

Appendix E Ground Investigation Report

National Transport Authority Belfield / Blackrock to City Centre Core Bus Corridor Scheme Ground Investigation Report

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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.

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1 Introduction

1.1 Project Overview

The BusConnects Dublin – Core Bus Corridors Infrastructure Works (hereafter called the 'CBC Infrastructure Works') involves the development of continuous bus priority infrastructure and improved pedestrian and cycling facilities on sixteen 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 encompass the delivery of approximately 230km of dedicated bus lanes and 200km of cycle tracks along 16 of the busiest corridors in Dublin.

1.2 The Proposed Scheme – Belfield / Blackrock to City Centre Core Bus Corridor Scheme

The Proposed Scheme consists of two main alignments and runs primarily from Blackrock to the City Centre, with Nutley Lane forming a secondary alignment in a southwest-to-northeast direction.

The Blackrock to City Centre alignment of the Proposed Scheme commences at the R113 Temple Hill, to the north of the R827 Stradbrook Road, travels along the N31 Frascati Road, the R118 Rock Road / Merrion Road / Pembroke Road, turns at the Lansdowne Road junction onto the R816 Pembroke Road / Baggot Street Upper / Baggot Street Lower, turns onto Fitzwilliam Street Lower and terminates at the junction of Mount Street Upper / Merrion Square South / Merrion Square East.

The Nutley Lane alignment of the Proposed Scheme commences at the junction with the R138 Stillorgan Road, travels along Nutley Lane and terminates at the junction with the R118 Merrion Road.

The Proposed Scheme includes the construction of a new retaining wall near Blackrock Park and the widening and upgrading of the existing road infrastructure.

The Proposed Scheme is shown in Figure 1.

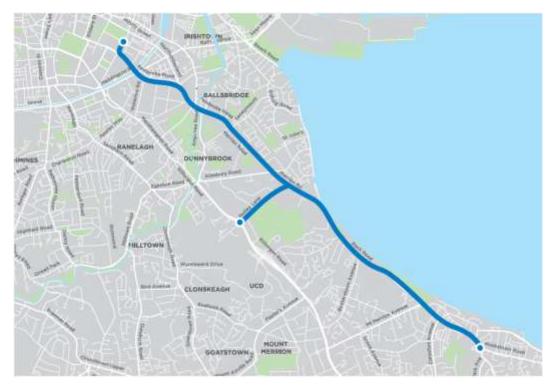


Figure 1: Belfield / Blackrock to City Centre CBC Scheme Alignments

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1.3 Scope and Objective of the Report

This Ground Investigation Report (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 Belfield / Blackrock to City Centre Core Bus Corridor 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.

1.4 Geotechnical Category of the Project

The project has been identified as a Geotechnical Category 2 scheme in accordance with IS EN 1997-1:2005.

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".

1.5 Study Area

The Proposed Scheme consists of two main alignments and runs primarily from Blackrock to the City Centre, with Nutley Lane forming a secondary alignment in a southwest-to-northeast direction. The routes have been divided into five sections:

- Section 1: Stradbrook Road to Booterstown Avenue
- Section 2: Booterstown Avenue to Nutley Lane
- Section 3: Merrion Road (Nutley Lane to Ballsbridge)
- Section 4: Ballsbridge to Merrion Square (Pembroke Road, Baggot Street and Fitzwilliam Street)
- Section 5: Nutley Lane (R138 to Merrion Road)

1.6 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
- $c_{\rm u}$ 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"
- DPSH Dynamic Probe Super-Heavy, results expressed using "N100"
- N_{100} in blows/100mm.

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 investigations listed below:

- Ground Investigations Ireland, Bus Connect Detailed Stage 1 Lot 1, Route 14, National Transport Authority, Ground Investigation Report March 2021. Rev C, 08 March 2021.
- Ground Investigations Ireland, Bus Connect Detailed Stage 1 Lot 1, Route 15, National Transport Authority, Ground Investigation Report March 2021. Rev B, 19 March 2021.

The project-specific ground investigation reports are in Appendix D.

The publicly available sources of information reviewed are presented in Appendix A and are as follows:

- Geological Survey of Ireland (GSI) (<u>www.gsi.ie</u>):
 - o Bedrock
 - Quaternary sediments
 - Quaternary geomorphology
 - GeoUrban unconsolidated sediments
 - GeoUrban depth to bedrock
 - o Groundwater aquifer
 - Groundwater recharge
 - Groundwater well database
 - Groundwater vulnerability
 - Subsoil permeability
 - Karst landforms database
 - Mineral locations
 - o Quarry locations
 - Historical Geotechnical boreholes.
- Environmental Protection Agency (EPA) Map Viewer (https://gis.epa.ie/EPAMaps/):
 - Soils (National)
 - 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)
 - Google maps (www.google.com/maps) aerial photography online mapping
 - Rivers of Dublin (C.L. Sweeney, 1991)

2.2 Topography

2.2.1 Stradbrook Road to Booterstown Avenue

The Proposed Scheme begins at Stradbrook Road, which, according to the OSI 10m contours, is at an elevation between 10mOD and 20mOD and gradually falls towards Booterstown Avenue. The EPA river network map shows the scheme passing over the Brewery Stream on the Temple Road and the Priory Stream along the Frascati Road.

2.2.2 Booterstown Avenue to Nutley Lane

The Proposed Scheme continues at elevations between 0mOD and 10mOD. The EPA river network map shows the scheme passing over the Booterstown Stream at Trimleston Avenue and the Elm Park Stream near Merrion House.

2.2.3 Merrion Road (Nutley Lane to Ballsbridge)

The Proposed Scheme continues from Nutley Lane to Ballsbridge at a similar elevation, between 0mOD and 10mOD. The EPA river network map shows the scheme passing over the River Dodder via Ballsbridge.

2.2.4 Ballsbridge to Merrion Square (Pembroke Road, Baggot Street and Fitzwilliam Street)

The Proposed Scheme continues from Ballsbridge to Merrion Square at a similar elevation of between 0mOD and 10mOD. The EPA river network map shows the scheme passing over the Grand Canal at McCartney's Bridge.

2.2.5 Nutley Lane (R138 to Merrion Road)

The Proposed Scheme begins at the intersection of the R138 and Nutley Lane. According to the Ordnance Survey Ireland (OSI) 10m contours, the route is at elevations between 10mOD and 20mOD. The EPA river network map shows no interactions with rivers or streams within this section of the study area.

2.3 Geological Maps and Memoirs

2.3.1 Quaternary Sediments

2.3.1.1 Stradbrook Road to Booterstown Avenue

The GSI quaternary geomorphology map shows hummocky sands and gravels within Blackrock on the Stradbrook Road and at the Booterstown Avenue junction on the Rock Road.

The GSI quaternary subsoil map shows that this section of the Proposed Scheme is predominantly till derived from limestones.

Additionally, there are localised pockets of gravels derived from limestones, rock outcropping or subcropping and estuarine silts and clays.

The localised pockets of gravel derived from limestones are located around Stradbrook Road and Booterstown Avenue. Rock outcropping is located along the Rock Road at two locations, the first near the Frascetti Road and Mount Merrion Avenue junction and the second near Willow Terrace at Booterstown Avenue. Estuarine silts and clays are located along the Rock Road from Ben Inagh Park to Booterstown Avenue.

2.3.1.2 Booterstown Avenue to Nutley Lane

The GSI quaternary geomorphology map identifies a glacial meltwater channel associated with the Elm Park Stream.

The GSI quaternary subsoil map shows that this section of the Proposed Scheme is predominantly underlain by till derived from limestones. Additionally, there are localised pockets of gravels derived from limestones, rock outcropping or subcropping, estuarine silts and clays, alluvium and marine beach sands.

The localised pockets of gravel derived from limestones and rock outcropping are located around Booterstown Avenue. Estuarine silts and clays are located from Booterstown Avenue to Merrion House. Alluvial deposits are located around Merrion House and Elm Park apartments along the Merrion Road and again at the Nutley Lane junction with Merrion Road. Marine beach sands are located along the Merrion Road between the junctions with Strand Road and Nutley Lane.

2.3.1.3 Merrion Road (Nutley Lane to Ballsbridge)

The GSI quaternary geomorphology map shows no geomorphological features along this section of the study area.

The GSI quaternary subsoil map shows that this section of the Proposed Scheme is predominantly alluvial deposits. Additionally, there are localised pockets of till derived from limestones identified from Simmonscourt Road to Ballsbridge.

2.3.1.4 Ballsbridge to Merrion Square (Pembroke Road, Baggot Street and Fitzwilliam Street)

The GSI quaternary geomorphology map shows no geomorphological features along this section of the study area.

The GSI quaternary subsoil map shows that this section of the Proposed Scheme is predominantly made ground, alluvium and till derived from limestones.

Alluvial deposits are encountered from Ballsbridge to The Pembroke Road. Till derived from limestones are located from Pembroke Road to Baggot Street Upper. Made ground deposits cover the rest of the route.

2.3.1.5 Nutley Lane (R138 to Merrion Road)

The GSI quaternary geomorphology map shows no geomorphological features along this section of the study area.

The GSI quaternary subsoil map shows this section of the Proposed Scheme is predominantly tills derived from limestones. Additionally, there are localised pockets of alluvium at the Nutley Lane junction to the Merrion Road.

2.3.2 Solid Geology

The GSI karst landforms database shows there are no karst features identified within Proposed Scheme in the GSI karst database.

The GSI bedrock geology map is presented in Appendix A.

2.3.2.1 Stradbrook Road to Booterstown Avenue

The bedrock encountered within the study area for this section of the Proposed Scheme comprises of the Lucan Formation (locally known as Calp Limestone), Ballysteen Formation and Type 2p microcline porphyritic granite.

The underlying geology from Stradbook Road to the Rock Road at Ben Inagh Park is underlain by Type 2p microcline porphyritic granite. From Ben Inagh Park to Willow Terrace the route is underlain by the Ballysteen Formation. From Willow Terrace to Booterstown Avenue the route is underlain by the Lucan Formation.

Two faults are noted within the study area for this section. The first is located at the contact between the Ballysteen Formation and Lucan Formation and the second at the contact between the Ballysteen Formation and the Type 2p microcline porphyritic granite.

2.3.2.2 Booterstown Avenue to Nutley Lane

The bedrock encountered within the study area for this section of the Proposed Scheme comprises of the Lucan Formation (locally known as Calp Limestone).

No structural bedrock features were identified along this section.

2.3.2.3 Merrion Road (Nutley Lane to Ballsbridge)

The bedrock encountered within the study area for this section of the Proposed Scheme comprises of the Lucan Formation (locally known as Calp Limestone).

No structural bedrock features were identified along this section.

2.3.2.4 Ballsbridge to Merrion Square (Pembroke Road, Baggot Street and Fitzwilliam Street)

The bedrock encountered within the study area for this section of the Proposed Scheme comprises of the Lucan Formation (locally known as Calp Limestone). No structural bedrock features were identified along this section.

2.3.2.5 Nutley Lane (R138 to Merrion Road)

The bedrock encountered within the study area for this section of the Proposed Scheme comprises of the Lucan Formation (locally known as Calp Limestone).

No structural bedrock features were identified along this section.

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 (<u>http://map.geohive.ie/mapviewer.html</u>). The following maps have been studied and presented in Appendix A:

- 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

2.4.1.1 Stradbrook Road to Booterstown Avenue

The OSI 6-inch mapping (between 1837 and 1842) shows that the study area between Stradbrook Road and Booterstown Avenue comprises a mix of agricultural land and urban development, with a higher density of urban development closer to Blackrock Village. Much of the land on the eastern side of the Proposed Scheme was tidal, flooded or marsh land. The Dublin and Kingstown Railway runs parallel to the Proposed Scheme along the seafront. A gravel pit is located at Temple Hill.

The OSI 25-inch mapping (between 1888 and 1913) shows a significant increase in urban development within the study area, particularly in Blackrock Village. A tramway is located along Newtown Avenue, Blackrock Main Street and Rock Road. A tramway depot is located on Newtown Avenue. A graveyard is located at Temple Hill.

It should be noted that the 1995 OSI aerial photography is in black and white and of poor resolution. Significant urban development is evident in the area and includes the Frascatti Road which bypasses Blackrock Village and the construction of the Frascati and Blackrock shopping centres.

The 2000 OSI aerial photography shows no notable change in land use from the 1995 OSI aerial photography.

The 2005 OSI aerial photography imagery shows no notable change in land use from the 2000 OSI aerial photography.

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

2.4.1.2 Booterstown Avenue to Nutley Lane

The OSI 6-inch mapping (between 1837 and 1842) shows that the study area between Booterstown Avenue and Nutley Lane comprised agricultural land with scattered residential properties. The land on the eastern side of the Proposed Scheme between Booterstown Avenue and Strand Road was tidal, flooded or marsh land. The Dublin and Kingstown Railway runs parallel to the Proposed Scheme along the seafront.

The OSI 25-inch mapping (between 1888 and 1913) shows an increase in urban development within the study area. A tramway is located along Rock Road. A graveyard is located at Bellevue Avenue.

It should be noted that the 1995 OSI aerial photography is in black and white and of poor resolution. Significant urban development is evident in the area, particularly the residential development around Booterstown Avenue and St Vincent's Hospital, south of Nutley Lane.

The 2000 OSI aerial photography shows no notable change in land use from the 1995 OSI aerial photography.

The 2005 OSI aerial photography imagery shows construction at Elm Park Green. No other notable change in land use is evident.

The 2019 Google Maps aerial imagery shows the Elm Park Green development completed. No other notable change in land use is evident.

2.4.1.3 Merrion Road (Nutley Lane to Ballsbridge)

The OSI 6-inch mapping (between 1837 and 1842) shows that the study area between Nutley Lane and Simmonscourt Road comprises predominantly agricultural land with scattered residential development. The density of development is greater between Simmonscourt Road and Ballsbridge. Gravel pits were located at Shrewsbury Park and at Serpentine Avenue. A railway line runs parallel, and to the east, of the Proposed Scheme.

The OSI 25-inch mapping (between 1888 and 1913) shows an increase in residential, industrial, and commercial development within the study area, including at the Royal Dublin Society's (RDS) agricultural premises. The Royal Dublin Society's Branch Railway extends between the RDS and the Kingstown and Bray Branch railway line to the east of the Proposed Scheme. A tramline was present along Merrion Road and a tramline depot was situated on Shelbourne Road. The gravel pit located at Shrewsbury Park was expanded.

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.

The 2000 OSI aerial photography shows no notable change in land use from the 1995 OSI aerial photography, except for the development of the Intercontinental Hotel Dublin at Simmonscourt Road.

The 2005 OSI aerial photography imagery shows no notable change in land use from the 2000 OSI aerial photography.

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

2.4.1.4 Ballsbridge to Merrion Square (Pembroke Road, Baggot Street and Fitzwilliam Street)

The OSI 6-inch mapping (between 1837 and 1842) shows that the study area between Ballsbridge and the Grand Canal comprises a mixture of agricultural and urban development. Trinity College Botanic Gardens is located at Northumberland Road. Industrial uses include the Calico printing factory, located at Pembroke Place, the Hammersmith ironworks located at the current location of Hume House Pembroke Road and a hat factory located on Mespil Road.

The OSI 25-inch mapping (between 1888 and 1913) shows a significant increase in urban development within the study area. The land between Ballsbridge and the Grand Canal underwent significant residential development during this period. Industrial land use included a tramway along Pembroke Road and Baggot Street, a tramway depot on Shelbourne Road, Hammersmith ironworks on Pembroke Street and two laundries on Mespil Road.

It should be noted that the 1995 OSI aerial photography is in black and white and of poor resolution. Urban development is recorded in the study area including development of the Trinity College Botanic Gardens at Northumberland Road and the former lawn tennis grounds at Pembroke Row.

The 2000 OSI aerial photography shows no notable change in land use from the 1995 OSI aerial photography.

The 2005 OSI aerial photography imagery shows no notable change in land use from the 2000 OSI aerial photography.

The 2019 Google Maps aerial imagery shows little change in land use from the OSI 2005 aerial photography. The aerial mapping shows construction works at the intersection of Baggot Street Lower and Fitzwilliam Street Upper.

2.4.1.5 Nutley Lane (R138 to Merrion Road)

The OSI 6-inch mapping (between 1837 and 1842) shows predominantly agricultural land with scattered residential development. A railway is located 200m northeast of Nutley Lane.

The OSI 25-inch mapping (between 1888 and 1913) shows an increase in residential development within the study area.

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. Areas recorded as being relatively undeveloped are pockets of parklands including the Elm Park Golf and Sports Club south of Nutley Lane and parts of St Vincent's hospital.

The 2000 OSI aerial photography shows no notable change in land use from the 1995 OSI aerial photography.

The 2005 OSI aerial photography imagery shows an increase in development of the St Vincent's hospital site.

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

2.5 **Records of Mines and Mineral Deposits**

2.5.1 Active mines and mineral localities

The GSI bedrock active and historic pits and quarries database shows no active pits, mines or quarries located near the Proposed Scheme. Historic Quarries are determined near Saint Vincent's Park, Ballsbridge, interface of Merrion Road with Simmonscourt Road in the historical maps. The historical maps are presented in Appendix A.

The GSI mineral localities database states that there are no non-metallic mineral locations within the study area

GSI mineral localities map is presented in Appendix A.

2.5.2 Aggregate potential

2.5.2.1 Stradbrook Road to Booterstown Avenue

The GSI aggregate potential mapping shows the crushed rock aggregate potential along this section of the study area ranging from low to very high. In areas of shallower rock, such as along the coastline from Monkstown to Booterstown, the crushed rock aggregate potential is very high.

The granular aggregate potential along the Stradbrook Road is generally high, an area of very low potential is identified in Avondale Court and Monkstown Valley. There is a section of low to moderate granular aggregate potential at Booterstown Avenue.

2.5.2.2 Booterstown Avenue to Nutley Lane

The GSI aggregate potential mapping shows the crushed rock aggregate potential along this section of the study area ranging from very low to very high.

The crushed rock aggregate potential from Booterstown Avenue to Trimlestown Avenue ranges from high to very high.

From Trimlestown Avenue to Nutley Lane the crushed rock aggregate potential is generally moderate with areas of low potential noted around Nutley Avenue.

The granular aggregate potential for this section of the study area ranges from very low to very high.

Low granular aggregate potential is associated with Elm Park Stream. Moderate aggregate potential was noted from Saint Mary's Home to Ailesbury Park and very high potential is noted around Nutley Lane.

2.5.2.3 Merrion Road (Nutley Lane to Ballsbridge)

The GSI aggregate potential mapping shows the crushed rock aggregate potential along this section of the study area ranging from low to moderate.

The crushed rock aggregate potential mapping from Nutley Lane to Serpentine Avenue is variable. The mapping generally shows areas of moderate potential along the southern extents of Merrion Road and areas of low aggregate potential north of Merrion Road.

The granular aggregate potential is generally very high within this section of the study area. The granular aggregate potential decreases to moderate near Sydenham Road and reduces to low near Serpentine Avenue.

2.5.2.4 Ballsbridge to Merrion Square (Pembroke Road, Baggot Street and Fitzwilliam Street)

The GSI aggregate potential mapping shows the crushed rock aggregate potential along this section of the study area ranges from low to moderate.

The crushed rock aggregate potential from the American Embassy to the Northumberland Road is low. The remaining sections of the study area have moderate crushed rock aggregate potential and the crushed rock aggregate potential around James Street East is low.

The granular aggregate potential along Pembroke Road ranges from low to high.

2.5.2.5 Nutley Lane (R138 to Merrion Road)

The GSI aggregate potential mapping shows the crushed rock aggregate potential along this section of the study area ranging from low to moderate.

Areas of low crushed rock aggregate potential are identified at the beginning of the route at the R138 to the Merrion Shopping Centre before passing into an area of moderate crushed rock aggregate potential.

The granular aggregate potential is very high around the Merrion Shopping Centre within this section of the study area.

2.6 Land Use Information

2.6.1.1 Stradbrook Road to Booterstown Avenue

The Corine Land Cover 2018 (EPA 2018) classifies the land between Stradbrook Road and Mount Merrion Avenue as continuous urban fabric. The land between Mount Merrion Avenue and Booterstown Avenue is classified as discontinuous urban fabric.

2.6.1.2 Booterstown Avenue to Nutley Lane

The Corine Land Cover 2018 (EPA 2018) classifies the land between Booterstown Avenue and Nutley Lane as discontinuous urban fabric. The Elm Park Golf and Sports Club is located to the west of the Proposed Scheme between Elm Park and Nutley Lane and is classified as sports and leisure facilities.

2.6.1.3 Merrion Road (Nutley Lane to Ballsbridge)

The Corine Land Cover 2018 (EPA 2018) classifies the land between Nutley Lane and Shrewsbury Road as discontinuous urban fabric. Between Shrewsbury Road and Ballsbridge the land use is classified as industrial and commercial units.

2.6.1.4 Ballsbridge to Merrion Square (Pembroke Road, Baggot Street and Fitzwilliam Street)

The Corine Land Cover 2018 (EPA 2018) classifies the land between Ballsbridge and Lansdowne Road as industrial and commercial units. The land between Lansdowne Road and the Grand Canal is classified as discontinuous urban fabric. The area between the Grand Canal and Merrion Square is classified as continuous urban fabric.

2.6.1.5 Nutley Lane (R138 to Merrion Road)

The Corine Land Cover 2018 (EPA 2018) classifies the land use within the Nutley Lane area as discontinuous urban fabric and artificial non-agricultural vegetated areas used for sport and leisure facilities where the Elm Park Golf and Sports Club is located

2.7 Archaeological and Historical Sites

The National Inventory of Architectural Heritage (NIAH) database states that there are two NIAH sites within 30m of the alignment at the intersection of Monkstown Road and Temple Hill. These are a 'Gates/Railings/Wall' and a 'Gate Lodge'.

