	<0.04	0.10	<0.04	<0.04	<0.04	mg/kg	TM4/PM8
Anthracene #	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	0.04	<0.04	<0.04	<0.04	mg/kg	TM4/PM8
Fluoranthene #	<0.03	<0.03	0.18	<0.03	<0.03	0.08	0.36	<0.03	0.06	<0.03	mg/kg	TM4/PM8
Pyrene #	<0.03	<0.03	0.17	<0.03	<0.03	0.07	0.35	<0.03	0.04	<0.03	mg/kg	TM4/PM8
Benzo(a)anthracene#	<0.06	<0.06	0.12	<0.06	<0.06	0.07	0.27	<0.06	<0.06	<0.06	mg/kg	TM4/PM8
Chrysene #	<0.02	<0.02	0.13	<0.02	<0.02	0.06	0.30	<0.02	0.03	<0.02	mg/kg	TM4/PM8
Benzo(bk)fluoranthene #	<0.07	<0.07	0.26	<0.07	<0.07	0.09	0.66	<0.07	<0.07	<0.07	mg/kg	TM4/PM8
Benzo(a)pyrene #	<0.04	<0.04	0.14	<0.04	<0.04	0.04	0.37	<0.04	<0.04	<0.04	mg/kg	TM4/PM8
Indeno(123cd)pyrene	<0.04	<0.04	0.10	<0.04	<0.04	<0.04	0.30	<0.04	<0.04	<0.04	mg/kg	TM4/PM8
Dibenzo(ah)anthracene #	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	0.05	<0.04	<0.04	<0.04	mg/kg	TM4/PM8
Benzo(ghi)perylene # Coronene	<0.04 <0.04	<0.04 <0.04	0.10 <0.04	<0.04 <0.04	<0.04 <0.04	<0.04 <0.04	0.31	<0.04 <0.04	<0.04 <0.04	<0.04 <0.04	mg/kg	TM4/PM8 TM4/PM8
PAH 17 Total	<0.64	<0.64	1.31	<0.64	<0.64	<0.64	3.18	<0.64	<0.64	<0.64	mg/kg mg/kg	TM4/PM8
Benzo(b)fluoranthene	<0.05	<0.05	0.19	<0.05	<0.05	0.06	0.48	<0.05	<0.05	<0.05	mg/kg	TM4/PM8
Benzo(k)fluoranthene	<0.02	<0.02	0.07	<0.02	<0.02	0.03	0.18	<0.02	<0.02	<0.02	mg/kg	TM4/PM8
PAH Surrogate % Recovery	78	88	83	74	75	85	80	75	80	<0	%	TM4/PM8
Mineral Oil (C10-C40) (EH_CU_1D_Total)	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	mg/kg	TM5/PM8/PM16
						i				 i		

Client Name: Ground Investigations Ireland

Reference: 9754-07-20

Location: BusConnects Route 5

Contact: John Duggan EMT Job No: 20/16404

Report : Solid

EMT Job No:	20/16404									_		
EMT Sample No.	1-3	4-6	7-9	10-12	13-15	16-18	19-21	22-24	25-27]		
Sample ID	R5 TP01	R5 TP01	R5 TP05	R5 TP05	R5 TP05B	R5 TP06	R5 TP06	R5 TP07B	R5 TP07B			
Depth	0.50	1.50	0.50	1.50	0.90	0.50	1.50	0.50	1.50	Please se	e attached n	otes for all
COC No / misc											ations and a	
Containers	VJT	VJT	VJT	VJT	VJT	VJT	VJT	VJT	VJT			
Sample Date	17/11/2020	17/11/2020	16/11/2020	16/11/2020	16/11/2020	16/11/2020	16/11/2020	16/11/2020	16/11/2020			
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil			
Batch Number	1	1	1	1	1	1	1	1	1			
										LOD/LOR	Units	Method No.
Date of Receipt	23/11/2020	23/11/2020	23/11/2020	23/11/2020	23/11/2020	23/11/2020	23/11/2020	23/11/2020	23/11/2020			
TPH CWG												
Aliphatics	<0.1 ^{sv}	.0.4	.0.4	.0.4	-0.4	-0.4	-0.4	sv	-0.4	-0.4		TMOC/DMAA
>C5-C6 (HS_1D_AL)#	<0.1°°	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1 ^{SV}	<0.1	<0.1	mg/kg	TM36/PM12
>C6-C8 (HS_1D_AL)#	<0.1 ^{SV}	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1 ^{SV}	<0.1	<0.1	mg/kg	TM36/PM12
>C8-C10 (HS_1D_AL)	<0.1 ^{sv}	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1 ^{SV}	<0.1	<0.1	mg/kg	TM36/PM12
>C10-C12 (EH_1D_AL)#	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	mg/kg	TM5/PM8/PM16
>C12-C16 (EH_1D_AL)#	<4	<4	<4	<4	<4	<4	<4	<4	<4	<4	mg/kg	TM5/PM8/PM16
>C16-C21 (EH_1D_AL)#	<7	<7	<7	<7	<7	<7	<7	<7	<7	<7	mg/kg	TM5/PM8/PM16
>C21-C35 (EH_1D_AL)#	<7	<7	<7	<7	<7	<7	<7	<7	<7	<7	mg/kg	TM5/PM8/PM16
>C35-C40 (EH_1D_AL)	<7	<7	<7	<7	<7	<7	<7	<7	<7	<7	mg/kg	TM5/PM8/PM16
Total aliphatics C5-40 (EH+HS_1D_AL)	<26	<26	<26	<26	<26	<26	<26	<26	<26	<26	mg/kg	TM5/TM36/PM8/PM12/PM1
>C6-C10 (HS_1D_AL)	<0.1 ^{sv}	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1 ^{SV}	<0.1	<0.1	mg/kg	TM36/PM12
>C10-C25 (EH_1D_AL)	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	mg/kg	TM5/PM8/PM16
>C25-C35 (EH_1D_AL)	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	mg/kg	TM5/PM8/PM16
Aromatics "	sv							sv				
>C5-EC7 (HS_1D_AR)#	<0.1 ^{SV}	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1 sv	<0.1	<0.1	mg/kg	TM36/PM12
>EC7-EC8 (HS_1D_AR) #	<0.1 ^{SV}	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1 ^{SV}	<0.1	<0.1	mg/kg	TM36/PM12
>EC8-EC10 (HS_1D_AR)#	<0.1 ^{sv}	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1 ^{SV}	<0.1	<0.1	mg/kg	TM36/PM12
>EC10-EC12 (EH_1D_AR)#	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	mg/kg	TM5/PM8/PM16
>EC12-EC16 (EH_1D_AR)#	<4	<4	<4	<4	<4	<4	<4	<4	<4	<4	mg/kg	TM5/PM8/PM16
>EC16-EC21 (EH_1D_AR)#	<7	<7	<7	<7 <7	<7	<7	<7	<7	<7 <7	<7 <7	mg/kg	TM5/PM8/PM16 TM5/PM8/PM16
>EC21-EC35 (EH_1D_AR) #	<7 <7	<7 <7	79	<7	<7 <7	<7 <7	<7 <7	<7 <7	<7	<7	mg/kg	TM5/PM8/PM16
>EC35-EC40 (EH_1D_AR)			<7 79						<26	<26	mg/kg	TM5/TM36/PM8/PM12/PM1
Total aromatics C5-40 (EH+HS_1D_AR) Total aliphatics and aromatics(C5-40) (EH+HS_CU_1D_Total)	<26	<26		<26 <52	<26	<26	<26	<26			mg/kg	TM5/TM36/PM8/PM12/PM1
_	<52 <0.1 sv	<52 <0.1	79 <0.1	<0.1	<52 <0.1	<52 <0.1	<52 <0.1	<52 <0.1 sv	<52 <0.1	<52 <0.1	mg/kg	TM36/PM12
>EC6-EC10 (HS_1D_AR)*											mg/kg	TM5/PM8/PM16
>EC10-EC25 (EH_1D_AR) >EC25-EC35 (EH_1D_AR)	<10 <10	<10 <10	26 53	<10 <10	<10 <10	<10 <10	<10 <10	<10 <10	<10 <10	<10 <10	mg/kg mg/kg	TM5/PM8/PM16
- L020-L000 (LII_ID_AIN)	-10	-10	33	-10	-10	-10	-10	-10	-10	-10	mg/kg	orr with
MTBE#	<5sv	<5	<5	<5	<5	<5	<5	<5 ^{sv}	<5	<5	ug/kg	TM36/PM12
Benzene #	<5 ^{SV}	<5	<5	<5	<5	<5	<5	<5 ^{sv}	<5	<5	ug/kg	TM36/PM12
Toluene #	<5 ^{SV}	<5	<5	<5	<5	<5	<5	<5 ^{sv}	<5	<5	ug/kg	TM36/PM12
Ethylbenzene #	<5 sv	<5	<5	<5	<5	<5	<5	<5 ^{sv}	<5	<5	ug/kg	TM36/PM12
m/p-Xylene #	<5 sv	<5	<5	<5	<5	<5	<5	<5 ^{sv}	<5	<5	ug/kg	TM36/PM12
o-Xylene #	<5 ^{sv}	<5	<5	<5	<5	<5	<5	<5 ^{sv}	<5	<5	ug/kg	TM36/PM12
											-	
PCB 28#	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	ug/kg	TM17/PM8
PCB 52#	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	ug/kg	TM17/PM8
PCB 101 #	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	ug/kg	TM17/PM8
PCB 118#	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	ug/kg	TM17/PM8
PCB 138#	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	ug/kg	TM17/PM8
PCB 153#	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	ug/kg	TM17/PM8
PCB 180#	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	ug/kg	TM17/PM8
Total 7 PCBs #	<35	<35	<35	<35	<35	<35	<35	<35	<35	<35	ug/kg	TM17/PM8

Client Name: Ground Investigations Ireland

Reference: 9754-07-20

Location: BusConnects Route 5

Contact: John Duggan EMT Job No: 20/16404

Report : Solid

EMT Job No:	20/16404									 _		
EMT Sample No.	1-3	4-6	7-9	10-12	13-15	16-18	19-21	22-24	25-27			
Sample ID	R5 TP01	R5 TP01	R5 TP05	R5 TP05	R5 TP05B	R5 TP06	R5 TP06	R5 TP07B	R5 TP07B			
Depth	0.50	1.50	0.50	1.50	0.90	0.50	1.50	0.50	1.50	Please se	e attached n	otes for all
COC No / misc											ations and a	
Containers	VJT											
Sample Date	17/11/2020	17/11/2020	16/11/2020	16/11/2020	16/11/2020	16/11/2020	16/11/2020	16/11/2020	16/11/2020			
Sample Type	Soil											
Batch Number	1	1	1	1	1	1	1	1	1	LOD/LOR	Units	Method
Date of Receipt	23/11/2020	23/11/2020	23/11/2020	23/11/2020	23/11/2020	23/11/2020	23/11/2020	23/11/2020	23/11/2020	LOD/LOR	Units	No.
Natural Moisture Content	14.6	11.7	19.6	14.6	9.8	10.3	9.6	8.5	11.2	<0.1	%	PM4/PM0
Moisture Content (% Wet Weight)	12.7	10.5	16.4	12.8	8.9	9.4	8.8	7.9	10.1	<0.1	%	PM4/PM0
Hexavalent Chromium #	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	mg/kg	TM38/PM20
Chromium III	39.8	34.0	53.4	71.4	40.8	43.4	47.0	36.4	48.0	<0.5	mg/kg	NONE/NONE
Total Cyanide [#]	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	mg/kg	TM89/PM45
Total Organic Carbon #	0.76	0.70	1.01	0.32	0.23	0.30	0.60	0.50	0.54	<0.02	%	TM21/PM24
Loss on Ignition #	3.1	2.2	4.0	1.7	1.5	1.9	2.3	1.4	2.2	<1.0	%	TM22/PM0
pH#	8.22	8.47	8.36	8.44	8.66	8.63	8.52	8.38	8.59	<0.01	pH units	TM73/PM11
Mass of raw test portion	0.101	0.102	0.0998	0.0984	0.1012	0.1001	0.095	0.101	0.1022		kg	NONE/PM17
Mass of dried test portion	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09		kg	NONE/PM17

Client Name: Ground Investigations Ireland

Reference: 9754-07-20

Location: BusConnects Route 5

Contact: John Duggan EMT Job No: 20/16404

Report: CEN 10:1 1 Batch

EMT Sample No.	1-3	4-6	7-9	10-12	13-15	16-18	19-21	22-24	25-27			
Sample ID	R5 TP01	R5 TP01	R5 TP05	R5 TP05	R5 TP05B	R5 TP06	R5 TP06	R5 TP07B	R5 TP07B			
Depth	0.50	1.50	0.50	1.50	0.90	0.50	1.50	0.50	1.50	Please se	e attached n	ntes for all
COC No / misc											ations and a	
Containers	VJT											
Sample Date	17/11/2020	17/11/2020	16/11/2020	16/11/2020	16/11/2020	16/11/2020	16/11/2020	16/11/2020	16/11/2020			
Sample Type	Soil											
Batch Number	1	1	1	1	1	1	1	1	1	100#00	11.24.	Method
Date of Receipt	23/11/2020	23/11/2020	23/11/2020	23/11/2020	23/11/2020	23/11/2020	23/11/2020	23/11/2020	23/11/2020	LOD/LOR	Units	No.
Dissolved Antimony#	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	mg/l	TM30/PM17
Dissolved Antimony (A10)#	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	mg/kg	TM30/PM17
Dissolved Arsenic#	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	mg/l	TM30/PM17
Dissolved Arsenic (A10)#	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	mg/kg	TM30/PM17
Dissolved Barium #	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	mg/l	TM30/PM17
Dissolved Barium (A10)#	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	mg/kg	TM30/PM17
Dissolved Cadmium #	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	mg/l	TM30/PM17
Dissolved Cadmium (A10)#	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	mg/kg	TM30/PM17
Dissolved Chromium #	<0.0015	<0.0015	<0.0015	<0.0015	<0.0015	<0.0015	<0.0015	<0.0015	<0.0015	<0.0015	mg/l	TM30/PM17
Dissolved Chromium (A10)#	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	mg/kg	TM30/PM17
Dissolved Copper#	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007	mg/l	TM30/PM17
Dissolved Copper (A10)#	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	mg/kg	TM30/PM17
Dissolved Lead #	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	mg/l	TM30/PM17
Dissolved Lead (A10)#	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	mg/kg	TM30/PM17
Dissolved Molybdenum#	0.006	0.017	<0.002	<0.002	<0.002	0.003	0.003	0.003	0.005	<0.002	mg/l	TM30/PM17
Dissolved Molybdenum (A10)#	0.06	0.17	<0.02	<0.02	<0.02	0.03	0.03	0.03	0.05	<0.02	mg/kg	TM30/PM17
Dissolved Nickel#	<0.002	<0.002 <0.02	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002 <0.02	<0.002	mg/l	TM30/PM17
Dissolved Nickel (A10)# Dissolved Selenium#	<0.02 <0.003	<0.02	<0.02 <0.003	<0.02 <0.003	<0.02 <0.003	<0.02 <0.003	<0.02 <0.003	<0.02 <0.003	<0.02	<0.02 <0.003	mg/kg	TM30/PM17 TM30/PM17
Dissolved Selenium (A10)#	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	mg/l mg/kg	TM30/PM17
Dissolved Zinc#	0.004	<0.003	<0.003	<0.003	<0.003	0.003	<0.003	<0.003	0.003	<0.003	mg/l	TM30/PM17
Dissolved Zinc (A10) #	0.04	<0.03	<0.03	<0.03	<0.03	0.03	<0.03	<0.03	0.03	<0.03	mg/kg	TM30/PM17
Mercury Dissolved by CVAF#	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	mg/l	TM61/PM0
Mercury Dissolved by CVAF #	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	mg/kg	TM61/PM0
,												
Total Phenols HPLC	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	mg/l	TM26/PM0
Total Phenois HPLC	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	mg/kg	TM26/PM0
Fluoride	0.3	<0.3	<0.3	<0.3	<0.3	0.3	<0.3	<0.3	0.3	<0.3	mg/l	TM173/PM0
Fluoride	<3	<3	<3	<3	<3	3	<3	<3	3	<3	mg/kg	TM173/PM0
Sulphate as SO4 #	1.3	14.5	<0.5	<0.5	<0.5	1.3	1.3	0.9	3.8	<0.5	mg/l	TM38/PM0
Sulphate as SO4 Sulphate as SO4	1.3	14.5	<0.5 <5	<0.5 <5	<0.5 <5	1.3	1.3	9	3.6	<0.5 <5	mg/kg	TM38/PM0
Chloride #	1.6	<0.3	<0.3	<0.3	<0.3	0.5	0.5	<0.3	<0.3	<0.3	mg/l	TM38/PM0
Chloride #	1.6	<3	<3	<3	<3	5	5	<3	<3	<3	mg/kg	TM38/PM0
	-	_	_	_	-	_	-				55	
Dissolved Organic Carbon	4	2	<2	<2	<2	<2	<2	<2	2	<2	mg/l	TM60/PM0
Dissolved Organic Carbon	40	<20	<20	<20	<20	<20	<20	<20	20	<20	mg/kg	TM60/PM0
Total Dissolved Solids #	72	48	65	49	39	56	62	42	49	<35	mg/l	TM20/PM0
Total Dissolved Solids #	720	480	650	490	390	560	620	420	490	<350	mg/kg	TM20/PM0

Client Name: Ground Investigations Ireland

 Reference:
 9754-07-20

 Location:
 BusConnects Route 5

 Contact:
 John Duggan

 EMT Job No:
 20/16404

Report : EN12457_2

Solids: V=60g VOC jar, J=250g glass jar, T=plastic tub

EMT Sample No. 10-12 22-24 4-6 7-9 13-15 16-18 19-21 25-27 R5 TP01 R5 TP01 R5 TP05 R5 TP05 R5 TP05B R5 TP06 R5 TP07B R5 TP07B Sample ID R5 TP06 Depth 0.50 1.50 0.50 1.50 0.90 0.50 1.50 0.50 1.50 COC No / misc

Please see attached notes for all abbreviations and acronyms

COC No / misc																
Containers	VJT	VJT	VJT	VJT	VJT	VJT	VJT	VJT	VJT							
Sample Date	17/11/2020	17/11/2020	16/11/2020	16/11/2020	16/11/2020	16/11/2020	16/11/2020	16/11/2020	16/11/2020							
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil							
Batch Number	1	1	1	1	1	1	1	1	1							
Date of Receipt	23/11/2020	23/11/2020	23/11/2020	23/11/2020	23/11/2020	23/11/2020	23/11/2020	23/11/2020	23/11/2020		Inert	Stable Non- reactive	Hazardous	LOD LOR	Units	Method No.
Solid Waste Analysis																
Total Organic Carbon #	0.76	0.70	1.01	0.32	0.23	0.30	0.60	0.50	0.54		3	5	6	<0.02	%	TM21/PM24
Sum of BTEX	<0.025 ^{sv}	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025 ^{sv}	<0.025		6	-	-	<0.025	mg/kg	TM36/PM12
Sum of 7 PCBs#	<0.035	<0.035	<0.035	<0.035	<0.035	<0.035	<0.035	<0.035	<0.035		1	-	-	<0.035	mg/kg	TM17/PM8
Mineral Oil	<30	<30	<30	<30	<30	<30	<30	<30	<30		500	-	-	<30	mg/kg	TM5/PM8/PM16
PAH Sum of 17	<0.64	<0.64	1.31	<0.64	<0.64	<0.64	3.18	<0.64	<0.64		100	-	-	<0.64	mg/kg	TM4/PM8
CEN 10:1 Leachate																
Arsenic#	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025		0.5	2	25	<0.025	mg/kg	TM30/PM17
Barium #	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03		20	100	300	<0.03	mg/kg	TM30/PM17
Cadmium #	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005		0.04	1	5	<0.005	mg/kg	TM30/PM17
Chromium #	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015		0.5	10	70	<0.015	mg/kg	TM30/PM17
Copper #	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07		2	50	100	<0.07	mg/kg	TM30/PM17
Mercury#	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001		0.01	0.2	2	<0.0001	mg/kg	TM61/PM0
Molybdenum #	0.06	0.17	<0.02	<0.02	<0.02	0.03	0.03	0.03	0.05		0.5	10	30	<0.02	mg/kg	TM30/PM17
Nickel #	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02		0.4	10	40	<0.02	mg/kg	TM30/PM17
Lead #	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05		0.5	10	50	<0.05	mg/kg	TM30/PM17
Antimony#	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02		0.06	0.7	5	<0.02	mg/kg	TM30/PM17
Selenium #	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03		0.1	0.5	7	<0.03	mg/kg	TM30/PM17
Zinc#	0.04	<0.03	<0.03	<0.03	<0.03	0.03	<0.03	<0.03	0.03		4	50	200	<0.03	mg/kg	TM30/PM17
Total Dissolved Solids#	720	480	650	490	390	560	620	420	490		4000	60000	100000	<350	mg/kg	TM20/PM0
Dissolved Organic Carbon	40	<20	<20	<20	<20	<20	<20	<20	20		500	800	1000	<20	mg/kg	TM60/PM0
Mass of raw test portion	0.101	0.102	0.0998	0.0984	0.1012	0.1001	0.095	0.101	0.1022		-	-	-		kg	NONE/PM17
Dry Matter Content Ratio	89.1	88.5	90.2	91.8	89.0	89.9	94.8	89.2	87.9		-	-	-	<0.1	%	NONE/PM4
Leachant Volume	0.889	0.888	0.89	0.892	0.889	0.89	0.895	0.889	0.888		-	-	-		ı	NONE/PM17
Eluate Volume	0.8	0.4	0.8	0.8	0.8	0.8	0.8	0.8	0.8		-	-	-		I	NONE/PM17
pH#	8.22	8.47	8.36	8.44	8.66	8.63	8.52	8.38	8.59		-	-	-	<0.01	pH units	TM73/PM11
Fluoride	<3	<3	<3	<3	<3	3	<3	<3	3			_	_	<3	mg/kg	TM173/PM0
Tidoride	10		-10			J			J			_	_		mgmg	THE TOTAL THE
Sulphate as SO4 #	13	145	<5	<5	<5	13	13	9	38		1000	20000	50000	<5	mg/kg	TM38/PM0
Chloride #	16	<3	<3	<3	<3	5	5	<3	<3		800	15000	25000	<3	mg/kg	TM38/PM0
																,
	1	i		l	l	l	l	l	l	i l		ĺ	Ì	1		1

Reference: 20/07/9754

Location: BusConnects Route 5

Contact: John Duggan

Note:

Asbestos Screen analysis is carried out in accordance with our documented in-house methods PM042 and TM065 and HSG 248 by Stereo and Polarised Light Microscopy using Dispersion Staining Techniques and is covered by our UKAS accreditation. Detailed Gravimetric Quantification and PCOM Fibre Analysis is carried out in accordance with our documented in-house methods PM042 and TM131 and HSG 248 using Stereo and Polarised Light Microscopy and Phase Contrast Optical Microscopy (PCOM). Samples are retained for not less than 6 months from the date of analysis unless specifically requested.

Opinions, including ACM type and Asbestos level less than 0.1%, lie outside the scope of our UKAS accreditation.

Where the sample is not taken by a Element Materials Technology consultant, Element Materials Technology cannot be responsible for inaccurate or unrepresentative sampling.

EMT Job No.	Batch	Sample ID	Depth	EMT Sample No.	Date Of Analysis	Analysis	Result
20/16404	1	R5 TP01	0.50	2	30/11/2020	General Description (Bulk Analysis)	soil/stones
					30/11/2020	Asbestos Fibres	NAD
					30/11/2020	Asbestos ACM	NAD
					30/11/2020	Asbestos Type	NAD
					30/11/2020	Asbestos Level Screen	NAD
20/16404	1	R5 TP01	1.50	5	30/11/2020	General Description (Bulk Analysis)	soil/stones
					30/11/2020	Asbestos Fibres	NAD
					30/11/2020	Asbestos ACM	NAD
					30/11/2020	Asbestos Type	NAD
					30/11/2020	Asbestos Level Screen	NAD
20/16404	1	R5 TP05	0.50	8	30/11/2020	General Description (Bulk Analysis)	soil/stones
					30/11/2020	Asbestos Fibres	NAD
					30/11/2020	Asbestos ACM	NAD
					30/11/2020	Asbestos Type	NAD
					30/11/2020	Asbestos Level Screen	NAD
20/16404	1	R5 TP05	1.50	11	30/11/2020	General Description (Bulk Analysis)	Soil/Stones
					30/11/2020	Asbestos Fibres	NAD
					30/11/2020	Asbestos ACM	NAD
					30/11/2020	Asbestos Type	NAD
					30/11/2020	Asbestos Level Screen	NAD
20/16404	1	R5 TP05B	0.90	14	30/11/2020	General Description (Bulk Analysis)	Soil/Stones
					30/11/2020	Asbestos Fibres	NAD
					30/11/2020	Asbestos ACM	NAD
					30/11/2020	Asbestos Type	NAD
					30/11/2020	Asbestos Level Screen	NAD
20/16404	1	R5 TP06	0.50	17	30/11/2020	General Description (Bulk Analysis)	Soil/Stones
					30/11/2020	Asbestos Fibres	NAD
					30/11/2020	Asbestos ACM	NAD
					30/11/2020	Asbestos Type	NAD
					30/11/2020	Asbestos Level Screen	NAD
20/16404	1	R5 TP06	1.50	20	30/11/2020	General Description (Bulk Analysis)	Soil/Stones
					30/11/2020	Asbestos Fibres	NAD
					30/11/2020	Asbestos ACM	NAD

Reference: 20/07/9754

Location:BusConnects Route 5Contact:John Duggan

EMT Job No.	Batch	Sample ID	Depth	EMT Sample No.	Date Of Analysis	Analysis	Result
20/16404	1	R5 TP06	1.50	20	30/11/2020	Asbestos Type	NAD
							NAD
20/16404	1	R5 TP07B	0.50	23	30/11/2020	General Description (Bulk Analysis)	Soil/Stones
20/10404			0.00	20			NAD
							NAD
							NAD
						Asbestos Level Screen	NAD
					30/11/2020	Aspestos Level Screen	INAL
20/16404	1	R5 TP07B	1.50	200	20/44/2020	Canada Bassintian (Bulk Analysis)	Cail/Change
20/10404	'	NO IFOID	1.50	26		General Description (Bulk Analysis)	Soil/Stones NAD
							NAD
						* *	NAD
					30/11/2020	Asbestos Level Screen	NAD
Щ							

Reference: 9754-07-20

Location: BusConnects Route 5

Contact: John Duggan

EMT Job No.	Batch	Sample ID	Depth	EMT Sample No.	Analysis	Reason
					No deviating sample report results for job 20/16404	

Please note that only samples that are deviating are mentioned in this report. If no samples are listed it is because none were deviating. Only analyses which are accredited are recorded as deviating if set criteria are not met.

NOTES TO ACCOMPANY ALL SCHEDULES AND REPORTS

EMT Job No.: 20/16404

SOILS

Please note we are only MCERTS accredited (UK soils only) for sand, loam and clay and any other matrix is outside our scope of accreditation.

Where an MCERTS report has been requested, you will be notified within 48 hours of any samples that have been identified as being outside our MCERTS scope. As validation has been performed on clay, sand and loam, only samples that are predominantly these matrices, or combinations of them will be within our MCERTS scope. If samples are not one of a combination of the above matrices they will not be marked as MCERTS accredited

It is assumed that you have taken representative samples on site and require analysis on a representative subsample. Stones will generally be included unless we are requested to remove them.

All samples will be discarded one month after the date of reporting, unless we are instructed to the contrary.

If you have not already done so, please send us a purchase order if this is required by your company.

Where appropriate please make sure that our detection limits are suitable for your needs, if they are not, please notify us immediately.

All analysis is reported on a dry weight basis unless stated otherwise. Limits of detection for analyses carried out on as received samples are not moisture content corrected. Results are not surrogate corrected. Samples are dried at 35°C ±5°C unless otherwise stated. Moisture content for CEN Leachate tests are dried at 105°C ±5°C.

Where Mineral Oil or Fats, Oils and Grease is quoted, this refers to Total Aliphatics C10-C40.

Where a CEN 10:1 ZERO Headspace VOC test has been carried out, a 10:1 ratio of water to wet (as received) soil has been used.

% Asbestos in Asbestos Containing Materials (ACMs) is determined by reference to HSG 264 The Survey Guide - Appendix 2 : ACMs in buildings listed in order of ease of fibre release.

Sufficient amount of sample must be received to carry out the testing specified. Where an insufficient amount of sample has been received the testing may not meet the requirements of our accredited methods, as such accreditation may be removed.

Negative Neutralization Potential (NP) values are obtained when the volume of NaOH (0.1N) titrated (pH 8.3) is greater than the volume of HCl (1N) to reduce the pH of the sample to 2.0 - 2.5. Any negative NP values are corrected to 0.

The calculation of Pyrite content assumes that all oxidisable sulphides present in the sample are pyrite. This may not be the case. The calculation may be an overesitimate when other sulphides such as Barite (Barium Sulphate) are present.