The National Monuments (DAHG) database states that there are two DAHG sites within 30m of the alignment. These are a bridge and Castle Tower House. Castle Tower House is located in Eastmoreland Place and the bridge is constructed on River Dodder on Merrion Road.

2.8 Hydrology and Hydrogeology

The GSI groundwater vulnerability map, subsoil permeability map, wells and spring map and groundwater aquifer map are presented in Appendix A.

2.8.1 Aquifers

The GSI groundwater aquifer map indicates the Proposed Scheme overlies a locally important aquifer described as bedrock which is moderately productive only in local zones and poor aquifer bedrock which is described as generally unproductive except for local zones.

The GSI gravel aquifer map shows there are no gravel aquifers within the study area.

2.8.2 Groundwater vulnerability

2.8.2.1 Stradbrook Road to Booterstown Avenue

The GSI groundwater vulnerability mapping shows the groundwater vulnerability along this section of the study area ranges moderate to extreme. The high to extreme areas are where rock is at or near the surface. This occurs along the coastline, adjacent to the Proposed Scheme.

2.8.2.2 Booterstown Avenue to Nutley Lane

The GSI groundwater vulnerability mapping shows the groundwater vulnerability along this section of the study area ranges from moderate to extreme. The high to extreme areas are where rock is at or near the surface. This occurs along the coastline, adjacent to the Proposed Scheme.

2.8.2.3 Merrion Road (Nutley Lane to Ballsbridge)

The GSI groundwater vulnerability mapping shows the groundwater vulnerability along this section of the study area ranges low to moderate.

Groundwater vulnerability is low from Nutley Lane to Ailesbury Road, before passing into an area of moderate groundwater vulnerability from Ailesbury Road to Serpentine Avenue. After Serpentine Avenue the groundwater vulnerability returns to low in Ballsbridge.

2.8.2.4 Ballsbridge to Merrion Square (Pembroke Road, Baggot Street and Fitzwilliam Street)

The GSI groundwater vulnerability mapping shows the groundwater vulnerability along this section of the study area is generally low with a small area of moderate groundwater vulnerability. Groundwater vulnerability is low from Ballsbridge to the American Embassy before entering a small zone of moderate vulnerability from the American Embassy to Lansdowne House and continuing to low groundwater vulnerability for the remainder of the route.

2.8.2.5 Nutley Lane (R138 to Merrion Road)

The GSI groundwater vulnerability mapping shows the groundwater vulnerability along this section of the study area ranges low to moderate.

Groundwater vulnerability is low from the R138 to the Merrion Shopping Centre before passing into an area of moderate groundwater vulnerability at the Merrion Shopping Centre.

2.9 Contaminated Land

The Proposed Scheme is in the urban environment and there are some potential sources of contamination. These are shown in Appendix A.

In the recent ground investigations, geo-environmental testing was undertaken on 32 No. samples, in natural ground and made ground, from ten ground investigation locations. Waste Acceptance Criteria (WAC) classification was carried out on these samples. The results of the WAC classification are given below:

- 22 No. of 32 No. test results were Inert.
- 5 No. of 32 No. these test results were Non-Hazardous.
 - At Clayton Hotel, near Merrion road, R14 TP01 (0.5m)
 - Near Applegreen petrol station, Merrion Road, R15 TP01 (2.3m)
 - At Rock Road near Blackrock Park, R15 CP03 (0.5m)
 - Near Applegreen petrol station, Merrion Road, R15 CP06 (2.5m) and CP07 (2.5m)
- 5 No. of 32 No. test results were Hazardous.
 - Near Blackrock College, R15 TP02 (0.5m, 1.5m, 2.4m)
 - o Interface of Castledawson Avenue and Rock Road, R15 CP02 (0.5m)
 - Near Applegreen petrol station, Merrion Road, R15 CP07 (0.5m)

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.

- Maxol petrol station
- Old tramway depot
- Old gravel pits
- Royal Dublin Society's agricultural premises
- Old Royal Dublin Society's branch railway
- Dublin and Kingstown/Great Southern railway line

- Circle K Elm Park Petrol station
- Texaco petrol station
- Applegreen petrol station
- Booterstown train station
- Car dealers
- Railway
- Frascati Road, previously used for residential and farming.

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:

32 No. Negligible ($M_L \leq 1.0$);

- 50 No. Micro $(1.0 < M_L \le 1.9);$
- 24 No. Minor $(2.0 < M_L \le 3.9)$;
- 2 No. Light $(4.0 < M_L \le 4.9)$;

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 1962 and 1996. Some historical ground investigation years are unknown.

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

GSI Report ID	Title	Year	Author	Location	Used GI
R4223	Commercial/Residential Development	Unknown	Unknown	Sweetmans Lane, Blackrock.	2 Cable Percussion Boreholes
R3720	New Residential/ Hospice Development	Unknown	Unknown	Frascati Road	2 Cable Percussive boreholes
R1110	Phoenix Terrace	1989	IGSL	Junction of Rock Rd. & Phoenix Terrace	3 Cable Percussion Boreholes
R1098	Site Development	1990	IGSL	Opposite Blackrock college	8 Trial pits
R528	Tara Towers Hotel	1969	The Cementation Co. Ltd, Ireland.	Merrion Road, Dublin.	2 Cable Percussion boreholes
R5002	Residential/Commercial Development	Unknown	Unknown	Merrion Road, Dublin.	2 Cable Percussion
R519	Office development	1974	Site Investigations Ltd.	Merrion Road, Dublin.	6 Percussion Boreholes

Table 1: Historical ground investigations (GSI)

GSI Report ID	Title	Year	Author	Location	Used GI
R1465	Embassy of the Netherlands	1996	IGSL	Merrion Road, Dublin.	1 Percussion borehole 2 Trial pits
R3483	Commercial & Underground Carpark Development	Unknown	Unknown	RDS Simmonscourt	4 Cable Percussion boreholes 1 Rotary Coring boreholes
R3964	Horseshow house bar	Unknown	Unknown	Ballsbridge	1 Cable Percussion Boreholes
R263	Hammersmith Works	1964	The Cementation Co. Ltd, Ireland.	Ballsbridge.	4 Cable Percussion boreholes
R891	East Digifone Office	1976	Geotechnical Consulting Services Ltd.	Baggot Street	3 Cable Percussion Boreholes
R771	Baggot Street Bridge House	1975	Irish Soils Laboratories Ltd.	Lower Baggot Street	3 Cable Percussion boreholes
R693	Development	1971	Unknown	James Street East	2 Cable Percussion boreholes
R1108	Development	1982	Geotechnical Consulting Services Ltd.	Blackrock	3 Cable Percussion boreholes
R331	Site Investigation - Allied Irish Banks Site.	1975	J. Mc Cullcugh And Partners.	Ballsbridge	2 Cable Percussion boreholes

GSI Report ID	Title	Year	Author	Location	Used GI
R3720	New Residential/hospice Development	Unknown	Unknown	Frascati Road, Blackrock	2 Cable Percussion boreholes
R453	Site Investigation, Baggot Street Development,	1971	The Cementation Co. Ltd, Ireland.	Baggot Street	3 Cable Percussion boreholes
R509	Humming Dirt Ltd. Proposed Development At Lower Baggot street	1969	Unknown	Lower Baggot Street	2 Cable Percussion boreholes
R525	Unknown	1971	The Cementation Co. Ltd, Ireland.	Baggot Street	2 Cable Percussion boreholes
R536	Site Investigations at Granite :house	1968	Unknown	Ballsbridge	1 Trial pit
R573	Jurys Hotel, Ballsbridge	1961	The Cementation Co. Ltd, Ireland.	Jurys Hotel, Ballsbridge	1 Cable Percussion boreholes
R596	Dodder Valley Drainage	1967	Unknown	South Dublin	1 Cable Percussion boreholes
R655	Proposed Office Development. Pembroke Road	1969	Unknown	Pembroke Road	3 Trial pits
R723	Hotel at Simmonscourt	1988	Site Investigations Ltd.	Simmonscourt Road	2 Cable Percussion boreholes
R741	Development At Merrion Road	1981	Site Investigations Ltd.	Merrion Road	8 Cable Percussion boreholes

GSI Report ID	Title	Year	Author	Location	Used GI
R752	RDS Ballsbridge	1965	The Cementation Co. Ltd, Ireland.	Ballsbridge	2 Cable Percussion boreholes
R888	Site Investigation at East James' Street, Dublin	1977	Geotechnical Consulting Services Ltd.	East James' Street	1 Cable Percussion boreholes
R889	Site Investigation at Baggot Street, Dublin	1990	IGSL	Baggot Street	2 Cable Percussion boreholes
R890	Site Investigation at Baggot Street, Dublin	1980	Geotechnical Consulting Services Ltd	Baggot Street	2 Cable Percussion boreholes

3.2 Recent Ground Investigation

This section details the recent ground investigations listed below:

- Ground Investigations Ireland, Bus Connect Detailed Stage 1 Lot 1, Route 14, National Transport Authority, Ground Investigation Report March 2021. Rev C, 08 March 2021.
- Ground Investigations Ireland, Bus Connect Detailed Stage 1 Lot 1, Route 15, National Transport Authority, Ground Investigation Report March 2021. Rev B, 19 March 2021.

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

Exploratory Hole Type	Quantity	
Trial Pit	5 No.	
Cable Percussive Borehole*	7 No.	
*3 No. standpipes were installed in cable percussive boreholes.		

Table 2: Summary of exploratory holes in the recent ground investigation

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

In situ Testing	Quantity
Standard Penetration Test	21 No.

Table 4: Summary of laboratory testing in the recent ground investigation

Laboratory Testing	Quantity
Moisture Content	10 No.
Particle Size Distribution	10 No.
Atterberg Limits	10 No.
Geo - Environmental Testing (WAC Assessment)	32 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.

4.1 Topsoil

Topsoil is recorded at surface in non-paved areas. Topsoil is recorded in 30 No. out of 93 No. ground investigation locations.

The topsoil is generally described as brown slightly sandy slightly gravelly. The general thickness of the topsoil is between 0.2 to 0.6m with local exceptions thinner than 0.2m or thicker than 0.6m.

4.2 Made Ground

Made ground is recorded at 74 No. out of 93 No. ground investigation locations. From the descriptions, it is locally reworked glacial till. Waste material, such as brick, concrete and plastic, is recorded in 42 No. of the 74 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 is variable between 0.3m to 3.7m with an average of 1.5m.

A general description of the made ground is brown to grey, slightly sandy, slightly gravelly to gravelly clay with some angular to subangular cobbles, occasional boulders, occasional rootlets. Fragments of plastic, rope, concrete, wood, cloth, tarmacadam, brick and organic matter are recorded. At some locations the made ground is described as brown, gravelly, clayey, fine to coarse sand with occasional angular to subrounded cobbles, rootlets and fragments of metal, plastic and red brick.

Due to the variability of the thickness and composition of the made ground, further ground investigation is recommended for to provide information for use in detailed design.

4.2.1.1 Classification

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

The Natural Moisture Content (NMC) was determined from two samples and Atterberg limits were determined from one sample. The NMC results for the made ground are 13% and 25%.

The liquid limit is 38%, the plastic limit is 28% and the plasticity index is 10%. Cohesive made ground is described as intermediate plasticity silt.

The Particle Size Distribution (PSD) test was carried out on one sample. It recorded a fines content greater than 30% passing the 0.063mm sieve, with 30% gravel.

4.2.1.2 Unit Weight

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

4.2.1.3 Standard Penetration Tests

Standard Penetration Tests (SPTs) were carried out on the made ground and the range of SPT 'N' values recorded are presented in Appendix B.

The SPT 'N' values ranged from 4 to refusal. SPTs are typically between 4 and 24. The design SPT value for made ground is conservatively considered to be 4. Made ground should be assessed locally for detailed design.

4.2.1.4 Undrained Shear Strength

Laboratory undrained shear strength 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:

• $c_u = f_1 \ge N$ (kPa) (f₁ has conservatively been taken as 5kPa based on the plasticity index test result).

The undrained shear strength (c_u) is determined as 20kPa. The strength of the made ground should be assessed locally during detailed design.

4.2.1.5 Effective Stress Parameters

Laboratory strength testing was not conducted on samples of made ground. Therefore, reference was made to Kenney (1959).

An effective angle of shearing resistance of 30° is recommended, based on the available plasticity index test result.

4.2.1.6 Soil Stiffness

The soil undrained stiffness (E_u) can be estimated from a relationship with undrained shear strength. Jamiolkowski (1979) suggests a value of E_u between 200c_u and 1000c_u. In this case the E_u will be estimated as follows:

 E_u ' = 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.

4.3 Cohesive Deposits

4.3.1 Glacial Till Cohesive Deposits

Local glacial till is known as Dublin Boulder Clay which is a subdivision of till derived from limestone. It is encountered at 86 No. out of 93 No. ground investigation locations.

A general description of the glacial till is firm to very stiff, brown to grey, slightly sandy to sandy, slightly gravelly to gravelly clay with occasional cobbles. Some of the glacial till is described as very stiff to hard black silty stony clay.

The thickness of the glacial till is variable between 0.3 m to 20m.

4.3.1.1 Classification

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

The Natural Moisture Content (NMC) was determined for 26 No. samples and Atterberg limits were determined for 17 No. samples. The NMC of the glacial till cohesive deposits ranges from 8% to 43%. The average NMC for the glacial till cohesive deposits is 14%. The average liquid limit is 32% with a minimum limit of 5% and maximum of 44%. The average plastic limit is 18% with a minimum limit of 5% and a maximum of 31%. The average plasticity index is 14% with a minimum plasticity index of 8% and a maximum of 18%. Cohesive material is described as low to intermediate plasticity clay and intermediate plasticity silt.

The PSD test was carried out for seven samples. The PSD curves for the cohesive deposits have fines contents between 30% and 50% passing the 0.063mm sieve, with 20% to 45% gravel.

4.3.1.2 Unit Weight

In accordance with BS8002:2015, a clay with medium undrained shear strength, has a weight density which typically varies from 16 to 20kN/m³. A value of 18kN/m³ is adopted.

4.3.1.3 Standard Penetration Tests

Standard Penetration Tests (SPT) were carried out on the glacial till in boreholes. The range of SPT 'N' values recorded are presented in Appendix B.

The recorded SPTs values shown at the borehole logs are mostly between 8 and refusal. Only at one historical borehole (R88/B62317) one SPT result is 4.

The design SPT value for glacial till is 10.

4.3.1.4 Undrained Shear Strength

Laboratory undrained shear strength 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 plasticity indices)

The general undrained shear strength (c_u) for the alignment is determined as 55kPa.

4.3.1.5 Effective Stress Parameters

Laboratory effective stress 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 $34^{\circ}\pm1^{\circ}$ 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 (E_u) can be calculated based on a relationship with undrained shear strength. Jamiolkowski (1979) suggests a value of E_u between 500c_u and 1000c_u. In this case, the E_u is calculated as follows:

• $E_u = 500 \text{ x } c_u = 27 \text{MPa}$

The drained stiffness (E[']) can be approximated by taking 80% of this value which leads to a value of approximately 21MPa.

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 ground investigations. 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

Alluvial deposits are encountered at 12 No. out of 93 No. ground investigation locations.

A general description of the alluvium is very soft to firm, brownish to grey, slightly sandy to sandy, slightly gravelly silty clay or silty sandy gravel. Alluvium is described as gravelly in the GSI web page.

The thicknesses of the alluvial deposits are variable between 0.3 m to 4.5m.

4.3.2.1 Classification

The laboratory testing for alluvial deposits is presented in Appendix C.

The Natural Moisture Content (NMC) and Atterberg limits were determined for two samples. The NMC of the alluvial deposits are 17% and 27%. The liquid limits are 33% and 43%. The plastic limits are 21% and 33%. The plasticity indices are 12% and 20%. Alluvial deposits are described as intermediate plasticity clay and intermediate plasticity silt.

The PSD test was carried out on two samples. The PSD curves for the alluvial deposits have fines contents of 35% and 50% passing the 0.063mm sieve, with 20% and 25% gravel.

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

Five Standard Penetration Tests (SPT) were carried out on the alluvial deposits in boreholes. The range of SPT 'N' values recorded are presented in Appendix B.

The recorded SPTs values shown at the borehole logs are variable between 2 to 8.

The design SPT value for alluvium is conservatively considered to be 2.

4.3.2.4 Undrained Shear Strength

Laboratory undrained shear strength testing was not conducted on samples of alluvium. 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 (c_u) is determined as 10kPa.

4.3.2.5 Effective Stress Parameters

Laboratory effective stress 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 (E_u) can be calculated based on the relationship with undrained shear strength. Jamiolkowski (1979) suggests a value of E_u between 200c_u and 1000c_u. In the examined case the E_u will be calculated as follows:

 $E_u' = 200 \text{ x } c_u = 2MPa$

The drained stiffness (E') can be approximated by taking 80% of this value which leads to a value of E' = 1.5MPa

4.3.3 Estuarine silts and clays

Estuarine silt and clay is not identified in the available ground investigation data. It is presented in the GSI quaternary sediments map and will likely be encountered near between intersection of Landaff Terrace and Bellevue Avenue to Blackrock Park.

Parameters have not been determined for estuarine silt and clay because they were not encountered in the ground investigation. This material, if encountered, will have poor engineering qualities. Its extent and properties should be investigated for detailed design.

4.4 Granular Deposits

4.4.1 Sand and Gravel

The sand and gravel deposits are encountered in 34 No. of 93 No. ground investigation locations. Based on GSI Quaternary map sand and gravel deposits are likely to be glacial material.

The description of sand and gravel deposit is brownish grey to dark grey, fine medium dense to very coarse, gravelly fine to coarse sand or sandy gravel with subangular to subrounded cobbles.

The thickness of the sand and gravel deposits is variable between 0.3m to 5.7m with an average of 2m. The thickness of granular deposits is greater than 5.7m only at one historic borehole located at the intersection of Merrion Road and Sandymount Ave. The thickness of the glacial till granular deposit in this borehole is 16m. However, it should be noted that this borehole is drilled with rotary core and another cable percussive borehole in the vicinity which is drilled 15m away only described 5m of gravel.

4.4.1.1 Classification

The laboratory testing for sand and gravel deposits is presented in Appendix B.

The Natural Moisture Content (NMC) was determined for three samples. The NMC of the sand and gravel deposits range from 5% to 12%. The average NMC is 7%. The Atterberg limits were determined for one sample of cohesive material within the granular deposits. The liquid limit is 36%.

The plastic limit is 23% and the plasticity index is 23%. Cohesive material in the sand and gravel deposits is described as intermediate plasticity clay.

PSD testing was carried out on five samples taken from four exploratory locations. The PSD curves for the granular deposits have 1% to 5% passing the 0.063mm sieve, with 60% to 90% gravel.

4.4.1.2 Unit Weight

Based on the available ground investigation results, this stratum is typically described as gravel or sand below groundwater level. The design SPT N-value is considered to be 10 which, according to BS5930, corresponds to a loose layer. This leads to a γ value ranging between 18kN/m³ to 21kN/m³ (BS8002: 2015). A value of 20kN/m³ is adopted.

4.4.1.3 Standard Penetration Tests

In total, 27 No. Standard Penetration Tests (SPTs) were carried out on the sand and gravel deposits in boreholes. The range of SPT 'N' values recorded are presented in Appendix B.

The SPT 'N' values range from 10 to refusal. The preliminary design SPT value is considered to be 10.

4.4.1.4 Effective Stress Parameters

Peck *et al* established a relationship between the SPT N and critical state friction angle ($\varphi'_{cv,k}$) for coarse grained soils. Following from that, a graph was introduced correlating the above parameters. Several SPT tests were completed within the sand and gravel deposits. The results ranged from 10 to refusal. An SPT N value of 10 according to the graph mentioned above, corresponds to a $\varphi'_{cv,k}$ of approximately 32°.

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

4.4.1.5 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 15MPa.

4.4.1.6 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 ground investigation.

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

 $K_0 = 1 - \sin \phi = 0.47*$

* ϕ value is presented above as $\phi'_{cv,k}$

4.4.2 Marine Beach Sand

The marine beach sand deposits are encountered in 10 No. of 93 No. ground investigation locations.

The description of marine beach sand deposits is brownish grey to black, fine to coarse, gravelly sand or sandy gravel with subangular to subrounded cobbles.

The thickness of the marine beach sand deposits is variable between 0.3m to 2.3m with an average of 1.2m.

4.4.2.1 Classification

The laboratory testing for marine beach sand deposits is presented in Appendix C

The Natural Moisture Content (NMC) were determined for one sample. The NMC of the marine beach sand deposits is 19%.

The PSD test was carried out for one sample. The PSD curve for the marine beach sand has a fines content 8% passing the 0.063mm sieve, with 50% gravel.

4.4.2.2 Unit Weight

Based on the available ground investigation results, this stratum is typically described as gravel or sand below groundwater level. The design SPT N is considered as 10 which, according to BS5930, corresponds to a loose layer. This leads to a γ value ranging between 18kN/m³ to 21kN/m³ (BS8002: 2015). A value of 20kN/m³ is adopted.

4.4.2.3 Standard Penetration Tests

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

The recorded SPTs values shown at the borehole logs are variable between 8 and refusal.

The preliminary design SPT value for alluvium is conservatively considered to be 8.

4.4.2.4 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. An SPT N value of 8 according to the graph mentioned above, corresponds to a $\phi'_{cv,k}$ of approximately 30°.

A $\phi'_{cv,k}$ value of 30° is selected for preliminary design. Due to the nature of this layer (coarse-grained) c'= 0kPa

4.4.2.5 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 12MPa.

4.4.2.6 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 ground investigation.

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

 $K_0 = 1 - \sin \phi = 0.5*$

* ϕ value is presented above as $\phi'_{cv,k}$

4.5 Bedrock

Bedrock was encountered in some of the historical ground investigations. The top of the bedrock is variable between 3m to 16m below ground level.

The bedrock is mainly described as black, fine to coarse grained, grey, limestone.

Depth to bedrock map presented in "GeoUrban Depth to Bedrock (GSI)" shows that depth to bedrock from the surface is variable between 1m and 10m. At specific locations, the map is usually consistent with the top of the bedrock determined from the borehole logs.

The Proposed Scheme includes works which will only be close to the existing ground level. The proposed retaining wall is expected to be founded on glacial till. Therefore, derivation of design parameters for the underlying bedrock will not be required.

4.6 Stratigraphic Profile

The stratigraphic profile for the Proposed Scheme is summarised in Table 5.

Stratum	Typical Depth (m BGL)	Typical Thickness (m)	
Topsoil	0.0	0.0 to 0.6	
Made Ground	0.0 to 0.8	0.3 to 3.7	
Glacial Till Cohesive Deposits	0.3 to 6.8	0.3 to 20	
Alluvium	0 to 2.5	0.3 to 4.5	

 Table 5: Summary of stratigraphic profile for the Proposed Scheme

Stratum	Typical Depth (m BGL)	Typical Thickness (m)
Marine Beach Sand	1.2 to 3	0.2 to 2.3
Sand and Gravel Deposits	0.2 to 8	0.3 to 5.7
Bedrock	4 to 8	N/A

* Esturine silts and clay is likely to be encountered Landaff Terrace and Bellevue Avenue to Blackrock Park. Marine beach sands are localised deposits and likely to be encountered in the vicinity of the Merrion Strand.

4.7 Groundwater

4.7.1 Summary of Groundwater Conditions

Groundwater data is presented in Table 6.

 Table 6: Groundwater level data

Borehole	Date	Groundwater Level (m BGL)	Standpipe / Water strike/Observation Reading
R15-CP06	24.09.2020	3.8	Standpipe
R15-CP07A	25.09.2021	2.5	Standpipe
R525/59365	25.05.1971	2.7	Water Strike
R528/59371	21.05.1969	1	Water Strike
R528/59371	15.05.1969	1.8	Water Strike
R723/61223	13.09.1988	5.7	Water Strike
R723/61222	8.09.1988	5.6	Water Strike
R741/61351	25/11/1981	0.9	Ground Water Observation
R741/61346	13.11.1981	1.0	Ground Water Observation
R741/61347	08.12.198	0.8	Ground Water Observation
R741/61348	18.11.1981	1.5	Ground Water Observation
R888/62317	08.09.1977	3.8	Ground Water Observation
R889/62323	22.11.1990	3.6	Ground Water Observation
R890/62321	17.07.1980	2.0	Ground Water Observation
R890/62328	14.07.1980	1.2	Ground Water Observation
R891/62331	06.08.1976	1.2	Ground Water Observation
R891/62329	04.08.1976	4.9	Ground Water Observation
R891/62330	05.08.1976	1.2	Ground Water Observation
R1108/64363	11.05.1982	4.2	Ground Water Observation
R1110/64368	13.12.1989	2.1	Ground Water Observation
R1110/64370	15.12.1989	3.7	Ground Water Observation
R3468/107937	17.12.1997	4.4	Ground Water Observation

Borehole	Date	Groundwater Level (m BGL)	Standpipe / Water strike/Observation Reading
R3468/107938	18.12.1997	4.3	Ground Water Observation
R3468/107939	20.12.1997	4.8	Ground Water Observation

The groundwater measures listed above are the highest recorded water groundwater depths. All groundwater measures are recorded during the site investigation works.

Based on these groundwater measures, groundwater level for preliminary design should be taken as 1m below ground level.

4.8 Summary of Preliminary Design Parameters

A summary of the preliminary design parameters for each stratum is presented in Table 7.

Stratum	γ (kN/m ³)	cu (kPa)	φ (°)	c´ (kPa)	Eu (MPa)	E´ (MPa)
Topsoil	No geotechnical parameters will be provided for this layer.					
Made Ground	18	20	30	0	4	3
Glacial Till Cohesive Deposits	18	55	32	0	27	21
Alluvial Deposits	18	10	27	0	2	1.5
Marine Beach Sand	20	N/A	30	0	N/A	15
Sand and Gravel Deposits	20	N/A	32	0	N/A	15

Table 7: Summary of Preliminary Design Parameters

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

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

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

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.

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 Belfield/Blackrock to City C. Alignment

ARUP

Belfield/Blackrock to City C.

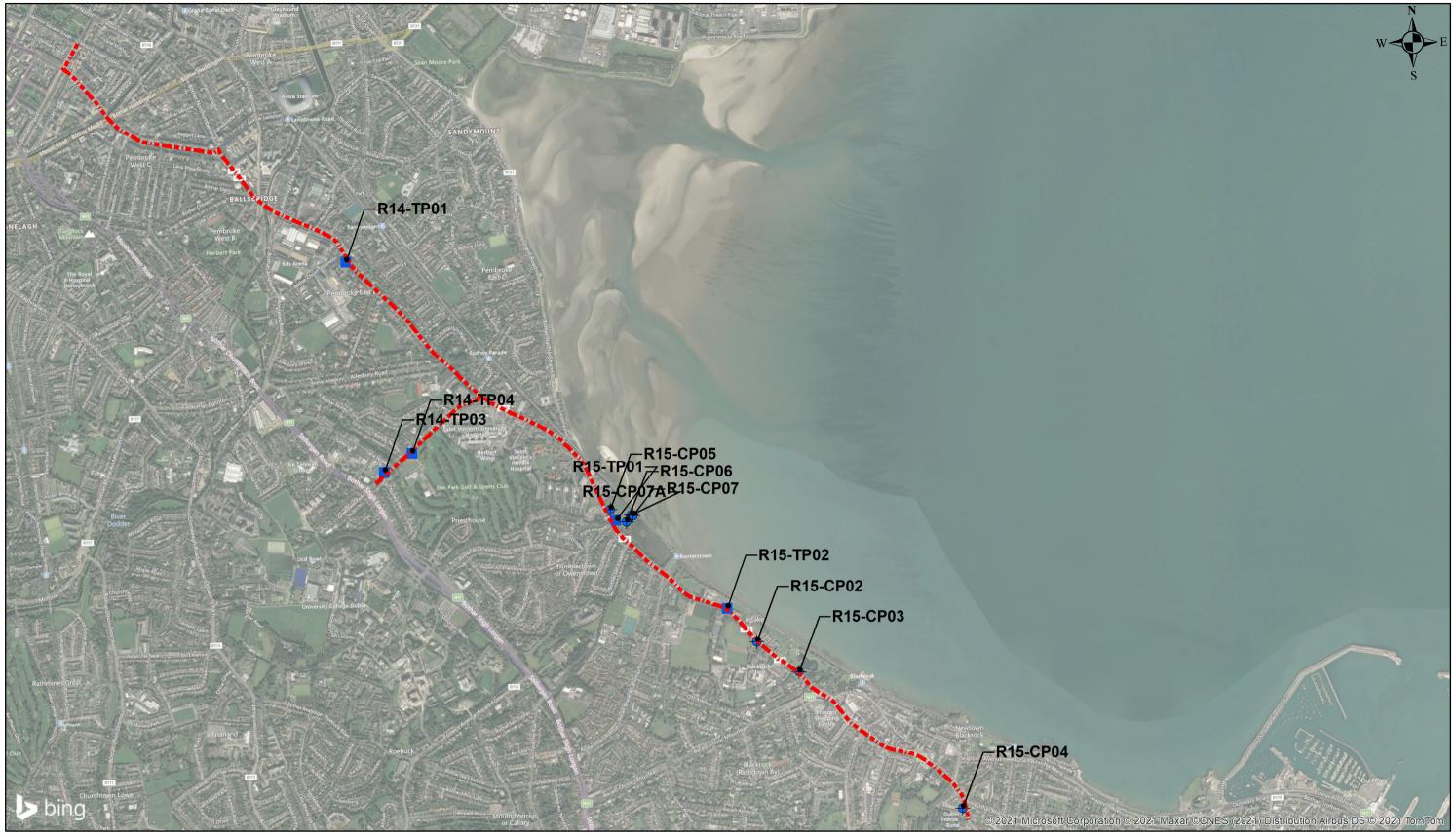
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Aerial View (Bing Map)



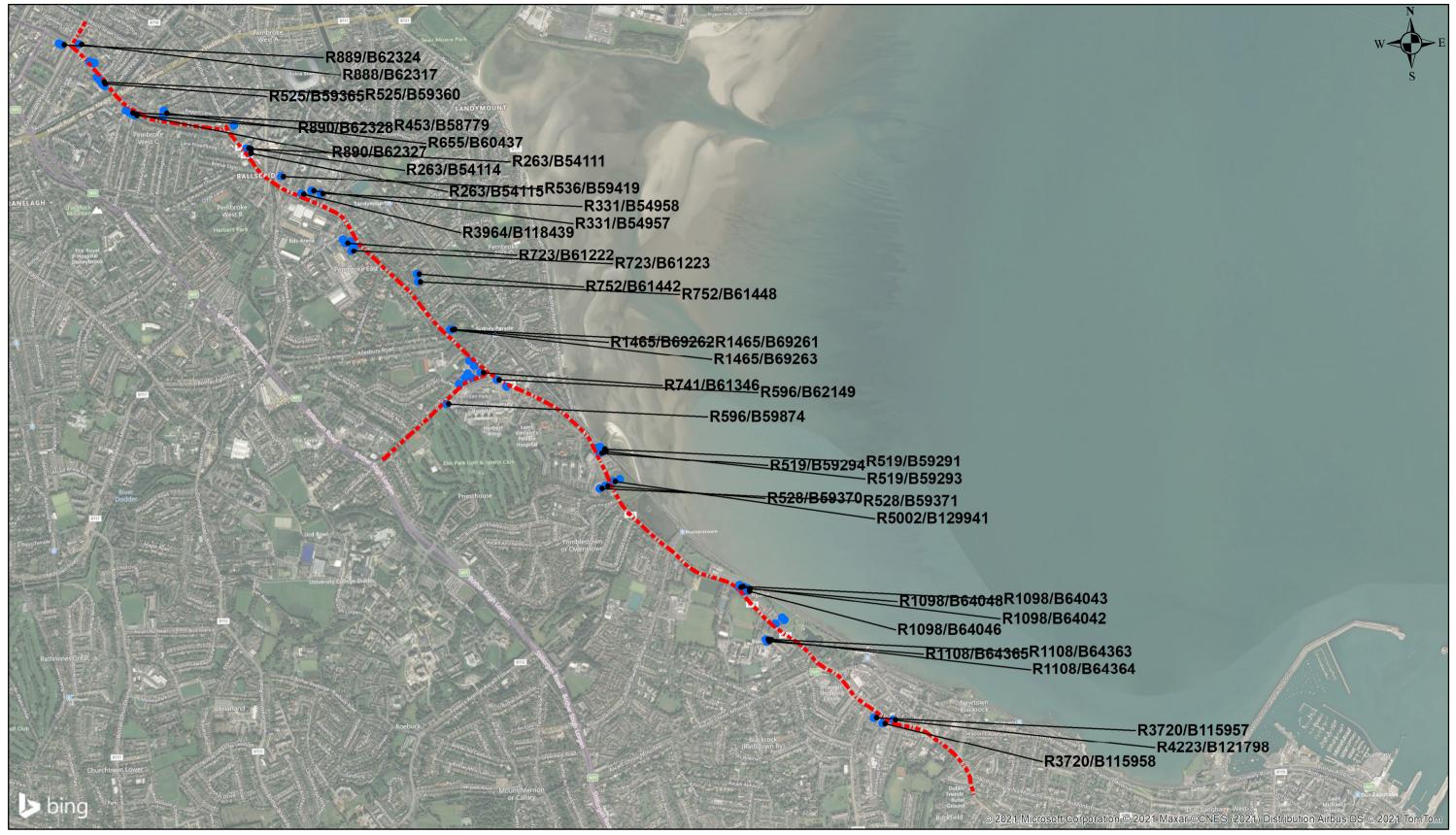
	Legend Belfield/Blackrock to City C. Alignment			
	Site Specific Ground Investigation			Belfield
	TP			Site Speci
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eld/Blackrock to City C.

pecific Ground Investigation on Plan





Belfield/Blackrock to City C. Alignment

Historical Boreholes (GSI) Approximately 20m offset

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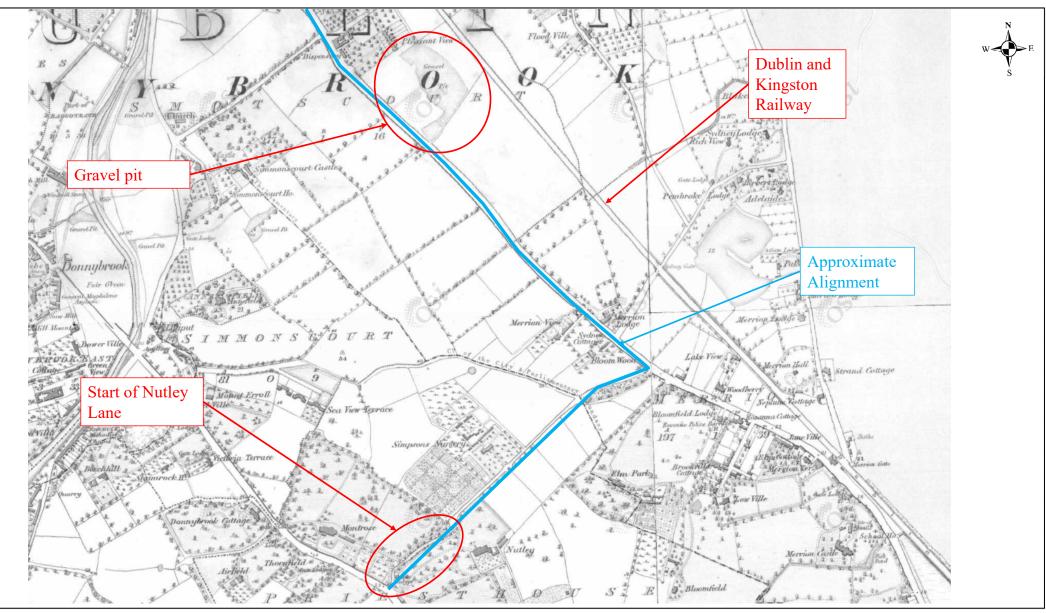
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Belfield/Blackrock to City C.

Historical Boreholes (GSI) 20m Offset



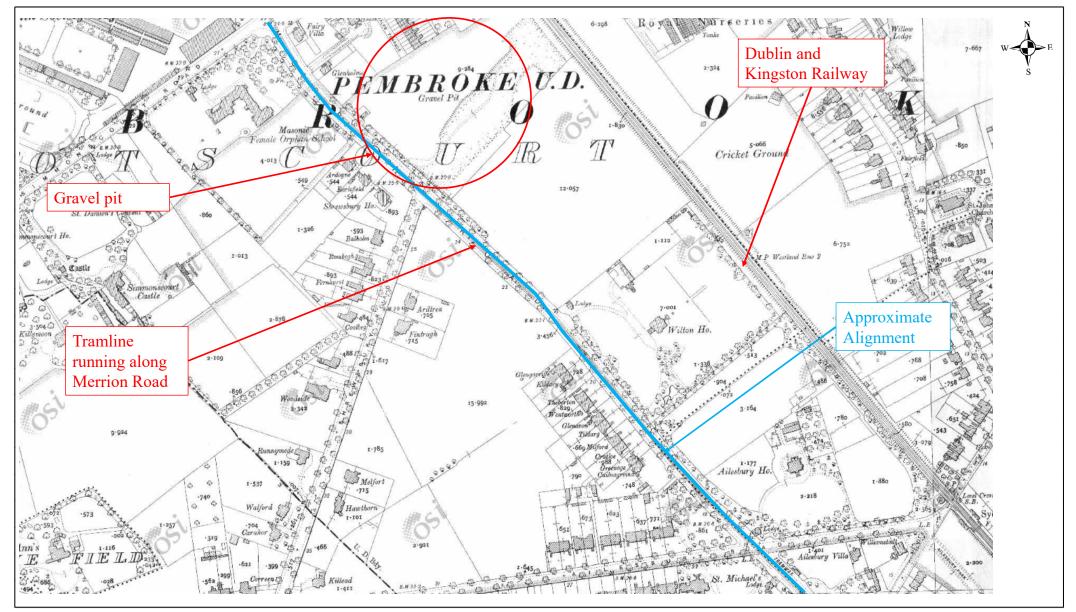
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Belfield/Blackrock to City C.

Historic Map 6 Inch (1837 - 1842)

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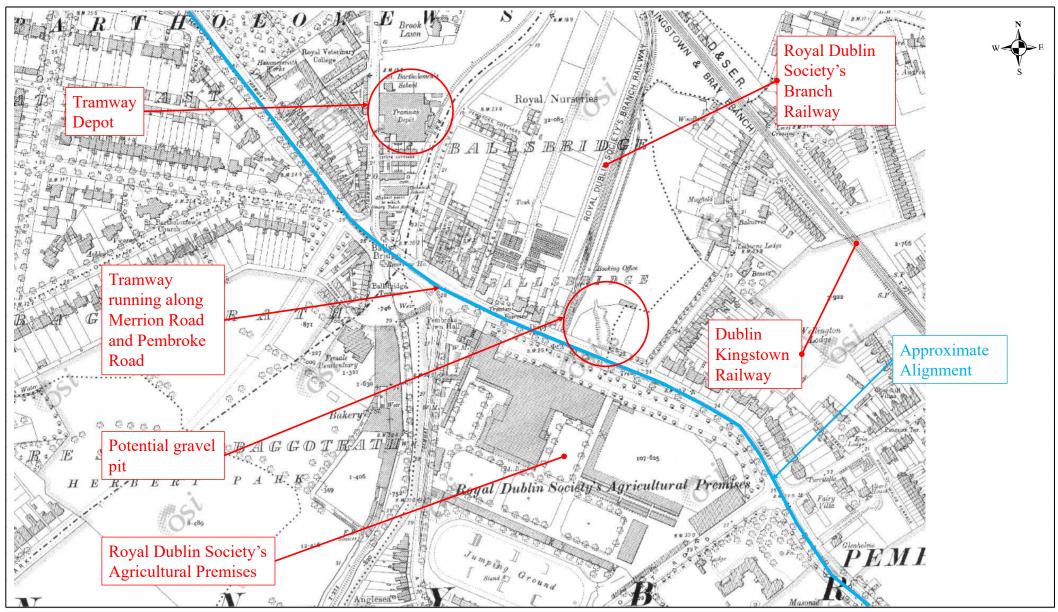
Belfield/Blackrock to City C.

Historic Map 25 Inch (1888 = 1913)

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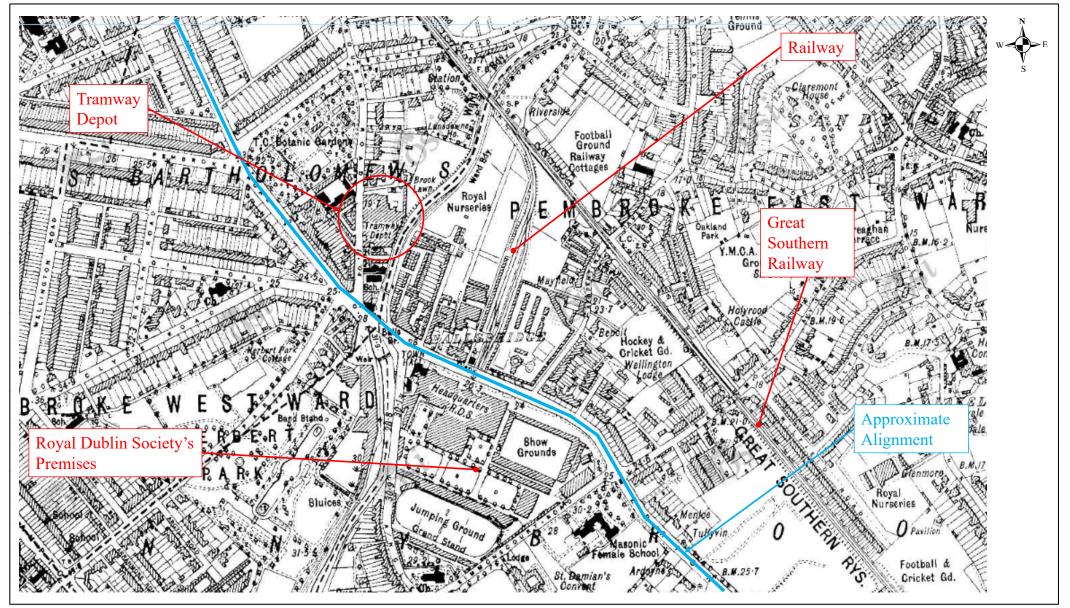
Belfield/Blackrock to City C.