WATERS

Please note we are not a UK Drinking Water Inspectorate (DWI) Approved Laboratory.

ISO17025 accreditation applies to surface water and groundwater and usually one other matrix which is analysis specific, any other liquids are outside our scope of accreditation.

As surface waters require different sample preparation to groundwaters the laboratory must be informed of the water type when submitting samples.

Where Mineral Oil or Fats, Oils and Grease is quoted, this refers to Total Aliphatics C10-C40.

DEVIATING SAMPLES

All samples should be submitted to the laboratory in suitable containers with sufficient ice packs to sustain an appropriate temperature for the requested analysis. The temperature of sample receipt is recorded on the confirmation schedules in order that the client can make an informed decision as to whether testing should still be undertaken.

SURROGATES

Surrogate compounds are added during the preparation process to monitor recovery of analytes. However low recovery in soils is often due to peat, clay or other organic rich matrices. For waters this can be due to oxidants, surfactants, organic rich sediments or remediation fluids. Acceptable limits for most organic methods are 70 - 130% and for VOCs are 50 - 150%. When surrogate recoveries are outside the performance criteria but the associated AQC passes this is assumed to be due to matrix effect. Results are not surrogate corrected.

DILUTIONS

A dilution suffix indicates a dilution has been performed and the reported result takes this into account. No further calculation is required.

BLANKS

Where analytes have been found in the blank, the sample will be treated in accordance with our laboratory procedure for dealing with contaminated blanks.

NOTE

Data is only reported if the laboratory is confident that the data is a true reflection of the samples analysed. Data is only reported as accredited when all the requirements of our Quality System have been met. In certain circumstances where all the requirements of the Quality System have not been met, for instance if the associated AQC has failed, the reason is fully investigated and documented. The sample data is then evaluated alongside the other quality control checks performed during analysis to determine its suitability. Following this evaluation, provided the sample results have not been effected, the data is reported but accreditation is removed. It is a UKAS requirement for data not reported as accredited to be considered indicative only, but this does not mean the data is not valid.

Where possible, and if requested, samples will be re-extracted and a revised report issued with accredited results. Please do not hesitate to contact the laboratory if further details are required of the circumstances which have led to the removal of accreditation.

EMT Job No.: 20/16404

REPORTS FROM THE SOUTH AFRICA LABORATORY

Any method number not prefixed with SA has been undertaken in our UK laboratory unless reported as subcontracted.

Measurement Uncertainty

Measurement uncertainty defines the range of values that could reasonably be attributed to the measured quantity. This range of values has not been included within the reported results. Uncertainty expressed as a percentage can be provided upon request.

ABBREVIATIONS and ACRONYMS USED

-	
#	ISO17025 (UKAS Ref No. 4225) accredited - UK.
SA	ISO17025 (SANAS Ref No.T0729) accredited - South Africa
В	Indicates analyte found in associated method blank.
DR	Dilution required.
М	MCERTS accredited.
NA	Not applicable
NAD	No Asbestos Detected.
ND	None Detected (usually refers to VOC and/SVOC TICs).
NDP	No Determination Possible
SS	Calibrated against a single substance
SV	Surrogate recovery outside performance criteria. This may be due to a matrix effect.
W	Results expressed on as received basis.
+	AQC failure, accreditation has been removed from this result, if appropriate, see 'Note' on previous page.
>>	Results above calibration range, the result should be considered the minimum value. The actual result could be significantly higher, this result is not accredited.
*	Analysis subcontracted to an Element Materials Technology approved laboratory.
AD	Samples are dried at 35°C ±5°C
СО	Suspected carry over
LOD/LOR	Limit of Detection (Limit of Reporting) in line with ISO 17025 and MCERTS
ME	Matrix Effect
NFD	No Fibres Detected
BS	AQC Sample
LB	Blank Sample
N	Client Sample
ТВ	Trip Blank Sample
ОС	Outside Calibration Range

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/S ANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
PM4	Gravimetric measurement of Natural Moisture Content and % Moisture Content at either 35°C or 105°C. Calculation based on ISO 11465:1993(E) and BS1377-2:1990.	PM0	No preparation is required.			AR	
TM4	Modified USEPA 8270D v5:2014 method for the solvent extraction and determination of PAHs by GC-MS.	PM8	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required.			AR	Yes
TM4	Modified USEPA 8270D v5:2014 method for the solvent extraction and determination of PAHs by GC-MS.	PM8	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required.	Yes		AR	Yes
TM5	Modified 8015B v2:1996 method for the determination of solvent Extractable Petroleum Hydrocarbons (EPH) within the range C8-C40 by GCFID. For waters the solvent extracts dissolved phase plus a sheen if present.	PM8/PM16	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required/Fractionation into aliphatic and aromatic fractions using a Rapid Trace SPE.			AR	Yes
TM5	Modified 8015B v2:1996 method for the determination of solvent Extractable Petroleum Hydrocarbons (EPH) within the range C8-C40 by GCFID. For waters the solvent extracts dissolved phase plus a sheen if present.	PM8/PM16	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required/Fractionation into aliphatic and aromatic fractions using a Rapid Trace SPE.	Yes		AR	Yes
TM5/TM36	please refer to TM5 and TM36 for method details	PM8/PM12/PM16	please refer to PM8/PM16 and PM12 for method details			AR	Yes
TM17	Modified US EPA method 8270D v5:2014. Determination of specific Polychlorinated Biphenyl congeners by GC-MS.	PM8	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required.	Yes		AR	Yes
TM20	Modified BS 1377-3:1990/USEPA 160.1/3 (TDS/TS: 1971) Gravimetric determination of Total Dissolved Solids/Total Solids	PM0	No preparation is required.	Yes		AR	Yes
TM21	Modified BS 7755-3:1995, ISO10694:1995 Determination of Total Organic Carbon or Total Carbon by combustion in an Eltra TOC furnace/analyser in the presence of oxygen. The CO2 generated is quantified using infra-red detection. Organic Matter (SOM) calculated as per EA MCERTS Chemical Testing of Soil, March 2012 v4.	PM24	Dried and ground solid samples are washed with hydrochloric acid, then rinsed with deionised water to remove the mineral carbon before TOC analysis.	Yes		AD	Yes
TM22	Modified BS1377-3:1990 Gravimetric determination of Loss on Ignition by temperature controlled Muffle Furnace (35C-440C). On request modified ASTM D2974-00 LOI (105C-440C)	- PM0	No preparation is required.	Yes		AD	Yes

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/S ANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
TM26	Determination of phenols by Reversed Phased High Performance Liquid Chromatography and Electro-Chemical Detection.	PM0	No preparation is required.			AR	Yes
TM30	Determination of Trace Metals by ICP-OES (Inductively Coupled Plasma – Optical Emission Spectrometry): WATERS by Modified USEPA Method 200.7, Rev. 4.4, 1994; Modified EPA Method 6010B, Rev.2, Dec 1996; Modified BS EN ISO 11885:2009: SOILS by Modified USEP	PM15	Acid digestion of dried and ground solid samples using Aqua Regia refluxed at 112.5 °C. Samples containing asbestos are not dried and ground.			AD	Yes
TM30	Determination of Trace Metals by ICP-OES (Inductively Coupled Plasma – Optical Emission Spectrometry): WATERS by Modified USEPA Method 200.7, Rev. 4.4, 1994; Modified EPA Method 6010B, Rev.2, Dec 1996; Modified BS EN ISO 11885:2009: SOILS by Modified USEP	PM15	Acid digestion of dried and ground solid samples using Aqua Regia refluxed at 112.5 °C. Samples containing asbestos are not dried and ground.	Yes		AD	Yes
TM30	Determination of Trace Metals by ICP-OES (Inductively Coupled Plasma – Optical Emission Spectrometry): WATERS by Modified USEPA Method 200.7, Rev. 4.4, 1994; Modified EPA Method 6010B, Rev.2, Dec 1996; Modified BS EN ISO 11885:2009: SOILS by Modified USEP	PM17	Modified method BS EN12457-2:2002 As received solid samples are leached with water in a 10:1 water to soil ratio for 24 hours, the moisture content of the sample is included in the ratio.	Yes		AR	Yes
TM36	Modified US EPA method 8015B v2:1996. Determination of Gasoline Range Organics (GRO) in the carbon chain range of C4-12 by headspace GC-FID. MTBE by GCFID coelutes with 3-methylpentane if present and therefore can give a false positive. Positive MTBE results will be re-run using GC-MS to double check, when requested.	PM12	Modified US EPA method 5021A v2:2014. Preparation of solid and liquid samples for GC headspace analysis.			AR	Yes
TM36	Modified US EPA method 8015B v2:1996. Determination of Gasoline Range Organics (GRO) in the carbon chain range of C4-12 by headspace GC-FID. MTBE by GCFID coelutes with 3-methylpentane if present and therefore can give a false positive. Positive MTBE results will be re-run using GC-MS to double check, when requested.	PM12	Modified US EPA method 5021A v2:2014. Preparation of solid and liquid samples for GC headspace analysis.	Yes		AR	Yes
TM38	Soluble Ion analysis using Discrete Analyser. Modified US EPA methods: Chloride 325.2 (1978), Sulphate 375.4 (Rev.2 1993), o-Phosphate 365.2 (Rev.2 1993), TON 353.1 (Rev.2 1993), Nitrite 354.1 (1971), Hex Cr 7196A (1992), NH4+ 350.1 (Rev.2 1993 (comparabl	PM0	No preparation is required.	Yes		AR	Yes
TM38	Soluble Ion analysis using Discrete Analyser. Modified US EPA methods: Chloride 325.2 (1978), Sulphate 375.4 (Rev.2 1993), o-Phosphate 365.2 (Rev.2 1993), TON 353.1 (Rev.2 1993), Nitrite 354.1 (1971), Hex Cr 7196A (1992), NH4+ 350.1 (Rev.2 1993 (comparabl	PM20	Extraction of dried and ground or as received samples with deionised water in a 2:1 water to solid ratio using a reciprocal shaker for all analytes except hexavalent chromium. Extraction of as received sample using 10:1 ratio of 0.2M sodium hydroxide to soil for hexavalent chromium using a reciprocal shaker.	Yes		AR	Yes
TM60	TC/TOC analysis of Waters by High Temperature Combustion followed by NDIR detection. Based on the following modified standard methods: USEPA 9060A (2002), APHA SMEWW 5310B:1999 22nd Edition, ASTM D 7573, and USEPA 415.1.	PM0	No preparation is required.			AR	Yes
TM61	Determination of Mercury by Cold Vapour Atomic Fluorescence - WATERS: Modified USEPA Method 245.7, Rev 2, Feb 2005. SOILS: Modified USEPA Method 7471B, Rev.2, Feb 2007	PM0	No preparation is required.	Yes		AR	Yes

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/S ANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
TM65	Asbestos Bulk Identification method based on HSG 248 First edition (2006)	PM42	Modified SCA Blue Book V.12 draft 2017 and WM3 1st Edition v1.1:2018. Solid samples undergo a thorough visual inspection for asbestos fibres prior to asbestos identification using TM065.	Yes		AR	
TM73	Modified US EPA methods 150.1 (1982) and 9045D Rev. 4 - 2004) and BS1377-3:1990. Determination of pH by Metrohm automated probe analyser.	PM11	Extraction of as received solid samples using one part solid to 2.5 parts deionised water.	Yes		AR	No
TM89	Modified USEPA method OIA-1667 (1999). Determination of cyanide by Flow Injection Analyser. Where WAD cyanides are required a Ligand displacement step is carried out before analysis.	PM45	As received solid samples are extracted with 1M NaOH by orbital shaker for Cyanide, Sulphide and Thiocyanate analysis.	Yes		AR	Yes
TM173	Analysis of fluoride by ISE (Ion Selective Electrode) using modified ISE method 9214 - 340.2 (EPA 1998)	PM0	No preparation is required.			AR	Yes
NONE	No Method Code	NONE	No Method Code			AD	Yes
NONE	No Method Code	PM17	Modified method BS EN12457-2:2002 As received solid samples are leached with water in a 10:1 water to soil ratio for 24 hours, the moisture content of the sample is included in the ratio.				
NONE	No Method Code	PM17	Modified method BS EN12457-2:2002 As received solid samples are leached with water in a 10:1 water to soil ratio for 24 hours, the moisture content of the sample is included in the ratio.			AR	
NONE	No Method Code	PM4	Gravimetric measurement of Natural Moisture Content and % Moisture Content at either 35°C or 105°C. Calculation based on ISO 11465:1993(E) and BS1377-2:1990.			AR	



Unit 3 Deeside Point

Zone 3

Deeside Industrial Park

Deeside CH5 2UA P: +44 (0) 1244 833780

F: +44 (0) 1244 833781

W: www.element.com

Ground Investigations Ireland Catherinestown House Hazelhatch Road Newcastle Co. Dublin Ireland





Attention: Mike Sutton

Date: 17th June, 2021

Your reference: 9754-07-20

Our reference : Test Report 21/8443 Batch 1

Location : Bus Connections Route 5

Date samples received: 4th June, 2021

Status: Final report

Issue:

Seven samples were received for analysis on 4th June, 2021 of which seven were scheduled for analysis. Please find attached our Test Report which should be read with notes at the end of the report and should include all sections if reproduced. Interpretations and opinions are outside the scope of any accreditation, and all results relate only to samples supplied.

All analysis is carried out on as received samples and reported on a dry weight basis unless stated otherwise. Results are not surrogate corrected.

Authorised By:

HAPous

Hayley Prowse

Project Manager

Please include all sections of this report if it is reproduced

Client Name: Ground Investigations Ireland

Reference: 9754-07-20

Location: Bus Connections Route 5

Contact: Mike Sutton EMT Job No: 21/8443

Report : Solid

Solids: V=60g VOC jar, J=250g glass jar, T=plastic tub

EMT Sample No.	1-3	4-6	7-9	10-12	13-15	16-18	19-21				
Sample ID	R5-CP01A	R5-CP01A	R5-CP01A	R5-CP01A	R5-CP03A	R5-CP03A	R5-CP03A				
Depth	0.50	1.50	2.50	3.50	0.50	1.00	1.80		Please se	notes for all	
COC No / misc									abbrevi	cronyms	
Containers	VJT										
Sample Date	28/05/2021	28/05/2021	28/05/2021	28/05/2021	28/05/2021	28/05/2021	28/05/2021				
Sample Type	Soil										
Batch Number	1	1	1	1	1	1	1		LOD/LOR	Units	Method
Date of Receipt	04/06/2021	04/06/2021	04/06/2021	04/06/2021	04/06/2021	04/06/2021	04/06/2021		LOD/LOR	Offics	No.
Antimony	3	2	2	3	1	<1	2		<1	mg/kg	TM30/PM15
Arsenic [#]	16.2	17.4	14.1	22.9	12.7	4.6	14.1		<0.5	mg/kg	TM30/PM15
Barium [#]	131	118	131	147	125	54	84		<1	mg/kg	TM30/PM15
Cadmium #	1.1	1.5	1.2	2.5	0.2	0.7	1.3		<0.1	mg/kg	TM30/PM15
Chromium#	43.7	52.3	71.2	64.6	19.8	35.7	29.1		<0.5	mg/kg	TM30/PM15
Copper#	33	32	28	35	7	10	45		<1	mg/kg	TM30/PM15
Lead [#]	33	39	39	46	11	6	24		<5	mg/kg	TM30/PM15
Mercury#	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1		<0.1	mg/kg	TM30/PM15
Molybdenum #	2.9	3.7	4.6	2.3	1.2	2.7	3.8		<0.1	mg/kg	TM30/PM15
Nickel#	76.7	69.9	56.9	144.4	12.0	17.2	35.9		<0.7	mg/kg	TM30/PM15
Selenium#	1	2	3	3	<1	<1	3		<1	mg/kg	TM30/PM15
Zinc#	95	128	136	114	26	35	67		<5	mg/kg	TM30/PM15
PAH MS											
Naphthalene#	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04		<0.04	mg/kg	TM4/PM8
Acenaphthylene	<0.03	<0.03	<0.03	<0.03	0.04	<0.03	<0.03		<0.03	mg/kg	TM4/PM8
Acenaphthene #	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05		<0.05	mg/kg	TM4/PM8
Fluorene#	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04		<0.04	mg/kg	TM4/PM8
Phenanthrene#	<0.03	0.04	0.09	<0.03	0.31	0.13	0.14		<0.03	mg/kg	TM4/PM8
Anthracene #	<0.04	<0.04	<0.04	<0.04	0.14	0.04	<0.04		<0.04	mg/kg	TM4/PM8
Fluoranthene #	<0.03	0.07	0.15	<0.03	1.32	0.27	0.27		<0.03	mg/kg	TM4/PM8
Pyrene#	<0.03	0.07	0.13	<0.03	1.18	0.21	0.22		<0.03	mg/kg	TM4/PM8
Benzo(a)anthracene#	<0.06	<0.06	0.12	<0.06	0.87	0.14	0.16		<0.06	mg/kg	TM4/PM8
Chrysene #	<0.02	0.04	0.09	<0.02	0.85	0.14	0.15		<0.02	mg/kg	TM4/PM8
Benzo(bk)fluoranthene #	<0.07	<0.07	0.13	<0.07	1.88	0.26	0.25		<0.07	mg/kg	TM4/PM8
Benzo(a)pyrene #	<0.04	<0.04	0.07	<0.04	1.04	0.14	0.12		<0.04	mg/kg	TM4/PM8
Indeno(123cd)pyrene#	<0.04	<0.04	<0.04	<0.04	0.73	0.11	0.07		<0.04	mg/kg	TM4/PM8
Dibenzo(ah)anthracene #	<0.04	<0.04	<0.04	<0.04	0.13	<0.04	<0.04		<0.04	mg/kg	TM4/PM8
Benzo(ghi)perylene #	<0.04	<0.04	<0.04	<0.04	0.74	0.11	0.09		<0.04	mg/kg	TM4/PM8
Coronene	<0.04	<0.04	<0.04	<0.04	0.13	<0.04	<0.04		<0.04	mg/kg	TM4/PM8
PAH 17 Total	<0.64	<0.64	0.78	<0.64	9.36	1.55	1.47		<0.64	mg/kg	TM4/PM8
Benzo(b)fluoranthene	<0.05	<0.05	0.09	<0.05	1.35	0.19	0.18		<0.05	mg/kg	TM4/PM8
Benzo(k)fluoranthene	<0.02	<0.02	0.04	<0.02	0.53	0.07	0.07		<0.02	mg/kg	TM4/PM8
PAH Surrogate % Recovery	79	90	98	86	95	93	90		<0	%	TM4/PM8

157

<30

<30

al Oil (C10-C40) (EH_CU_1D_AL

<30

<30

<30

<30

<30

mg/kg

Client Name: Ground Investigations Ireland

Reference: 9754-07-20

Location: Bus Connections Route 5

Contact: Mike Sutton EMT Job No: 21/8443

Report : Solid

EMT Sample No.	1-3	4-6	7-9	10-12	13-15	16-18	19-21		Ī		
							-				
Sample ID	R5-CP01A	R5-CP01A	R5-CP01A	R5-CP01A	R5-CP03A	R5-CP03A	R5-CP03A				
Depth	0.50	1.50	2.50	3.50	0.50	1.00	1.80		Please se	e attached n	otes for all
COC No / misc										ations and a	
		\/ I.T	\/ LT)/ I.T	\/ LT	\/ LT	\/ LT				
Containers	VJT	VJT	VJT	VJT	VJT	VJT	VJT				
Sample Date	28/05/2021	28/05/2021	28/05/2021	28/05/2021	28/05/2021	28/05/2021	28/05/2021				
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil				
Batch Number	1	1	1	1	1	1	1				Method
Date of Receipt	04/06/2021	04/06/2021	04/06/2021	04/06/2021	04/06/2021	04/06/2021	04/06/2021		LOD/LOR	Units	No.
TPH CWG											
Aliphatics											
>C5-C6 (HS_1D_AL)#	<0.1	<0.1	<0.1	<0.1	<0.1 ^{SV}	<0.1	<0.1 ^{sv}		<0.1	mg/kg	TM36/PM12
>C6-C8 (HS_1D_AL)#	<0.1	<0.1	<0.1	<0.1	<0.1 ^{SV}	<0.1	<0.1 sv		<0.1	mg/kg	TM36/PM12
>C8-C10 (HS_1D_AL)	<0.1	<0.1	<0.1	<0.1	<0.1 ^{sv}	<0.1	<0.1 ^{sv}		<0.1	mg/kg	TM36/PM12
>C10-C12 (EH_CU_1D_AL)#	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		<0.2	mg/kg	TM5/PM8/PM16
>C12-C16 (EH_CU_1D_AL)#	<4	<4	<4	<4	<4	<4	<4		<4	mg/kg	TM5/PM8/PM16
>C16-C21 (EH_CU_1D_AL)#	<7	<7	<7	<7	<7	<7	<7		<7	mg/kg	TM5/PM8/PM16
>C21-C35 (EH_CU_1D_AL)#	<7	<7	<7	<7	119	<7	<7		<7	mg/kg	TM5/PM8/PM16
>C35-C40 (EH_1D_AL)	<7	<7	<7	<7	38	<7	<7		<7	mg/kg	TM5/PM8/PM16
Total aliphatics C5-40 (EH+HS_1D_AL)	<26	<26	<26	<26	157	<26	<26		<26	mg/kg	TM5/TM38/PM8/PM12/PM16
>C6-C10 (HS_1D_AL)	<0.1	<0.1	<0.1	<0.1	<0.1 ^{SV}	<0.1	<0.1 ^{sv}		<0.1	mg/kg	TM36/PM12
>C10-C25 (EH_1D_AL)	<10	<10	<10	<10	<10	<10	<10		<10	mg/kg	TM5/PM8/PM16
>C25-C35 (EH_1D_AL)	<10	<10	<10	<10	119	<10	<10		<10	mg/kg	TM5/PM8/PM16
Aromatics											
>C5-EC7 (HS_1D_AR)#	<0.1	<0.1	<0.1	<0.1	<0.1 ^{SV}	<0.1	<0.1 ^{sv}		<0.1	mg/kg	TM36/PM12
>EC7-EC8 (HS_1D_AR)#	<0.1	<0.1	<0.1	<0.1	<0.1 ^{sv}	<0.1	<0.1 ^{sv}		<0.1	mg/kg	TM36/PM12
>EC8-EC10 (HS_1D_AR)#	<0.1	<0.1	<0.1	<0.1	<0.1 ^{sv}	<0.1	<0.1 ^{sv}		<0.1	mg/kg	TM36/PM12
>EC10-EC12 (EH_CU_1D_AR)#	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2		<0.2	mg/kg	TM5/PM8/PM16
>EC12-EC16 (EH_CU_1D_AR)#	<4	<4	<4	<4	<4	<4	<4		<4	mg/kg	TM5/PM8/PM16
>EC16-EC21 (EH_CU_1D_AR)#	<7	<7	<7	<7	12	<7	<7		<7	mg/kg	TM5/PM8/PM16
>EC21-EC35 (EH_CU_1D_AR)*	<7	<7	<7	<7	324	<7	<7		<7	mg/kg	TM5/PM8/PM16
>EC35-EC40 (EH_1D_AR)	<7	<7	<7	<7	108	<7	<7		<7	mg/kg	TM5/PM8/PM16
Total aromatics C5-40 (EH+HS_1D_AR) Total aliphatics and aromatics(C5-40) (EH+HS_CU_1D_Total)	<26	<26	<26	<26	444	<26	<26 <52		<26	mg/kg	TMS/TMS8/PM8/PM12/PM16 TMS/TMS8/PM8/PM12/PM16
_	<52 <0.1	<52 <0.1	<52 <0.1	<52 <0.1	601 <0.1 sv	<52 <0.1	<0.1 sv		<52 <0.1	mg/kg	TM36/PM12
>EC6-EC10 (HS_1D_AR) * >EC10-EC25 (EH_1D_AR)	<10	<10	<10	<10	<0.1 51	<10	<0.1		<10	mg/kg mg/kg	TM5/PM8/PM16
>EC10-EC25 (EH_1D_AR) >EC25-EC35 (EH_1D_AR)	<10	<10	<10	<10	284	<10	<10		<10	mg/kg	TM5/PM8/PM16
	10	10	10	10	207	10	10			9/1.9	
MTBE#	<5	<5	<5	<5	<5 ^{sv}	<5	<5 ^{SV}		<5	ug/kg	TM36/PM12
Benzene#	<5	<5	<5	<5	<5	<5	<5 ^{sv}		<5	ug/kg	TM36/PM12
Toluene #	<5	<5	<5	<5	<5 ^{sv}	<5	<5 ^{sv}		<5	ug/kg	TM36/PM12
Ethylbenzene#	<5	<5	<5	<5	<5 ^{sv}	<5	<5 ^{sv}		<5	ug/kg	TM36/PM12
m/p-Xylene [#]	<5	<5	<5	<5	<5 ^{sv}	<5	<5 ^{sv}		<5	ug/kg	TM36/PM12
o-Xylene #	<5	<5	<5	<5	<5 ^{sv}	<5	<5 ^{sv}		<5	ug/kg	TM36/PM12
PCB 28#	<5	<5	<5	<5	<5	<5	<5		<5	ug/kg	TM17/PM8
PCB 52#	<5	<5	<5	<5	<5	<5	<5		<5	ug/kg	TM17/PM8
PCB 101 #	<5	<5	<5	<5	<5	<5	<5		<5	ug/kg	TM17/PM8
PCB 118#	<5	<5	<5	<5	<5	<5	<5		<5	ug/kg	TM17/PM8
PCB 138#	<5	<5	<5	<5	<5	<5	<5		<5	ug/kg	TM17/PM8
PCB 153 #	<5	<5	<5	<5	<5	<5	<5		<5	ug/kg	TM17/PM8
PCB 180 #	<5	<5	<5	<5	<5	<5	<5		<5	ug/kg	TM17/PM8
Total 7 PCBs #	<35	<35	<35	<35	<35	<35	<35		<35	ug/kg	TM17/PM8

Client Name: Ground Investigations Ireland

Reference: 9754-07-20

Location: Bus Connections Route 5

Contact: Mike Sutton EMT Job No: 21/8443

Report : Solid

EMT Sample No.	1-3	4-6	7-9	10-12	13-15	16-18	19-21				
Sample ID	R5-CP01A	R5-CP01A	R5-CP01A	R5-CP01A	R5-CP03A	R5-CP03A	R5-CP03A				
Depth	0.50	1.50	2.50	3.50	0.50	1.00	1.80		Please se	e attached r	otes for all
COC No / misc										cronyms	
Containers	VJT	VJT	VJT	VJT	VJT	VJT	VJT				
Sample Date											
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil				
Batch Number		1	1	1	1	1	1		LOD/LOR	Units	Method No.
Date of Receipt				04/06/2021							
Natural Moisture Content	18.9 15.9	36.6 26.8	46.4	31.6 24.0	8.4	7.0 6.5	24.1 19.4		<0.1 <0.1	%	PM4/PM0 PM4/PM0
Moisture Content (% Wet Weight)	15.9	20.8	31.7	24.0	7.7	0.5	19.4		<0.1	70	PIVI4/PIVIU
Hexavalent Chromium #	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3		<0.3	mg/kg	TM38/PM20
Chromium III	43.7	52.3	71.2	64.6	19.8	35.7	29.1		<0.5	mg/kg	NONE/NONE
											ĺ
Total Cyanide #	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5		<0.5	mg/kg	TM89/PM45
Total Organic Carbon #	0.37	1.30	1.99	0.33	0.32	0.23	1.01		<0.02	%	TM21/PM24
Loss on Ignition#	3.9	6.5	8.8	5.1	<1.0	<1.0	1.9		<1.0	%	TM22/PM0
pH#	8.54	7.44	7.47	7.52	9.48	10.13	8.23		<0.01	pH units	TM73/PM11
Mass of raw test portion	0.1061	0.1241	0.1307	0.1172	0.1002	0.0952	0.0974			kg	NONE/PM17
Mass of dried test portion	0.09	0.09	0.09	0.09	0.09	0.09	0.09			kg	NONE/PM17

Element Materials Technology

Client Name: Ground Investigations Ireland

Reference: 9754-07-20

Location: Bus Connections Route 5

Contact: Mike Sutton EMT Job No: 21/8443

Report: CEN 10:1 1 Batch

Solids: V=60g VOC jar, J=250g glass jar, T=plastic tub

	1	1		1									
EMT Sample No.	1-3	4-6	7-9	10-12	13-15	16-18	19-21				ļ		
Sample ID	R5-CP01A	R5-CP01A	R5-CP01A	R5-CP01A	R5-CP03A	R5-CP03A	R5-CP03A						
Depth	0.50	1.50	2.50	3.50	0.50	1.00	1.80				Please se	e attached n	otes for all
COC No / misc												ations and a	
Containers	VJT	VJT	VJT	VJT	VJT	VJT	VJT				Ì		
Sample Date	28/05/2021	28/05/2021	28/05/2021	28/05/2021	28/05/2021	28/05/2021	28/05/2021						
Sample Type				Soil		Soil	Soil				1		
	Soil	Soil	Soil		Soil								
Batch Number	1	1	1	1	1	1	1				LOD/LOR	Units	Method No.
Date of Receipt	04/06/2021	04/06/2021	04/06/2021	04/06/2021	04/06/2021	04/06/2021	04/06/2021						140.
Dissolved Antimony#	<0.002	<0.002	<0.002	<0.002	0.005	0.004	<0.002				<0.002	mg/l	TM30/PM17
Dissolved Antimony (A10) #	<0.02	<0.02	<0.02	<0.02	0.05	0.04	<0.02				<0.02	mg/kg	TM30/PM17
Dissolved Arsenic#	<0.0025	<0.0025	<0.0025	<0.0025	0.0027	<0.0025	0.0025				<0.0025	mg/l	TM30/PM17 TM30/PM17
Dissolved Arsenic (A10) # Dissolved Barium #	<0.025 <0.003	<0.025 0.035	<0.025 0.034	<0.025 0.012	0.027 0.005	<0.025 0.007	0.025 0.004				<0.025 <0.003	mg/kg	TM30/PM17
Dissolved Barium Dissolved Barium (A10) #	<0.003	0.035	0.034	0.012	0.005	0.007	0.004				<0.003	mg/l mg/kg	TM30/PM17
Dissolved Cadmium #	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005				<0.005	mg/l	TM30/PM17
Dissolved Cadmium (A10)#	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005				<0.005	mg/kg	TM30/PM17
Dissolved Chromium #	<0.0015	<0.0015	<0.0015	<0.0015	<0.0015	<0.0015	<0.0015				<0.0015	mg/l	TM30/PM17
Dissolved Chromium (A10)#	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015				<0.015	mg/kg	TM30/PM17
Dissolved Copper#	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007				<0.007	mg/l	TM30/PM17
Dissolved Copper (A10)#	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07				<0.07	mg/kg	TM30/PM17
Dissolved Lead #	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005				<0.005	mg/l	TM30/PM17
Dissolved Lead (A10)#	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05				<0.05	mg/kg	TM30/PM17
Dissolved Molybdenum#	0.003	0.011	0.003	<0.002	0.005	0.006	0.006				<0.002	mg/l	TM30/PM17
Dissolved Molybdenum (A10) #	0.03	0.11	0.03	<0.02	0.05	0.06	0.06				<0.02	mg/kg	TM30/PM17
Dissolved Nickel#	<0.002	<0.002	0.002	<0.002	<0.002	<0.002	<0.002				<0.002	mg/l	TM30/PM17
Dissolved Nickel (A10)#	<0.02	<0.02	0.02	<0.02 <0.003	<0.02	<0.02 <0.003	<0.02 <0.003				<0.02	mg/kg	TM30/PM17 TM30/PM17
Dissolved Selenium* Dissolved Selenium (A10)*	<0.003 <0.03	<0.003	<0.003 <0.03	<0.003	<0.003 <0.03	<0.003	<0.003				<0.003 <0.03	mg/l mg/kg	TM30/PM17
Dissolved Zinc#	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003				<0.003	mg/l	TM30/PM17
Dissolved Zinc (A10) #	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03				<0.03	mg/kg	TM30/PM17
Mercury Dissolved by CVAF #	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001				<0.00001	mg/l	TM61/PM0
Mercury Dissolved by CVAF #	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001				<0.0001	mg/kg	TM61/PM0
Total Phenols HPLC	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05				<0.05	mg/l	TM26/PM0
Total Phenols HPLC	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5				<0.5	mg/kg	TM26/PM0
												_	
Fluoride	0.4	<0.3	0.3	<0.3	<0.3	<0.3	<0.3				<0.3	mg/l	TM173/PM0
Fluoride	4	<3	3	<3	<3	<3	<3				<3	mg/kg	TM173/PM0
Sulphate as SO4#	<0.5	18.8	<0.5	<0.5	19.4	12.0	20.9				<0.5	mg/l	TM38/PM0
Sulphate as SO4#	<5	188	<5	<5	194	120	209				<5	mg/kg	TM38/PM0
Chloride [#]	<0.3	0.7	1.1	1.0	0.9	0.4	0.7				<0.3	mg/l	TM38/PM0
Chloride #	<3	7	11	10	9	4	7				<3	mg/kg	TM38/PM0
Dissolved Organic Carbon	<2	7	12	4	<2	<2	<2				<2	mg/l	TM60/PM0
Dissolved Organic Carbon	<20	70	120	40	<20	<20	<20				<20	mg/kg	TM60/PM0
Total Dissolved Solids #	58	201	176	120	66	42	53				<35	mg/l	TM20/PM0
Total Dissolved Solids #	580	2010	1760	1201	660	420	530				<350	mg/kg	TM20/PM0
		l	<u> </u>		l .	l .	l .	l .	l .	<u>I</u>	J	<u> </u>	1

Element Materials Technology

Client Name: Ground Investigations Ireland

Reference: 9754-07-20

Location: Bus Connections Route 5

Contact: Mike Sutton EMT Job No: 21/8443

Report: EN12457_2

Solids: V=60g VOC jar, J=250g glass jar, T=plastic tub

	21/0440								i					
EMT Sample No.	1-3	4-6	7-9	10-12	13-15	16-18	19-21							
Sample ID	R5-CP01A	R5-CP01A	R5-CP01A	R5-CP01A	R5-CP03A	R5-CP03A	R5-CP03A							
Depth	0.50	1.50	2.50	3.50	0.50	1.00	1.80					Please se	e attached n	otes for all
COC No / misc													ations and ad	
Containers	VJT	VJT	VJT	VJT	VJT	VJT	VJT							
Sample Date	28/05/2021	28/05/2021	28/05/2021	28/05/2021	28/05/2021	28/05/2021	28/05/2021							
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil							
Batch Number	1	1	1	1	1	1	1							
									Inert	Stable Non- reactive	Hazardous	LOD LOR	Units	Method No.
Date of Receipt Solid Waste Analysis	04/06/2021	04/06/2021	04/06/2021	04/06/2021	04/06/2021	04/06/2021	04/06/2021							
Total Organic Carbon #	0.37	1.30	1.99	0.33	0.32	0.23	1.01		3	5	6	<0.02	%	TM21/PM24
Sum of BTEX	<0.025	<0.025	<0.025	<0.025	<0.025 ^{sv}	<0.025	<0.025 ^{sv}		6	-	-	<0.025	mg/kg	TM36/PM12
Sum of 7 PCBs#	<0.035	<0.035	<0.035	<0.035	<0.035	<0.035	<0.035		1	-	-	<0.035	mg/kg	TM17/PM8
Mineral Oil	<30	<30	<30	<30	157	<30	<30		500	-	-	<30	mg/kg	TM5/PM8/PM16
PAH Sum of 17	<0.64	<0.64	0.78	<0.64	9.36	1.55	1.47		100	-	-	<0.64	mg/kg	TM4/PM8
CEN 10:1 Leachate Arsenic #	<0.025	<0.025	<0.025	<0.025	0.027	<0.025	0.025		0.5	2	25	<0.025	mg/kg	TM30/PM17
Arsenic Barium #	<0.025	0.35	0.025	0.12	0.027	0.025	0.025		20	100	300	<0.025	mg/kg	TM30/PM17
Cadmium #	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005		0.04	1	5	<0.005	mg/kg	TM30/PM17
Chromium #	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015		0.5	10	70	<0.015	mg/kg	TM30/PM17
Copper#	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07		2	50	100	<0.07	mg/kg	TM30/PM17
Mercury#	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001		0.01	0.2	2	<0.0001	mg/kg	TM61/PM0
Molybdenum #	0.03	0.11	0.03	<0.02	0.05	0.06	0.06		0.5	10	30	<0.02	mg/kg	TM30/PM17
Nickel #	<0.02	<0.02	0.02	<0.02	<0.02	<0.02	<0.02		0.4	10	40	<0.02	mg/kg	TM30/PM17
Lead #	<0.05 <0.02	<0.05 <0.02	<0.05 <0.02	<0.05 <0.02	<0.05 0.05	<0.05 0.04	<0.05 <0.02		0.5	10 0.7	50 5	<0.05 <0.02	mg/kg mg/kg	TM30/PM17 TM30/PM17
Antimony # Selenium #	<0.02	<0.02	<0.02	<0.02	<0.03	<0.03	<0.02		0.00	0.5	7	<0.02	mg/kg	TM30/PM17
Zinc#	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03		4	50	200	<0.03	mg/kg	TM30/PM17
Total Dissolved Solids#	580	2010	1760	1201	660	420	530		4000	60000	100000	<350	mg/kg	TM20/PM0
Dissolved Organic Carbon	<20	70	120	40	<20	<20	<20		500	800	1000	<20	mg/kg	TM60/PM0
Dry Matter Content Ratio	85.1	72.6	69.1	76.6	89.9	94.3	91.9		-	-	-	<0.1	%	NONE/PM4
pH#	8.54	7.44	7.47	7.52	9.48	10.13	8.23		-	-	-	<0.01	pH units	TM73/PM11
pii													P	
Fluoride	4	<3	3	<3	<3	<3	<3		-	-	-	<3	mg/kg	TM173/PM0
Sulphate as SO4#	<5	188	<5	<5	194	120	209		1000	20000	50000	<5	mg/kg	TM38/PM0
Chloride #	<3	7	11	10	9	4	7		800	15000	25000	<3	mg/kg	TM38/PM0
										1		1		
														•

Client Name: Ground Investigations Ireland

Reference: 20/07/9754

Location: Bus Connections Route 5

Contact: Mike Sutton

Note:

Asbestos Screen analysis is carried out in accordance with our documented in-house methods PM042 and TM065 and HSG 248 by Stereo and Polarised Light Microscopy using Dispersion Staining Techniques and is covered by our UKAS accreditation. Detailed Gravimetric Quantification and PCOM Fibre Analysis is carried out in accordance with our documented in-house methods PM042 and TM131 and HSG 248 using Stereo and Polarised Light Microscopy and Phase Contrast Optical Microscopy (PCOM). Samples are retained for not less than 6 months from the date of analysis unless specifically requested.

Opinions, including ACM type and Asbestos level less than 0.1%, lie outside the scope of our UKAS accreditation.

Where the sample is not taken by a Element Materials Technology consultant, Element Materials Technology cannot be responsible for inaccurate or unrepresentative sampling.

EMT Job No.	Batch	Sample ID	Depth	EMT Sample No.	Date Of Analysis	Analysis	Result
21/8443	1	R5-CP01A	0.50	2	11/06/2021	General Description (Bulk Analysis)	Soil/Stone
					11/06/2021	Asbestos Fibres	NAD
					11/06/2021	Asbestos ACM	NAD
					11/06/2021	Asbestos Type	NAD
					11/06/2021	Asbestos Level Screen	NAD
21/8443	1	R5-CP01A	1.50	5	11/06/2021	General Description (Bulk Analysis)	Soil/Stone
					11/06/2021	Asbestos Fibres	NAD
					11/06/2021	Asbestos ACM	NAD
					11/06/2021	Asbestos Type	NAD
					11/06/2021	Asbestos Level Screen	NAD
21/8443	1	R5-CP01A	2.50	8	11/06/2021	General Description (Bulk Analysis)	Soil/Stone
					11/06/2021	Asbestos Fibres	NAD
					11/06/2021	Asbestos ACM	NAD
					11/06/2021	Asbestos Type	NAD
					11/06/2021	Asbestos Level Screen	NAD
21/8443	1	R5-CP01A	3.50	11	11/06/2021	General Description (Bulk Analysis)	soil
					11/06/2021	Asbestos Fibres	NAD
					11/06/2021	Asbestos ACM	NAD
					11/06/2021	Asbestos Type	NAD
					11/06/2021	Asbestos Level Screen	NAD
21/8443	1	R5-CP03A	0.50	14	11/06/2021	General Description (Bulk Analysis)	soil
					11/06/2021	Asbestos Fibres	NAD
					11/06/2021	Asbestos ACM	NAD
					11/06/2021	Asbestos Type	NAD
					11/06/2021	Asbestos Level Screen	NAD
21/8443	1	R5-CP03A	1.00	17	11/06/2021	General Description (Bulk Analysis)	soil
					11/06/2021	Asbestos Fibres	NAD
					11/06/2021	Asbestos ACM	NAD
					11/06/2021	Asbestos Type	NAD
					11/06/2021	Asbestos Level Screen	NAD
21/8443	1	R5-CP03A	1.80	20	11/06/2021	General Description (Bulk Analysis)	Soil/Stones
					11/06/2021	Asbestos Fibres	NAD
					11/06/2021	Asbestos ACM	NAD

Client Name: Ground Investigations Ireland

Reference: 20/07/9754

Location: Bus Connections Route 5

Contact: Mike Sutton

EMT Job No.	Batch	Sample ID	Depth	EMT Sample No.	Date Of Analysis	Analysis	Result
21/8443	1	R5-CP03A	1.80	20	11/06/2021	Asbestos Type	NAD
							NAD
					Ů.		

Client Name: Ground Investigations Ireland

Reference: 9754-07-20

Location: Bus Connections Route 5

Contact: Mike Sutton

EMT Job No.	Batch	Sample ID	Depth	EMT Sample No.	Analysis	Reason
					No deviating sample report results for job 21/8443	

Please note that only samples that are deviating are mentioned in this report. If no samples are listed it is because none were deviating. Only analyses which are accredited are recorded as deviating if set criteria are not met.

NOTES TO ACCOMPANY ALL SCHEDULES AND REPORTS

EMT Job No.: 21/8443

SOILS

Please note we are only MCERTS accredited (UK soils only) for sand, loam and clay and any other matrix is outside our scope of accreditation.

Where an MCERTS report has been requested, you will be notified within 48 hours of any samples that have been identified as being outside our MCERTS scope. As validation has been performed on clay, sand and loam, only samples that are predominantly these matrices, or combinations of them will be within our MCERTS scope. If samples are not one of a combination of the above matrices they will not be marked as MCERTS accredited.

It is assumed that you have taken representative samples on site and require analysis on a representative subsample. Stones will generally be included unless we are requested to remove them.

All samples will be discarded one month after the date of reporting, unless we are instructed to the contrary.

If you have not already done so, please send us a purchase order if this is required by your company.

Where appropriate please make sure that our detection limits are suitable for your needs, if they are not, please notify us immediately.

All analysis is reported on a dry weight basis unless stated otherwise. Limits of detection for analyses carried out on as received samples are not moisture content corrected. Results are not surrogate corrected. Samples are dried at 35°C ±5°C unless otherwise stated. Moisture content for CEN Leachate tests are dried at 105°C ±5°C.

Where Mineral Oil or Fats, Oils and Grease is quoted, this refers to Total Aliphatics C10-C40.

Where a CEN 10:1 ZERO Headspace VOC test has been carried out, a 10:1 ratio of water to wet (as received) soil has been used.

% Asbestos in Asbestos Containing Materials (ACMs) is determined by reference to HSG 264 The Survey Guide - Appendix 2 : ACMs in buildings listed in order of ease of fibre release.

Sufficient amount of sample must be received to carry out the testing specified. Where an insufficient amount of sample has been received the testing may not meet the requirements of our accredited methods, as such accreditation may be removed.

Negative Neutralization Potential (NP) values are obtained when the volume of NaOH (0.1N) titrated (pH 8.3) is greater than the volume of HCI (1N) to reduce the pH of the sample to 2.0 - 2.5. Any negative NP values are corrected to 0.

The calculation of Pyrite content assumes that all oxidisable sulphides present in the sample are pyrite. This may not be the case. The calculation may be an overesitimate when other sulphides such as Barite (Barium Sulphate) are present.

WATERS

Please note we are not a UK Drinking Water Inspectorate (DWI) Approved Laboratory .

ISO17025 accreditation applies to surface water and groundwater and usually one other matrix which is analysis specific, any other liquids are outside our scope of accreditation.

As surface waters require different sample preparation to groundwaters the laboratory must be informed of the water type when submitting samples.

Where Mineral Oil or Fats, Oils and Grease is quoted, this refers to Total Aliphatics C10-C40.

DEVIATING SAMPLES

All samples should be submitted to the laboratory in suitable containers with sufficient ice packs to sustain an appropriate temperature for the requested analysis. The temperature of sample receipt is recorded on the confirmation schedules in order that the client can make an informed decision as to whether testing should still be undertaken.

SURROGATES

Surrogate compounds are added during the preparation process to monitor recovery of analytes. However low recovery in soils is often due to peat, clay or other organic rich matrices. For waters this can be due to oxidants, surfactants, organic rich sediments or remediation fluids. Acceptable limits for most organic methods are 70 - 130% and for VOCs are 50 - 150%. When surrogate recoveries are outside the performance criteria but the associated AQC passes this is assumed to be due to matrix effect. Results are not surrogate corrected.

DILUTIONS

A dilution suffix indicates a dilution has been performed and the reported result takes this into account. No further calculation is required.

BLANKS

Where analytes have been found in the blank, the sample will be treated in accordance with our laboratory procedure for dealing with contaminated blanks.

NOTE

Data is only reported if the laboratory is confident that the data is a true reflection of the samples analysed. Data is only reported as accredited when all the requirements of our Quality System have been met. In certain circumstances where all the requirements of the Quality System have not been met, for instance if the associated AQC has failed, the reason is fully investigated and documented. The sample data is then evaluated alongside the other quality control checks performed during analysis to determine its suitability. Following this evaluation, provided the sample results have not been effected, the data is reported but accreditation is removed. It is a UKAS requirement for data not reported as accredited to be considered indicative only, but this does not mean the data is not valid.

Where possible, and if requested, samples will be re-extracted and a revised report issued with accredited results. Please do not hesitate to contact the laboratory if further details are required of the circumstances which have led to the removal of accreditation.

EMT Job No.: 21/8443

REPORTS FROM THE SOUTH AFRICA LABORATORY

Any method number not prefixed with SA has been undertaken in our UK laboratory unless reported as subcontracted.

Measurement Uncertainty

Measurement uncertainty defines the range of values that could reasonably be attributed to the measured quantity. This range of values has not been included within the reported results. Uncertainty expressed as a percentage can be provided upon request.

ABBREVIATIONS and ACRONYMS USED

#	ISO17025 (UKAS Ref No. 4225) accredited - UK.
SA	ISO17025 (SANAS Ref No.T0729) accredited - South Africa
В	Indicates analyte found in associated method blank.
DR	Dilution required.
М	MCERTS accredited.
NA	Not applicable
NAD	No Asbestos Detected.
ND	None Detected (usually refers to VOC and/SVOC TICs).
NDP	No Determination Possible
SS	Calibrated against a single substance
sv	Surrogate recovery outside performance criteria. This may be due to a matrix effect.
W	Results expressed on as received basis.
+	AQC failure, accreditation has been removed from this result, if appropriate, see 'Note' on previous page.
>>	Results above calibration range, the result should be considered the minimum value. The actual result could be significantly higher, this result is not accredited.
*	Analysis subcontracted to an Element Materials Technology approved laboratory.
AD	Samples are dried at 35°C ±5°C
CO	Suspected carry over
LOD/LOR	Limit of Detection (Limit of Reporting) in line with ISO 17025 and MCERTS
ME	Matrix Effect
NFD	No Fibres Detected
BS	AQC Sample
LB	Blank Sample
N	Client Sample
ТВ	Trip Blank Sample

HWOL ACRONYMS AND OPERATORS USED

HS	Headspace Analysis.
EH	Extractable Hydrocarbons - i.e. everything extracted by the solvent.
CU	Clean-up - e.g. by florisil, silica gel.
1D	GC - Single coil gas chromatography.
Total	Aliphatics & Aromatics.
AL	Aliphatics only.
AR	Aromatics only.
2D	GC-GC - Double coil gas chromatography.
#1	EH_Total but with humics mathematically subtracted
#2	EU_Total but with fatty acids mathematically subtracted
-	Operator - underscore to separate acronyms (exception for +).
+	Operator to indicate cumulative e.g. EH+HS_Total or EH_CU+HS_Total
MS	Mass Spectrometry.

EMT Job No: 21/8443

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/S ANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
PM4	Gravimetric measurement of Natural Moisture Content and % Moisture Content at either 35°C or 105°C. Calculation based on ISO 11465:1993(E) and BS1377-2:1990.	PM0	No preparation is required.			AR	
TM4	Modified USEPA 8270D v5:2014 method for the solvent extraction and determination of PAHs by GC-MS.	PM8	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required.			AR	Yes
TM4	Modified USEPA 8270D v5:2014 method for the solvent extraction and determination of PAHs by GC-MS.	PM8	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required.	Yes		AR	Yes
TM5	Modified 8015B v2:1996 method for the determination of solvent Extractable Petroleum Hydrocarbons (EPH) within the range C8-C40 by GCFID. For waters the solvent extracts dissolved phase plus a sheen if present.	PM8/PM16	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required/Fractionation into aliphatic and aromatic fractions using a Rapid Trace SPE.			AR	Yes
TM5	Modified 8015B v2:1996 method for the determination of solvent Extractable Petroleum Hydrocarbons (EPH) within the range C8-C40 by GCFID. For waters the solvent extracts dissolved phase plus a sheen if present.	PM8/PM16	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required/Fractionation into aliphatic and aromatic fractions using a Rapid Trace SPE.	Yes		AR	Yes
TM5/TM36	please refer to TM5 and TM36 for method details	PM8/PM12/PM16	please refer to PM8/PM16 and PM12 for method details			AR	Yes
TM17	Modified US EPA method 8270D v5:2014. Determination of specific Polychlorinated Biphenyl congeners by GC-MS.	PM8	End over end extraction of solid samples for organic analysis. The solvent mix varies depending on analysis required.	Yes		AR	Yes
TM20	Modified BS 1377-3:1990/USEPA 160.1/3 (TDS/TS: 1971) Gravimetric determination of Total Dissolved Solids/Total Solids	PM0	No preparation is required.	Yes		AR	Yes
TM21	Modified BS 7755-3:1995, ISO10694:1995 Determination of Total Organic Carbon or Total Carbon by combustion in an Eltra TOC furnace/analyser in the presence of oxygen. The CO2 generated is quantified using infra-red detection. Organic Matter (SOM) calculated as per EA MCERTS Chemical Testing of Soil, March 2012 v4.	PM24	Dried and ground solid samples are washed with hydrochloric acid, then rinsed with deionised water to remove the mineral carbon before TOC analysis.	Yes		AD	Yes
TM22	Modified BS1377-3:1990 Gravimetric determination of Loss on Ignition by temperature controlled Muffle Furnace (35C-440C). On request modified ASTM D2974-00 LOI (105C-440C)	- PM0	No preparation is required.	Yes		AD	Yes

Element Materials Technology

EMT Job No: 21/8443

EMT Job No:	21/0443			•	1		
Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/S ANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
TM26	Determination of phenols by Reversed Phased High Performance Liquid Chromatography and Electro-Chemical Detection.	PM0	No preparation is required.			AR	Yes
TM30	Determination of Trace Metals by ICP-OES (Inductively Coupled Plasma – Optical Emission Spectrometry): WATERS by Modified USEPA Method 200.7, Rev. 4.4, 1994; Modified EPA Method 6010B, Rev.2, Dec 1996; Modified BS EN ISO 11885:2009: SOILS by Modified USEP 6010B, Rev.2, Dec.1996; Modified EPA Method 3050B, Rev.2, Dec.1996	PM15	Acid digestion of dried and ground solid samples using Aqua Regia refluxed at 112.5 °C. Samples containing asbestos are not dried and ground.			AD	Yes
TM30	Determination of Trace Metals by ICP-OES (Inductively Coupled Plasma – Optical Emission Spectrometry): WATERS by Modified USEPA Method 200.7, Rev. 4.4, 1994; Modified EPA Method 6010B, Rev.2, Dec 1996; Modified BS EN ISO 11885:2009: SOILS by Modified USEP 6010B, Rev.2, Dec.1996; Modified EPA Method 3050B, Rev.2, Dec.1996	PM15	Acid digestion of dried and ground solid samples using Aqua Regia refluxed at 112.5 °C. Samples containing asbestos are not dried and ground.	Yes		AD	Yes
TM30	Determination of Trace Metals by ICP-OES (Inductively Coupled Plasma – Optical Emission Spectrometry): WATERS by Modified USEPA Method 200.7, Rev. 4.4, 1994; Modified EPA Method 6010B, Rev.2, Dec 1996; Modified BS EN ISO 11885:2009: SOILS by Modified USEP 6010B, Rev.2, Dec.1996; Modified EPA Method 3050B, Rev.2, Dec.1996	PM17	Modified method BS EN12457-2:2002 As received solid samples are leached with water in a 10:1 water to soil ratio for 24 hours, the moisture content of the sample is included in the ratio.	Yes		AR	Yes
TM36	Modified US EPA method 8015B v2:1996. Determination of Gasoline Range Organics (GRO) in the carbon chain range of C4-12 by headspace GC-FID. MTBE by GCFID coelutes with 3-methylpentane if present and therefore can give a false positive. Positive MTBE results will be re-run using GC-MS to double check, when requested.	PM12	Modified US EPA method 5021A v2:2014. Preparation of solid and liquid samples for GC headspace analysis.			AR	Yes
TM36	Modified US EPA method 8015B v2:1996. Determination of Gasoline Range Organics (GRO) in the carbon chain range of C4-12 by headspace GC-FID. MTBE by GCFID coelutes with 3-methylpentane if present and therefore can give a false positive. Positive MTBE results will be re-run using GC-MS to double check, when requested.	PM12	Modified US EPA method 5021A v2:2014. Preparation of solid and liquid samples for GC headspace analysis.	Yes		AR	Yes
TM38	Soluble Ion analysis using Discrete Analyser. Modified US EPA methods: Chloride 325.2 (1978), Sulphate 375.4 (Rev.2 1993), 0-Phosphate 365.2 (Rev.2 1993), TON 353.1 (Rev.2 1993), Nitrite 354.1 (1971), Hex Cr 7196A (1992), NH4+ 350.1 (Rev.2 1993) – All anions comparable to BS ISO 15923-1: 2013l	PM0	No preparation is required.	Yes		AR	Yes
ТМ38	Soluble Ion analysis using Discrete Analyser. Modified US EPA methods: Chloride 325.2 (1978), Sulphate 375.4 (Rev.2 1993), 0-Phosphate 365.2 (Rev.2 1993), TON 353.1 (Rev.2 1993), Nitrite 354.1 (1971), Hex Cr 7196A (1992), NH4+ 350.1 (Rev.2 1993) – All anions comparable to BS ISO 15923-1: 2013I	PM20	Extraction of dried and ground or as received samples with deionised water in a 2:1 water to solid ratio using a reciprocal shaker for all analytes except hexavalent chromium. Extraction of as received sample using 10:1 ratio of 0.2M sodium hydroxide to soil for hexavalent chromium using a reciprocal shaker.	Yes		AR	Yes
TM60	TC/TOC analysis of Waters by High Temperature Combustion followed by NDIR detection. Based on the following modified standard methods: USEPA 9060A (2002), APHA SMEWW 5310B:1999 22nd Edition, ASTM D 7573, and USEPA 415.1.	PM0	No preparation is required.			AR	Yes
TM61	Determination of Mercury by Cold Vapour Atomic Fluorescence - WATERS: Modified USEPA Method 245.7, Rev 2, Feb 2005. SOILS: Modified USEPA Method 7471B, Rev.2, Feb 2007	PM0	No preparation is required.	Yes		AR	Yes

EMT Job No: 21/8443

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/S ANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
TM65	Asbestos Bulk Identification method based on HSG 248 First edition (2006)	PM42	Modified SCA Blue Book V.12 draft 2017 and WM3 1st Edition v1.1:2018. Solid samples undergo a thorough visual inspection for asbestos fibres prior to asbestos identification using TM065.	Yes		AR	
TM73	Modified US EPA methods 150.1 (1982) and 9045D Rev. 4 - 2004) and BS1377-3:1990. Determination of pH by Metrohm automated probe analyser.	PM11	Extraction of as received solid samples using one part solid to 2.5 parts deionised water.	Yes		AR	No
TM89	Modified USEPA method OIA-1667 (1999). Determination of cyanide by Flow Injection Analyser. Where WAD cyanides are required a Ligand displacement step is carried out before analysis.	PM45	As received solid samples are extracted with 1M NaOH by orbital shaker for Cyanide, Sulphide and Thiocyanate analysis.	Yes		AR	Yes
TM173	Analysis of fluoride by ISE (Ion Selective Electrode) using modified ISE method 9214 - 340.2 (EPA 1998)	PM0	No preparation is required.			AR	Yes
NONE	No Method Code	NONE	No Method Code			AD	Yes
NONE	No Method Code	PM17	Modified method BS EN12457-2:2002 As received solid samples are leached with water in a 10:1 water to soil ratio for 24 hours, the moisture content of the sample is included in the ratio.			AR	
NONE	No Method Code	PM4	Gravimetric measurement of Natural Moisture Content and % Moisture Content at either 35°C or 105°C. Calculation based on ISO 11465:1993(E) and BS1377-2:1990.			AR	



LABORATORY REPORT



4043

Contract Number: PSL21/1998

Report Date: 12 April 2021

Client's Reference: 2868817

Client Name: Ground Investigations Ireland Ltd

Catherinestown House Hazelhatch Road

Newcastle Co Dublin D22 YD52

For the attention of: Patrick Cochran

Contract Title: Bus Connect Route 5

Date Received: 10/3/2021 Date Commenced: 10/3/2021 Date Completed: 12/4/2021

Notes: Opinions and Interpretations are outside the UKAS Accreditation

A copy of the Laboratory Schedule of accredited tests as issued by UKAS is attached to this report. 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 other than in full, without the prior written approval of the laboratory.