Historic Map 25 Inch (1888 - 1913)

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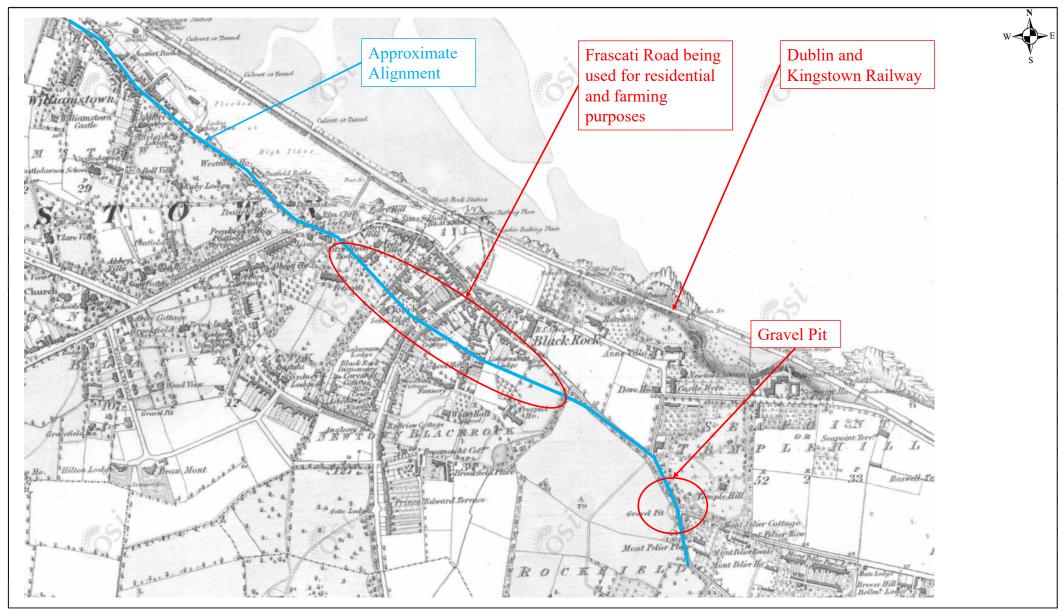
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Belfield/Blackrock to City C.

6 Inch Cassini (1830 - 1930)

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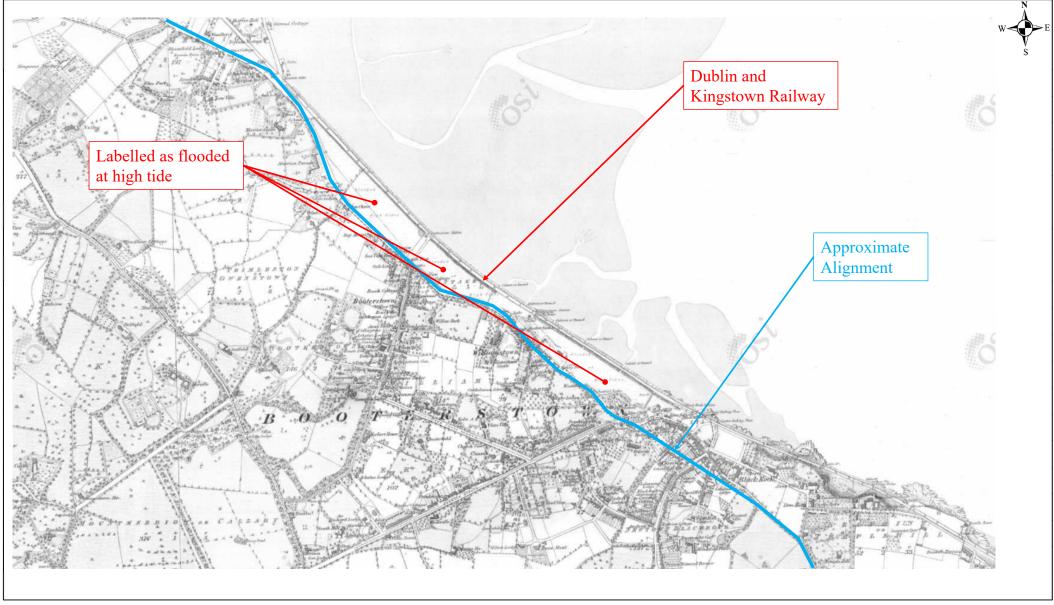
Belfield/Blackrock to City C.

Historic Map 6 Inch (1837 - 1842)

Not to Scale

FIGURE A08

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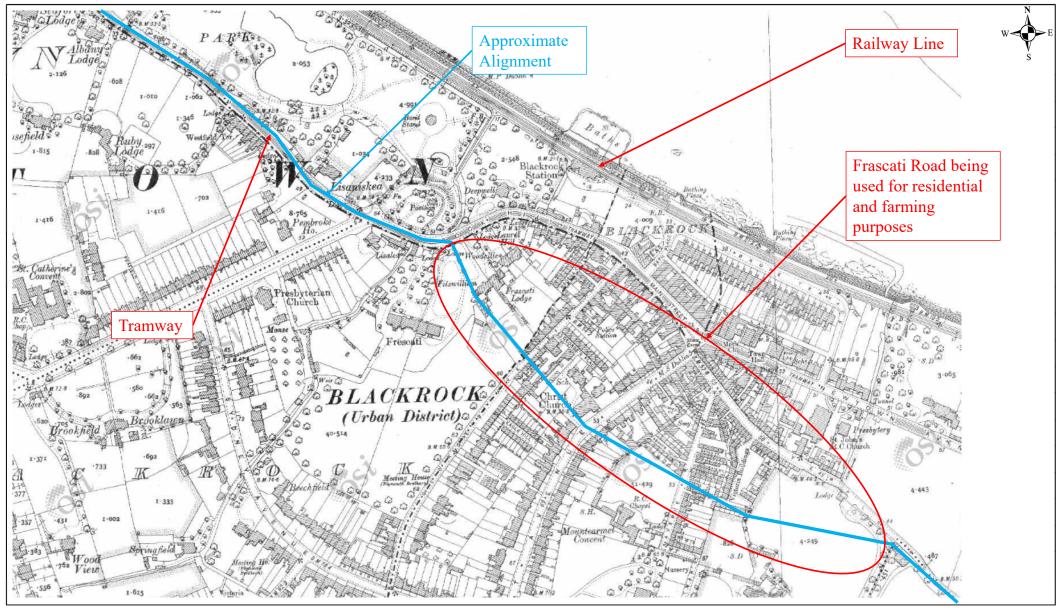
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Belfield/Blackrock to City C.

Historic Map 6 Inch (1837 - 1842)

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Not to Scale



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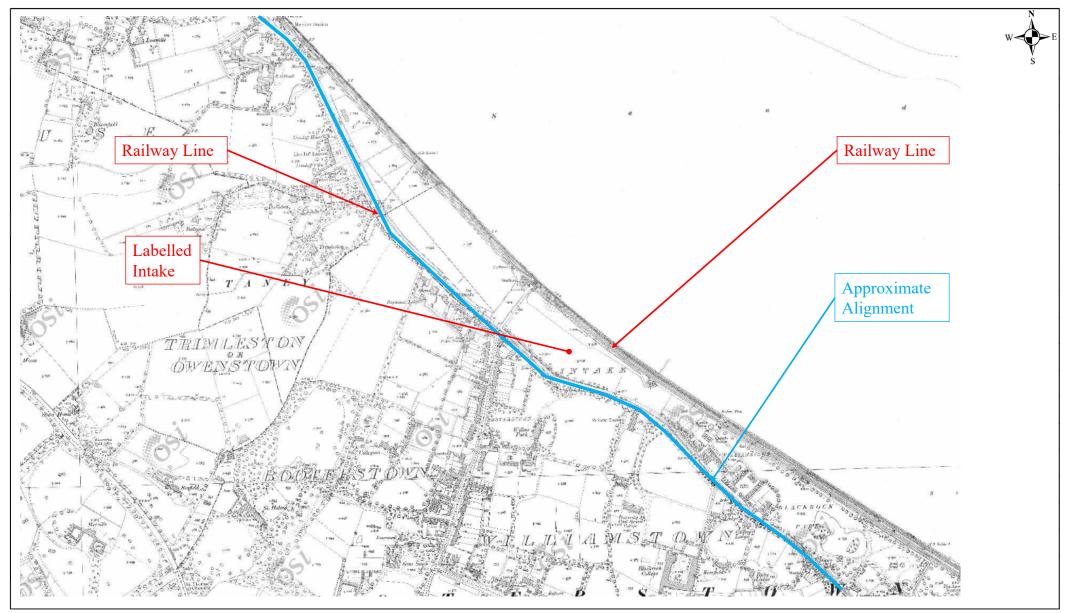
Belfield/Blackrock to City C.

Historic Map 25 Inch (1888 - 1913)

Not to Scale

FIGURE A10

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Belfield/Blackrock to City C.

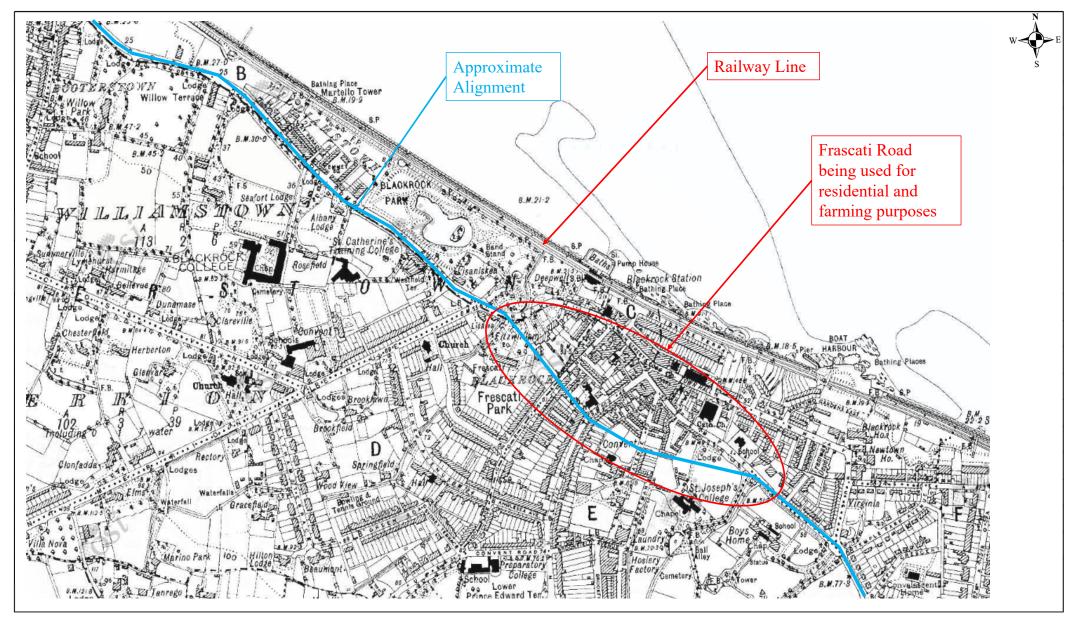
Historic Map 25 Inch (1888 - 1913)

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Not to Scale

FIGURE (A11

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Belfield/Blackrock to City C.

6 Inch Cassini (1830 - 1930)

FIGURE A12

Not to Scale

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Belfield/Blackrock to City C. Alignment

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EPA 20m Contour Map



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- Belfield/Blackrock to City C. Alignment
- A, Alluvium
- Ag, Alluvium (gravelly)
- GLs, Gravels derived from Limestones
- Mbs, Marine beach sands
- Mesc, Esturine silts and clays
- Rck, Bedrock outcrop or subcrop
- TLs, Till derived from limestones
 - Urban

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Belfield/Blackrock to City C.

Quaternary Sediments

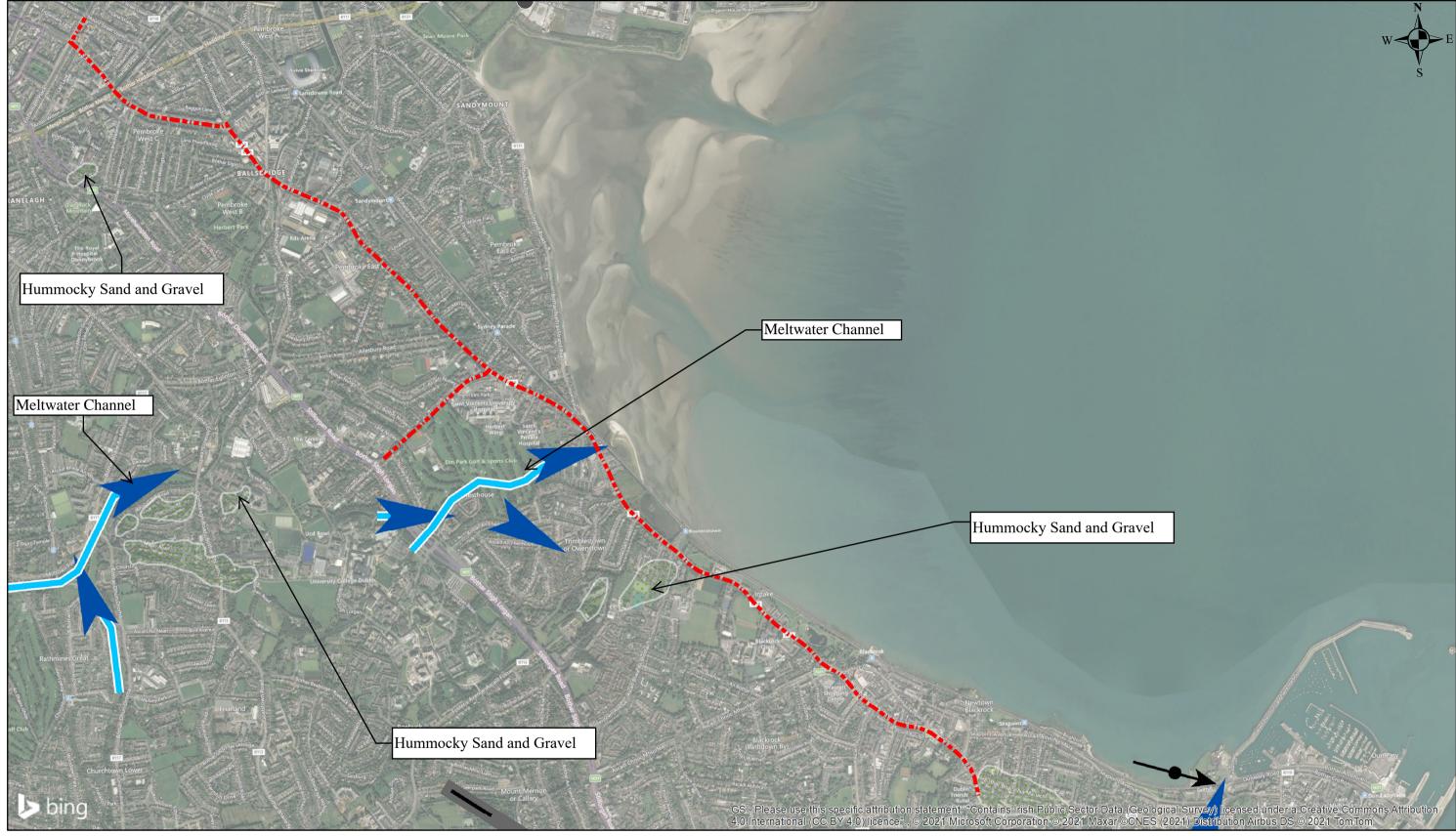
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Meters

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Belfield/Blackrock to City C. Alignment

Quaternary Geomorphology

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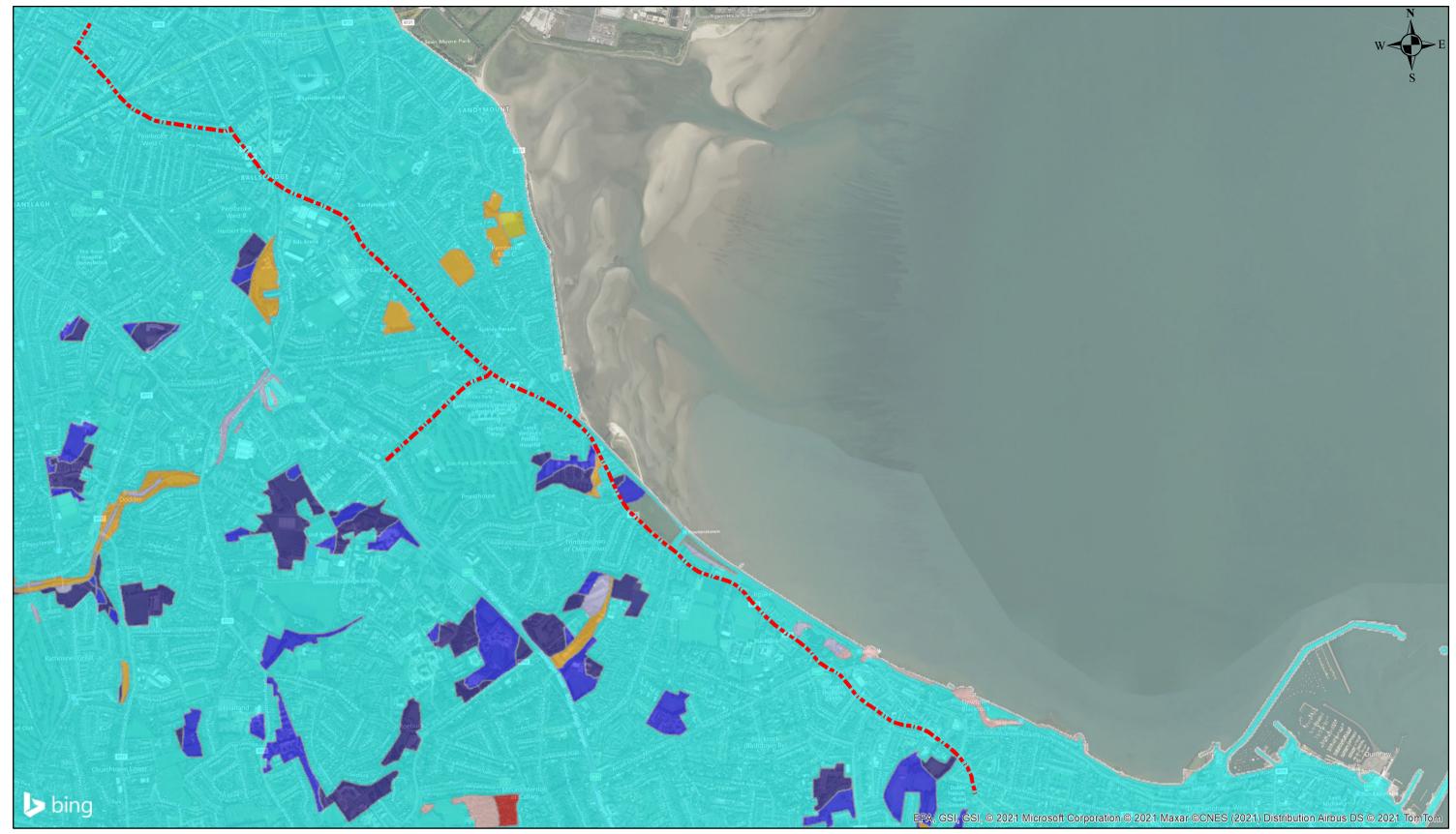
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FIGURE A15

Belfield/Blackrock to City C.