Checked and Approved Signatories:

A Watkins R Berriman S Royle

(Director) (Quality Manager) (Laboratory Manager)

L Knight S Eyre H Daniels (Senior Technician) (Senior Technician) (Senior Technician)

Page 1 of

5 – 7 Hexthorpe Road, Hexthorpe,

Doncaster DN4 0AR tel: +44 (0)844 815 6641 fax: +44 (0)844 815 6642

e-mail: rberriman@prosoils.co.uk awatkins@prosoils.co.uk

DETERMINATION OF UNCONFINED COMPRESSIVE STRENGTH

ISRM Suggested Methods, pp 111 –116, 1981.

Hole	Camala	Carrala	Т	D	C	Cl -	II all all 4	Initial	Bulk	Moisture	D	Land	HOO	Failure	Date	Remarks
Number	Number	Sample Type	Top Depth	Base Depth	Sample Diameter	Sample Length	Height Ratio	Mass	Density	Content	Dry Density	Load Failure	UCS	Mode	Tested	Kemai Ks
Number	Nullibei	турс	(m)	(m)	(mm)	(mm)	Natio	(g)	(Mg/m)	(%)	(Mg/m)	(kN)	(MPa)	Wiode	resteu	
R05-CP03		C	10.67	10.90	64	128	2.0	1094	2.66	0.4	2.65	190.3	59.1	Brittle	06/04/21	
R05-RC04		C	2.25	2.50	64	128	2.0	1072	2.60	1.5	2.56	68.7	21.4	Brittle	06/04/21	
R05-RC04		<u>C</u>	2.50	2.76	64	128	2.0	1104	2.68	0.8	2.66	71.5	22.2	Brittle	06/04/21	
R05-RC04		C	5.00	5.19	64	118	1.8			0.7		91.9	28.6		06/04/21	
								1011	2.66		2.64			Brittle		
R05-RC04		C	5.29	5.54	64	98	1.5	838	2.66	0.7	2.64	67.9	21.1	Brittle	06/04/21	
R05-RC04		C	7.33	7.52	64	128	2.0	1100	2.67	0.7	2.65	67.1	20.9	Brittle	06/04/21	
R05-RC04		C	8.16	8.44	64	133	2.1	1131	2.64	1.6	2.60	49.0	15.2	Brittle	06/04/21	
R05-RC04		C	9.80	10.00	64	131	2.0	1101	2.61	2.4	2.55	51.8	16.1	Brittle	06/04/21	

PSIL
Professional Soils Laboratory

Bus Connect Route 5

Contract No:
PSL21/1998
Client Ref:
9754-07-20

SUMMARY OF POINT LOAD TEST RESULTS

ISRM Suggested Methods: 2007

Borehole Number	Depth (m)	Sample Ref	Test Type	Orientation	Dimei (m		Area	D _e ²	$\mathbf{D}_{\mathbf{e}}$	Failure 1	Load (P)	I _s	Corr Fac	I_{s50}	Failure Type	Remarks
rvamber		1401	1,100	Par / Perp	W	D	(mm2)		(mm)	(Mpa)	(kN)	(MPa)	F	(MPa)	Type	
R05-CP01	5.90		A	Perp	64	31	1984	2526.11	50.26	ı	14.02	5.55	1.002	5.56	Valid	
R05-CP01	7.65		A	Perp	64	46	2944	3748.42	61.22	-	27.47	7.33	1.095	8.03	Valid	
R05-CP03	8.80		A	Perp	64	35	2240	2852.06	53.40	ı	15.99	5.61	1.030	5.78	Valid	
R05-CP03	10.10		A	Perp	64	37	2368	3015.03	54.91	-	17.51	5.81	1.043	6.06	Valid	
R05-RC04	2.76		A	Perp	64	55	3520	4481.80	66.95	-	10.57	2.36	1.140	2.69	Valid	
R05-RC04	3.50		A	Perp	64	48	3072	3911.39	62.54	-	25.11	6.42	1.106	7.10	Valid	
R05-RC04	5.69		A	Perp	64	30	1920	2444.62	49.44	-	3.79	1.55	0.995	1.54	Valid	
R05-RC04	7.17		A	Perp	64	29	1856	2363.13	48.61	-	17.29	7.32	0.987	7.22	Valid	
R05-RC04	8.00		A	Perp	64	32	2048	2607.59	51.06	-	15.46	5.93	1.010	5.99	Valid	

*Note All testing carried out on samples at as received water content

Par = parallel, Perp = perpendicular, U = Random

A = Axial, D = Diametral, I = Irregular





Bus Connect Route 5

Contract No:
PSL21/1998
Client Ref:
9754-07-20

SUMMARY OF POINT LOAD TEST RESULTS

ISRM Suggested Methods: 2007

Borehole Number	Depth (m)	Sample Ref	Test Type	Orientation	Dimei (m	nsions m)	D _e ²	\mathbf{D}_{e}	Failur	e Load	I_s	Corr Fac	I _{s50}	Failure Type	Remarks
1 (4111001	()	1101	1,100	Par / Perp	L	D		(mm)	(Mpa)	(kN)	(MPa)	F	(MPa)	1,100	
R05-CP01	6.93		D	Par	ı	64	4096	64.00	-	9.12	2.227	1.117	2.49	Valid	
R05-RC04	3.94		D	Par	-	64	4096	64.00	-	10.65	2.600	1.117	2.91	Valid	
R05-RC04	6.65		D	Par	-	64	4096	64.00	-	12.36	3.018	1.117	3.37	Valid	
R05-RC04	6.85		D	Par	-	64	4096	64.00	-	14.96	3.652	1.117	4.08	Valid	

*Note All testing carried out on samples at as received water content

Par = parallel, Perp = perpendicular, U = Random



Bus Connect Route 5

Contract No:
PSL21/1998
Client Ref:
9754-07-20



LABORATORY REPORT



4043

Contract Number: PSL21/2671

Report Date: 20 April 2021

Client's Reference: 2868817

Client Name: Ground Investigations Ireland Ltd

Catherinestown House

Hazelhatch Road

Newcastle Co Dublin D22 YD52

For the attention of: Patrick Cochran

Contract Title: Bus Connect Route 5

Date Received: 31/3/2021
Date Commenced: 31/3/2021
Date Completed: 20/4/2021

Notes: Opinions and Interpretations are outside the UKAS Accreditation

A copy of the Laboratory Schedule of accredited tests as issued by UKAS is attached to this report. 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 other than in full, without the prior written approval of the laboratory.

Checked and Approved Signatories:

A Watkins R Berriman S Royle

(Director) (Quality Manager) (Laboratory Manager)

L Knight S Eyre H Daniels (Senior Technician) (Senior Technician) (Senior Technician)

Page 1 of

5 – 7 Hexthorpe Road, Hexthorpe,

Doncaster DN4 0AR tel: +44 (0)844 815 6641

fax: +44 (0)844 815 6642 e-mail: rberriman@prosoils.co.uk awatkins@prosoils.co.uk

DETERMINATION OF UNCONFINED COMPRESSIVE STRENGTH

ISRM Suggested Methods, pp 111 –116, 1981.

Hole Number	Sample Number	Sample Type	Top Depth (m)	Base Depth (m)	Sample Diameter (mm)	Sample Length (mm)	Height Ratio	Initial Mass (g)	Bulk Density (Mg/m)	Moisture Content (%)	Dry Density (Mg/m)	Load Failure (kN)	UCS (MPa)	Failure Mode	Date Tested	Remarks
R05-RC06		C	8.00	8.35	63	125	2.0	1071	2.75	0.9	2.72	95.4	30.6	Brittle	15/04/21	
R05-RC06		С	9.90	10.17	63	126	2.0	1090	2.77	0.8	2.75	131.1	42.1	Brittle	15/04/21	
R05-RC06		C	11.67	11.86	63	124	2.0	1071	2.77	0.8	2.75	148.1	47.5	Brittle	15/04/21	

PSL
Professional Soils Laboratory

Bus Connect Route 5

Contract No:
PSL21/2671
Client Ref:
9754-07-20

SUMMARY OF POINT LOAD TEST RESULTS

ISRM Suggested Methods: 2007

Borehole Number	Depth (m)	Sample Ref	Test Type	Orientation	Dimei (m		Area	D _e ²	D _e	Failure 1	Load (P)	I_s	Corr Fac	I _{s50}	Failure Type	Remarks
1 (4111001		1401	1340	Par / Perp	W	D	(mm2)		(mm)	(Mpa)	(kN)	(MPa)	F	(MPa)	1,100	
R05-RC06	8.35		A	Perp	63	51	3213	4090.92	63.96	ı	9.38	2.29	1.117	2.56	Valid	
R05-RC06	10.17		A	Perp	63	31	1953	2486.64	49.87	-	8.88	3.57	0.999	3.57	Valid	
R05-RC06	11.55		A	Perp	63	48	3024	3850.28	62.05	-	10.48	2.72	1.102	3.00	Valid	
R05-RC07	15.50		A	Perp	63	59	3717	4732.63	68.79	-	3.68	0.78	1.154	0.90	Valid	
R05-RC07	16.03		A	Perp	63	38	2394	3048.14	55.21	-	2.33	0.76	1.046	0.80	Valid	
R05-RC07	16.63		A	Perp	63	46	2898	3689.85	60.74	-	5.11	1.38	1.092	1.51	Valid	
_		_	_				_		_	_						

*Note All testing carried out on samples at as received water content

Par = parallel, Perp = perpendicular, U = Random

A = Axial, D = Diametral, I = Irregular





Bus Connect Route 5

Contract No:
PSL21/2671
Client Ref:
9754-07-20

SUMMARY OF POINT LOAD TEST RESULTS

ISRM Suggested Methods: 2007

Borehole Number	Depth (m)	Sample Ref	Test Type	Orientation	Dimei (m	nsions m)	D _e ²	$\mathbf{D}_{\mathbf{e}}$	Failur	e Load	I _s	Corr Fac	I_{s50}	Failure Type	Remarks
rumber	()	1401	1340	Par / Perp	L	D		(mm)	(Mpa)	(kN)	(MPa)	F	(MPa)	Турс	
R05-RC06	4.80		D	Par	1	63	3969	63.00	-	5.46	1.376	1.110	1.53	Valid	
R05-RC06	5.89		D	Par	1	63	3969	63.00	-	3.53	0.889	1.110	0.99	Valid	
R05-RC07	10.95		D	Par	1	63	3969	63.00	-	4.47	1.126	1.110	1.25	Valid	
	_										_				

All testing carried out on samples at as received water content

Par = parallel, Perp = perpendicular, U = Random



Professional Soils Laboratory

Bus Connect Route 5

Contract No: PSL21/2671 **Client Ref:** 9754-07-20

APPENDIX 5 – Groundwater Monitoring





Catherinestown House, Hazelhatch Road, Newcastle, Co. Dublin. D22 YD52

Tel: 01 601 5175 / 5176

Email: info@gii.ie Web: www.gii.ie

GROUNDWATER MONITORING

Bus Connects Stage 1 Lot 1 - Route 5

BOREHOLE	DATE	TIME	GROUNDWATER (m BGL)	Comments
R5-RC01	09/04/2021	16:10	5.69	
R5-CP04	09/04/2021	16:35	3.02	Possible water sitting at base of hole

Appendix E

Historical Ground Investigation Data

IRISH SOIL LABORATORIES LTD. BOREHOLE No. 40 CONTRACT BLAKESTORN SECTION "2A" Bored for DUBLIN GURPURATION Site Address BLANCHARDSTORN, DUBLIN Type and Dim MECHANICAL EXCAVATOR of Boring Completed 8.9.80 Water Seriess Water Levels Recorded During Boring 1. Causing Depth 2. Causing Depth 3. Water Level Description Scale Samples & S.P.T. Depth Legand Ref. No. Type Depth TOPSOIL Reddish brown silty CLAY 0.30 0.50 Stiff greyish brown stony BULDER CLAY with occasional angular cobbles and small boulders below 1.75m. Dense brownish grey sandy clayey GRAVEL 2.60 CONTRACT BLAKESTORN SECTION "2A" REPORT No. 5. 372/2 Report	107						
Bored for DUBLIN CORPORATION Site Address BLANCHARDSTOWN, DUBLIN Type and Dia of Boring Commenced 8.9.80 Type and Dia of Boring Completed 8.9.80 Water Strikess Water Levels Recorded During Boring 1. Hole Depth Casing Depth Water Level Casing Depth Water Level Description Description Scale Samples & S.P.T. Depth Legend Ref. No. Type Depth Casing Population Completed 8.0.50 Stiff greyish brown stony BOULDER CLAY with occasional angular cobbles and small boulders below 1.75m. Dense brownish grey sandy	IRISH SOIL LABORATORIES	LTD.	BORE	HOLE N	0. 4	0	
Site Address BLANCHARDSTOWN, DUBLIN Boring Commenced 7.9.80 8.0 80 8.0	CONTRACT BLAKESTOWN SECTION "	'2A"		RE	PORT N	o. s. 372/	2
Type and Dia. MECHANICAL EXCAVATOR Mater Strikes	ored for DUBLIN CORPORATION			Gr	ound Lev	el	
Water Strikes Hole Depth Casing Depth Casing Depth Water Levels Recorded During Boring	ite Address BLANCHARDSTONN, DUBL	LIN		Bo Bo	ring Comi	menced 7.9.	80 80
1. Hole Depth 2. Casing Depth 3. Water Level Description Scale Description Scale Depth Legend Ref. No. Type Depth Stiff greyish brown stony BOULDER CLAY with occasional angular cobbles and small boulders below 1.75m. Dense brownish grey sandy	ype and Dia. MECHANICAL EXCAVATOR of Boring	₹					
2. Casing Depth Water Level 3. Demarks Pit stable, no seepage Description Description Scale Depth Legend Ref. No. Type Depth Topsoil Reddish brown silty CLAY 0.30 0.50 Stiff greyish brown stony BOULDER CLAY with occasional angular cobbles and small boulders below 1.75m. Dense brownish grey sandy		Water Levels	Recorded Du	ring Boring			
3. Water Level Description Description Description Depth Topsoil Reddish brown silty CLAY Stiff greyish brown stony BOULDER CLAY with occasional angular cobbles and small boulders below 1.75m. Dense brownish grey sandy Dense brownish grey sandy	1. Hole Depth						
Description Description Depth Legend Ref. No. Type Depth Topsoil Reddish brown silty CLAY O.30 O.50 Stiff greyish brown stony BOULDER CLAY with occasional angular cobbles and small boulders below 1.75m. Dense brownish grey sandy					-		Í
Depth Legend Ref. No. Type Depth Topsoil Reddish brown silty CLAY Stiff greyish brown stony BOULDER CLAY with occasional angular cobbles and small boulders below 1.75m. Depth Legend Ref. No. Type Depth 2.00 Depth Legend Ref. No. Type Depth 2.00		e					<u> </u>
Depth Legend Ref. No. Type Depth Topsoil Reddish brown silty CLAY Stiff greyish brown stony BOULDER CLAY with occasional angular cobbles and small boulders below 1.75m. Dense brownish grey sandy	Description	Scale			San	nples & S.P.T.	
Reddish brown silty CLAY 0.30 0.50 Stiff greyish brown stony BOULDER CLAY with occasional angular cobbles and small boulders below 1.75m. 2.00 Dense brownish grey sandy		Depth	Legen	d Ref. No	. Type	Depth	2
	BOULDER CLAY with occasional angular cobbles and small boulders below 1.75m. Dense brownish grey sandy	2.00					

UVE AHUP & PARTNERS

INY 10 51 971

RECORD OF TRIAL PIT

102

R210

FB65 ACIX 108 NO DEED CO . MAGE BY DATE MADE

DAILY PEQURESS	OEPTH- IQ Water	SAMPLES OF CERTIFIE	·	(1) - WH	us.	יין אלר אנבייאינים	, they to stand
1, 4, 86		**	+ -		 6 0	61.24	And the second second
							Topeci se before
					1.50	60.95	Light omain firm Silty Clay
					0.70	60 54	
					1.00	60 24	Bown Sity clay with Fondy brown Veins and peaty veens FM coboles Firem
							Dark brown grey Siltly Clayey / Clayey Silt - NACOT F.M.C Combles Some yellow Sandy Veins
					145	59 19	Some yellow Sondy Veins
							Clayey stover with boulders and dark great Early veins V Field and mear homizortal beobling appearance and some which mixed thro:
					7:0U	503 24	
15.					<u>.</u>		Clayey blue grey Sandy growed bouble. (LST) V. Firm. some Undercusting from 17000.
							From Trees.
######################################					7.70.	58 44	,
				:			
					-		
							·
			111-				
			##	-			
							METHOD OF EXCAVATION

Veins : East west face > 130 @ IM. W L. @ 233PH. = 7.43PH

P.T 2.8.

350mm.

TRIAL PIT

RECORD OF TRIAL PIT

162

R210

Tare alse -CB 40 (() 6) (L2 440E 3Y BAFE MACE

PTH DEFENS	0 00 59 0 00 59 0 50 59	Taprami are texture. (4) Aght brown Clay with Fine Stone V Firm dark brown Clay with Very conductating and peoply verys Farm angular couples.
FRCM	0 00 59 0 00 59 0 90 90	14 Aght brown Clay with Fine Strone 14 Y Firm dark brown Clay with Very contain Editing and peoply Veins Form congular couples.
	0 00 59 0 40 59 0 90 59	14 Aght brown Clay with Fine Strone 14 V Firm dark brown Clay with Very contain Edition and peoply Veins Form congular conteins.
	0.40 50	U FIRM dark brown Clay with Very Small Enterty and peoply Verns Form angular couples.
	0.50 %	19 19ht brown Clay With Fine Strone V Firm dark brown Clay with Very Simon Entryly and penty Verns Farm langular College.
	0.50 %	V Firm dark brown class with they contain shirtly and peoply being Faill congular couples.
	0.50 %	V Firm dark brown class with very consultatively and peoply veins Form congular collect.
		y Firm dark brown class with very ennou shring and peoply veins form congular couples.
		V Firm dark brown class with very conson showing and peoply veins form congular collect.
	1 112 58	<u>\$4</u>
	1 10 58	<u>\$4</u>
	1 10 58	<u>\$4</u>
	1 10 58	<u>\$4</u>
	1 10 58	1
		1
		The work has a visited them Salty Class
		The Park Dicease and Living and Line
		F.M. C. Copples dark brown Saland
1 '		The boson very firm sity clay Fine company for South Example dark brook Example company thro' sampage all ordered
		I deep running thro' support all ordered
	型.3c 5/	14.
		the state of the s
		Vision income builder Chy
		- mar in
		· 1
	300 56	
		· ·
		, de la companya del companya de la companya del companya de la co
		•••
	\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \	and the second second
		MCTHOD OF EXCAVATION
		icter Completical of Pitak fam 13 22 5

No Vanes possible

1 Diamen

No water Collecting out B & Copin

FIRM TO dig and day.

Bridge Zeer x Slos.

TRIAL PIT

Greater Dublin Drainage Scheme

LAYERS FOR BOREHOLE 58814 (Company Name: 2B)

LAYER	TOP	BASE	STRENGTH	COLOUR	MINORLITH	MAJORLITH	INTERPRETATION
5881401	0	6.86				Boulder Clay	Boulder Clay
5881402	6.86	8.08		Black		Boulder Clay	Boulder Clay
5881403	8.08	9.91				Bedrock	Bedrock

Greater Dublin Drainage Scheme

LAYERS FOR BOREHOLE 58836 (Company Name: 1J)

LAYER	TOP	BASE	STRENGTH	COLOUR	MINORLITH	MAJORLITH	INTERPRETATION
5883601	0	1.22		Brown		Boulder Clay	Boulder Clay
5883602	1.22	2.9		Grey	Gravelly	Clay	Clay
5883603	2.9	4.72				Bedrock	Bedrock

North Eastern Gas Pipeline (NEP1)

LAYERS FOR BOREHOLE 61121 (Company Name: T7/365)

LAYER	TOP	BASE	STRENGTH	COLOUR	MINORLITH	MAJORLITH	INTERPRETATION
6112101	0	.3				Top Soil	Top Soil
6112102	.3	1.3	Soft to Firm	Orangish Brown	Silty	Clay	Clay
6112103	1.3	3.3	Loose	Grey Brown	Silty Sandy Gravelly	Clay	Clay

North Eastern Gas Pipeline (NEP1)

LAYERS FOR BOREHOLE 61166 (Company Name: B7/368)

LAYER	TOP	BASE	STRENGTH	COLOUR	MINORLITH	MAJORLITH	INTERPRETATION
6116601	0	.5				Top Soil	Top Soil
6116602	.5	1.6	Firm	Red Brown	Sandy	Clay	Clay
6116603	1.6	2	Firm	Grey	Gravelly	Clay	Clay
6116604	2	3.8		Grey	Gravelly	Clay	Clay
6116605	3.8	10				Bedrock	Bedrock

North Eastern Gas Pipeline (NEP1)

LAYERS FOR BOREHOLE 61167 (Company Name: B7/412)

LAYER	TOP	BASE	STRENGTH	COLOUR	MINORLITH	MAJORLITH	INTERPRETATION
6116701	0	.1				Top Soil	Top Soil
6116702	.1	2	Firm to Stiff		Silty Sandy Gravelly	Clay	Clay
6116703	2	4	Medium		Gravelly	Silt	Silt
			Dense				
6116704	4	5.15				Gravel And Cobbles	Gravel And Cobbles
6116705	0	10				Bedrock	Bedrock

BOREHOLE RECORD

CONTRACT Redevelopment at Benburb Street.

ROPETHOKE No.

R.742

Bored for J. McCullough & Partners.

Site Address Dublin.

Boring Commenced 31/5/85

Type of Boring J.C.B.

Ground Level -

O.D.

Water Struck (1) 2.40m BGL.

(2)

31/5/85

Diameter of Borehole

Boring Completed

mm.

61363

(3)

Standing Water Level -

Remarks All levels are related to ground level

	Meters				nples	Slight seepage at 2.40m BGL.
From	To	Thickness	Ref. No.		Depth	Description of Strata
0.00		0.10				
	0.10	0.10				Concrete.
0.10		2.30				Fill of grey brown sandy silt
	2.40					and some rubble.
2.40		1.10	31502	D	0.40	Very compact black sandy silt
	3.50		31302	ע	2.40	with large gravel and small boul- ders. (Possible Fill) (Rock breaker
3.50						needed to excavate).
						Final Level.
		·				
						1
						1.
1						
	1 : 1 1 : 1					1 1
<u> </u>						
	<u> </u>					
					·	
					,	
						1 1
			<u> </u>			

BOREHOLE RECORD

CONTRACT Redevelopment at Benburb Street.

ROBERIORE No.

31/5/85

Bored for J. McCullough & Partners.

Site Address Dublin.

Boring Commenced 31/5/85 **Boring Completed**

Type of Boring J.C.B. Diameter of Borehole

mm.

Ground Level -

O.D.

(3)

Water Struck (1) 2.40m BGL.

Standing Water Level 3.85m BGL after 2 hours.

Remarks All levels are related to ground level.

	Depth in	Meters			Sar	nples		
	From	То	Thickness	Rel. No.	Туре		Description of Strata	
,	0.00	1.70	1,70				Grey brown sandy silt and rubble.	·
	1.70	1.85	0.15				Concrete.	
	1.85	2.55	0.70				Rubble fill.	1
	2.55	3.20	0.65				Very compact grey sandy silt with coarse gravel (Possible Fill (Rock breaker needed to excavate)	1
·	3.20	4.00	0.80	31501	D	3.20	Fine to coarse sandy silty gravel with boulders.	
	4.00						Final Level.	
1								
								1
					-			7
								1
								1

BOREHOLE RECORD

CONTRACT Redevelopment at Benburb Street.

BOREHOVENO.

Bored for J. McCullough & Partners.

Site Address Dublin.

61364

Boring Commenced 31/5/85

Boring Completed 31/5/85

Type of Boring J.C.B.

Diameter of Borehole

mm.

Ground Level

O.D.

Water Struck (1) Nil.

(2)

(3)

Standing Water Level -

Remarks All levels are related to ground level.

Depth in	Meters			_	mples	
From	То	Thickness	Ref. No.	_		Description of Strata
0.00		2,00			-	Fill of man house
	2.00					Fill of grey brown sandy silt and rubble.
2.00		1.20				Very compact sandy silt with
	3.20					large gravel. (Possible Fill). (Rock breaker needed to excavate)
3.20						
						Final Level.
						·
						1 1
						1.
)						
				Ŀ		
<u> </u>			<u> </u>	<u> </u>	<u> </u>	

BOREHOLE RECORD

CONTRACT Redevelopment at Benburb Street.

KONKERCIKE NO. T.P. A K/42

Bored for J. McCullough & Partners.

Site Address Dublin.

61361

Boring Commenced 3/5/85

Type of Boring J.C.B.

0 17 1

Diameter of Borehole -

Boring Completed 31/5/85

mm.

Ground Level -

O.Ď.

Water Struck (1) Nil.

(2)

(3)

Standing Water Level -

Remarks All levels are related to ground level. Concrete block wall on North and South sides of Pit.

1		52408	of Pit.				el.Concrete block wall on North and South
		Meters	Thickness			mples	Davis at 2
į	From	To		Ref. No.	Туре	Depth	Description of Strata
	0.00		1.70				Fill of grey brown sandy silt
		1.70					and rubble.
	1.70		0.15				
		1.85					Concrete.
	1.85		0.70				
		2.55	0.70				Rubble fill.
	2.55						Very compact grey sandy silt with
		3.20	0.65				coarse gravel (Possible Fill). (Rock breaker needed to excavate)
	3.20						Medium dense brown very silty
		4.00	0.80				gravelly sand with boulders.
	4.00						
							Final Level.
('	' '						
1							
		11 : 1 :					·
	· · · · · · · · · · · · · · · · · · ·						
	· · · · · · · · · · · · · · · · · · ·						

BOREHOLE RECORD

R742

CONTRACT Redevelopment at Benburb Street.

BOREHOLDNo. T.P. 1A.

Bored for J.McCullough & Partners.

61358

Site Address Dublin.

Boring Commenced 27/5/85

Boring Completed 27/5/85

Type of Boring J.C.B.

Diameter of Borehole -

mm.

Ground Level -

O.D.

Water Struck (1) 2.40m BGL.

(2)

(3)

Standing Water Level 3.30m BGL.

Remarks All levels are related to ground level. Concrete broken out out with Rock Breaker.

		Meters			nples	.Concrete broken out out with Rock Breake
	From	То	Thickness	Rel. No.	 Depth	Description of Strata
	0.00	1.90	1,90			Fill of loose brown sandy clay with red brick etc.
	1.90	2.75	0.85			Concrete.
	2.75	2.90	0.15			Firm grey silt.
	2.90	4.30	1.40			Fine to coarse silty gravel with cobbles and boulders.
	4.30					Final Level.
)						

BOREHOLE RECORD

R742

CONTRACT Redevelopment at Benburb Street.

BOREHOLE No. T.P. 3A.

Bored for J.McCullough & Partners.

Site Address Dublin.

61360

Boring Commenced 27/5/85

Boring Completed 27/5/85

Type of Boring J.C.B.

Diameter of Borehole -

mm.

Ground Level

O.D.

Water Struck (1) -

(2)

(3)

Standing Water Level

3.20m BGL.

Remarks All levels are related to ground level. Concrete broken out with Rock Breaker.

Depth in Meters			Sar	mples	
From To	Thickness	Ref. No.	Туре		Description of Strata
0.00					Fill of loose brown sandy clay with red brick.
1.50					Concrete slab.
1.80					Fill of brown sandy clay, red brick etc.
3.00					Fine to coarse silty gravel with large boulders.
3.30 4.40	7				Final Level.
4.40				·	
				·	·

	•				

BOREHOLE RECORD

R742

CONTRACT Redevelopment at Benburb Street.

BOREHOLENO. T.P. 2A.

Bored for J. McCullough & Partners.

Site Address Dublin.

61359

Boring Commenced 27/5/85

Tune of Rosins, J. C. R.

Boring Completed 27/5/85

Type of Boring J.C.B.

Diameter of Borehole

mm.

Ground Level -

O.D.

Water Struck (1) 3.50m BGL.

(2)

(3)

Standing Water Level -

Remarks All levels are related to ground level. Concrete broken out with Rock Breaker.