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- Belfield/Blackrock to City C. Alignment
- Alluvium AminSW - Bedrock at surface-Non calcareous BminDW - Till derived chiefly from limestone BminPD - Till derived chiefly from limestone BminSW - Bedrock at Surface - Calcareous Made Ground MarSed - Marine/Estuarine Sediments

1:22,000

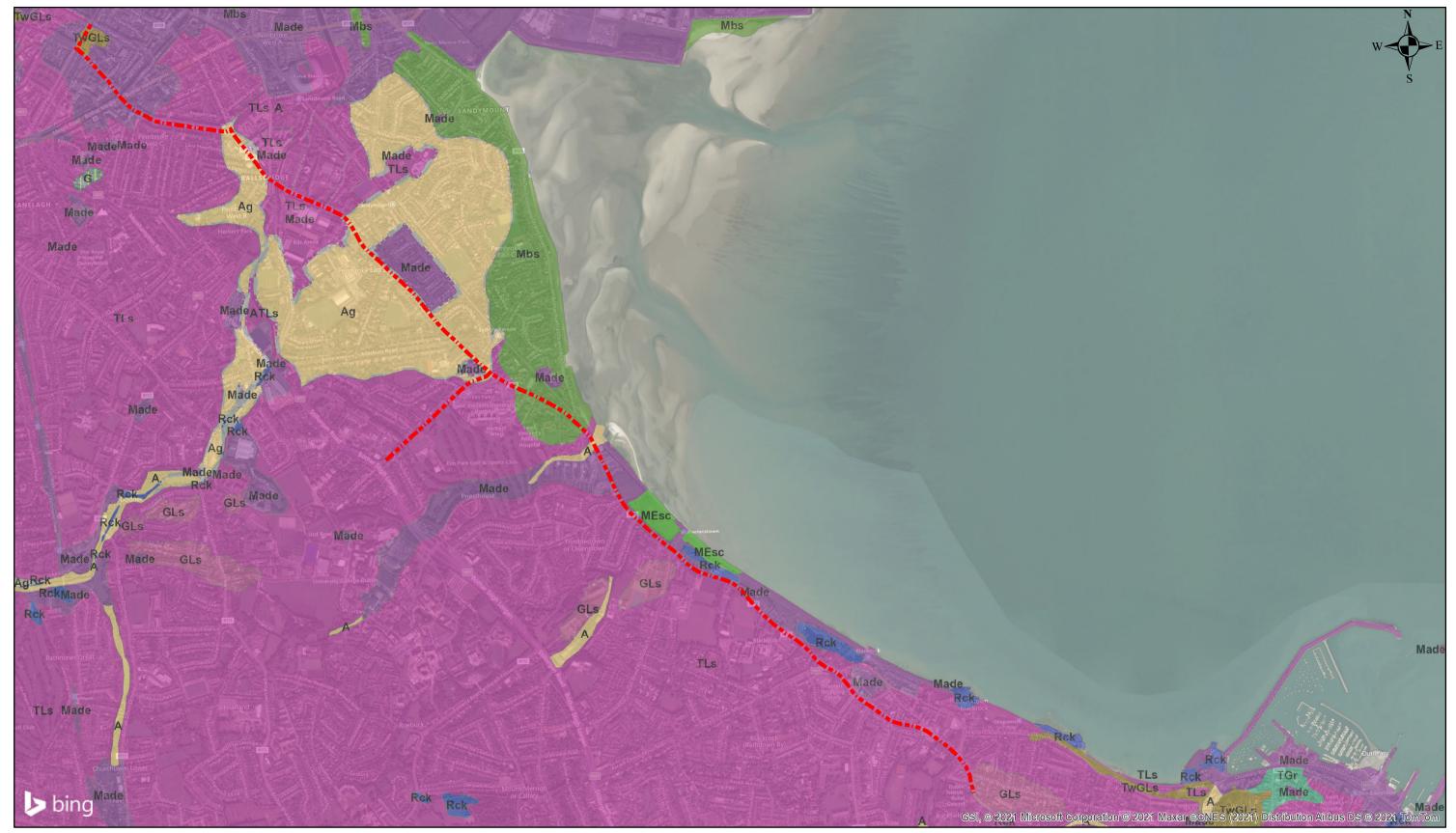


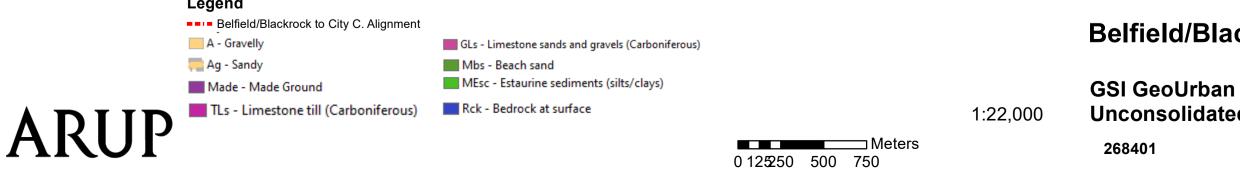
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Belfield/Blackrock to City C.

GSI Groundwater Subsoils (Teagasc)





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Belfield/Blackrock to City C.

Unconsolidated Sediments



- Belfield/Blackrock to City C. Alignment
- Bedrock Outcrops 100 ITM 2018
- ----- Fault

ARUP

- Ballysteen Formation
- Lucan Formation
- Type 2p microcline porphyritic

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<u>Meters</u> 0 125250 500 750

GSI Bedrock Geology 100k 268401

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Belfield/Blackrock to City C.



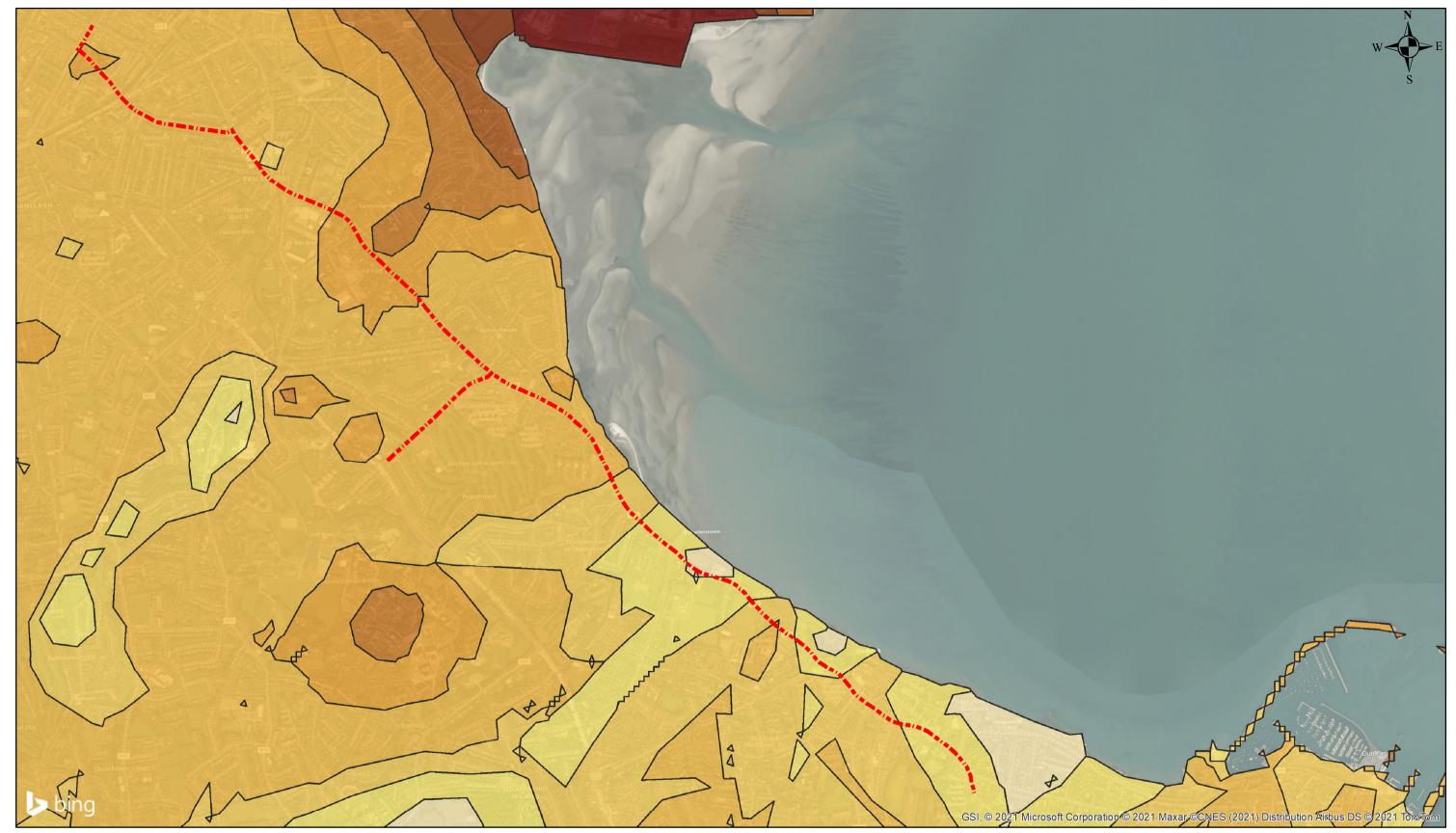


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Belfield/Blackrock to City C.

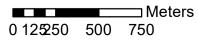
GSI Karst Features





Legend Belfield/Blackrock to City C. Alignment 0 to 1m 1 to 3m 3 to 5m 5 to 10m 10 to 15m 15 to 20m 20 to 25m 30 to 45m

GS 1:22,000 **De**p



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eld/Blackrock to City C.

GSIGeoUrban Depth to Bedrock





ARUP

Belfield/Blackrock to City C. Alignment

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

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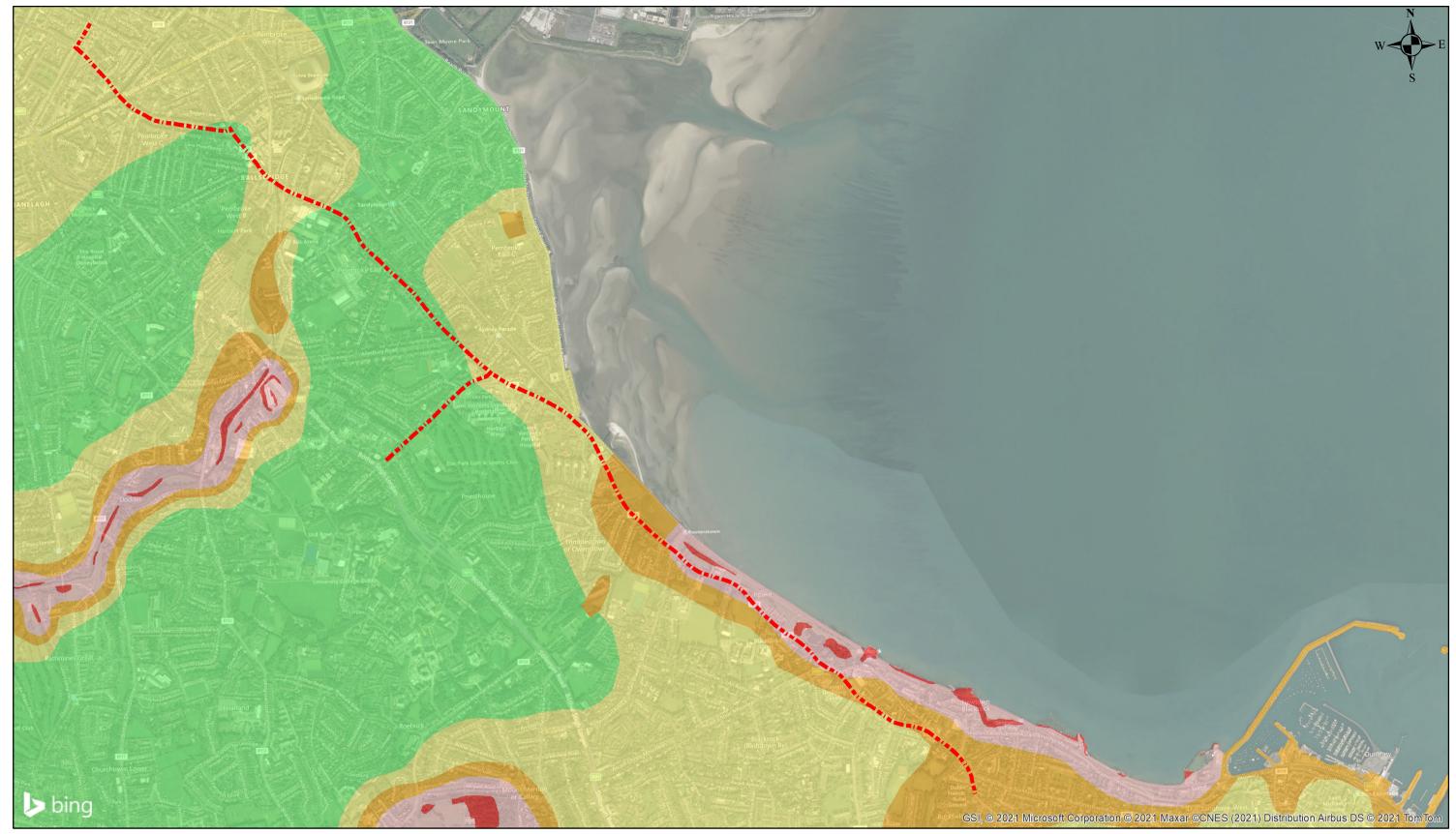
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Belfield/Blackrock to City C.

GSI Groundwater Aquifer



Belfield/Blackrock to City C. Alignment National Groundwater Vulnerability Ireland

Rock at or near Surface or Karst

Extreme

— High

Moderate Low

ARUP Water 1:22,000



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Belfield/Blackrock to City C.

GSI Groundwater Vulnerability



ARUP

Belfield/Blackrock to City C. Alignment

Groundwater Wells and Springs

Belfield/Blackrock to City C.

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GSI GW Wells & Springs





ARUP

Belfield/Blackrock to City C. Alignment

- River Network and River Flow Direction Arrows
- Lake Segments

Estimated Historic Rivers and Streams

Estimated Historic Rivers and Streams

1:22,000



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Belfield/Blackrock to City C.

River of Dublin & EPA Waterbodies





Belfield/Blackrock to City C. Align National Groundwater Recharge Ireland Annual Recharge (mm)

- 1401-2000 mm
- 1001-1400 mm 901-1000 mm
- 801-900 mm
- 701-800 mm

ARUP

601-700 mm

iment	
	551-600 mm 🥌 51-100 mm
-	501-550 mm 💻 1-50 mm
	451-500 mm 💻 0 mm
-	401-450 mm 💻 Water
-	351-400 mm
-	301-350 mm
-	251-300 mm
	201-250 mm
	151-200 mm
	101-150 mm

Belfield/Blackrock to City C.

Groundwater Recharge

1:22,000

Meters

0 125250 500 750

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Meters

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Belfield/Blackrock to City C.

Subsoil Permeablity





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Belfield/Blackrock to City C. Alignment 🕀 Pit Early to Mid-20thC: Pits Mid-19thC: Quarries Audited Sites Unaudited Sites

1:22,000

 Meters 0 125250 500 750

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Belfield/Blackrock to City C.

GSI Active and Historic Pits & Quarries





- Belfield/Blackrock to City C. Alignment
- Not Specified
- Both

ARUP

Metallic

• Non-metallic

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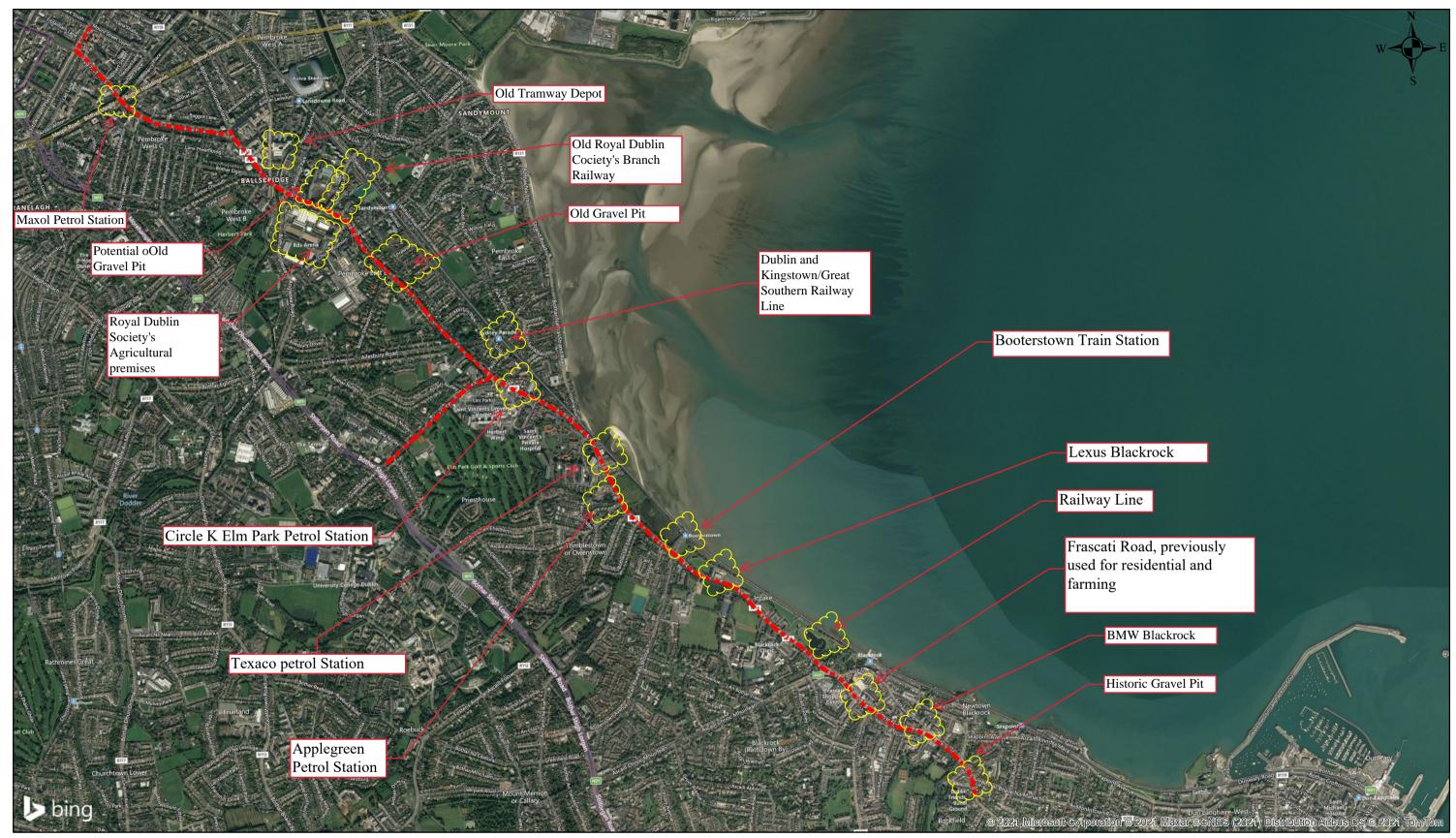
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Belfield/Blackrock to City C.

GSI Mineral Localities





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Belfield/Blackrock to City C. Alignment

Belfield/Blackrock to City C.

Potential Sources of Contamination

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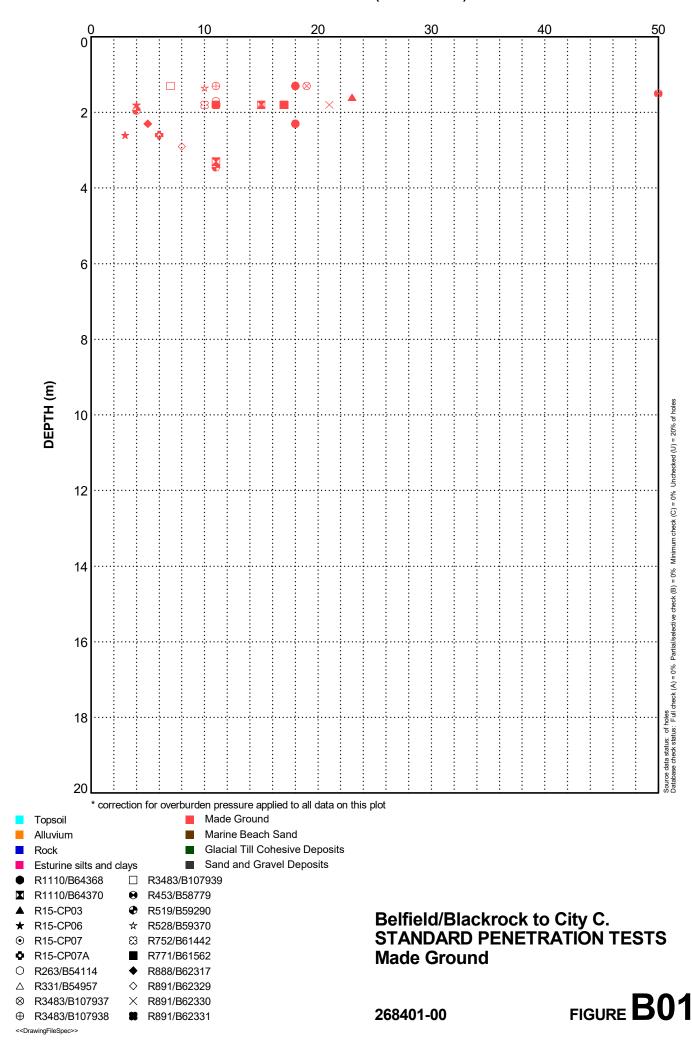