Depth is	Meters		1		nples	Concrete broken out with Rock Breaker.
From	То	Thickness	Ref. No.	Туре		Description of Strata
0.00	1.88					Fill of loose brown sandy clay with red brick etc.
1.88	2.10					Concrete slab.
2.10	3.10	1.00				Fill of loose brown sandy clay red brick etc.
3.10	3.50	0.40				Cobbles with hard grey silt. (Rock breaker needed).
3.50	4.50	1.00				Silty sand.
4.50	5.00	0.50				Presumed silty sand.
5.00						Presumed hard material. Final Level.

BOREHOLE RECORD

BOSTHARN

CONTRACT Street. Queen

Bored for

J. McCullough & Partners.

24 / 2 / 84

Site Address

Dublin.

Boring Commenced

Boring Completed

61379

J.C.B.

24 / 2 / 84.

Type of Boring

Diameter of Borehole _ mm.

Ground Level

Water Struck (1)

Nil.

Standing Water Level

Nil.

Remarks

All levels are related to ground level.

			•		o ground leve	·
	Depth in Meters	Thickness		. — .	nples	Description of Strata
	From To	i i	Rei. No.	Туре	Depth	
Ì	0.00 2.65	2.65				Loose fill of rubble, brick, stone, etc.
		1		-		l etc.
	2.65					Fine to coarse sandy gravel.
		-	 	-		 - - - - - - - -
		1				
			<u> </u>		·	
		<u> </u>				
		.				
						·
			 	-		
•						
		-	₩ -	+		1
		1				
				1		
		<u> </u>	<u> </u>	1_		
						,
			1	1	 	
				1_		
			1	1		

BOREHOLE RECORD

FNEST GATION

CONTRACT

Queen Street.

BOREHOLE No.

Bored for

J. McCullough & Partners.

23 / 2 / 84

ID 61375

Site Address

Dublin.

Boring Completed

27 / 2 / 84

Type of Boring Shell & Auger.

Boring Commenced

Diameter of Borehole 200 mm.

Ground Level

Water Struck (1)

5.50 m BGL.

Standing Water Level

5.50 m BGL.

Remarks

All levels are related to ground level. Chiselling $5\frac{3}{4}$ hours.

				to ground to	
Depth in Meters	Thickness			ples	Description of Shade
From To	1 mcruess	Ref. No.	Туре	Depth	Description of Strata
0.00 0.15	0.15				Concrete slab. (Chiselling } hour).
0.15	2.50	33191	D	1.00	Very loose fill of rubble, brick, ash, silty clay etc.
2.65		33192	D	2.00	
2.65	0.20	33193	D	2.60	Medium dense fine to coarse silty sandy gravel.
2.85 3.25	0.40	33194	D	3.00	Medium dense fine to coarse sandy gravel.
3.25	2.25	33195 33196	D D	4.50 5.00	Dense fine to coarse gravel with cobbles and boulders. (Chiselling 3 hours),
5.50	0.35	33197		5.50	Dense brown coarse sand.
	 	33199	W	5.50	Daniel Marie Assessment 1
5,85	0.65	33198	D	6.00	Dense fine to coarse gravel with cobbles and boulders. (Chiselling 2 hours)
6.50					Final Level. Standard Penatration Tests:
					At 1.15 3 blows to 12" At 2.00 2 blows to 17"
					At 3.15 112 blows to 12" At 4.65 62 blows to 12". At 6.20 620 blows to 12"
			-		
			-		

BOREHOLE RECORD Pit 2.

R745

CONTRACT

Bored for

Queen Street.

J. McCullough & Partners.

613+7

Site Address

Dublin.

Boring Commenced 24 / 2 / 84

Boring Completed 24 / 2 / 84.

Type of Boring J.C.B.

Diameter of Borehole - mm.

Ground Level -

Water Struck (1)

Nil.

Standing Water Level Nil.

All levels are related to ground level.

ľ	Depth in	Meters		1	Sar	nples		_
Ì	From	To	Thickness	Ref. No.	Type		Description of Strata	
	0.00						Loose fill of rubble, brick, stones	٦
		2.10	2.10				etc.	
	2.10						Fine to coarse silty sandy gravel.	
		3,15	1.05			· · · · · · · · · · · · · · · · · · ·	The to course birty bandy graver.	
-	3.15						Fine to coarse sandy gravel.	
		*		·				
1								Ì
								ı
1								٦
١								I
								1
								1
					j			ı
								1
								ı
				_				1
١					l			
								1
								ı
								1
								į
								1
]				1
								_]
								1
						CD		-4

R838 61972

Report No.	145	2	В	ORIN	G RECC	RD						IG	SL
Contract ²	E	LLIS Q	UAY DEV	/ELOF					i	Boreho Sheet	le No.	1	
Location	EL	LIS QU	AY,DUBI		<u>`</u>			1	nd Diame		200		
Client .					•	_		l	le To	01 2			
	LAR	K HOME:	S					Data		an –	15.2	90	
				-		þ	Τ		11	Sample		Field Re	
	Desc	ription			Reduced Level	Legend	ו	Depth	Ref. No.	Type	Depth	And Test	
Concr	ete fl	oors			1		0	.75					N
FILL	: Bric	k rubb	ole,sto	nes		\rangle	1	•,3	5731	D	1.50	(1,5)	34
		er etc				X						(- , - ,	3.
		•				$\langle \rangle \rangle$	Ē						
								.20	5733	D	3.20	(3.1)	1
	t dark	grey	organi	c _		# X	<u>, </u>	.00	·				
SILT Firm	brown	grey S	SILT			* * * ×	4	.70	5734 5732		5.00	(4.5)	17
Mediu			o dens			0.							
fine	to coa	rse sa	indy GR	AVEL					5735	D	6.00	(6.0)	24
						o .	ليبنيا						
						0,						(7.5)	27
							<u>=</u> .		5736	D	8.00		
						. 2	=			•		(9.0)	21
Compa					_ 1			.30	5737	D	9.50	•	
	boulde		oarse	grav	eī	o, , ,	<u>-</u>						
						00	<u>-</u>					(11.0)	60
							=		5738	D	12.00		
						00	<u></u>				(12.5)	58
						رن	·.		5739	W	Water		
							 E		5740	D	14.00	14.0)	69
						0	- -	j	3,10		11.00	14.07	
						<i>(</i> ,	<u>-</u>		 - -				
						'O		6.00	5741	D.	16.00(16 (1)	53
			h thin			0,0 0,0 0,0,0			5742		16.50	⊥ ∪ • ₩ /	ررر
			own si				•	marks					
Date	Hole Depth	Casing Depth	Depth to Water	F	Remarks		E	Breaki	ng out	cond	crete &	boring	in
13.2.90	4.70	4.70	4.70	Wate	r note	đ			fill = ling bo			12.50 =	l½hr:
							L		est key				
							U-	Tube S	est key ample ed Sampl	۵	N-Blow	Penetrations/0.3 metre	n lest. es
								Water S			R-Refu V-Vane		

R838

BORING RECORD—Continuation

Report No	.			ROBINI	G RECC	IRD	-Continu		58	· ,		
1452 Contract									-	<u>l</u>		
Contract	ELLIS Q	OUAY DEVI	ELOPEMEN	T 					Boreho Sheet	ole No. [*]	1	
				-		egend	T		Sample	es	Field R	ecords
		cription			Reduced Level	Lege	Depth	Ref. No.	Тур	Depth	And Te	· · · · · · · · · · · · · · · · · · ·
Compa with	ct fine boulders	to coars	se GRAVE	L		000	17.00	5743	D	18.00	(17.5)	30/15
Hard B	lack sil	ty CLAV	with fr	amont	c	00	19.50				(19.5)	40/75
of gr	ey LIMES	TONE	widi ii	agmerru	. 5	x 0		5744	D	20.00		
	ack lime		agments			Q _Q	21.50	11			(21.5)	Refus
* Blow	wing in s	sand and 9.00	gravels	5		-						
	Matarita	1.05					<u>-</u>					
Date	Hole	Casing	ons during E Depth to Water		emarks		Remarks Chisel	lina t	Erom 1	9.50-2	21.50 =1	khre
15.2.90	Depth 22.00	Depth 21.00 Nil	Water 5.50 3,00	End o	f bori level	-					00 = 2 h	
				1 2	TOAGT							

					K	(\&).	38			
Report No.	BORIN	G REC	·RD					IG	SL	
Contract * ELLI	S QUAY DEVELOR	PEMENT				Boreho Sheet	ole No.	3		
Location ELLIS	QUAY, DUBLIN	•		1	nd Diam		200	_		
Client		•		Ground Level						
LARK H	IOMES			Date		1.2.9	00 - 1	9.2.90		
Description	on	Reduced Level	Legend	Depth	Ref. No.			Field Rec		
FILL: Brick, concrete, glass	boulders,timbe s,gravel &	,	X			1			N	
			X		3848	D	3.50	(2.0)	23	
				- -	3546		3.30	(4.0)	2	
Soft grey blac silt with bone			X U X	4.50	3849	D	5.00	(5.0)	2 .	
	m sandy GRAVEL		√ = 0 = 1 = 1 = 1 = 1 = 1 = 1 = 1 = 1 = 1	5.50 -				(6.0)	10	
			0 1	7.00	3850		6.50	(7.0)	16	
Fine to coarse a little sand & boulders			.00		3851	D	7.50	(8.0)	32	
	ncentration fr	om		-	3852	D	9.00	(9.0)	45	
9.00 - 10.5				-	3853	D	10.50	(10.5)	61	
·				-	3854	D	12.00	(12.0)	58	
			∫. [=		3855	D	13.50	(13.5)	32/15	
					3856	D	15.00	(15.0)	48	
Fragments of c	grey limestone		٧ ۵ 🗐	16.50 17.00	3857	D	16.50	(16.5)	R	
										
Date Hole Depth Ca Depth 4.2.90 3.50 3	epth Water	Remarks er not		Chise	ellin	g in	bould	= 2½ hi ders = 4 stone =	4 hrs	
17.00 N	Jil 3.00 Fina	al lev		Sample/T J-Tube Sa J-Disturb V-Water S G-Standard	a <mark>mple</mark> ed Samp Sample		N-Blow R-Refu V-Vane			

	_				R	(8)	38		*	1
Report No. 1452	BORIN	G RECO	RD						SL	,
Contract É	IS QUAY DEVELOR	PEMENT				Boreho Sheet 1	le No.	4		
Location ELLI	S QUAY, DUBLIN	•	``	1 ''	nd Diam					1
Client				Ground		001 2	200mm			
LARK	HOMES			Date	20.2	2.90	- 22.2	2.90		1
Descript	ion	Reduced Level	Legend	Depth	Ref.	Sample:	Depth	Field R And Te		1
FILL: Demoli brick, boulder tin, steel etc	s,wood,glass,		X Institution					1.5)	<u>N</u> 7	-
Grey black or			* *	3.00	3858	D	3.50	3.0)	2	
Fine to mediu	am sandy GRAVEL		X X	4.50	3859	D	4.50	4.0) 5.0)	3	
with some thi sandy silt	e GRAVEL with:		3	6.00	3860	D	6.00(6.0)	17	
some coarse s cobbles & bou	and and occ.		ا المالية		3861	D	7.50	7.0) 8.0)	28	
** (Some blow - 9.00)	ring from 7.00				3862	D	9.00		48	
			0.		3863	D	10.50	10.5)	49	
					3864	D	12.00	12.0)	57	
					3365	D	13.50	13.5)	49	
					3866		15.00(15.0)	64	
Water Level Oh	servations during Boring			7.00 emarks	3867	D	16.50(16.5)	58	
Date Hole Depth De	asing Depth to Water 4.00 4.00 Wate 9.50 4.50	Remarks er no	ted	Cnise Chise Chise	lling	gin	fill = boulde 19.50	ers& g	grave	1= :
20.00	Nil 3 75 Fin	al le	D W	ample/Te -Tube Sa -Disturbe -Water Sa Standard	mple ed Samp ample		N-Blows R-Refus V-Vane	Penetrations/0.3 met al	on Test res	

Report No.		BORIN	IG RECO	RD-		ation				 _
Contract	ELLIS QU	AY , DEVELO	PEMENT	<u> </u>		1	Boreho Sheet	le No.	4	_
	Description		Reduced Level	Legend	Depth	Ref. No.	Sample	1	Field Reco	rds
Fine to		RAVEL with			17.00	11	D	18.00	(18,00)	6
Coarse g	RAVEL wit broken li	h fragments mestone	-	000	19.50 20.00	3869 3870	D W _	19.50 Water	(19.5)	R
	·									
						-				
		ions during Boring			Remarks					
Date H	ole Casing epth Depth	Depth to Water	Remarks		from	G.L.	to	20.00n	stalled 1 0 - 4.00	

D020

								K838						
Report No.	145	2	В	ORING RECO	RD					IG	SL			
Contract	E	LLIS Q	UAY DEV	/ELOPEMENT	1			Boreho Sheet	le No. v	5				
Location	EL	LIS OU	AY, DUBI		Type and Diameter Cable Tool 200mm									
Client .		_	Ground		4									
	LAR	K HOME	S			Date		90		23.2.9	0	-		
					pu			Sample	<u> </u>	Field Records	cords	=		
_	Desc	ription		Reduced Level	Legend	Depth	Ref. No.	Type	Depth	1				
FILL:	Brick,	clay ,st	cones		X	-					N			
				3				<u> </u>		(1.5)	22			
						<u>-</u>	5757	D	2.00					
					$\langle \rangle$	2.90								
BOULDE	ERS				0	3.50								
Fine	to coa	rse ve	ry sand	dy	00	<u>-</u>	5758	D	4.00	(4.0)	28			
GRAVE	EL				0.	=======================================				-				
					00	- - - -					20			
					٠٠٠)	6.10	5759	D	6.00	(6.0)	32			
					ŀÚ.	= = =	5760	D	7.00	(7.5)	49			
Coarse	e gravel	s with b	∞ulders		() 0	= = = =				(,,3)	13			
and s	some co	arse s	and											
	•);(<u>-</u>	5761	D	9.00	(9.0)	41			
					• • •	10.50				(10.5)	45			
						- 10.30 	5762	Ü	Water					
						<u>-</u> -					j			
						-						 		
							į			•				
				ļ		=								
					j									
	Water Leve	Observation	ons during E			Remarks								
Date	Hole Depth	Casing Depth	Depth to Water	Remarks	_	Chise	lling	8.00	- 10.0	00 = 1½hr	rs			
						Chise	elling	in	Fill	& conc	rete	= 3hrs		
						Sample/T U-Tube S D-Disturb	ample ed Samp	le	N-Blov R-Refu					
								W-Water Sample V-Vane S-Standard Penetration Test						

Report No.	ВО	RING REC	ORD		_			IG	SL		
Contract ² ELLI	S QUAY DEVE	ELOPEMEN	r		1	Borehole No. 2 Sheet					
ocation ELLIS	QUAY, DUBLI				nd Diam						
Client .			_		ole To	ool 2	200mm		· .		
LARK H	OMES			Date	16.2.	90	 2	20:2.90			
				<u> </u>	17	Sample		T			
Descriptio	n 	Reduced Level	Legend	Depth	Ref.		Depth	Field Re			
FILL: Heavy depo	osits of bric ,stones & cla	* 1		1.80	5745	D	1.60	(1.5)	N R		
FILL : Brick,glas	ss,black ston	У		-							
CLAI				-	5746	D	3.00	(3.0)	R		
				4.70	5748	D	4.00				
Fine to coarse gr		me	0	4.70	5749	D	5.00	(5.0)	35		
boulders Some blowing f			Co o o o		5750	D	7.00	(6.5)	26		
12.00								(8.0)	31		
			0		5/51	D	9,00	(10.0)	43		
				13.00	5752	D	12.00	(12.0)	33		
Compact coarse gr & boulders	ravel with cok	obles	0000	13.00	5753	D I	.5.00	(14.0)	47		
Coarse sand with	boulders		0	16.00				(16.0)	29		
Fragments of lime	stone		17 / / / / /	17.00 17.50				(17.5)	R		
	rvations during Bor	ing	<u> </u>	emarks							
Date Hole Depth Cas Depth 6.2.90 4.70 4.20.2.90 20.2.90 17.50 Ni	70 4.70 50 5.50	Remarks Water no Final le	vel s	Chise Chise Insta ample/Te	lling lling lled	oou at	lders 17.00 m PVC	fill = 2½ 1 = 2 hi pipe = ePenetratio	nrs rs in ho		
			D W	I-Tube Sa I-Disturbe I-Water S	mple ed Sampl		N-Blov R-Refu V-Van	vs/0.3 metro usal			

REP	ORT	NO.						GE	OTECHNIC	AL C	OF	RE LOC	REC	CORD	I.G.S.
	RACT:			y Terr	race						-			DRILLHOLE NO.:	RC1
CLIEN	т.	Luce	Light	Rail	Syste				OPENHOLE DRI	LING:		76mm /	ODEX	SHEET: DATE STARTED:	2 of 2 27.7.00
JLIEN	1.	Luas	Ligiti	TICH	Cyolo	2111			GROUND LEVE			,		DATE COMPLETED	
OCA"	TION:	Arrar	Qua	y Terr	race,	Dublir	n	INCLINATION: Vertical						DRILLED BY:	IGSL
				_					FLUSH:		1	Water	Г.	LOGGED BY:	IGSL
₽						ractur cing (}		Pa			1	}	
DOWNHOLE DEPTH (m)	CORE RUN DEPTH (m)			ļ	Spa	iong (,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,]		POINT LOAD IS(50) MPa		6		}	
FP	P			}						18(5	0	ĕ	1		
H D	ğ							DISCONTI	NUMES	PA PA	SYMBOLICLOG	ELEVATION (mOD)	2	GEOTECHNICAL	DESCRIPTION
호	Ž	№	%	8		0	00			2	F) E	DEРТН (m)		
× ×	끮	T.C.R.%	S.C.R.%	R.Q.D.%	0	-250	500			N N	MB	EV.	PT		
8	<u>8</u>	j.	SC	Ä.						<u>a</u>	Š	_ ==	ă		
10									-						12
														Overburden - Retur	
					1									gravel material (fr sub rouned and sul	
1								SPT @ 11.00 N =	49 (7, 9, 10, 9,	1 11, 1	9)			and boulder size m	
					1										
- 1									, i						
2								SPT @ 12.00 N =	Ref (25,30)						
					1										
					1						-	_			
3								SPT @ 13.00 N =	: 54 for 225mm ((10, 9	,10, I I	19,25 R)		
.					1				:						
14								SPT @ 14.00 N =	70 (5.9.11.12.2	4.23)			14.00		
									1					Drillhole Terminated	1
								¥							
5	1				1										
									-						
}					}										
6]					1]			
В															
										1					
7												}	ĺ		
												-	ļ		
										1					
					}		Ì]	}		
8										1					
							į		1	Ì		l			
									-		1		-		
							į		į	1		1			
19									,	}	- 1		1		
.			}							1	1	j	1		
							Ì		}		-		1		
20															
REMAR	RKS:							e with BS 5930 exc		of sol	id co	re	~~~	KEY TO SYMBOLI	CLOG
								fined by Norbury et	al 1986					MADE GROUND	
			4	roint	Load	Test	Sam	ple						OVERBURDEN LIMESTONE	

REI	PORT	NO.				-		GE	OTEC	HNIC	AL C	OR	ELOC	REC	ORD	I.G.S.L
CON	TRACT:	Arrar	Qua	y Terr	ace	-									DRILLHOLE NO.: SHEET:	RC2
CLIE				Rail					OPENH GROUN INCLINA	D LEVE			76mm /	ODEX	DATE STARTED: DATE COMPLETED DRILLED BY:	1 of 2 25.7.00 : 26.7.00
LOCA	ATION:	Arrar	ı Qua	y rem					FLUSH:	TIOIV.			Water		LOGGED BY:	IGSL IGSL
DOWNHOLE DEPTH (m)	CORE RUN DEPTH (m)	T.C.R.%	S.C.R.%	R.Q.D.%	7230	racturing (DISCONTI	NUMES		POINT LOAD Is(50) MPa	SYMBOLICLOG	ELEVATION (mOD)	DEPTH (m)	GEOTECHNICAI	_DESCRIPTION
0														0.40	MADE GROUND (some imported s	tone and tar)
- -1 -															MADE GROUND (Brick, clay, grave	
- -2 -																
- -3 -																
- - -	_													3.90	Overburden - Retur	no of goods and
-4 - - - -5 -								SPT @ 4.50m N =	30 (4, 5	5, 5, 5,	6, 14)				gravel material (fr sub rouned and sul and boulder size m	agments of angular cobble
- -6 -				2				SPT @ 6.00m N =	36 (4, 4	1, 7, 8,	11, 11)				
-7 - - - - -								SPT @ 6.50m N =	44 (5, 6	5, 5, 12	, 10, 1	7)				
-9								SPT @ 9.00m N ⇒	52 (8, 9	9, 7, 12	, 20, 1	6)			4.	
- -10																
REMA	ARKS:		which		ken a	as tha	at def	e with BS 5930 exc fined by Norbury et aple		etinition	of sol	d co	re		KEY TO SYMBOL MADE GROUND OVERBURDEN LIMESTONE	IC LOG

DE# =			CECTEC	LINII	CALE	ODIN	CPECO		1	100	
	RTNO.		GEOTEC	-UNI	CAL E	OKIN	G HECC		LENC:	I.G.S	
CONTI	RACT:	Proposed I	Liffey Brdge					BOREHO SHEET:	LE NO.:	4 (N) 1 of	
CLIEN	π.	Dublin Con	poration	1				DATE ST	ARTED:	26.6	
	.ENG:		O'Donovan	ВО	REHOLE	E DIAM.(i	mm) 200		MPLETED:	27.6	
OCAT			(Blackhall Place), Dublin	_	REHOLE	-	11.40	BORED B	I.G.S.		
				CAS	SING DE	PTH (m)	11.40	LOGGED	BY:	I.G.S.	L
E								SAMPLE	<u> </u>	╛.	•
=					6		REFERENCE NUMBER		Α		<u>"</u>
声				6	ELEVATION (mOD)		1		E E	į į	i N
4			DESCRIPTION	19	Z		N N	<u> </u>	À	Ĭ	Ĩ
2				일	은	E	2		Ä	Į b	ß
DOWNHOLE DEPTH				8	≸	DEPTH (m)	F	SAMPLETYPE	F		7
3				SYMBOLICEG		DEF	臣	₹	DEPTH RECOVERED		TIELL LESS RESOLIS
_					3.4	9	 		 		
T	armacada	<u>m</u>			3.30	0.10				Dept	h
М	ADE GRO	OUND (Con	nprised of imported stone)								
		A PARTICION									
										1	
								1		1	
							2443	D	1.50	1.50	
					1.60	1.80			1.50	50	
				\Box							
			prised of red brick, silt, gravel								
្រា	mper, pott	ery, rope, g	lass and cobbles)						1		
				1 1							
							2444	D	3.00	3.00	
						1					
							1				
							-				
1											
							0445		4.50	1.50	_
							2445	D	4.50	4.50	1
					•			1			
							2446	D	6.00	6.00	7
						1 1					
			<u> </u>		-7400	7.40					
_							2447	D	7.50	7.50	4
			predominantly coarse) sandy cobbles and boulders								
Ĭ,	U-14-C- 1411	ii nequein c	obbies and bodiders								
							2448	D	9.00	9.00	60
nari	ks.			1 1		1			ns during bo		00
						DATE	HOLE	CASING	DEPTH TO		RS
n-41*	ina				ì		DEPTH	DEPTH	WATER		
selli		rom 0 - 15	0 for 3.25hrs			27.6	3.20	3 20	2 20	60000	no.
			2.30 for 1hr			21.0	3.20	3.20 3.20	3.20 3.00	seepa 20 mi	
			3.70 for 1.5hrs				7.50	7.50	7.50	strik	
	• `	2			ł		7.50	7.50	3.90	20 mi	17
			TEST KEY: U-U100, Db-Disturbed	i Same	do e er	T 10/ 10/			3.50	1111	

R2161 81466

		т			_				
REPORTNO.		<u> </u>	CHNI	CAL B	ORIN	G RECO			I.G.S.L.
CONTRACT:	Proposed	Liffey Brdge					BOREHO SHEET:	LENO.:	4 (N) Lan 2 of 2
CLIENT: CONS. ENG: .OCATION:		poration O'Donovan (Blackhall Place), Dublin		REHOLE		nm) 200 11.40	DATEST	MPLETED:	26.6.99 27.6.99 I.G.S.L
.00411014.	niver Liney			SING DE		11.40	LOGGED	BY:	I.G.S.L
TH (III)				a a		E	SAMPLES	T	JLTS
DOWNHOLE DEPTH (m)		DESCRIPTION	SYMBOLICLOG	ELEVATION (mOD)	DEРТН (m)	REFERENCE NUMBER	SAMPLETYPE	DEPTH RECOVERED	FIELD TEST RESULTS
				ᇳ	ä	<u> </u>	8		
		(predominantly coarse) sandy cobbles and boulders							Depth N
0						2449	D	10.00	
				٠,					10.50 60 for225mn then ref
1				_g.00	11.40	2450	D	11.40	.,
Refusal 2									
3									
		•							
marks.					DATE	Water level	observation CASING	ns during bo	
iselling	From 11.00	- 11,40 for 2hrs			27.6	DEPTH 11.40	DEPTH_	WATER 3.20	Bh End
					7				
	FIELD	TEST KEY: U-U100, Db-Disturb	ed Samp	ole, S-SP	T, W-Wa	iter Sample,	R-Refusal.		·

Development

LAYERS FOR BOREHOLE 116225 (Company Name: 1)

LAYER	TOP	BASE	STRENGTH	COLOUR	MINORLITH	MAJORLITH	INTERPRETATION
1162250	0	2.7				Fill - Made Ground	Fill - Made Ground
1							
1162250	2.7	3.6	Firm	Brown	Very Sandy, Very	Silt	Silt
2					Gravelly		
1162250	3.6	8.8		Brown	Silty Sandy	Gravel	Gravel
3							

Development

LAYERS FOR BOREHOLE 116226 (Company Name: 2)

LAYER	TOP	BASE	STRENGTH	COLOUR	MINORLITH	MAJORLITH	INTERPRETATION
1162260	0	2.2				Fill - Made Ground	Fill - Made Ground
1							
1162260	2.2	3.8	Stiff	Brown	Silty Gravelly	Clay	Clay
2						-	
1162260	3.8	5.5	Dense	Brown	Clayey	Gravel	Gravel
3							
1162260	5.5	12	Dense	Brown	Slightly silty sandy	Gravel	Gravel
4							

Law Society Premises

LAYERS FOR BOREHOLE 117742 (Company Name: 1)

LAYER	TOP	BASE	STRENGTH	COLOUR	MINORLITH	MAJORLITH	INTERPRETATION
1177420	0	.2				Fill - Made Ground	Fill - Made Ground
1							
1177420	.2	2.3				Fill - Made Ground	Fill - Made Ground
2							
1177420	2.3	9.7			Fine to Coarse	Gravel	Gravel
3					Sandy		

Law Society Premises

LAYERS FOR BOREHOLE 117743 (Company Name: 2)

LAYER	TOP	BASE	STRENGTH	COLOUR	MINORLITH	MAJORLITH	INTERPRETATION
1177430	0	.2				Fill - Made Ground	Fill - Made Ground
1							
1177430	.2	2.9				Fill - Made Ground	Fill - Made Ground
2							
1177430	2.9	9.1			Fine to Coarse	Gravel	Gravel
3					Sandy		

Law Society Premises

LAYERS FOR BOREHOLE 117744 (Company Name: 3)

LAYER	TOP	BASE	STRENGTH	COLOUR	MINORLITH	MAJORLITH	INTERPRETATION
1177440	0	.2				Fill - Made Ground	Fill - Made Ground
1							
1177440	.2	1.7				Fill - Made Ground	Fill - Made Ground
2							
1177440	1.7	2.1	Dense	Brown	Sandy Clayey	Gravel	Gravel
3							
1177440	2.1	8.7			Fine to Coarse	Gravel	Gravel
4							

Law Society Premises

LAYERS FOR BOREHOLE 117745 (Company Name: 4)

LAYER	TOP	BASE	STRENGTH	COLOUR	MINORLITH	MAJORLITH	INTERPRETATION
1177450	0	.2				Fill - Made Ground	Fill - Made Ground
1							
1177450	.2	1.6				Fill - Made Ground	Fill - Made Ground
2							
1177450	1.6	2	Dense	Brown Grey	Very Clayey Sandy	Gravel	Gravel
3							
1177450	2	9			Fine to Coarse	Gravel	Gravel
4					Sandy		

CEPL	ORT NO. GEOTECH	INIC	AL BO	ORING	RECO	RD	1.	G.S.L.
	TRACT: Proposed Residential Development					BOREHOLE SHEET:		1 1 of 1
.OC/	NT: Dublin Corporation S. ENG: Thorburn Colquhoun ATION: Queen Street, Dublin	BOR	EHOLE D EHOLE D ING DEPT	EPTH	7.20 7.20	DATE STAF DATE COM BORED BY: LOGGED BY SAMPLES	PLETED:	4.6.99 4.6.99 I.G.S.L.
DOWNHOLE DEPTH (m)	DESCRIPTION	SYMBOLIC LOG	ELEVATION (mOD)	ОЕРТН (m)	REFERENCE NUMBER	SAMPLE TYPE	DEPTH RECOVERED	FIELD TEST RESULTS
)	Tarmacadam / Imported Stone			0.30				Depth
1	MADE GROUND (Comprised of red brick, clay, gravel ash, clinkers and some cobbles)				1004	D	1.00	1.00
2				2.00	1005	D	2.00	2.00
3	Dense fine to coarse slightly silty sandy GRAVEL with frequent cobbles and boulders				1006	D	3.00	3.00
1			1	4.10	1007	D	4.00	4.00
	Very stiff brown silty gravelly CLAY with some cobbles			4.50	1008	D	4.30	
5	Hard black slightly silty gravelly CLAY with frequent cobbles and boulders				1009	D	5.50	5.00
ŝ								6.00
7				7.20	1010	D	6.50	7.00 f
3	Refusal							
len	l narks.	1			Water leve		ns during be	
	Move rig on and off site each shift.			DATE	HOLE DEPTH	CASING DEPTH	DEPTH TO WATER	
Chi	From 0.20 - 0.90 for 1.5hrs From 3.40 - 3.50 for 1hr From 4.40 - 4.60 for 0.75hrs From 7.00 - 7.20 for 2hrs			8.6	7.20	nil	Dry	Bh En

I.G.S.L. GEOTECHNICA REPORT NO. **BOREHOLE NO.:** 2 Proposed Residential Development CONTRACT: SHEET: 1 of 1 DATE STARTED: 9.6.99 **Dublin Corporation** CLIENT: 9.6.99 DATE COMPLETED: BOREHOLE DIAM.(mm) 200 CONS. ENG: Thorburn Colquhoun I.G.S.L. 7.10 BORED BY: BOREHOLE DEPTH Queen Street, Dublin LOCATION: LOGGED BY: I.G.S.L. CASING DEPTH (m) 7.10 SAMPLES E **RESULTS** REFERENCE NUMBER DEPTH RECOVERED DOWNHOLE DEPTH ELEVATION (mOD) SYMBOLIC LOG SAMPLE TYPE **IELD TEST** DESCRIPTION Ξ θ Depth N 0.20 Tarmacadam / Imported Stone MADE GROUND (Comprised of red brick, clay, gravel ash, concrete, timber, steel and some cobbles) 1.00 11 1011 D 1.00 -1 1.80 1012 D 2.00 2.00 55 -2 Dense fine to coarse slightly silty sandy GRAVEL with frequent cobbles and boulders 3.00 64 -3 3.50 D 1013 4.00 48 -4 4.30 5.00 79 5.00 1014 Đ Hard black slightly silty gravelly CLAY with frequent -5 cobbles and boulders 6.00 31 -6 for150mm then Ref D 6.50 1015 7.00 Ref -7 7.10 Refusal -8 9 Water level observations during boring Remarks. DEPTH TO REMARKS CASING Move rig on and off site each shift. DATE HOLE WATER **DEPTH DEPTH** Chiselling Bh End 7.10 nil Dry 9.6 From 3.50 - 3.90 for 1.25rs From 6.80 - 7.10 for 2hrs

FIELD TEST KEY: U-U100, Db-Disturbed Sample, S-SPT, W-Water Sample, R-Refusal.

D	2	Ò	1	0
\boldsymbol{D}		フ	1	フ

EPORT NO		GEOTECH	HNIC	AL B	JKING	KECUI	ROPELIOLE :		G.S.L.
ONTRACT	: Proposed	Residential Development				. 4	BOREHOLE I SHEET:		3 1 of 1 [⊟]
JENT:	Dublin Cor	poration					DATE STAR	TED:	3.6.99
DNS. ENG		Colquhoun			AM.(mm		DATE COMP		3.6.99
CATION		reet, Dublin		ehole d Ing dept		6.30 6.30	BORED BY: LOGGED BY:		.G.S.L. .G.S.L.
- [LA3	ING DEI	[[SAMPLES		
DOWNHOLE DEPTH (III)				6		REFERENCE NUMBER		9	FIELD TEST RESULTS
			ي	ELEVATION (mOD)]	₹		DEPTH RECOVERED	RESI
2		DESCRIPTION	9	Z	ا ۾ ا	- H	} }		ST
∮ l			그	Ę	두	EN C	<u> </u>	Ξ.	7
Z 3			SYMBOLIC LOG	Ŋ.	ОЕРТН (m)	莊	SAMPLE TYPE	EPT	
3	<u></u>		λS	_ 립	_ = _	<u> </u>	Ŋ		<u> </u>
Tarm	acadam / Impo	rted Stone			0.20				Depth 1
MAD	E GROUND (Cor	mprised of red brick, clay, gravel and some cobbles)							
l asn,	concrete, steel	and some coopies /				1000	D	1.00	1.00 1
					1.30				
 					1				
	-	B. L. C St L. CD4VEL							2.00 3
2 Dens	frequent could	e slightly silty sandy GRAVEL es and boulders							_
WILLI	Hednetic coppie	es and bodisers				1001	D	2.50	
					-				
3			1	1					3.00 3
٠									for 150m
									(11011 110
					1	1000		4.00	4.00 5
4	- 105 L 10a	ty gravelly CLAY			4.00	1002	D	4.00	4.00
very	/ Stiff brown Siid	ly gravery CLAT			4.40				
·	a televile elimbales a	siles grouply CLAV with frequent							
5 cob	bles and boulde	silty gravelly CLAY with frequent rs				1003	D	5.00	5.00 8
.							1		
-						1006	۵	6.00	6.00
-6						1000		0.00	for150n
					6.30				then R
- Ref -7	usal								
-									
-									
-8									
_									
-									
9									
Remarl	ks.		-		DATE	Water lev	el observati CASING	ons during t DEPTH TO	oring REMAR
	Move ri	g on and off site each shift.			DATE	DEPTH		WATER	
Chisell	ing				2.0	6.20	sil	Dry	Bh Er
	From 0	.30 - 0.90 for 1hr			3.6	6.30	nil	Ury	511 =11
		.40 - 3.60 for 1hr .40 - 5.60 for 0.75hrs							
	r c	10 6 20 for 2hrs				1			
		FIELD TEST KEY: U-U100, Db-Distu	irbed S	ample, S	-SPT, W-	Water Sam	pie, R-Refusa	31.	

		GEOTECH		AL DI	DRING	RECOR	2D	- 10	S.S.L.
PORT NO.		Residential Development	אואור	AL D	JANING	KECON	BOREHOLE N	O.: 4	
LIENT: ONS. ENG: OCATION:	Dublin Co Thorburn		BOR	EHOLE DI EHOLE DI ING DEPT) 200 6.20	SHEET: DATE START DATE COMPL BORED BY: LOGGED BY: SAMPLES	ED: 1 ETED: 1	of 1 0.6.99 0.6.99 G.S.L. G.S.L.
DOWNHOLE DEPTH (m)		DESCRIPTION	SYMBOLIC LOG	ELEVATION (mOD)	DЕРТН (m)	REFERENCE NUMBER	SAMPLE TYPE	DEPTH RECOVERED	FIELD TEST RESULTS
	cadam / Impo	rted Stone			0.15				Depth N
MADE	GROUND (Co	mprised of red brick, clay, gravel er, steel and some cobbles)				1022	D	1.00	1.00 22
2									2.00 Re
3						1023	D	3.00	3.00 1
4			_		4.00	1024	D	4.00	4.00 2
Mediu GRAV	ım dense to d 'EL with frequ	ense fine to coarse silty sandy ent cobbles and boulders				1025	D	5.00	5.00 €
6					6.20	1026	D	6.00	6.00 R
- Refu -7 -	sal								
-8									
Remark:	S. Move :	ig on and off site each shift.			DATE	HOLE	el observation	DEPTH TO	oring REMAR
Chisellin	ng From (From 3	0.40 - 0.90 for 0.50hrs 3.30 - 3.50 for 0.75hrs 5.00 - 6.20 for 2hrs			10.6	6.20	DEPTH	Dry	Bh En
		FIELD TEST KEY: U-U100, Db-Dist	urbed S	Sample, S	-SPT, W	Water Sam	ole, R-Refusa	ıl.	

 _			_
		1	
~	u		u
 •			

EPORT	NO. GEOTECH	NIC	AL BO	DRING	RECO	RD		G.S.L.
ONTRA						BOREHOLE SHEET:		5 . 1 of 1
LIENT:	Dublin Corporation				·	DATE STAR		11.6.99
ONS. E	•	BOR	EHOLE D	IAM.(mm) 200	DATE COMP	PLETED:	11.6.99
OCATI			EHOLE D		6.60	BORED BY:		I.G.S.L.
-1		CAS	ING DEPT	H (M)	6.60	LOGGED BY SAMPLES	:	I.G.S.L.
DOWNHOLE DEPTH (m)	DESCRIPTION	SYMBOLIC LOG	ELEVATION (mOD)	ОЕРТН (m)	REFERENCE NUMBER	SAMPLE TYPE	DEРТН RECOVERED	FIELD TEST RESULTS
	/ Invested Comp			0.15				Depth
Ta	armacadam / Imported Stone			0.13				Deptil
	ADE GROUND (Comprised of red brick, clay, gravel sh, concrete, timber, glass and some cobbles)				1016	D	1.00	1.00
								2.00 4
				<u>.</u>	1017	D	3.00	3.00
				3.80				
4 Me Gf	edium dense to dense fine to coarse silty sandy RAVEL with frequent cobbles and boulders				1018	D	4.00	4.00
5					1019	D	5.00	5.00
5				6.60	1020	D	6.00	6.00 for150r then R
7 R	efusal			3.00				
8								
ema	rks.		<u></u>			observatio		oring
	Move rig on and off site each shift.			DATE	HOLE	CASING DEPTH	DEPTH TO WATER	REMAR
Chise	From 2.30 - 2.50 for 1hr From 3.50 -3.80 for 1hr From 6.30 - 6.60 for 2hrs			11.6	6.60	nil	Dry	Bh En
	FIELD TEST KEY: U-U100, Db-Disturbe	-d c-	mala C C	DT 1A/ 1A	later Samo	le RePatrical	<u> </u>	

DEDORT 110 0540	EOTEOUN	\mathcal{M}	ΪΉ	0.05	2000		10011			
· · · · · · · · · · · · · · · · · · ·	EOTECHNIC	AL B	OHIN	IG RE	BORE	HOLE N	IGSL L	.td.		
CONTRACT: Tolka River Flooding	GROUND LEVEL	/m OD\ _		1.65	Sheet	BOREHOLE NO: BH B1 Sheet 1 of 1				
CLIENT: Fingal County Council ENGINEER: RPS MCOS	BOREHOLE DIAM			00		STARTE	ED: 12/0 ETED: 12/0	05/2004 05/2004		
CO-ORDINATES : E 307159.75	BOREHOLE DEP	ΓH (m)	-	.00						
N 239888.33	CASING DEPTH (m)	8.	.00		- TO UT:	T McCarthy			
(W)		ELEVATION (mOD)	E)		SAMPLES щ		EST TS	STAND PIPE DETAILS		
된 DESCRIPTION	LEGEND	ELEVA (m00)	DEРТН (m)	REF. NUMBER	SAMPLE	DEPTH (m)	FIELD TEST RESULTS	STAND PII		
FILL comprising of soft to firm brown slightly	XXX	<u> </u>	2	£ ₹ 5172	∂ F B	0.00		- ES - ES		
sandy slightly gravelly CLAY	***	ቖ		0172		0.00				
		\otimes								
0111		60.85	0.80					i		
Stiff grey brown slightly sandy gravelly CLAY (possible fill)										
,		3								
				5173	В	1.50	N=22			
	2011 2011	<u>\$</u>								
- 2 ¹										
	(2) (2)	*								
		Į.		5174	В	2.50	N=34			
		\$								
-3	<u> </u>	P								
	<u> </u>	Į.								
				5175	В	3.50	N=16			
		<u>.</u>								
4	<u> </u>	3								
				5176	В	4.50	N=25			
	1000 de 1000 d La compansación de 1000 de 100									
5										
·										
	100 mg 100 m 100 mg 100 mg			5177	В	5.50	N=78/			
							190mm	:		
6	医									
		집								
				5178	В	6.50	N=26			
7		-								
		3								
				5179	В	7.50	N=18			
Modium dans a brown slightly a 1. f		53.85	7.80							
Medium dense brown slightly sandy fine to medium GRAVEL		53.65	8.00		i					
End of Borehole at 8.00 m										
						i				
ai !	ļ							ĺ		
į	ļ	ļ .	İ							
t	į				ĺ					
	i	i i	:		İ		F			
10 · · · · · · · · · · · · · · · · · · ·		i	1				į			
Hard Strata Boring / Chiselling From (m) To (m) Hours Comn	nonto	167	0	Water	Strike Deta					
2.90 3.10 0.50	nerits	Water Strike	Casing _Depth_	Sealed At_	Rise Tim		Comments			
5.70 6.00 0.75 7.10 7.30 0.50		7.80	-	-	6.30 20	Mediu	m] [
		D	! Hole	Ground	water Obser					
Standpipe Installation Details Date Tip Depth RZ Top RZ Base	Туре	Date	Debip	Depth	Depth to Water	Cor	nments			
THE POPUL TIE TOP TIZ BASE	туре									
Remarks: Hand dig service inspection pit			1							
Harriagna, Francially service inspection pit								- 1		

RE	PORT NO	O. 9540	TRL	AL PIT /	DYN	AM	IC P	RO	BE R	EC	ORI)	IG	SSL L	⊥td.
CON	TRACT:	Tolka River Flood	ing						l Pit No.:			TP 17			
CLIE	NT	Fingal County Cou						Shee				Sheet 1			
1	INEER:	RPS MCOS	mi¢ii					<u> </u>	avation M	lethod:		CAT432 03/03/20			
		E 308159.11		HAMMER MA		50.0	-	-	Complet	ed:		03/03/20			
CO-0	ORDINATES:	N 238753.49		INCREMENT: FALL HEIGHT	SIZE (mm `(mm) :) : 100 5 <mark>00</mark>			ınd Level):	44.30			
										Sample	25	Probe	Type:DP		
									-		<u> </u>				_
		Geotechnical De	scription				nOD)	Œ				Probe Readings (blows / increment)	Gra	phic Prob	o e
Œ					۳	Œ	ion (n	Strike			(m)	Read / incr	F	Record	
Depth (m)					Legend	Depth (m)	Elevation (mOD)	Water Strike (m)	Ref. No.	Type	Depth (m)	robe	5 10	15 20	25
-0.0	MADE GI	ROUND comprisin	g of firm b	prown sandy	****							0	<u>mendennahn</u>	<u>տոսհոստոհո</u>	<u> </u>
	gravelly C	LAY with many co onal pieces of plast	bbles som	e boulders								1 n L	2		
												321121]		
									J2961	В	0.60	1 1	,		
	Soft black	peaty sandy SILT/	CLAY co	ntaining		0.70	43.60		,	-	0.00	2 1 1	•		
-1.0		organic debris			_ %	1.00	43.30		ļ			7	<u> </u>		
-	Stiff grey v	very sandy slightly	gravelly S	ILT/CLAY		1.00	43.30					7 8	7222 7232		
												12	<u> </u>	.	
	Stiff orange	e brown sandy grav	elly CLA	Y with	2 2 2	1.40	42.90					10 22 6	777		
	3511K C3501	omios pina sonia	218		× × ×							20 <u>25</u>		<u> </u>	2
	OBSTRUC	TION - possible b	oulder				42.50								
-2.0	Final depth			·		1.85	42.45								
							ļ								
-															
3.0															
3.0															
													-		
.															
·														1	
-4.0	·												. <u></u>		
Ground	dwater Observat	tions: Rapid flow	at 0.4m												
Stabilty	y Remarks:	Pit collapsing													
<u>-</u>															
Genera	al Remarks:														
															- [

REPORT NO: 9253	GEOTECH	NICA	L B	ORI	NG RE	CORD		IGSL	Ltd.	· ·
CONTRACT: Pheonix Park Development						BORE	HOLE N	O: BH	1	7
CLIENT: Flynn & O'Flaherty ENGINEER: OMS Architects	GROUND LE			- im) 2	200	DATE	STARTE	ED: 2	8/11/2003	<u>.</u>
CO-ORDINATES : E -	BOREHOLE [DEPTH			1.00				8/11/2003	-
N -	· CASING DEP	TH (m)			2.60		D BY:	J.O'Hara		_
DESCRIPTION		g .	ELEVATION (mOD)	Ê	55	SAMPLES	I _	TEST	STAND PIPE DETAILS	
		LEGEND	ELEV (mOD)	ОЕРТН (m)	REF.	SAMPLE	DEPTH (m)	FIELD TEST	TAND	
MADE GROUND consisting of day, grave cobbles	and	****				- " -			8 5	1
Very soft to soft dark brown sandy gravell	4	****		0.40						}
CLAY with cobbles	,								\perp	
		7.6			7123	В	1.00	N∈5	R 5	61
	P							0	1/-	
Stiff brown sandy gravelly CLAY with cobi	les			1.70						
and pounders	ት 12 12				7124	В	2.00	N=32		
			,							
Very stiff to hard black/grey sandy gravelly CLAY with cobbles and boulders	1	000	į	2.50 2.60						
Obsruction - Possible rock/boulder	<u> </u>			3.00	7125		0.00			ł
End of Borehole at 3.00 m				3.00	7125	B .	3.00	N=R		,
	ļ									
		ŀ								
			ĺ							
	7.0									
		İ		1]			
•										
,										
								-	,	
							ŀ			
	}									
		1								
						•	İ			
•										
				}						
				ļ		ļ				
Hard Strata Boring / Chiselling					Water	Strike Details				
rom (m) To (m) Hours Co	nments	W	ater rike 50	Casing	Sealed F	lise Time		omments		
2.60 3.00 2.00 .		2.	50°	2.50	AI	lise Time	Moderat			
							Ì			
		<u> </u>		LIA!	Groundwa	ater Observa				
Standplpe Installation Details Date Tip Depth RZ Top RZ Base	Туре		ate	Hole Depth	Casing D Depth \		Comr	nents		
The Dase	- ype	28/11 26/11	/2003 /2003	3.00 3.00	3.00 0.00	1.90 BH 6 1.10 Casi	End ng pulled,	BH end.	-	
emarks:		L		L	ــــــــــــــــــــــــــــــــــــــ					

_					210						· /
		EOTECH	NIC	AL B	ORIN	G REC	ORD		IGSL L	<u>.td.</u>	
L	CONTRACT: Pheonix Park Development						BORE Sheet	HOLE NO	U: BH2		
	CLIENT: Flynn & O'Flaherty	GROUND LE						STARTE		1/2003	
I —	ENGINEER: OMS Architects	BOREHOLE I)() 80	DATE	COMPLE	TED: 29/	1/2003	
	CO-ORDINATES : E - N -	CASING DEP				60	BORE	D BY: 、	J.O'Hara		
S			T ⁻		Ê		SAMPLES	,	ST.	<u> </u>	
Ĕ	DESCRIPTION		LEGEND	ELEVATION (mOD)	DEPTH (m)	REF.	SAMPLE	Ę	FIELD TEST RESULTS	STAND PIPE DETAILS	
DEPTH (M)			l e	13 E	H .	濟	48 F	DEPTH	크는 SE	STA	
	TOPSOIL										
Н	Soft brown slightly peaty sandy gravelly CLAY	,			0.40						
	woth cobbles and boulders	;	1623. 1623.				j				
			15.32			7126	В	1.00	N=6	D	5610
						, 120		1.00	14=0	Γ	5619
			144		1.50			j i			
	Stiff dark brown sandy gravelly CLAY with cobbles and boulders		1								
2						7127	В	2.00	N=28		
					i		_	2.00	11-20		
	· .		7,77		2.50						
	Obsruction - Possible rock/boulder		000		2.80	7128	В	2.80	N=R		
3	End of Borehole at 2.80 m				2.00	1120		2.00	14=L(-
			·								
4											
	•										
-5											
		j									
				:							
-6			:					ŀ			
		İ									
					1						
		ļ			1						
- 7	•				ļ	.					
		ļ				İ					
		}									
		.	ĺ								•
- BÍ						f	-				
1			1		1		·				
		4									
					1						
Ħ											
								}			
- 15	·	}		}							
ľ						\A.f	Charles Co.		!		
ſ	Hard Strata Boring / Chiselling From (m) To (m) Hours Comm	nents		Water	Casing	Sealed	Strike Deta		Comments	<u> </u>	
	2.50 2.80 2.00		-	Strike 2.50	Depth 2.50	At	To 2.30 -	Slow			
İ			L			Ground	unter Ob	untin			
Ĺ	Standning Installation Data "			Date	Hole	Casina	vater Obser Depth to		nments		P. Carlotte
Ţ	Standpipe Installation Details Date Tip Depth RZ Top RZ Base	Туре	29)/11/200:)/11/200:	Depth 3, 2.80	0.00		·			
			29	0/11/200	3 2.80	2.80	1.50 Bi	1 End	d, BH end.		
_	Remarks:										
_											

Г		FEOUNIO	AL 5	0011	IO DE	2000	1	100: :	4 -1	, ~
Γ~	· · · · · · · · · · · · · · · · · · ·	TECHNIC	AL B	UKIN	IG HE	BORE	HOLF N	IGSL L	<u>td.</u>	-
H	CONTRACT: Pheonix Park Development	UND LEVEL (I	mOD)					IO: BH5	10/00	
		EHOLE DIAME			00		STARTE	ED: 02/ .ETED: 02/	12/2003 12/2003	
Ь.	CO-ORDINATES · E · BOR	EHOLE DEPTI	H (m)	1.	.80			J.O'Hara		
	IN- OAS	ING DEPTH (m		T	.80	SAMPLES		1 .	i w	ł
€	DESCRIPTION	9	ELEVATION (mOD)	Ę	<u></u>		I	PIELD TEST	STAND PIPE DETAILS	
Ф ОЕРТН (М)		LEGEND	ELEV.	DEPTH (m)	REF.	SAMPLE	DEPTH	FIELD TES	STAN	ļ
-0	TOPSOIL		<u> </u>							
	Stiff brown/black sandy gravelly CLAY with	77.		0.30						
	cobbles and boulders	70.3	8							
- 1	<i>,</i>		Ž		7141	В	1.00	N=38	D	611
			9		,,,,,		1.00	14=36	K.	5619
		303								
	Obstruction - Possible rock/boulder	0,00	•	1.60	7142	В.	1.80	N≖R		
· 4	End of Borehole at 1.80 m	}		7.50	1176		1.00	14=[
							-			
3										
	•					ļ			j	
					· 					
								ļ		
*					!			ŀ		
	•							,		
			, !							
5										
]								İ		
Ì				İ				 	, 1	
6										
İ										
7						1		1		
ĺ			ĺ							
8										
								į		
9										
				ĺ						
1p							·			
•	Hard Strata Boring / Chiselling				Wate	r Strike Deta	uls		<u>ا ۔ ا</u>	
-	From (m) To (m) Hours Comments 1.60 1.80 2.00		Water Strike	Casing Depth	g Sealed At	Rise Tim	- 1	Comments		
			-	•	-	-	Dry			
			1							
			D-1-	Hole	Ground	water Obser				
ſ	Standpipe Installation Details Date Tip Depth RZ Top RZ Base Typ		Date	Depth		Depth to Water		mments		
	THE COST INC. THE COST TYPE		2/12/ 20 0:	3 1.80	0.00	- 18	H dry, end	OIBH		
_	Remarks:			_l						
	rioritalito.									

Γ	REPORT NO: 9253 GI	OTECHNIC	AL BC	RING	RECO	ORD	1	GSL L	td.	
	CONTRACT: Pheonix Park Development					Sheet 1				
	ENGINEER: OMS Architects	GROUND LEVEL (n BOREHOLE DIAME	TER (mm				STARTE	D: 03/1 TED: 03/1	2/2003 2/2003	
	AA ARRINATES . E =	BOREHOLE DEPTH CASING DEPTH (m)	1.90			DBY: J	.O'Hara		
& DEPTH (M)	DESCRIPTION	LEGEND	ELEVATION (mOD)	DЕРТН (m)	NOMBER S	SAMPLES SAMPLE TYPE	DEPTH (m)	RELD TEST RESULTS	STAND PIPE DETAILS	
-0	TOPSOIL			0.20		•				
1	Soft to firm brown slightly sandy, peaty CLAY Very stiff dark brown sandy gravelly CLAY with cobbles and boulders			0.80	7143	В	1.00	N=54	J	R5619
\dagger	Obsruction - Possible rock/boulder	0,00	1	1.60						
-2	End of Borehole at 1.90 m	0.0	1 .	1.90	7144	В	1.90	N=R		
-3										
-4										
		•								
-5										
-6										
	7									
-	, B									
	9		į							
	-					-				
-	Hard Strata Boring / Chiselling		<u></u>			Strike Def	tails	<u> </u>		-
		rments	Water Strike	Casing Depth	Sealed At		me	Comment	3	
				Hole	Groundy	water Obse		omments		
	Standpipe Installation Details Date Tip Depth RZ Top RZ Base	Туре	Date 03/12/20	Débii	Depth 1.50	Depth to Water	BH dry, er			
	Remarks: Water added to assist drilling									-

135243 R5619 V

REPORT NO. 9253	TR	IAL	PIT	REC	CORD)	<u>-</u>		IGSL	Ltd.
CONTRACT: Pheonix Park I	Nevalor-mani				Trial Pit	No.:	Т	PRC1		
CONTRACT: Pheonix Park I	Development .				Sheet:		S	heet 1 of 1		
CLIENT:					Excavati	on Method:	J	СВ		
ENGINEER:					Date Star	rted:	1	3/11/2003		
CO-ORDINATES: E -					Date Cor	npleted:	1	3/11/2003		
N -		•			Ground I	Level (mOD): -			
							Sample	s		(Pa)
Geotechnica Obtif Obt	Description	Legend	Depth (m)	Elevation (mOD)	Water Strike (m)	Ref. No.	Type	Depth (m)	Vane Test (KPa)	Hand Penetrometer (KPa)
TOPSOIL	4 144			-	†					†
Loose brown gravelly SA			0.20 0.60							
Firm brown sandy gravell cobbles and boulders	y C211 Will occusional					K2763 K2764	В	1.00		
Stiff brown sandy gravell boulders and rock slabs	CLAY with cobbles,		2.00			K2765	В	2.00		į
Obstruction End of Trial Pit at 2.05 m			2.05			R2/03	, B	2.00		
-3.0										
							[
Groundwater Conditions: No g Stability: Stab	groundwater encountered		,							
Remarks:						`	_			

RI	EPORT NO. 9253	TRIAL	PIT	REC	CORD				IGSL	Ltd.
CON	VTRACT: Pheonix Park Development				Trial Pit	No.:	Т	PRC2		
					Sheet:			heet 1 of 1	<u> </u>	
CLI	ENT:					on Method:		CB		
ENG	SINEER:				Date Sta			4/11/2003		
CO-0	ORDINATES: E - N -				Date Cor			4/11/2003		
-	N.				Orbuna I	Level (mOD): - 			<u> </u>
							Sample	S		(Pa)
	Geotechnical Description			ରି	2					Hand Penetrometer (KPa)
<u> </u>	descention bescription			Elevation (mOD)	Water Strike (m)			_	Vane Test (KPa)	trom
Depth (m)		Legend	Depth (m)	vation	er Str	Ref. No.	ų.	Depth (m)	Test	d Pen
- 0.0		l 2g	Det	Ē	Wat	Ref.	Type	Dep	Van	Han
- 0.0	TOPSOIL									
-										
	-									
	Firm brown sandy gravelly CLAY with occasional		0.60							
-	Firm brown sandy gravelly CLAY with occasional cobbles and boulders. From 2m rock fragments present.	75.50	,							
-1.0	present.					K2768	В	1.00		
	•	State of the state				K2769	В	1.00		
							1			
		73.50							1	
-2.0		5.00				K2770	В	2.00		
			2.20			120,70		2.00		
	Obstruction End of Trial Pit at 2.20 m	-4	2.20				0			
	End of That Fit at 2.20 m									
	•							-	-	
-3.0										
			8							
					-			•		
										,
4.0					<u></u>					
Grou	ndwater Conditions: No groundwater encountered									
Stabi	lity: Stable									
Rema	arks:									····

 ${\bf Appendix} \; {\bf I-Cable} \; {\bf Tool} \; {\bf Borehole} \; {\bf Records}$