Appendix B

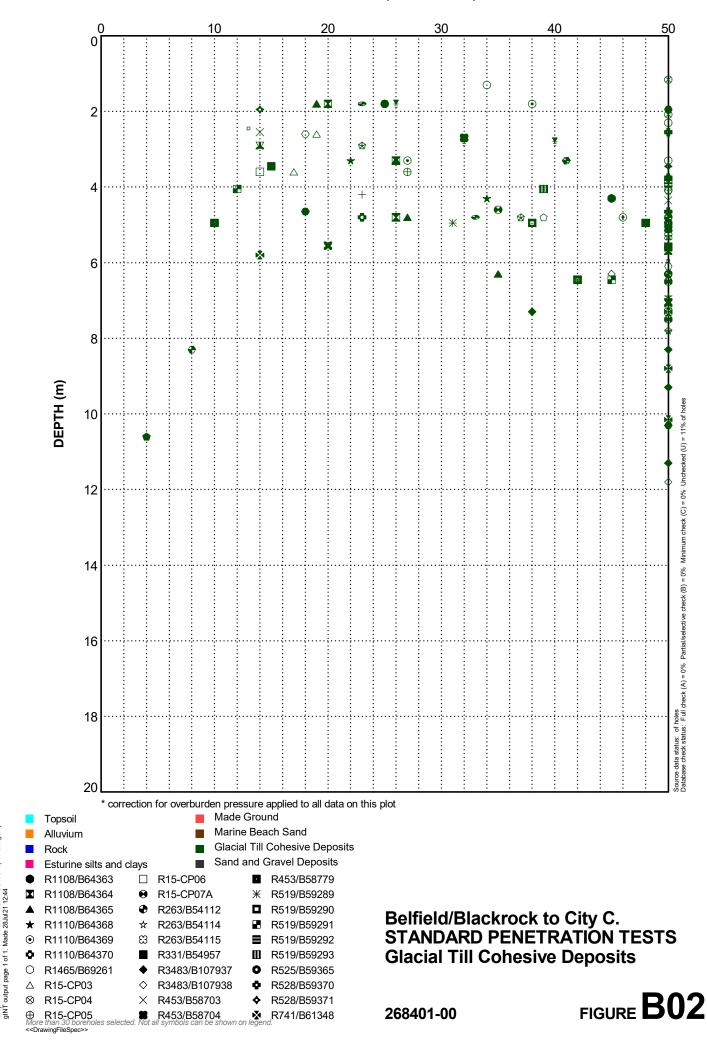
In-Situ Testing Figures

output

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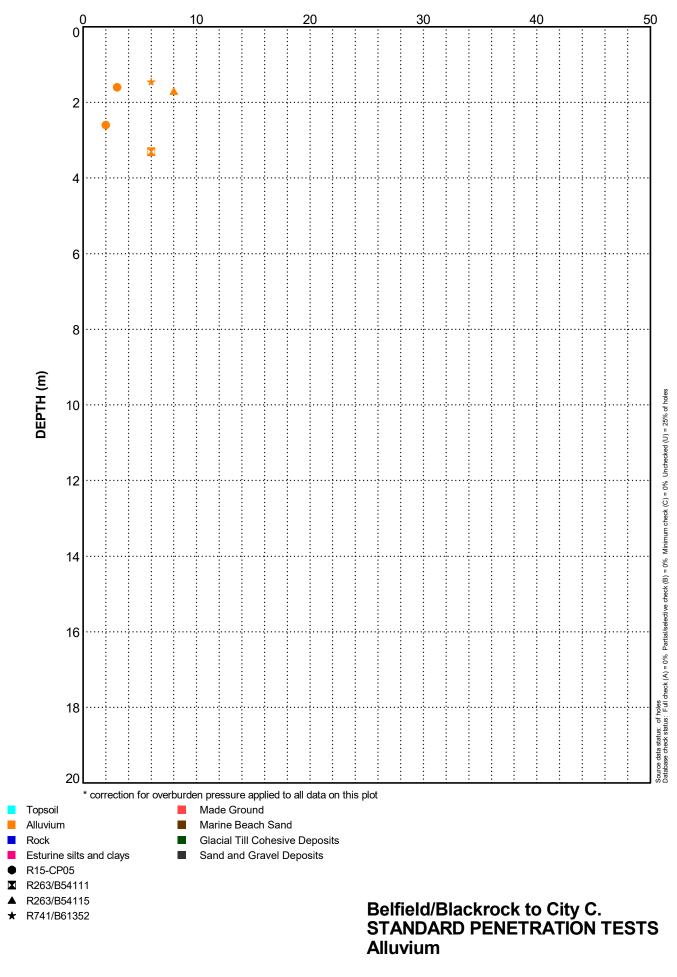


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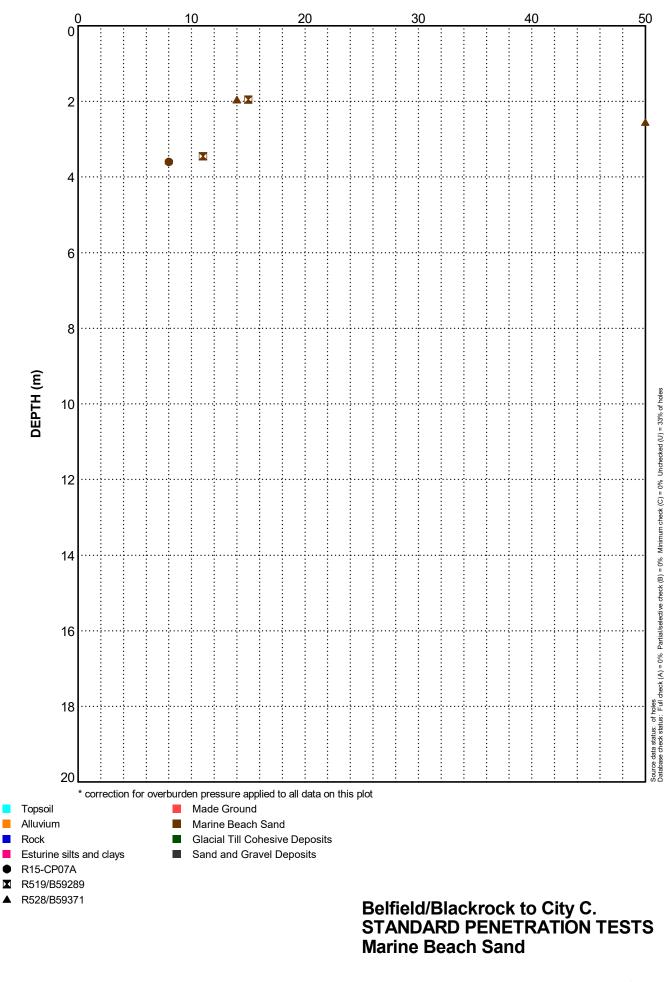


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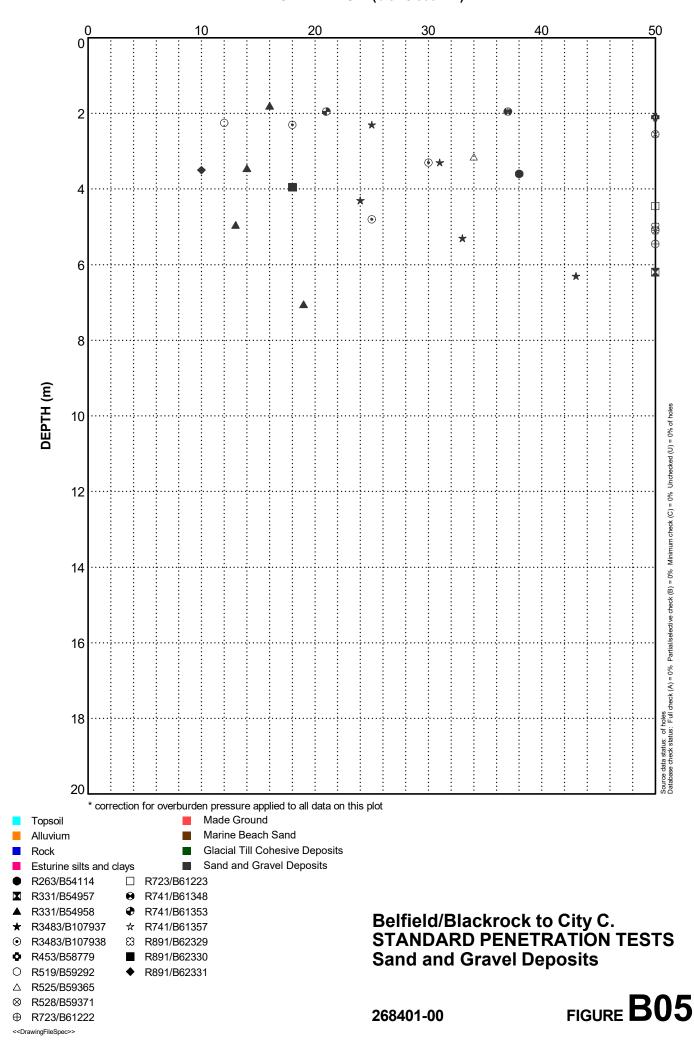


SPT N VALUE* (blows/300mm)



output

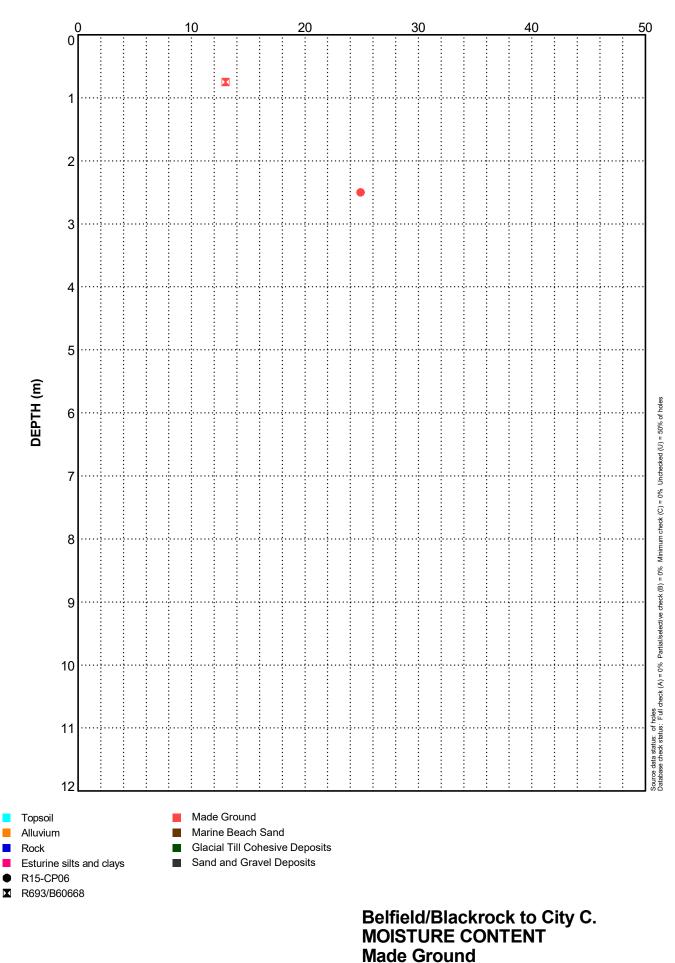
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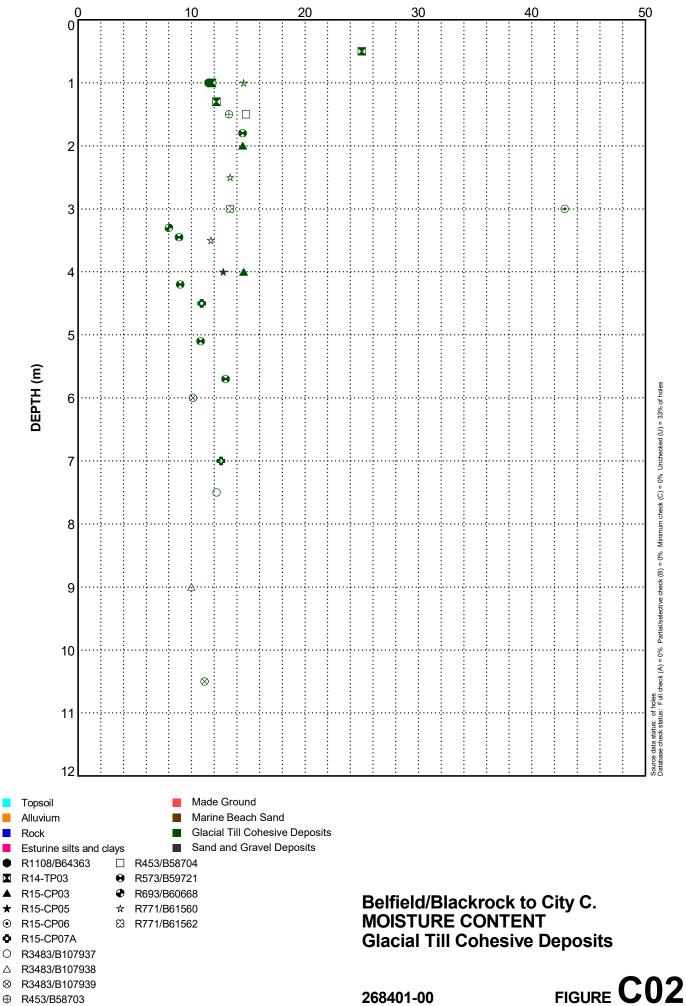
SPT N VALUE* (blows/300mm)

Appendix C

Laboratory Testing Figures



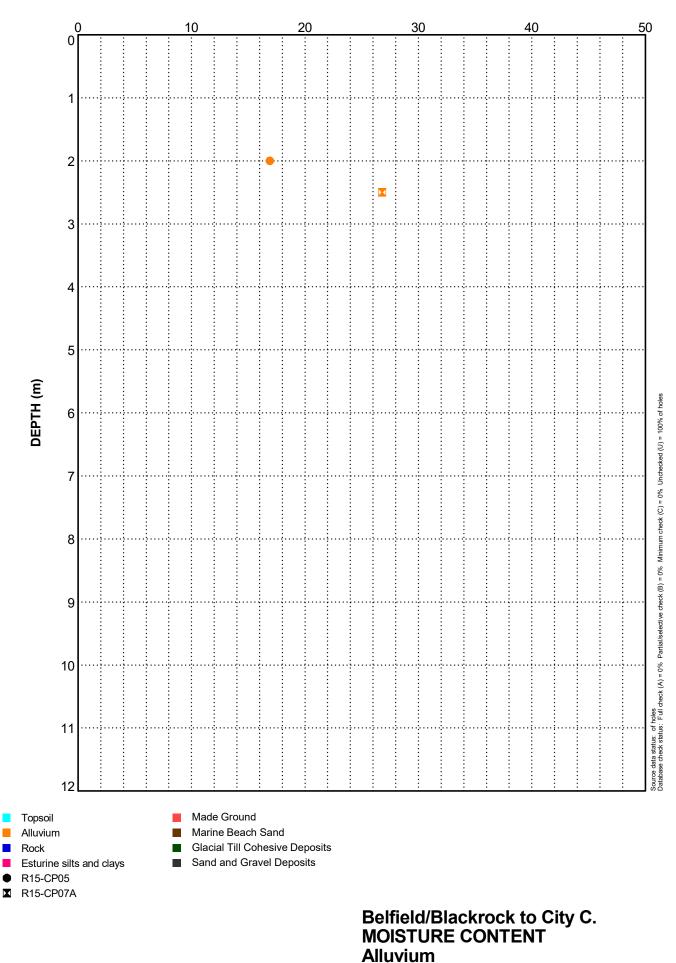




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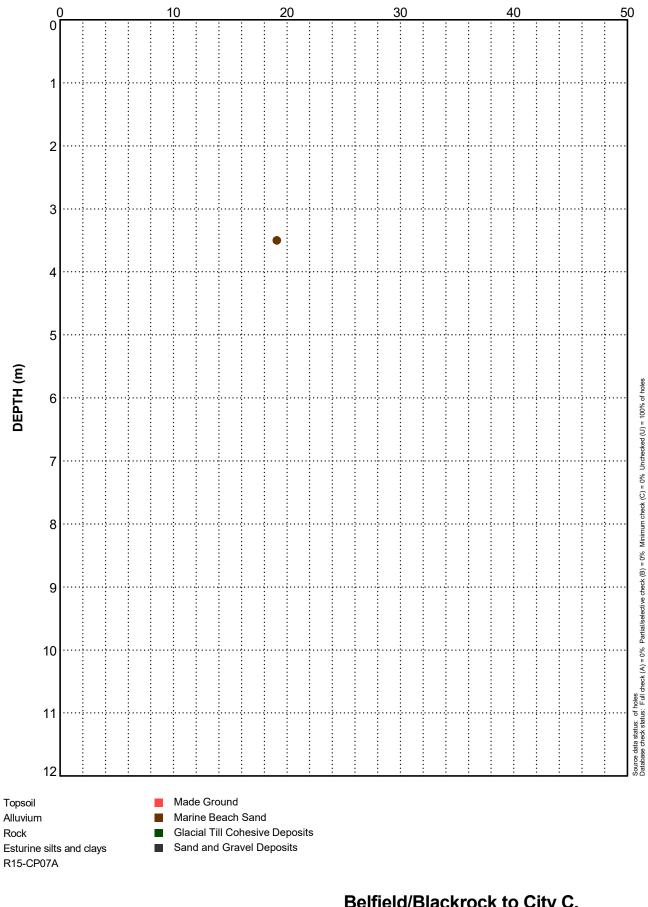
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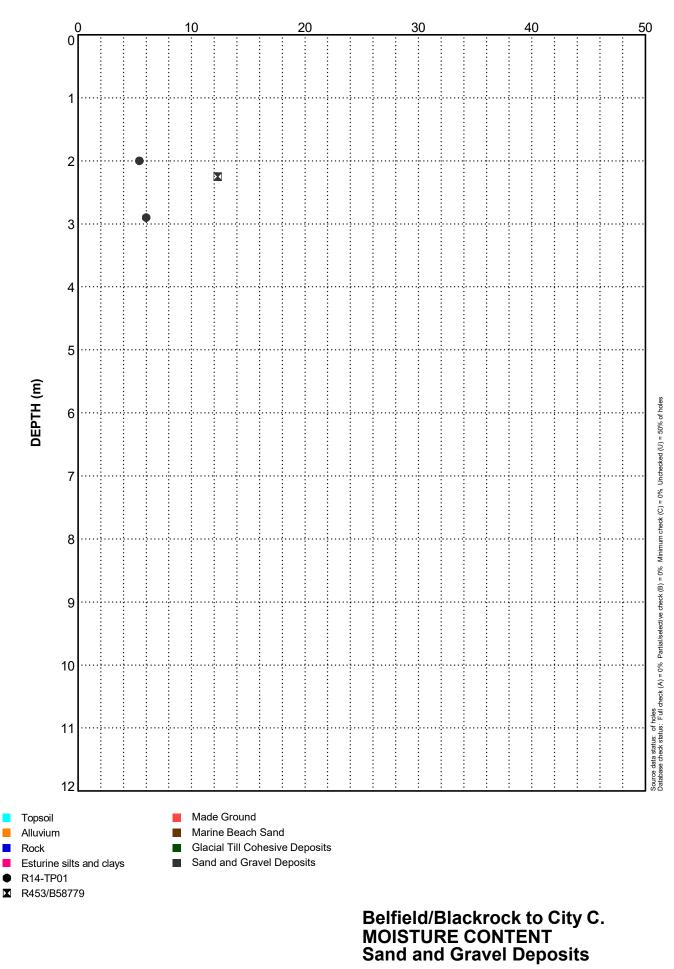




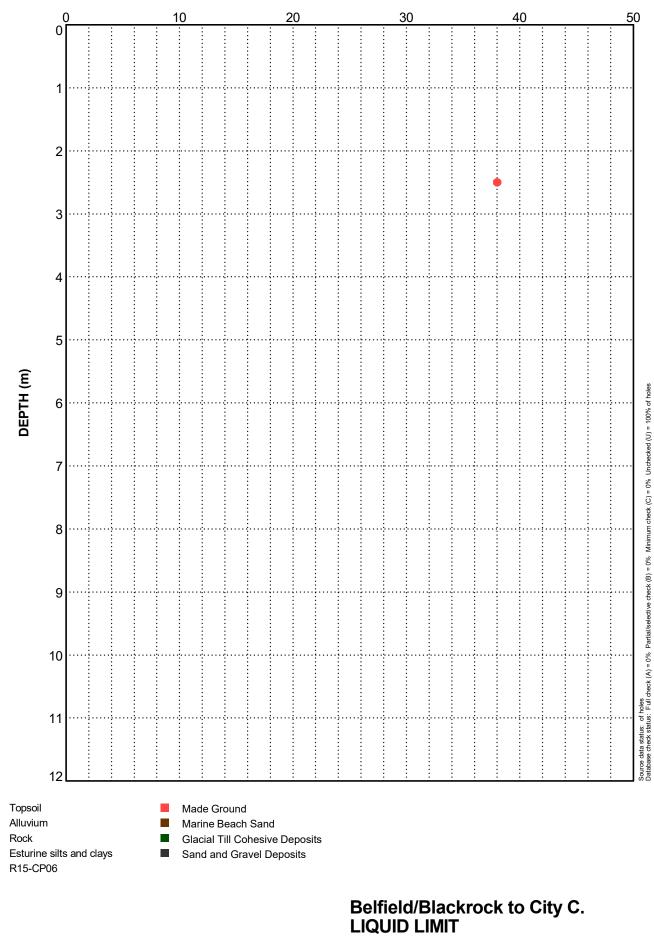
Belfield/Blackrock to City C. MOISTURE CONTENT Marine Beach Sand

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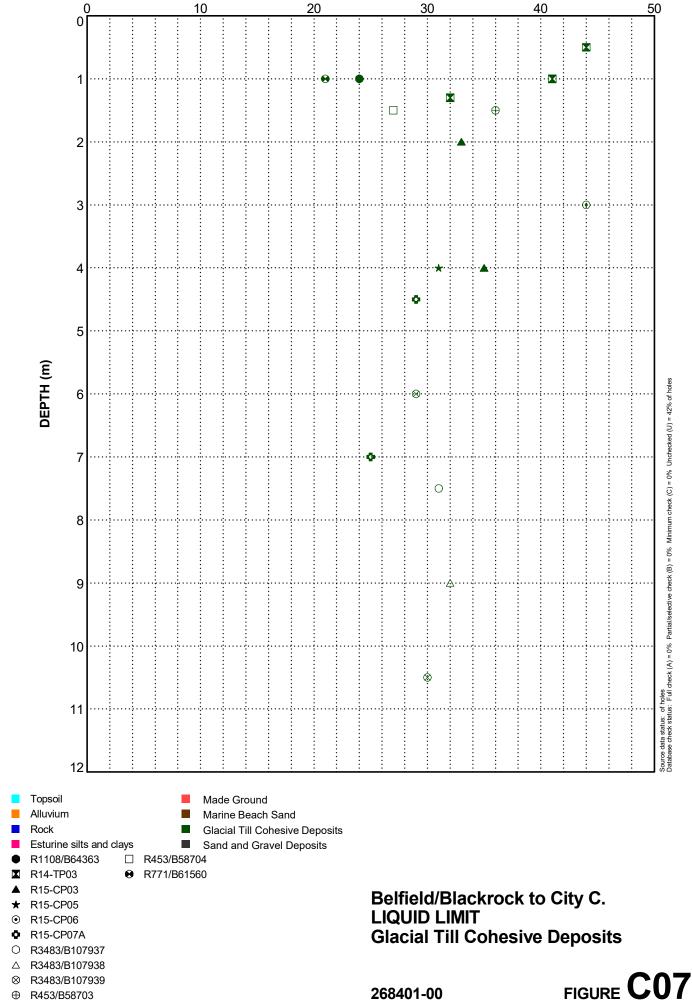