_	CONTRACT : Blackhall Place	EOTECH					E	OREH	OLE N	IGSL L	
	CLIENT:	GROUND LEVEL (MOD)						DATE STARTED: 06/04/20			
_	ENGINEER: Barrett Mahony	BOREHOLE DIAMETER (mm) 200 BOREHOLE DEPTH (m) 14.30					0	DATE C	OMPL	ETED: 07/	04/2
1	CO-ORDINATES : E - N -	CASING DEF				4.30 4.30	В	ORED	BY:	J. O'Hara	
2			T	T	Т-	L	SAMPLE	:9	-		- u
חבירות	DESCRIPTION		2	ELEVATION	DEPTH (m)	REF.	щ	$\neg \top$	<i>F</i>	RELD TEST RESULTS	STAND PIPE
			LEGEND	ELEVA	. 8	F. F. M	SAMPLE	TAPE.	DEPTH (m)	HELD TES	TAN I
1	MADE GROUND containing reinforced concr hardcore	ete and	****	3	1						1
ŀ	MADE GROUND containing loose brick rubbl	-	*****		0.40	ĺ		- :	174		
l	== a. rooteo cartaning loose brick lubbi	ч									ì
1				100					•		
ĺ	2:					3985	В		1.00	N=4	
l											
l											
١	W.							- 1			
1						3986	В		2.00	N=5	
l										***	
l											
						0000		,			
						3987	В		3.00	N=8	
l											
					8		_				
ĺ						3988	В		4.00	N=4	
				10							
1	Dense/very dense grey brown coarse GRAVE	L.	an i		4.60						
						3989			_		
						2989	В		5.00	N=61/ 225mm	
		ĺ									
						3990	В	- 1		N	
						2000	8		6.00	N=45	
		ŀ				3991	В		7.00	, 7	
		ŀ				3331	1 8		7.00	N=40	
		i									
]:				3992	В		8.00	N=38	
		[5336	"		0.00	N=38	
		ļ				3993	В	1.	9.00	N=45	
							-		- 55	14-40	
					1						
	Continued next sheet	ŀ									
	Committee Hext 20880	[2	17.			3994	В	# 1	0.00	N=R	
_	Hard Strata Boring / Chiselling					Wate	r Strike	!_		.,,	
H	From (m) To (m) Hours Comm 0.00 0.40 2.00	nents		Water Casing Septed Bice		Rise	Time Comments				
	4.60 4.80 0.50 5.40 5.70 0.75		Ī	Strike 7.80	7.80		6.80	*		loderate	
	5.40 5.70 0.75 10.30 10.60 0.75 12.20 12.50 1.00		ĺ								
Ļ	14.10 14.30 2.00					Ground	water O	bserva	tions		
_	Standplpe Installation Details Date Tip Depth RZ Top RZ Base	Time		Date	Hole Depth	Casing Depth	Depth to Water	9		ments	
_	TIZ TOP HZ Base	Туре	07	/04/200	4 14.30	0.00	11.50		of BH	19	

REPORT NO: 9638 GEOTECHNICAL BORNO RESORD IGSL Ltd. CONTRACT: Blackhall Place CLIENT: ENGINEER: Barrett Mahony CO-ORDINATES: E. DESCRIPTION DES
CONTRACT: Blackhall Place
CO-ORDINATES: E. DESCRIPTION D
BOREHOLE DEPTH (m) 14.30 BORED BY: J. O'Hara DESCRIPTION DESCRIPTION DESCRIPTION Description Densalvery dense grey brown coarse GRAVEL Densalvery dense grey brown coarse GRAVEL 3995 B 11.00 N=63/
DESCRIPTION Description Descr
Densalvery dense grey brown coarse GRAVEL 3995 B 11.00 N=63/
Densalvery dense grey brown coarse GRAVEL 3995 B 11.00 N=63/
Densalvery dense grey brown coarse GRAVEL 3995 B 11.00 N=63/
[27:24] 1 1 1 1 1 1 1 1 1
[27:24] 1 1 1 1 1 1 1 1 1
[27:24] 1 1 1 1 1 1 1 1 1
225mm
3996 B 12.00 N=R
3997 B 13.00 N≖65/
225mm
3998 B 14.00 N=50/
End of Borehole at 14,30 m 14.30 150mm
and of dollarious at 14,50 fff
Hard Strata Boring / Chiseiling Water Strike Details
0.00
Standpipe Installation Details Date Hole Casing Depth to Comments
Date Tip Depth RZ Top RZ Base Type P7/04/2004 14.30 0.00 11.50 End of BH
Remarks:

].	REPORT NO: 9638 G	EOTECHNIC	AL B	ORIN	IG RE				IGSL I	_td.
	CONTRACT: Blackhall Place						BORE Sheet	HOLE N	NO: 2	
	CLIENT: ENGINEER: Barrett Mahony	GROUND LEVEL (I BOREHOLE DIAME	ETER (m		00		DATE	START	ED: 01/ ETED: 02/	/04/200 /04/200
	CO-ORDINATES : E - N -	BOREHOLE DEPTI CASING DEPTH (m			0.50 0.50			D BY:	J. O'Hara	
OCUMPANO.	- DESCRIPTION	LEGEND	B.EVATION (mOO)	DEPTH (m)	REF.	SAMPLE		DEPTH (m)	FIELD TEST RESULTS	STAND PIPE
	MADE GROUND (consisting of reinforced con	ncrete)		0.20						1
	MADE GROUND (consisting of hard core)			0.50			ĺ			
	MADE GROUND (consisting of loose brick ru	bble)			3968		. 37 .99	1.00	N=9	
					3969	В	40	2.00	N=7	
					3970	В		3.00	N=6	
4					3971	В		4.00	N=20	
					3972	В		5.00	N=8	
	MADE GROUND (consisting of black organic s clay)	iit/		5.50	3973	В	(//44)	6.00	N=9	
	Very dense, grey/ brown slightly sandy GRAVE with frequent cobbles	L S		6,50	3974	В		7.00	N=64/ 225mm	
					3975	В		8.00	N=55	
					3976	В		9.00	N=R	
)	Continued next sheet				3977	В		0.00	N=45/	
	From (m) To (m) Hours Commo	ents	Water	Casinal	Wate Sealedi	r Strike Rise	Details Time			
	0.00 0.20 1.00 13-16m Contin 0.20 0.50 1.00 13-16m Contin 7.10 7.50 1.25 9.20 9.40 1.50 13.00 16.00 3.00	nons	Strike 5.50 8.00	Depth 5.50 8.00	Sealed At	Rise To 5.50 6.60	E	Did not Modera	rise nise	
			Date	Hole	Ground	water O	bserva			
L					I ALMOST IN	Anhair f	4	Com	iments	- 1
F	Standpipe Installation Details Date Tip Depth RZ Top RZ Base		04/2004	Depth 16.60	Casing Depth 0.00	13.80		of BH		

	REPORT NO: 9638	GEOTECH	NIC	ALE	RORII	NG RE	COI	3D		IGSL L	td
	CONTRACT: Blackhall Place					VQI III		BORE	HOLE N		<u>- LU.</u>
	CLIENT:	GROUND LE							2 of 2 STARTE	ED: 01/	04/2004
١	ENGINEER: Barrett Mahony	BOREHOLE			•	200				ETED: 02/	04/2004
	CO-ORDINATES : E .	CASING DEP				10,50	ः	BORE	D BY:	J. O'Hara	
		ONSING DEF	177 (0)	i -	_ °	L	SAME			T .	T W
	E DESCRIPTION		9	ELEVATION (mOD)	DEPTH (m)	5			I	RESULTS	STAND PIPE DETAILS
			LEGEND	ELEVA (mOD)	169	REF. NUMBER	8074	TYPE	THE ME	FIELD TES	ETAN
	Very dense, grey/ brown slightly sandy GR with frequent cobbles	AVEL					_				100
	Wild frequent Cobbies						1			[
1						1					
1	1						1.	_			
						3979	1	3	11.00	N=59	
1					1	ŀ		- 1			
1		ļ									
			1		1						
		Ĭ.				3980	1 6	3	12.00	N=63/ 275mm	
		ŀ							-	67 MIIII	
1					33			- 1			-
Į,					3						
T,						3981	E		13.00	N=66/ 190mm	
	8	ļ.				194				ISOMM	
		9			íI				ľ		
	330					Ť		ĺ			1 1
[9				3982	В		14.00	N=80/	
П		18						- 1		170mm	
П		Į.					1	- 1		1	
Ш							-				
11	•	Ď.				3983	В		15.00	N≖R	
Н							- 5.			,	
П		F.3.								- 1	
Ш		5								ł	- 1
ľľ		8			1	3984	В	+	16.00	N≂R	
Н		5					ŀ				
H	End of Borehole at 10-50 m		4.6.3	i	16.60			i			
Ш					100						
ľ	16.60"	6/3		100				- 1	Ì	-	
П											ľ
Ш					1				İ	- 1	
Ш			-				1			4	
Γľ					l				1	1	
Ш					- 1					i	
П		ì		F-1							
			ĺ	- 1			ĺ				
19											ŀ
Н		[- 1					1	ı
										- 1	
					İ			- 1			
-2p							L.,	_		}	
[From (m) To (m) Hours Com	ments	F 1	Vater	Caeine	Water		Details			
	0.00 0.20 1.00 13-16m Con		\$	Strike 5 50	Depth	Sealed At	To 5.50	Time		omments	
	7.10 7.50 1.25 9.20 9.40 1.50			8.00	8.00		6.60	-	Did not r Moderat	138	11
	13.00 16.00 3.00				2			*1			
	Standard A. H. J.			Date	Hole	Groundy	ator O	bserval			
	Standpipe Installation Details Date Tip Depth RZ Top RZ Base	Туре			Hole Depth	Casing Depth	Water	1_	Comr	nents	
	5430		no/0	14/2004	16.60	0.00	13.80	End	of BH		
	Remarks:			390	<u> </u>						

R5709

Appendix II – Laboratory Test Records



GEOTECHNICAL BORING RECORD R6617

REPORT NUMBER

11836

001	NTRACT	Blanc	hardstow	n S.C.	į							BORE SHEE	HOLE N	O. BH1 Sheet 1 of 1
CO-	ORDINAT	ES(_)			ŀ		.EVEL (1 E DIAME		(mm)	200		I	STARTE COMPL	
	ENT		er & Rus	she ulting L td.			E DEPTI EPTH (m			7.10 7.10		BORE	D BY ESSED I	IGSL BY Z. Knotkova
					1									
Deput (m)			Desc	cription			Legend	Elevation	Depth (m)	3ef	Number	Sample Type	Depth (m)	Field Test :
0	MADE GI	20HNL	\ /coneiet	ing of tarma	20)	\longrightarrow	××××	-ш	-	-	-	0,7		
Ì	MADE GI	ROUND	(consist	ing of comp	oact angular	×			0.20	_				
	\gravel - s Firm brov	ub-base vn CLA`	e) Y/S ILT wi	th occasion	nal fine gravel	-/[- [-			0.40	W7	7852	В	0.40	
1	Stiff brow	n grave	Ily CLAY	with cobble	es				1.10	W7	7853	В	1.00	N = 13 (1, 2, 3, 4, 3, 3)
						-								
2						11191				W7	7854	В	2.00	N = 17 (1, 2, 4, 4, 4, 5)
3						1 0 1				W7	7 855	В	3.00	N = 19 (2, 3, 4, 4, 5, 6)
							0							
1										W7	7856	В	4.00	N = 32 (1, 3, 5, 7, 10, 10)
5	Hard grey	/ gravel	ly CLAY v	vith cobble	s				5.00	W7	7857	В	5.00	N = 81 (2, 7, 15, 20, 22, 24)
						_0				W7	7858	В	5.70	
6										W7	7859	В	6.00	N = 43 (2, 5, 7, 10, 12, 14)
7	Obstructi	on							7.10					N = 75/150 mm (25, 50)
	End of Bo		at 7.10 m	1										(20, 50)
8														
9														
									· ·					
HA	RD STRA	TA BOR	ING/CHI	SELLING			WATE	R ST	RIKE DE	TAILS	<u></u>			
	n (m) To	\ 1	Time _	omments			Wate	r (Casing	Seale		Rise	Time (min)	Comments
3.	.6 3. .5 5.	8 ((h) 0.75 0.5 2				Strike		Depth	At		То	(111111)	BH Dry
							GROUI	VDW.	ATER DE	TAILS	3	<u> </u>		
NS.	TALLATIC	N DET	AILS				Date		Hole Depth	Cas	sing epth	Depth to Water	Comm	nents
	Date Ti 06/2006	p Depth 7.00	RZ T op	RZ Base 7.00	Type 50mm SP		02-06-	06	7.10		00		BH Dr	у
-1-	,		1	1			1							



GEOTECHNICAL BORING RECORD R6617

REPORT NUMBER

11836

co	-ORDINAT	ES(_)			D LEVEL (DLE DIAM	-	(mm) 2	200	1 .	START		
CLI	ENT	McAleer & F		BOREHO	OLE DEPT	H (m)	6	5.90	BORI	ED BY	IGSL	
EN	GINEER	lan Black Co	nsulting Ltd.	CASING	DEPTH (n	n)		5.90		CESSED	BY Z. Knotkova	
=						_	<u> </u>	<u> </u>	Samples			e e
Depth (m)		D	escription		Legend	Elevation	Depth (m)	Ref. Number	Sample Type	Depth (m)	Field Test Results	Standnine
0	MADE G	ROUND (cons	sisting of tarmac)									
	gravel - s MADE G	sub-base) ROUND (cons	sisting of compact a				0.20	W7816	В	0.50		
1		and fill materia	fine to coarse grave	el			1.20	_ W7817	В	1.00	N = 10 (1, 1, 2, 3, 3, 2)	
2						÷		W7818 W7819	ВВ	1.80 2.00	N = 18	
_						_					(1, 2, 4, 4, 5, 5)	
	Stiff to ve	ery stiff dark gr	ey gravelly CLAY w	ith cobbles			2.70	W7820	В	2.70	N = 28	
3								W7821	В	3.00	(2, 4, 7, 10, 5, 6)	
4								W7822	В	4.00	N = 35 (2, 4, 6, 9, 10, 10)	
5								W7823	В	5.00	N = 82 (2, 5, 15, 20, 22, 25)	
6						i :		W7824	В	6.00	N = 49 (3, 6, 8, 10, 15, 16))
7	Obstruct End of B	ion orehole at 6.9					6.70 6.90				N = 75/150 mm	44
•											(25, 50)	
8												
9									:			
	A DD OTD	TA POPINO//	NIIOCI LINO		MAT	ED CT	RIKE DET	TAIL S				
	ľ	(m) Time	Comments		Wate	er C	Casing	Sealed	Rise	Time	Comments	
		(iii) (h) .7 0.75	Johnnents		Strik	e	Depth	_At	То	(min)		_
	5.4 5	.6 0.75 i.9 2									BH Dry	
							ATER DE Hole	TAILS Casing	Donth to	n -		
INS		ON DETAILS		-	Dat		Depth	Depth	Depth to Water		ments	
	Date T	ip Depth RZ	op RZ Base	Type	31-05	5-06	6.90	0.00		BH D	ry	



GEOTECHNICAL BORING RECOR R6617

REPORT NUMBER

11836

UUI	NTRACT	biano	nardst	own S.C.							SHE	REHOLE N ET	O. BH3 Sheet 1 of 1	
00	-ORDINAT	ES(_)			l l	D LEVEL (OLE DIAM		R (mm)	2	00	DAT	E STARTI	ED 06/06/2006	
	ENT		eer & F		f .	OLE DEPT		n)		.90		RED BY	IGSL	
ENC	GINEER	lan Bl	ack Co	nsulting Ltd.	CASING	DEPTH (I	n)		7	.90		CESSED	BY Z. Knotkova	
E)							_	<u>.</u> .	Ê	<u> </u>	Samples	5	-	9
E L			De	escription		pue	Flevation		Depth (m)	Ref. Number	Sample Type	Æ	Field Test Results	idbi
nebin						Legend		Ď	De Pe	Nun Ref	San	Depth (m)	. 1004110	Standpipe
0	_MADE G	ROUNE) (cons	isting of tarmac)		*****		_						
	MADE G gravel - s	ROUNE) (cons e)	isting of compact a	angular			0	.20					
	Firm light	brown	sandy	CLAY with fine to	medium	F		0	.60	W7860	В	0.60		
1	gravel					<u> </u>				W7861	В	1.00	N = 18	
]			(1, 2, 4, 4, 5, 5)	
2										W7862	В	2.00	N = 20	
											-		(2, 3, 5, 7, 4, 4)	
3										W7863	В	3.00	N = 23	
	Very stiff	dark br	own/gr	ey gravelly CLAY v	vith cobbles	-0		3	.20	1.,,003	٥	0.00	(2, 2, 4, 5, 7, 7)	
4										W7864	В	4.00	N = 38	
										** / 504	٠	7.00	(2, 4, 7, 9, 10, 12)	
5										W7865	В	5.00	N = 82	
							1			VV / 803	D	5.00	(3, 7, 15, 20, 22, 25)	
]	
6							-			W7866	В	6.00	N = 42	
-										VV / 800	D	0.00	(2, 4, 7, 9, 12, 14)	
								ĺ						
7							}			MZCO	п	7.00	N = 45	
'										W7867	В	7.00	(3, 5, 8, 10, 12, 15)	
								<u> </u>	70	.				
8	Obstructi End of B	<u>on</u> orehole	at 7.90				1		.70 .90					
u														
9														
٦														
ш	IBD GAD V	TA BO	SING/C	HISELLING		\\\\\\\	FP 9	TRIKE	DET	LII S			<u> </u>	L
_	m (m) To		Time	Comments		Wate	er	Casing	3 5	Sealed	Rise	Time	Comments	
	3.4 3		(h) 0.75			Strik	e	Depth	-	At	<u>To</u>	(min)		
5	1.8 5 5.5 5	5	1.25 0.75 2										BH Dry	
_						GROL	JND\	WATER						
INS	STALLATIO					Da	te	Ho Dep		Casing Depth	Depth Wate	to Comn	nents	
	Date T	p Dept	RZT	op RZ Base	Type	06-06	3-06			0.00		BH D	ry	
	1		1	t I		-1		1		l	1	1		



GEOTECHNICAL BORING RECORP R6617

REPORT NUMBER

11836

BOREHOLE NO. BH4 CONTRACT Blanchardstown S.C. SHEET Sheet 1 of 1 GROUND LEVEL (m) CO-ORDINATES(_) **DATE STARTED** 01/06/2006 DATE COMPLETED 01/06/2006 **BOREHOLE DIAMETER (mm)** 200 **BOREHOLE DEPTH (m)** 8.70 **IGSL BORED BY** CLIENT McAleer & Rushe **PROCESSED BY** Z. Knotkova CASING DEPTH (m) 8.70 **ENGINEER** lan Black Consulting Ltd. Samples Standpipe Details $\widehat{\Xi}$ Ξ Ref. Number Sample Type Elevation Field Test Legend Depth (Description Depth Depth (m) Results MADE GROUND (consisting of tarmac) - 0 0.20 MADE GROUND (consisting of compact angular gravel - sub-base) Firm to stiff brown sandy gravelly CLAY 0.40 W7825 В 0.40 <u>_</u>@ N = 211.00 W7826 В (1, 2, 4, 4, 6, 7)N = 22- 2 В 2.00 W7827 (1, 3, 4, 5, 7, 6) N = 63- 3 W7828 В 3.00 (2, 4, 7, 14, 20, 22) 3.25 Very stiff to hard grey/grey brown gravelly CLAY with W7829 В 3.60 N = 44W7830 В 4.00 (2, 5, 8, 10, 12, 14) N = 515 В W7831 5.00 (3, 7, 10, 11, 14, 16) ō N = 42- 6 W7832 В 6.00 (2, 4, 8, 10, 12, 12) N = 46W7833 7.00 В (2, 3, 7, 10, 14, 15) N = 60- 8 W7834 В 8.00 (3, 5, 9, 14, 17, 20) Q 8.70 End of Borehole at 8.70 m - 9 WATER STRIKE DETAILS HARD STRATA BORING/CHISELLING Rise Water Casing Sealed Time Time Comments Comments From (m) To (m) To (min) Strike Depth Αt (h) 3.5 3.7 0.75 15/6/06 **BH Dry** 4.7 4.9 0.75 8.7 2 IGSL.GDT **GROUNDWATER DETAILS** Hole Casing Depth to Water Comments **INSTALLATION DETAILS** Date GPJ Depth Depth Date | Tip Depth RZ Top RZ Base **BH Dry** Type 01-06-06 8.70 0.00 106 REMARKS 띪

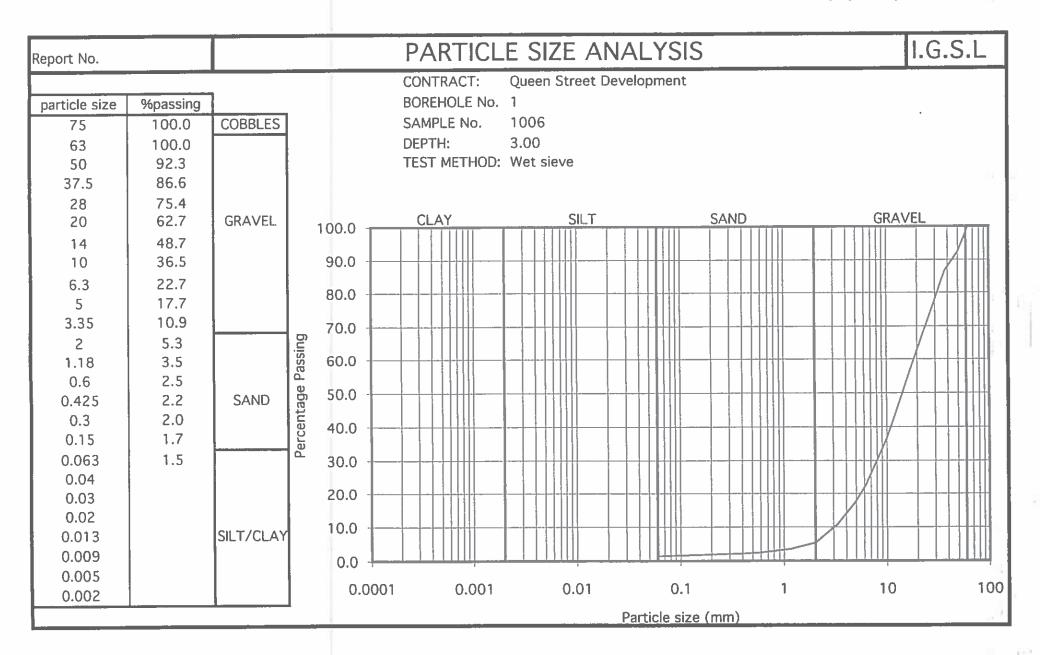
REPORT NUMBER **GEOTECHNICAL BORING RECORD** 11836 **|68|** BOREHOLE NO. BH₅ CONTRACT Blanchardstown S.C. SHEET Sheet 1 of 1 **GROUND LEVEL (m)** DATE STARTED 01/06/2006 CO-ORDINATES(__) DATE COMPLETED 01/06/2006 **BOREHOLE DIAMETER (mm)** 200 **BOREHOLE DEPTH (m)** 8.50 CLIENT **BORED BY IGSL** McAleer & Rushe **ENGINEER** CASING DEPTH (m) 8.50 **PROCESSED BY** Z. Knotkova lan Black Consulting Ltd. Samples Standpipe Details Ξ $\widehat{\Xi}$ Elevation Ref. Number Sample Type Field Test Depth (Depth (Description Depth (m) Results - 0 MADE GROUND (consisting of tarmac) MADE GROUND (consisting of compact angular 0.20 gravel - sub-base) Firm brown sandy CLAY with fine to coarse gravel 0.40 W7835 В 0.40 N = 16W7836 В 1.00 (1, 2, 5, 4, 4, 3)N = 192 В W7837 2.00 (1, 2, 4, 4, 5, 6)2.80 Very stiff to hard dark brown/grey brown sandy W7838 2.80 N = 38-3 gravelly CLAY with cobbles W7839 В 3.00 (2, 4, 7, 9, 10, 12) N = 424 W784d В 4.00 (2, 5, 8, 10, 12, 12) N = 725 W7841 В 5.00 (2, 4, 10, 18, 20, 24) N = 436 W7842 В 6.00 (1, 4, 7, 10, 12, 14) N = 53W7843 В 7.00 (2, 5, 9, 12, 15, 17) N = 49/85 mm 8 W7844 В 8.00 (2, 15, 24, 25) 8.50 End of Borehole at 8.50 m - 9 HARD STRATA BORING/CHISELLING WATER STRIKE DETAILS Water Casing Sealed Rise Time Time Comments From (m) To (m) Comments Strike Depth At (min) (h) 3.7 3.9 15/6/06 **BH Dry** 0.5 4.8 4.9 5.5 5.7 0.75 IGSL.GDT 8.3 8.5 2 **GROUNDWATER DETAILS** Depth to Water Hole Casing Comments **INSTALLATION DETAILS** Date 11836.GPJ Depth Depth Date | Tip Depth RZ Top | RZ Base Type **BH Dry** 01-06-06 8.50 0.00

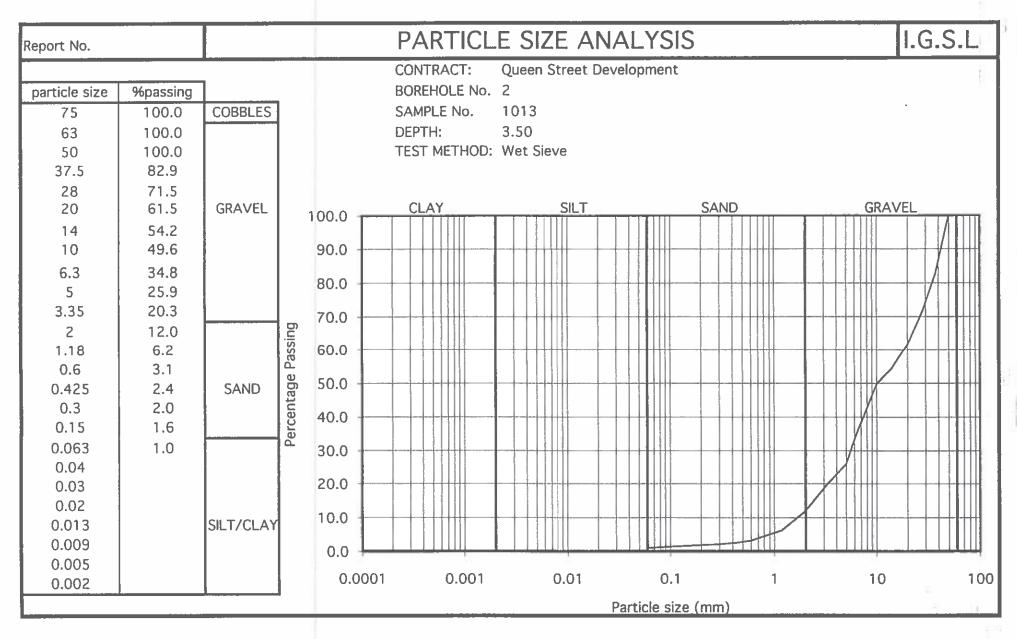
BHLOG

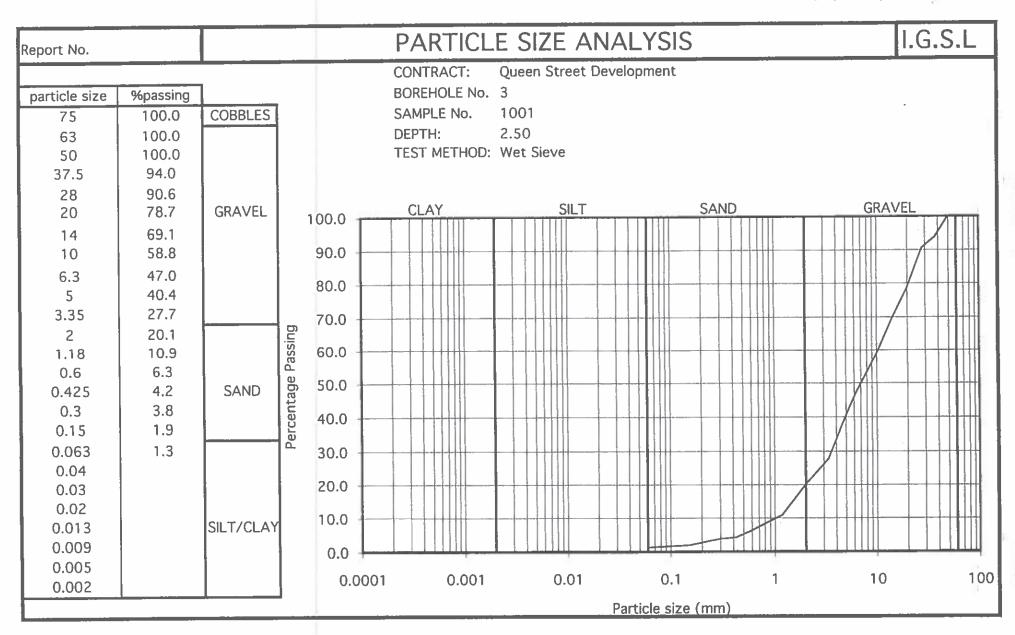
GSL

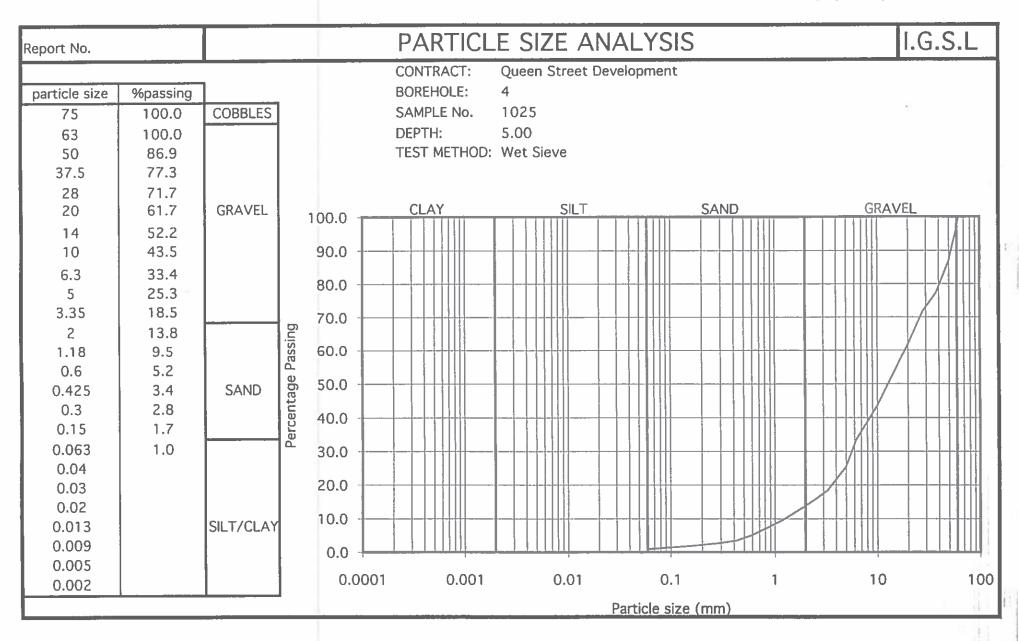
REMARKS

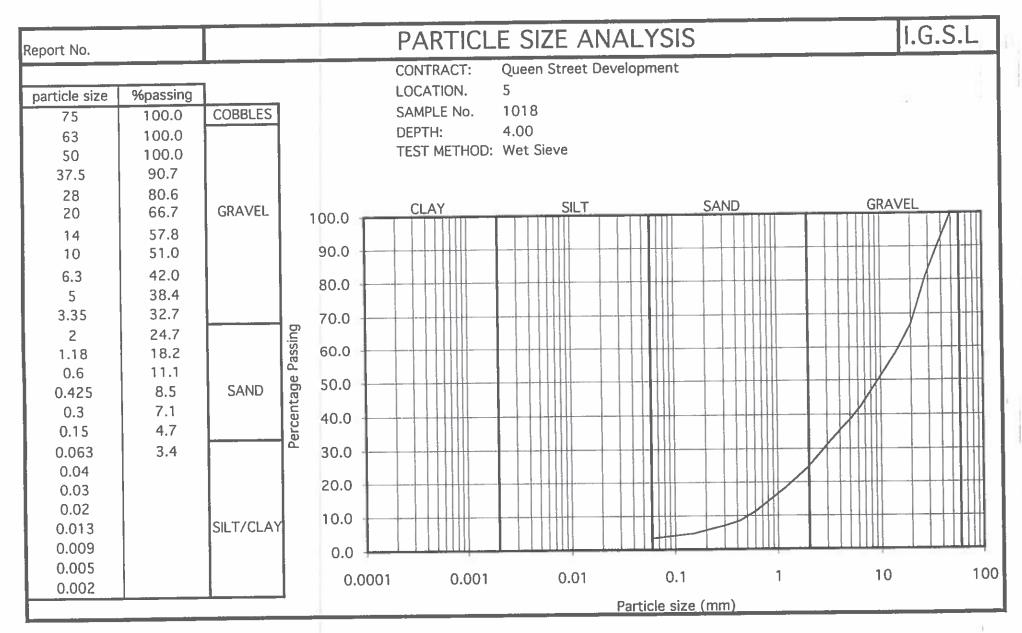
(Elp) IGSL)		GEO	TECHNICA	AL BORIN	G RE	ECO	RD	D (<i>–</i> 1	REPORT NUMBER	R
CONTRAC	T Blancha	ardstown :	S.C.						K6	HOLE N		
CO-ORDIN					ID LEVEL (m)	ER (mm	n) 2	.00	1	STARTI	Sheet 1 of 1 ED 02/06/2006	
CLIENT ENGINEER		er & Rushe ck Consulti		BOREH	IOLE DEPTH (G DEPTH (m)	-	5	.80	BORE		IGSL	
Depth (m)		Descrip	otion		Legend	Elevation	Depth (m)	Ref. Number	Samples Type	Depth (m)	Field Test Results	Standnine
MADE	GROUND (GROUND (- sub-base) rown sandy	(consisting	of compa	ct angular			0.20 0.40	W7845	В	0.40		
1	rown sandy	gravelly C	LAY		-0			W7846	В	1.00	N = 15 (1, 2, 4, 4, 3, 4)	
2								W7847	В	2.00	N = 18 (1, 3, 5, 7, 3, 3)	
3								W7848	В	3.00	N = 12 (1, 1, 2, 3, 3, 4)	
4 Stiff gr	ey brown gr	avelly CLA	ΑΥ				4.50	W7849	В	4.00	N = 14 (1, 1, 4, 3, 3, 4)	
5								W7850	В	5.00	N = 24 (1, 2, 3, 5, 7, 9)	
6	f Borehole a	t 5.80 m					5.80			•		
7												
8						La Peri						
9												
HARD ST	RATA BORII		LLING		WATER							
2.5 5.7	2.6 0.	75	nments		Water Strike	Casir Dept	ng S th	Sealed At	Rise To	Time (min)	Comments BH Dry	
5.7	3.0	2										
INSTALLA	TION DETAI	ILS			GROUND Date	H	ole	Casing	Depth to Water	Comn	nents	
Date 02/06/2006	Tip Depth		RZ Base 5.00	Type 50mm SP	02-06-06		epth .80	Depth 0.00	vvater	BH Di		
REMARKS			0.00				_		1			











						_			
Report No			CLASSIFICATION	EST RESULTS					IGSL
Contract:		Queen Stre	eet, Dublin						
Borehole No.	Depth (M)	Reference No.	Description	Liquid Limit (LL)	Plastic Limit (PL)	Plasticity Index (PI)	Water Content %	рН	Sulphate Content %
1	5.50	1009	Black slightly silty gravelly CLAY with cobbles	33	21	12	10.45		
3	5.00	1003	Black slightly silty gravelly CLAY with cobbles	23	14	9	11.89		ű.
						=			va.
									3
				*					19

					9553.499.500.0	Summary of					16	
		T	T			1377:Part 2:1				-		
BH/TP No.	Sample No.	Depth (m)	Sample Type	Moisture Content %	Liquid Limit %	Plastic Limit %	Plasticity Index	<425μm %	Preparation	Description	1	Classificati
A2	5150	2.50	В	8.2	26	16	10	44.5	ws	Grey brown sl	lightly sandy slightly gravelly CLAY	CL
A2	5154	6.50	В	19.9	27	16	11	52.7	ws	Grey brown st	lightly sandy slightly gravelly CLAY	CL
A1	5157	1.50	В	8.5	24	15	9.	45	ws	Grey brown sl	ightly sandy slightly gravelly CLAY	CL
A1	5160	4.50	В	9.8	27	16	11	51.5	ws	Grey brown si	ightly sandy slightly gravelly CLAY	CL
A1	5161	5.50	B	18.5	40	22	18	45.5	ws	Grey brown sl	ightly sandy slightly gravelly CLAY	CI
B2	5166	2.50	В	14.7	39	22	17	29	WS	Grey brown sl	ightly sandy slightly gravelly CLAY	СІ
B2	5170	6.50	В	13.4	30	19	11	42.2	WS	Brown slightly	sandy slightly gravelly CLAY	CL
B2	5171	7.50	В	10.5	23	16	7	35.3	WS	Grey slightly s	andy gravelly CLAY	CL
B1	5175	3.50	В	14	30	18	12	47.4	WS	Brown slightly	sandy slightly gravelly CLAY	CL
B1	5177	5.50	В	11.8	36	21	15	23.8	WS	Grey brown st	ightly sandy gravelly CLAY	CI
								_				
-												
			_									
			7									<u> </u>
			_		- 							
	L			-								
otes:	NAT - teste			et sieved (425 _k	um) NP - N	on Plastic						
			Contract			TOLKA	RIVER FLOC	DING			Contract No. 9540	
	IGSL		Compiled B	у		Date	Checked By			Date	Page	
<u> </u>			D CONNOL	LY		6/7/04					of	

Determination of Particle Size Distribution BS1377:Part2:1990, clauses 9.2 9540 Contract No: % particle TOLKA RIVER FLOODING Contract: passing R5614 size 75 100.0 COBBLES BH/TP No: B1 100.0 5173 63 SAMPLE No.: 50 100.0 DEPTH (m): 1.5-1.95 37.5 100.0 TEST METHOD: Wet sieve and hydrometer Grey brown slightly sandy, gravelly, SILT/CLAY 28 84.0 DESCRIPTION: 77.4 20 0.063 **GRAVEL** 69.4 14 62.8 10 100.0 6.3 56.5 90.0 53.7 5 80.0 3.35 49.8 45.6 70.0 Percentage passing (%) 1.18 41.9 60.0 37.5 0.6 SAND 35.4 0.425 50.0 0.3 33.2 40.0 28.9 0.15 30.0 0.063 23.6 0.04 20.0 20.0 0.03 18.1 10.0 0.02 15.8 SILT/CLAY 0.013 13.2 0.0 0.1 10 100 0.009 0.01 11.3 0.0001 0.001 0.005 9.4 SILT Sieve size (mm) SAND CLAY **GRAVEL** 0.002 6.2 Checked by: Page no: Compiled by: Date: Date: **IGSL** 6/7/04 D CONNOLLY PSD V3.1 12.01 IGSL LIMITED, UNIT F, M7 BUSINESS PARK, NAAS, CO.KILDARE.

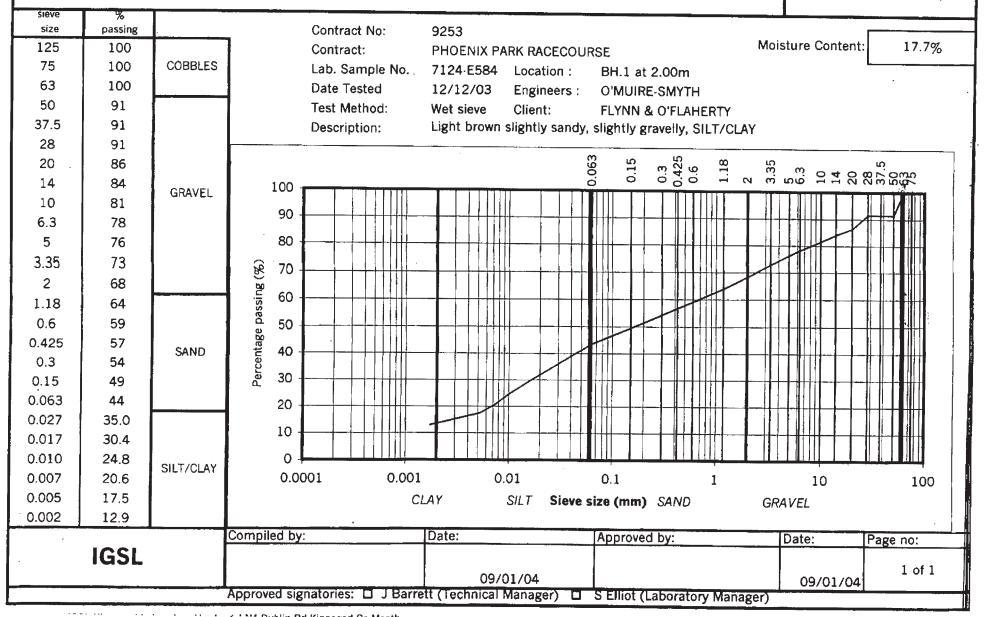
Determination of Particle Size Distribution BS1377:Part2:1990, clauses 9.2 Contract No: 9540 particle % R5614 Contract: TOLKA RIVER FLOODING size passing 100.0 COBBLES 75 BH/TP No: В1 90.7 63 SAMPLE No.: 5179 50 76.6 DEPTH (m): 7.5-7.95 37.5 76.6 **TEST METHOD:** Wet sieve and hydrometer Grey slightly sandy, very gravelly, SILT/CLAY with some cobbles 28 66.8 DE5CRIPTION: 20 61.4 **GRAVEL** 0.063 10 20 28 37.5 933 54.6 14 10 50.8 100.0 6.3 45.2 90.0 42.4 80.0 3.35 38.8 2 34.8 70.0 Percentage passing (%) 1.18 31.7 60.0 0.6 27.8 SAND 0.425 26.0 50.0 0.3 24.4 40.0 0.15 21.1 30.0 0.063 16.5 0.04 14.1 20.0 0.03 12.8 10.0 0.02 11.1 SILT/CLAY 9.3 0.013 0.0 0.009 0.01 0.1 100 7.9 0.0001 0.001 10 0.005 6.7 CLAY SILT Sieve size (mm) SAND **GRAVEL** 0.002 4.2 Checked by: Date: Page no: Compiled by: Date: **IGSL** 6/7/04 D CONNOLLY IGSL LIMITED, UNIT F, M7 BUSINESS PARK, NAAS, CO.KILDARE. PSD V3.1 12.01

CLASSIFICATION TEST RESULTS 9253 **IGSL** TO BS 1377:1990:PART2:CL 4 & 5 Contract: PHOENIX PARK DEVELOPMENT BH/TP Depth Ref Description Passing Test Liquid Plastic Water (M) No. No. 425um % Code Limit (LL) Limit (PL) Index (PI) Content % BH G2 2.00 7135 Brown sandy gravelly CLAY . 54 Α 24 12 12 CL12.4 BH G3 2.00 7130 Brown sandy gravelly CLAY 51 Α 22 11 11 CL10.9 BH1 2.00 Brown sandy gravelly CLAY 7124 48 Α 20 11 9 CL 10.6 BH 2 1.00 7126 Brown sandy CLAY with roots 68 24 Α 15 9 CL19.8 BH 5 1.00 7141 Grey brown sandy gravelly CLAY 42 21 Α 13 8 CL 10.3 **BH** 6 Dark brown sandy gravelly CLAY 1.00 7143 38 20 Α 10 10 СL 9.8 TP 1 2.00 2747 Brown sandy gravelly CLAY 49 Α 21 11 10 CL. 10.4 3.00 2748 Black gravelly CLAY 55 Α 23 12 11 , CL 8.6 TP 4 1.00 Brown sandy gravelly CLAY 2717 52 Α 24 13 11 CL14.5 3.00 2720 Black gravelly CLAY 49 22 Α 13 CL9 9.0

TEST REPORT

Determination of Particle Size Distribution & Moisture Content

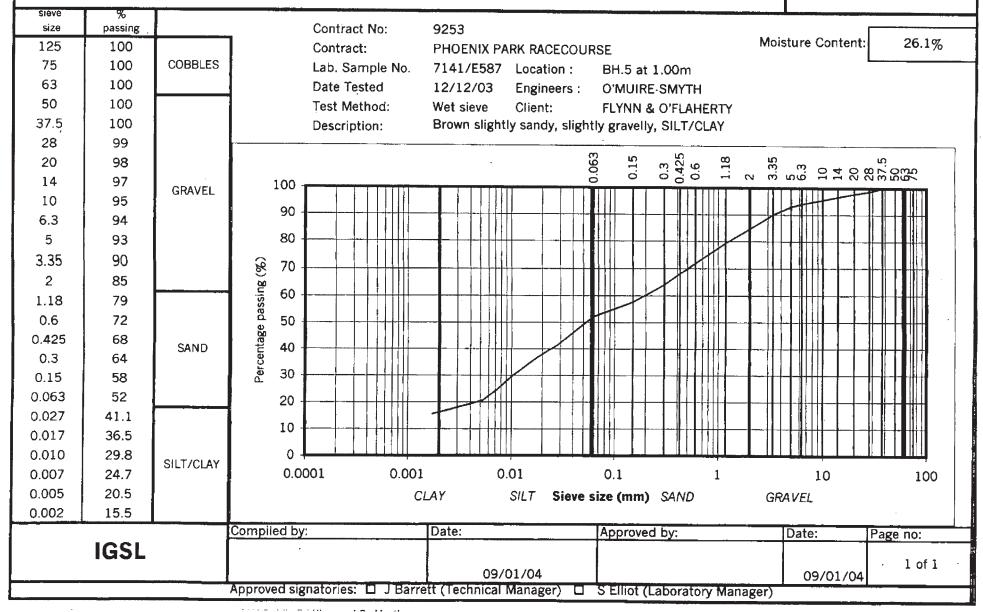
Tested in accordance with: BS1377:Part 2:1990 , clauses 3.2 & 9.2



TEST REPORT

Determination of Particle Size Distribution & Moisture Content

Tested in accordance with: BS1377:Part 2:1990, clauses 3.2 & 9.2



Determination of Particle Size Distribution BS1377:Part2:1990, clauses 9.2 % 11836 particle Contract No: R6617 passing Contract: BLANCHARDSTOWN TOWN CENTRE size 75 100 COBBLES BH/TP No: BH 1 63 100 7854 SAMPLE No.: 50 100 2.00 DEPTH (m): 37.5 100 TEST METHOD: Wet sieve and hydrometer Mottled brown slightly sandy, slightly gravelly, CLAY 28 96 **DESCRIPTION:** 20 94 GRAVEL 0.063 2 3.35 5.3 10 114 20 20 28 37.5 530 91 14 10 89 100 6.3 85 90 5 83 80 3.35 81 79 2 70 Percentage passing (%) 1.18 77 60 0.6 74 SAND 0.425 72 50 0.3 70 40 0.15 60 30 0.063 53 0.037 45 20 0.027 39 10 0.017 33 SILT/CLAY 0.010 27 0.007 24 0.0001 0.001 0.01 0.1 10 100 0.004 20 CLAYSILT Sieve size (mm) SAND GRAVEL 0.002 15 Issued By Date: Page no: **IGSL** 6/7/06 IGSL LIMITED, UNIT F, M7 BUSINESS PARK, NAAS, CO.KILDARE. PSD V3.1 12.01

Determination of Particle Size Distribution BS1377:Part2:1990, clauses 9.2 % Contract No: 11836 particle R6617 Contract: size passing **BLANCHARDSTOWN TOWN CENTRE** 75 100 COBBLES BH/TP No: BH 5 63 100 SAMPLE No.: 7840 50 100 DEPTH (m): 4.00 37.5 96 TEST METHOD: Wet sieve and hydrometer 28 96 Grey slightly sandy, slightly gravelly, CLAY DESCRIPTION: 20 95 **GRAVEL** 0.063 10 14 20 28 37.5 550 93 14 10 88 100 6.3 83 90 5 81 80 3.35 78 75 2 70 Percentage passing (%) 1.18 72 60 0.6 69 SAND 0.425 68 50 0.3 65 40 0.15 59 30 0.063 51 0.037 46 20 0.027 40 10 0.017 35 SILT/CLAY 0.010 29 0.007 26 0.0001 0.001 0.01 0.1 10 100 0.004 21 CLAY SILT Sieve size (mm) SAND GRAVEL 0.002 16 Issued B√ Date: Page no: **IGSL** 6/7/06 IGSL LIMITED, UNIT F, M7 BUSINESS PARK, NAAS, CO.KILDARE. PSD V3.1 12.01

Determination of Particle Size Distribution BS1377:Part2:1990, clauses 9.2 % Contract No: 11836 particle R6617 passing Contract: **BLANCHARDSTOWN TOWN CENTRE** size 100 75 COBBLES BH/TP No: BH 6 63 100 7849 SAMPLE No.: 50 100 DEPTH (m): 4.00 37.5 100 TEST METHOD: Wet sieve and hydrometer Grey brown slightly sandy, gravelly, CLAY 28 94 **DESCRIPTION:** 20 90 **GRAVEL** 0.063 10 14 20 28 37.5 550 84 14 10 78 100 6.3 71 90 5 68 80 3.35 63 58 2 70 Percentage passing (%) 1.18 54 60 0.6 49 SAND 0.425 47 50 0.3 45 40 39 0.15 30 0.063 33 0.037 30 20 0.027 26 10 0.017 22 SILT/CLAY 0.010 18 0.007 16 0.0001 0.001 0.01 0.1 10 100 0.004 13 CLAY SILT Sieve size (mm) SAND **GRAVEL** 0.002 Issued Bv Date: Page no: **IGSL** 6/7/06 IGSL LIMITED, UNIT F, M7 BUSINESS PARK, NAAS, CO.KILDARE. PSD V3.1 12.01

						Summary o 1377:Part 2:19						
BH/TP No.	Sample No.	Depth (m)	Sample Type	Moisture Content %	Liquid Limit %	Plastic Limit %		<425μm %	Preparation	Description	1	Classification
BH 1	7854	2.00	D	14.6	33	16	17	72.0	WS	Mottled brown	slightly sandy slightly gravelly CLAY	CL
BH 2	7281	3.00	D	11.7	28	16	12	61.7	WS	Mottled grey s	lightly sandy slightly gravelly CLAY	CL
BH 3	7862	2.00	D	11.9	31	15	16	75.1	WS	Brown slightly	sandy slightly gravelly CLAY	CL
BH 3	7866	6.00	D	12.2	31	15	16	72.5	WS	Mottled grey b	rown slightly sandy slightly gravelly CLAY	CL
BH 4	7826	1.00	D	10.5	32	15	17	75.3	WS	Mottled brown	slightly sandy slightly gravelly CLAY	CL
BH 5	7840	4.00	D	11.1	29	14	15	68.0	WS	Grey slightly s	andy slightly gravelly CLAY	CL
BH 6	7846	1.00	D	21	51	26	25	66.9	WS	Brown slightly	sandy slightly gravelly CLAY	СН
BH 6	7849	4.00	D	14.7	30	16	14	47.0	WS	Grey brown sli	ightly sandy slightly gravelly CLAY	CL
otes:	NAT - teste		ed WS - We Contract	et sieved (425)	[on Plastic BLANCHARDS	STOWN TOW	/N CENTRI		Date	Contract No. 11836 Page	
	IOOL	ŀ	/)	11/1/1/1/1/1/1/1/1/1/1/1/1/1/1/1/1/1/1/1	7	6/7/06		··		Date	of	

Appendix F

Geotechnical Risk Register

ARUP

JOB TITLE				Blanchardstown to City Centre Core Bus Corridor
JOB NUM	IBER			268401-00
MADE BY	•			Ozgur Alper
CHECKED	ВҮ			Geoff Petelka
DATE				30/06/021
Description	on of spread	sheet		Geotechnical Risk Register
Member	Location			
Filename				Geotechnical Risk Register
	S OF SPREA	DSHEET		
Sheet			Description	
Cover				
Notes				
Geotechn	ical Risk Reg	ister		
Hide			Hidden	
	SATION OF I		SION	
Signature	s & dates:		Made by	
			Checked	
	-	•	. 5	
REVISION	15	Curre	nt Revision	
		Cur	rent Status	
Rev.	Date	Made by	Checked	Description
1	08/07/021	OA	GP	JoC
-				

(1) Purpose of spreadsheet

- 1. The Geotechnical Risk Register should be utilised as a live document throughout the life cycle of the design process (i.e. from desk study stage through to construction)
- 2. The RR has been designed for the user to initially identify the hazard and subsequently identify the associated risks.
- 3. While in the past the hazard and associated risk may have been amalgamated into a single input, this suggested method forces the users to think about the specific hazard which may exists and additional risks which could arise.

(2) Key Notes of Guidance

- 1. This is a risk register. As such each item should be developed around a particular risk. In some situations, a single hazard may present two or more different risks. If this is the case, each risk should be identified and itemised in the register.
- 2. The sub-ref should be used in situations where a risk evolves over the life-cycle of the project. i.e. a subsequent aspect of the risk has been identified even after the prescribed mitigation control.

(3) Risk Analysis Matrix

Risk Table		Severity							
Likelihood	Н	M	L						
Н	Н	Н	M						
M	Н	M	L						
L	М	L	L						

(4) Sources of data & Links to other spreadsheets

Date	File path / URL	Description

(5) Special features

(6) Diary of development, including checking

(if supplement is needed to Cover page)

Date	Who	Description

Best Practice Guide

- 1. Don't duplicate raw data in the spreadsheet i.e. use cell references where possible.
- 2. Use colours to distinguish between fixed data, user-variable data, calculations and results.
- ${\it 3. Explicitly define constants to be used in equations, using named cells where appropriate.}\\$
- 4. Avoid password use unless essential and documented (to avoid loss of work with loss of password).
- 5. Ensure extracts copied to other documents can be traced back to the spreadsheet.
- $\ensuremath{\mathsf{6}}.$ Plot to engineering scale whenever sensible to do so, and make units obvious.
- 7. For charts, use colours/patterns which will be distinguishable if printed or photocopied in black & white.
- 8. Give sheets & workbooks descriptive names.
- 9. Use comments to describe the purpose of individual cells and ranges of cells.
- 10. Use the revision facility on the cover page and maintain the diary where further details required.

GEOTECHNICAL RISK REGISTER Please refer to notes for more information

Particular Definitions

JOB TITLE: Blanchardstown to City Centre Core Bus Corridor JOB NO: 268401-00

Hozard: Ground conditions and geotechnical related elements which have the potential to adversely impact on the project.

Risk: The consequence if a particular hazard was to occur or was left untreated.



	Sub	Created By		Phase of Works	ks	Hazard	Risk		Risk /	Pre-Mitigation Risk Analysis			Risk Control Mitigation Measures			Post-Mitigation Risk Analysis			Stat	
	Ref.	Date	Initials	and/or Source Initials	Hazard	Observation / Cause	Location of Hazard	Risk Exposure	Risk Impact Category	Opportunity	Likelihood L/M/H	Severity L/M/H	Risk L/M/H	Mitigation Measures	Phase of Application	Required by	Likelihood L/M/H	Severity L/M/H	Risk L/M/H	
1	(i)	30/06/2016	OA	Preliminary Design	Contamination	Encountering unexpected contaminated ground during construction.	Site Extent	Material present may be contaminated. This presents a health and safety risk during the construction.	Health & Safety	R	М	М	М	Further GI to be scheduled at detailed Design	Ground Investigation	Client	L	L	L	Acti
2	(i)	30/06/2016	OA	Preliminary Design	Contamination	Presence of made ground	Site Extent	Material excavated during the works may not be suitable for reuse on site and require disposal to a licenced landfill.	Commercial	R	М	М	М	Further GI to be scheduled at detailed Design	Ground Investigation	Client	м	L	L	Acti
3	(ii)	30/06/2016	OA	Preliminary Design	Unforeseen ground conditions	Less favourable ground material properties.		More excavation and replacement or ground treatment required.	Design	R	М	М	М	The detailed design should assess the proposed scheme elements and local ground conditions in accordance with Eurocode 7.		Client	L	L	L	Acti
4	(iii)	30/06/2016	OA	Preliminary Design	Settlement	Presence of very soft to soft material at Tolka River Bridge Widening		Material present may cause settlement and bearing resistance problems.	Design	R	н	н	н	The detailed design should consider the soft material.	Detailed Design	Client	L	L	L	Act
5	(iii)	30/06/2016	OA	Preliminary Design	Settlement	Presence of very soft to soft material at old Phoenix Park Racecourse based on historical ground investigation data		Material present may cause settlement and bearing resistance problems.	Design	R	М	М	М	Further GI to be scheduled at detailed Design	Detailed Design	Client	L	L	L	Act
6	(ii)	30/06/2016	OA	Preliminary Design	Unforeseen ground conditions	Low undrained shear strength and effective parameters of Made Ground		Material present may cause settlement and bearing resistance problems.	Design	R	н	М	Н	Strength and physical properties of made ground should be investigated at site before the construction	Detailed Design	Contractor	L	L	L	Acti
7	(iv)	30/06/2016	OA	Preliminary Design	Chemically reactive ground	Aggressive ground conditions		Chemical attack on buried concrete due to acid and/or sulphate in the soil or ground water.	Design	R	М	М	М	Limited sulphate and pH level testing indicates that aggressive ground is not present. Concrete class shall be chosen to ensure required durability.	Detailed Design	Contractor	L	L	L	Acti
8	(i)	30/06/2016	OA	Preliminary Design	Contamination	Re-useability of the material	Geology	Material excavated during the works may not be suitable for reuse on site and require disposal to a licenced landfill or require suitable material to be imported.	Design	R	М	М	М	Further GI to be scheduled at detailed Design	Ground Investigation	Client	L	L	L	Acti
9	(iii)	30/06/2016	OA	Preliminary Design	Settlement	Insufficient characterisation of the ground materials.	Geology	Unexpected or poor ground materials could lead to excessive deformation of the retaining walls if it is not assessed and considered during detailed design.	Design	R	М	м	м	Further GI to be scheduled at detailed Design	Detailed Design	Client	L	L	L	Acti

Page 1 of 1 Printed 08/07/2021 Time 17:34