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FIGURE C06



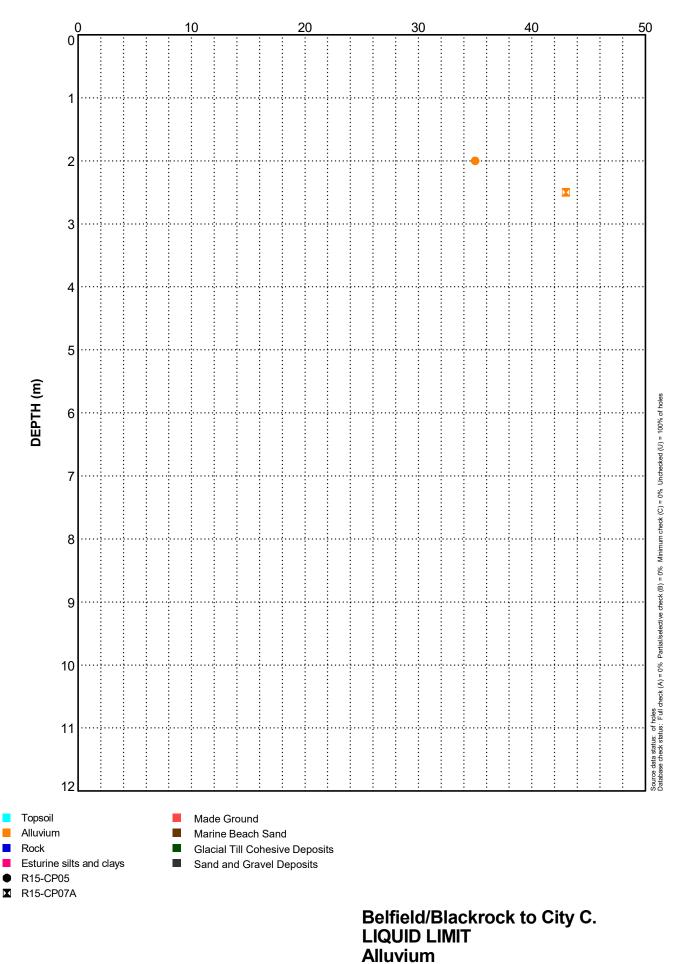
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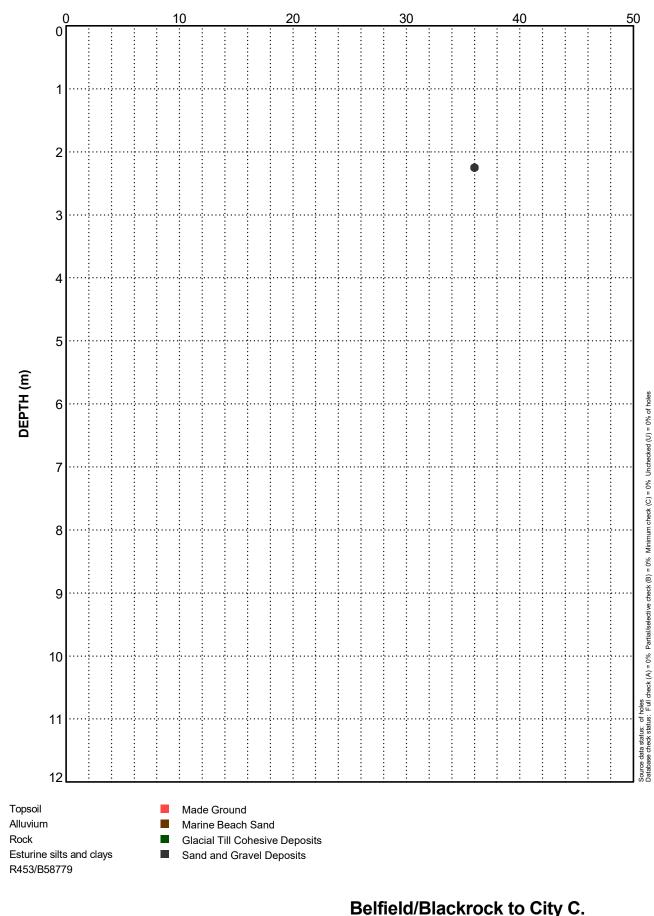
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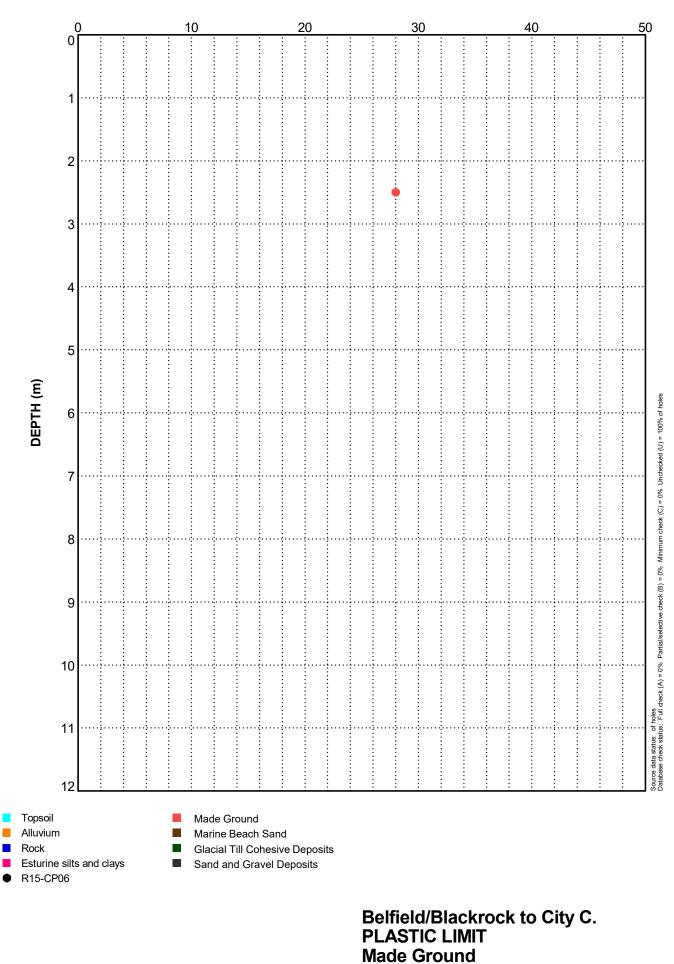




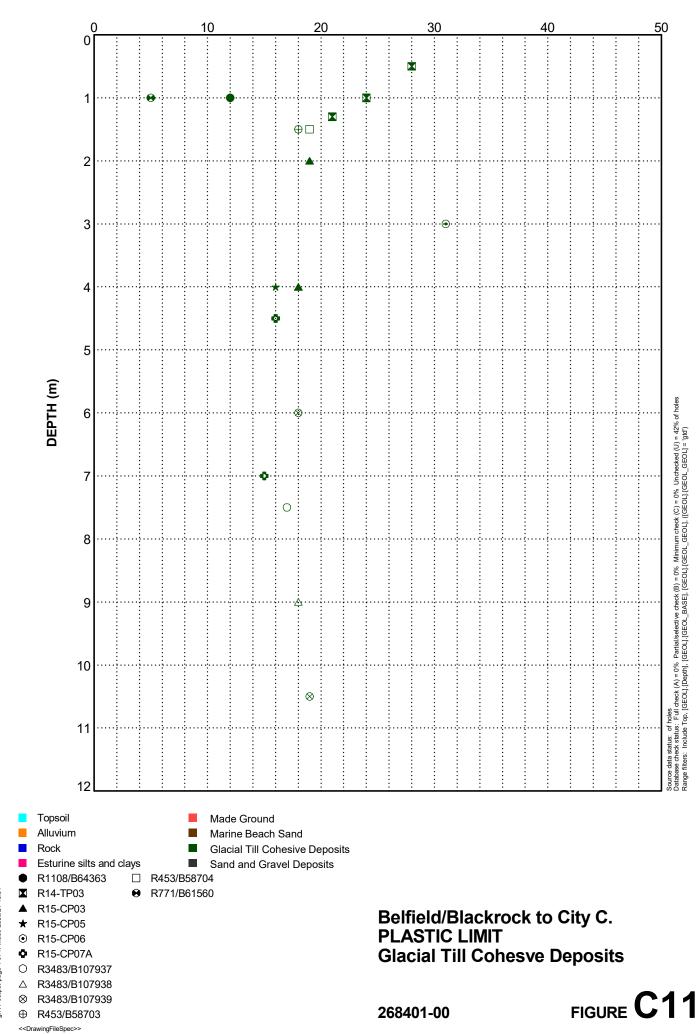
Belfield/Blackrock to City C. LIQUID LIMIT Sand and Gravel Deposits

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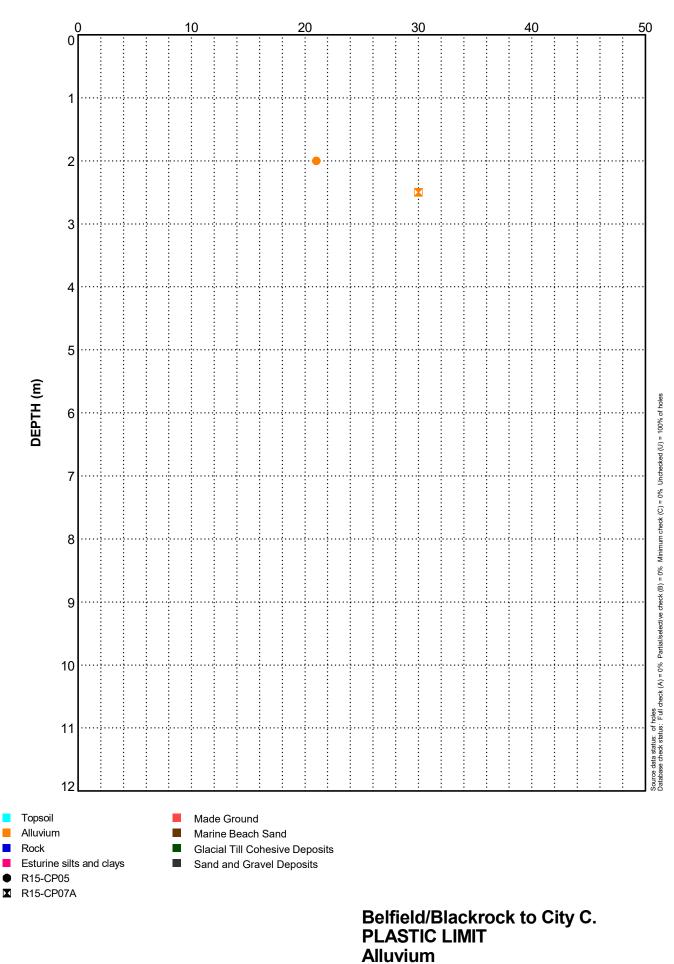
FIGURE C09



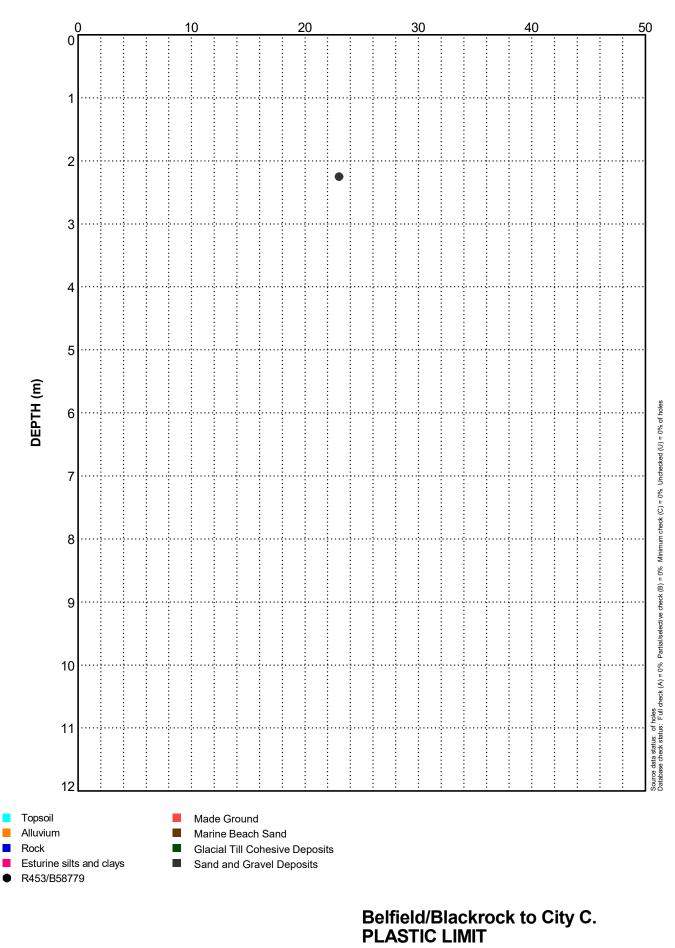
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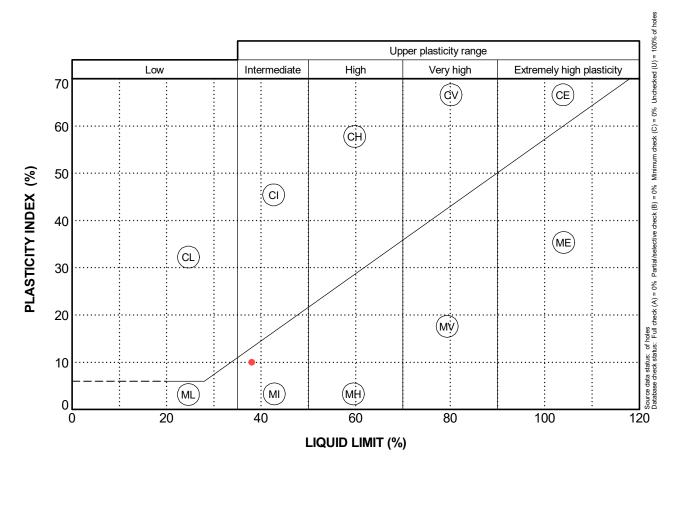


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Glacial Till Granular Deposits





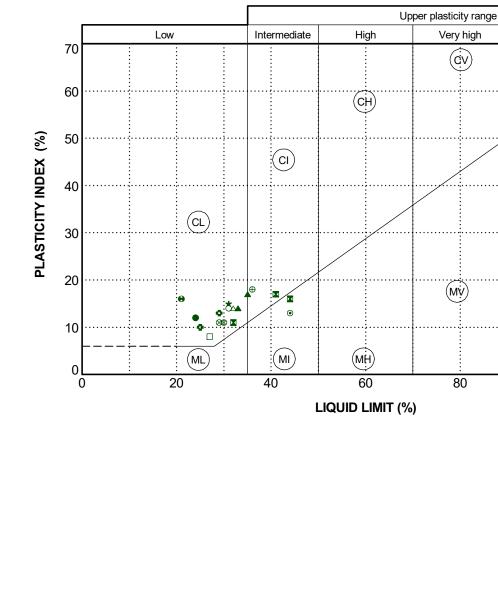
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- Made Ground
- Marine Beach Sand
- Glacial Till Cohesive Deposits
- Sand and Gravel Deposits

Belfield/Blackrock to City C. PLASTICITY CHART Made Ground

FIGURE C14



Made Ground

R453/B58704 R771/B61560

Marine Beach Sand

Glacial Till Cohesive Deposits

Sand and Gravel Deposits

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Belfield/Blackrock to City C. PLASTICITY CHART **Glacial Till Cohesive Deposits**



Source data status: of holes Database check status: Full check (A) = 0% Partial/selective check (B) = 0% Minimum check (C) = 0% Unchecked (U) = 42% of holes

120

Extremely high plasticity

(CE)

(ME)

100

268401-00

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Topsoil

Alluvium

Esturine silts and clays

A

R1108/B64363

R14-TP03

R15-CP03

R15-CP05

R15-CP06

R15-CP07A

R3483/B107937 R3483/B107938

R3483/B107939

R453/B58703

Rock

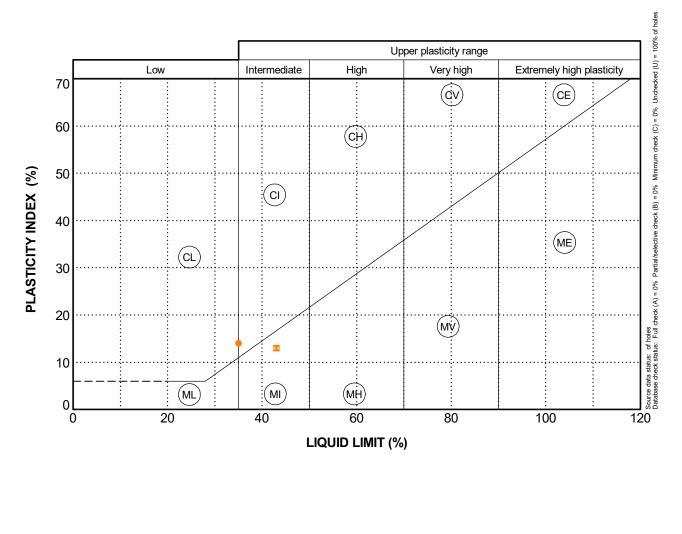
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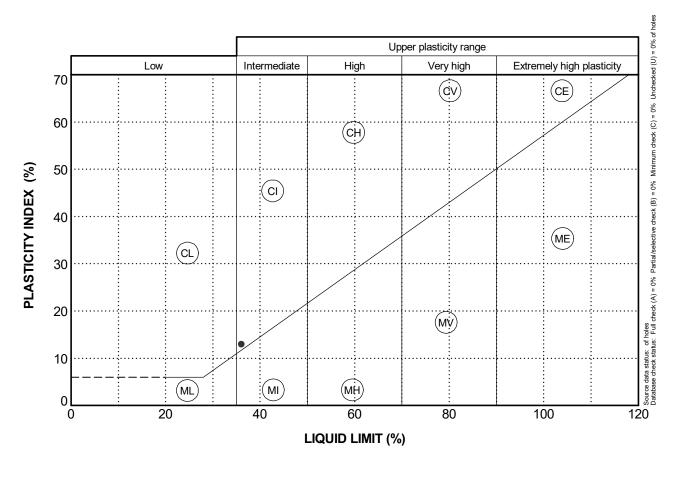




- Marine Beach Sand
- Glacial Till Cohesive Deposits
- Sand and Gravel Deposits

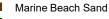
Belfield/Blackrock to City C. PLASTICITY CHART Alluvium

FIGURE C16









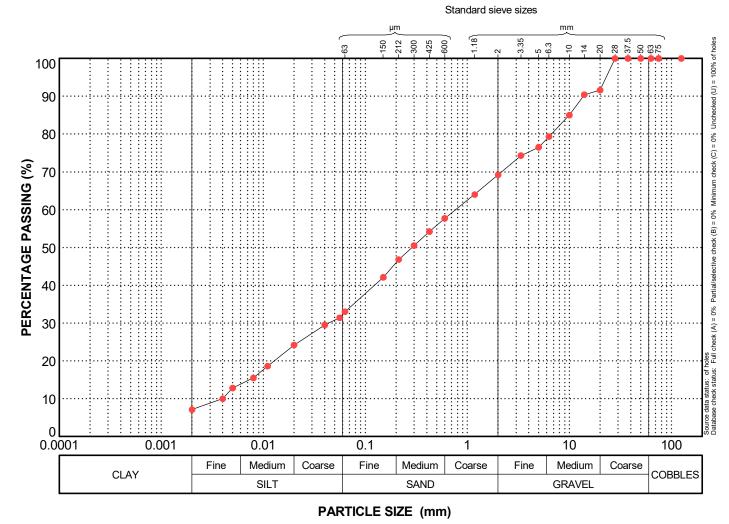
- Glacial Till Cohesive Deposits
- Sand and Gravel Deposits

Belfield/Blackrock to City C. PLASTICITY CHART Sand and Gravel Deposits

FIGURE C17



Project : c./users/ozgur/alpri/desktop/job shortcuts/arup job/268401-00 bus connects/gin/15/02_gint/route15.gpj, (Template : 3.0); Library : \\global\europe\dublin\\jobs2_civils\ground engineering\1.0 technical\personal folders\ozgur alper\gintrarp_ukllb_3-0-002-8.glb Graph: 3.3.31 PSD (SORTED BY TEST WITH COLOUR (rev 9Feb11) gNT output page 1 of 1. Made 28Jul21 16:33



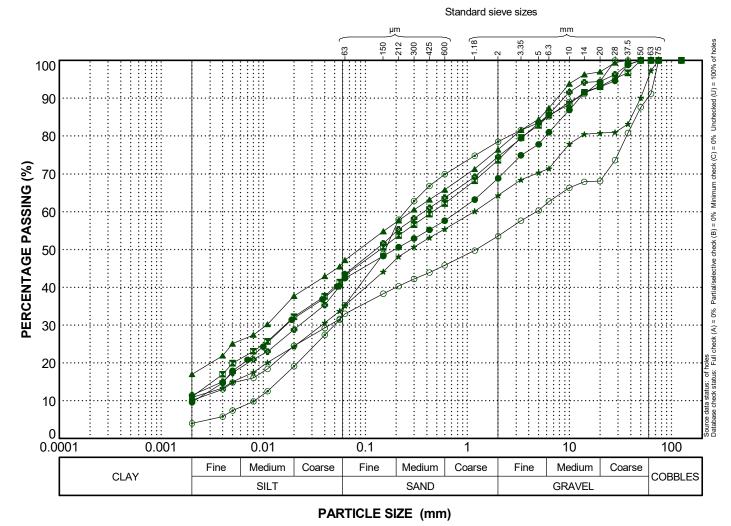
• R15-CP06, 2.50m



Belfield/Blackrock to City C. PARTICLE SIZE DISTRIBUTION Made Ground

<<DrawingFileSpec>>

268401-00



- R14-TP03, 1.00m
- R15-CP03, 2.00m
- ▲ R15-CP03, 4.00m
- ★ R15-CP05, 4.00m
- R15-CP06, 3.00m
- R15-CP07A, 4.50m
- O R15-CP07A, 7.00m

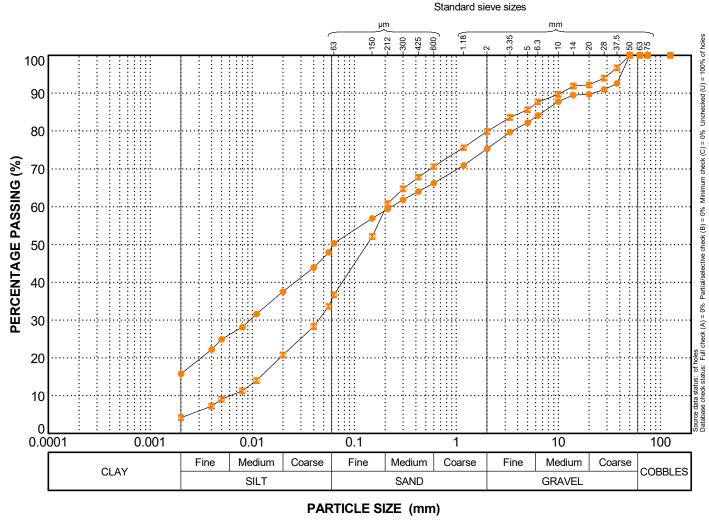
Made Ground
Alluvium
Marine Beach Sand
Rock
Glacial Till Cohesive Deposits

Topsoil

- Esturine silts and clays
- Sand and Gravel Deposits

Belfield/Blackrock to City C. PARTICLE SIZE DISTRIBUTION Glacial Till Cohesive Deposits

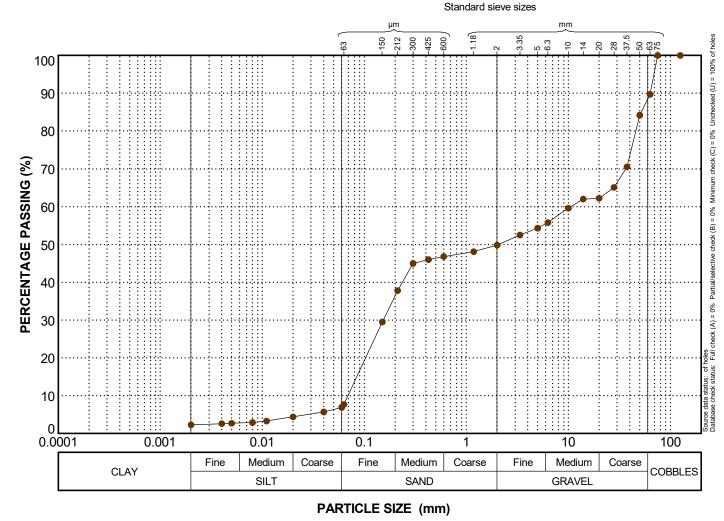




- R15-CP05, 2.00m
- R15-CP07A, 2.50m



Belfield/Blackrock to City C. PARTICLE SIZE DISTRIBUTION Alluvium Project : c./users/ozgur/alpri/desktop/job shortcuts/arup job/268401-00 bus connects/gin/15/02_gint/route15.gpj, (Template : 3.0); Library : \\global\europe\dublin\\jobs2_civils\ground engineering\1.0 technical\personal folders\ozgur alper\gint\anp_ukllb_3-0-002-8.glb Graph: 3.3.31 PSD (SORTED BY TEST WITH COLOUR (rev 9Feb11) gNT output page 1 of 1. Made 23.0.121 16:02



• R15-CP07A, 3.50m



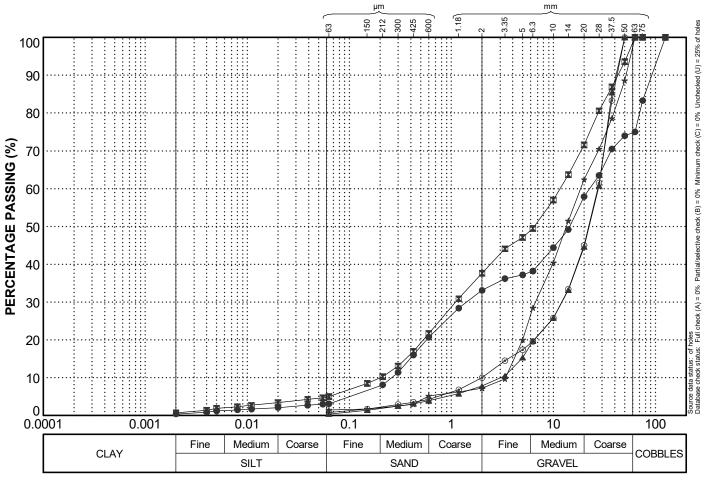
Belfield/Blackrock to City C. PARTICLE SIZE DISTRIBUTION Marine Beach Sand

<<DrawingFileSpec>>

268401-00



Standard sieve sizes



PARTICLE SIZE (mm)

- R14-TP01, 2.00m
- R14-TP01, 2.90m
- ▲ R3483/B107937, 5.00m
- ★ R3483/B107938, 3.50m
- R3483/B107939, 4.00m

Topsoil
Made Ground
Alluvium
Marine Beach Sand
Rock
Glacial Till Cohesive Deposits
Esturine silts and clays
Sand and Gravel Deposits

Belfield/Blackrock to City C. PARTICLE SIZE DISTRIBUTION Sand and Gravel Deposits

FIGURE C22

<<DrawingFileSpec>>

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Appendix D

Factual Ground Investigation Report

National Transport Authority Belfield / Blackrock 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

ARUP

Document verification



Job title Document title Document ref		Belfield / Blackrock to City Centre Core Bus Corridor SchemeFactual Ground Investigation Report			Job number 268401-00
					File reference
		268401-00			
Revision	Date	Filename	BCIDC-ARP-EF	RW_GI-001415_XX	_RP-CE-0002.docx
Final Draft	29 Sep 2021	Description	Checks and reviews limited to Quality Assurance. Technical content assumed to be correct and responsibility of contractor appointed by NTA.		
			Prepared by	Checked by	Approved by
		Name	Ground Investigation Ireland	Ozgur Alper	Niall Harte
		Signature		O Hoper	Niell flast
Issue	21 Dec	Filename	BCIDC-ARP-EF	RW_GI-001415_XX	RP-CE-0002.docx
	2021	Description	Checks and reviews limited to Quality Assurance. Technical content assumed to be correct and responsibility of contractor appointed by NTA.		
			Prepared by	Checked by	Approved by
		Name	Ground Investigation Ireland	Ozgur Alper	Niall Harte
		Signature		O Mper	Niel Harts
		Filename			
		Description			
			Prepared by	Checked by	
		Name			
		Signature			



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Ground Investigations Ireland Bus Connect Detailed Stage 1 Lot 1 Route 15 National Transport Authority Ground Investigation Report

March 2021



Directors: Fergal McNamara (MD), James Lombard, Conor Finnerty, Aisling McDonnell & Barry Sexton Ground Investigations Ireland Limited | Registered in Ireland Company Regsitration No.: 405726



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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	
Engineer	Arup	
Client	ΝΤΑ	
Project No	9754-07-20 R15	
Document Title	Ground Investigation Report	

Rev.	Status	Author(s)	Reviewed By	Approved By	Office of Origin	Issue Date
А	Final	J Duggan	J Duggan	A McDonnell	Dublin	21 January 2021
В	Final	P. Cochran	M. Sutton	A. McDonnell	Dublin	19 March 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.





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GROUND INVESTIGATIONS IRELAND

Geotechnical & Environmental

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APPENDICES

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Appendix 2	Trial Pit Records
Appendix 3	Cable Percussion Borehole Records
Appendix 4	Laboratory Testing



1.0 Preamble

On the instructions of Arup, a site investigation was carried out by Ground Investigations Ireland Ltd., between September and November 2020 at the site of the proposed bus corridor along Route 15: Blackrock to Merrion.

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 15 is proposed to run between Blackrock and Merrion.

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 2 No. Trial Pits to a maximum depth of 2.90m BGL
- Carry out 6 No. Cable Percussion boreholes to a maximum depth of 7.50m BGL
- Installation of 3 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 were 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 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.

3.3. 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. The cable percussion borehole logs are provided in Appendix 3 of this Report. R15-CP01 was not carried out as permission to access the site was not given.

3.4. Surveying

The exploratory hole locations have been recorded using a Trimble R10 GNSS 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.

3.5. Groundwater Monitoring Installations

Groundwater monitoring 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 HDPE slotted pipe with a pea gravel response zone and bentonite seal installed to the Engineers specification. The standpipe is 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.

3.6. 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 Engineers Ireland Suite E, organic matter content, pH, chloride and sulphate testing was carried out by Element Materials Technology Laboratory in the UK.

Geotechnical testing consisting of moisture content, Atterberg limits, Particle Size Distribution (PSD), hydrometer will be carried out in NMTL's Geotechnical Laboratory in Carlow.

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
- Cohesive Deposits
- Granular Deposits

TOPSOIL: Topsoil was encountered in R15- TP01 and TP02 and in R15-CP04 and CP05 and was present to a maximum depth of 0.6m BGL.

SURFACING: Concrete surfacing was encountered in R15-CP02 to and R15-CP03 to a depth of 0.20m BGL and 0.40m BGL respectively

MADE GROUND: Made Ground deposits were encountered beneath the Topsoil/Surfacing or from ground level in each of the exploratory holes apart from R15-CP04. Where the bottom of the Made Ground was reached it was present to depths of between 1.0m and 2.6m BGL. These deposits were described generally as *brown or greyish brown sandy gravelly CLAY with some cobbles and boulders and occasional pieces of concrete, red brick, glass and plastic etc.* Occasional granular layers were present within these Made Ground deposits.

COHESIVE DEPOSITS: Cohesive deposits were encountered beneath the Made Ground or Topsoil and were described typically as *brown slightly sandy gravelly CLAY with occasional cobbles and boulders* overlying a *stiff grey or dark 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. A layer of *firm dark greyish brown slightly gravelly sandy clayey SILT with some organics and shell fragments* was also encountered in R15-CP06. The strength of the cohesive deposits varied greatly across the site. These deposits had some, occasional or frequent cobble and boulder content where noted on the exploratory hole logs.

GRANULAR DEPOSITS: A layer of *loose greyish brown silty fine to coarse SAND with some shells* was encountered in R15-CP07A. Based on the SPT N values the deposits are loose.

4.2. Groundwater

Groundwater strikes are noted on the exploratory hole logs where they occurred and where possible drilling was suspended for twenty minutes to allow the subsequent rise in groundwater to be recorded. 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 tide, time of year, rainfall, nearby construction and other factors. For this reason, standpipes were installed in R15-CP05, CP06 and CP07A to allow the equilibrium groundwater level to be determined.

4.3. Laboratory Testing

4.3.1. Geotechnical Laboratory Testing

The geotechnical testing carried out on soil samples recovered generally confirm the descriptions on the logs with the primary constituent of the cohesive deposits found to be a CLAY of low to intermediate plasticity. The Particle Size Distribution tests confirm that generally the cohesive deposits are well-graded with percentages of sands and gravels ranging between 58.1% and 49.0% generally with fines contents of 33 to 50.3%.

The Particle Size Distribution tests confirm that generally the granular deposits are well-graded with percentages of silt/clay typically between 7.7% and 36.7% with a gravel/sand content of typically 63.1% to 82%.

4.3.2. Chemical Laboratory Testing

The pH and sulphate testing carried out indicate that pH results are near neutral and that the water-soluble sulphate results is low when compared to the guideline values from BRE Special Digest 1:2005. The samples tested classify the soil as a Design Sulphate Level DS-1.

4.3.3. Environmental Laboratory Testing

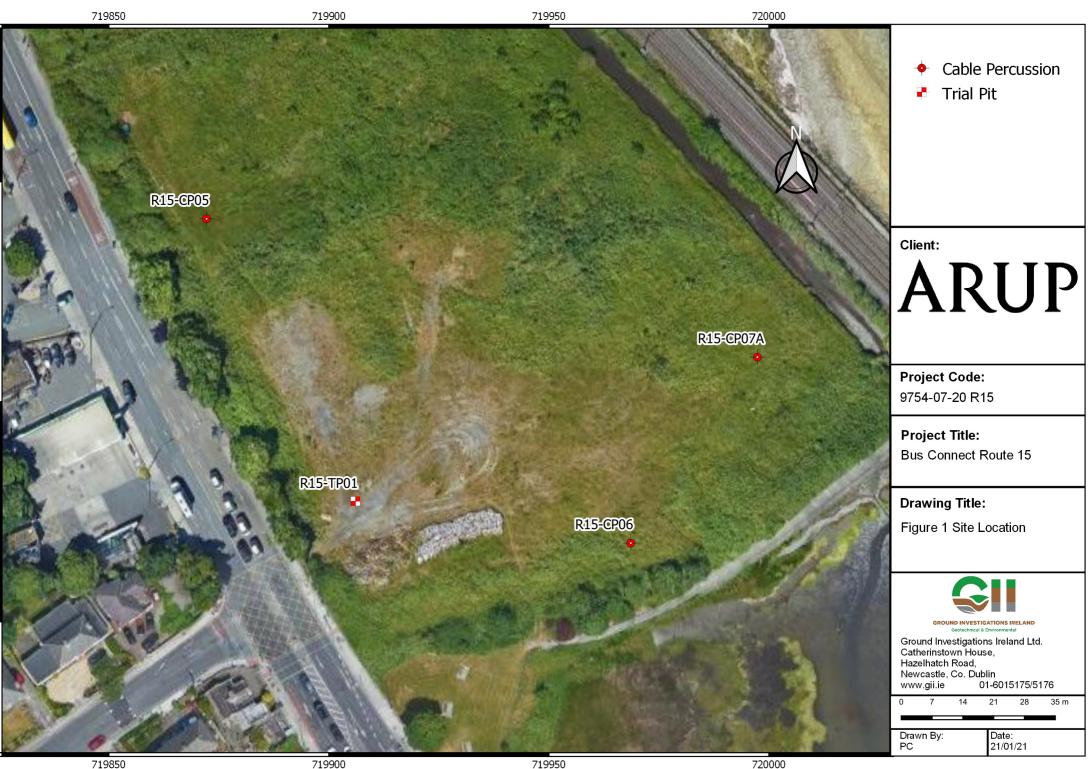
Twenty-five samples were analysed for a Suite of testing specified by ARUP based on suite E according to Engineers Ireland.

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.

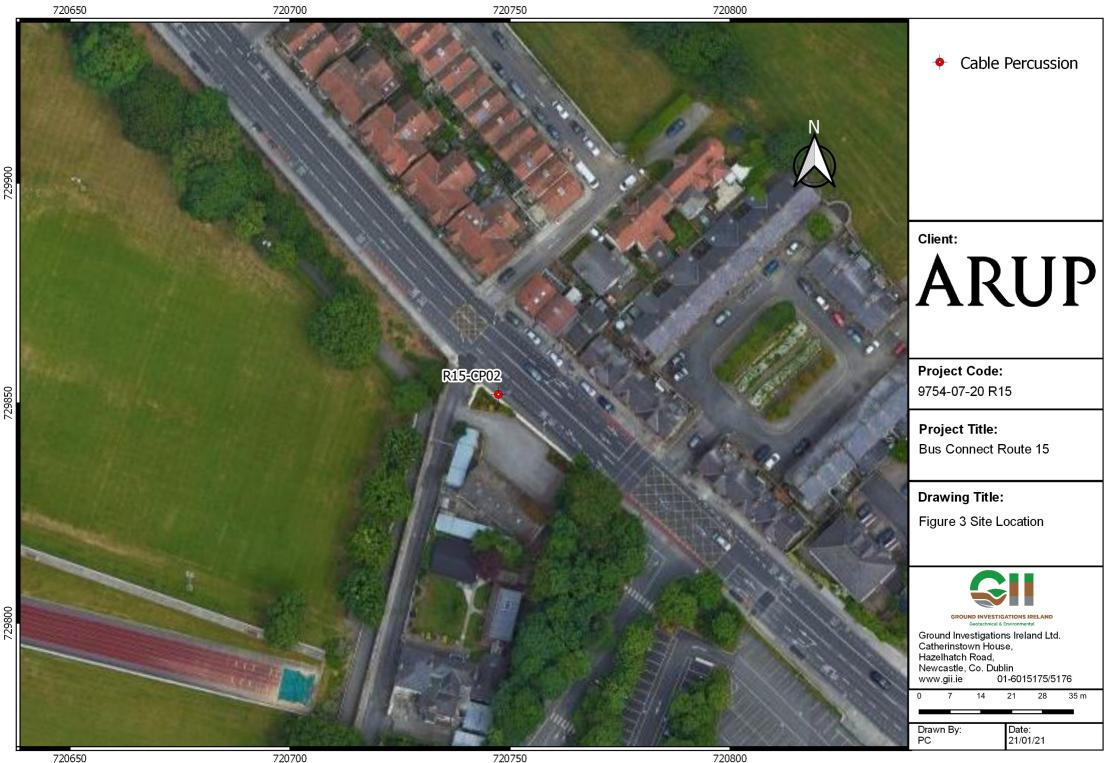
The results from the completed laboratory testing are included in Appendix 4 of this report.

APPENDIX 1 - Site Location Plan













APPENDIX 2 – Trial Pit Records



			www.gi	ons Ire i.ie	1		Bus Connect Detailed Sta	age 1 Lot 1	Numbe R15-TF	
lachine : 3 ⁻ lethod : ⊺r	⊺Tracked Excavator ial Pit	Dimens 1.60m	ions (L) x 0.30m (W) :	x 2.30m (D)	Ground	Level (mOD) 3.88	Client National Transport Author	ity	Job Numbe 9754-07	
		Locatio	n 9906 E 730577 <i>.2</i>	2 N	Dates 19	0/11/2020	Project Contractor Ground Investigations Irel	land	Sheet 1/1	
Depth (m)	Sample / Tests	Water Depth (m)	Field Re	ecords	Level (mOD)	Depth (m) (Thickness)	C	Description	Legend	i i i
					3.78	(0.10) - 0.10 - (0.30)	rootlets MADE GROUND: Grevisł	elly TOPSOIL with occasional		XXXXXX XX
50					3.48		subrounded cobbles, root concrete, fabric, plastic ar	e Gravel with some angular to lets and occasional fragments of nd red brick		
50 50	EN T						Clay with some angular to boulders, rootlets and occ	o subrounded cobbles, occasional assional fragments of red brick lar to subangular fine to coarse		
00 00	B T					(1.40)				
50	EN									
00	B T		Fast seepage(1) at 1.90m.	2.08	1.80 (0.50)	MADE GROUND: Greyist subangular fine to coarse subangular cobbles	n brown sandy clayey angular to Gravel with frequent angular to		
00 30	I				1.58	2.30	Complete at 2.30m			V
an							Remarks			
•		·		·			Trial pit terminated at 2.30m Trial pit stable	n BGL upon encountering of groun	dwater	
				·		· ·	Groundwater encountered a Trial pit backfilled upon com	at 1.90m BGL as fast seepage ppletion		
		·		·						
	· ·		· ·							

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S		nd Inv	vestigations Ire www.gii.ie	land	Ltd	Site Bus Connect Detailed Sta	ge 1 Lot 1	Trial P Numbo R15-TF	er
Machine:3 ⁻ Method :⊺	T Tracked Excavator ial Pit	Dimensio 1.50m (L	ons) x 0.30m (W) x 2.40m (D)	Ground	Level (mOD) 5.10	Client National Transport Authori	ty	Job Numb 9754-07	
		Location 7205	571.1 E 730051.4 N	Dates 19)/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	Wator
				4.00	(0.20)	Brown slightly sandy slight occasional rootlets	tly gravelly TOPSOIL with		
				4.90	- 0.20 	Clay with some angular to boulders rootlets and occ	brown slightly sandy gravelly subrounded cobbles, occasional asional fragments of ceramic, d wood. Gravel is angular to		
.50 .50	EN T				(0.90)				
.00	в								*****
.00	B T			4.00	- 1.10 	MADE GROUND: Grey sli some angular to subround and occasional fragments red brick and wood. Grave coarse	ghtly sandy gravelly Clay with ed cobbles, occasional boulders of ceramic, glass, metal, plastic, al is angular to subrounded fine to		
.50	EN				 (1.30)				
.00 .00	B T				- - - - - - -				
.40	EN			2.70	2.40	Complete at 2.40m			
Plan .					<u> </u>	Remarks			
						Trial pit terminated at 2.40m Trial pit unstable; side wall c No groundwater encountere Trial pit backfilled upon com	BGL due to side wall collapse ollapse below 1.30m BGL d during excavation pletion		
•									
	· ·	•		• •	· · s	Scale (approx)	Logged By Figur	re No.	

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APPENDIX 3 – Cable Percussion Borehole Records



Depth (m) Sample / Tests Casing Depth (m) Water Depth (m) Field Records Level (mOD) Depth (m) Depth (m) Depth (m) Depth (m) Depth (m) Depth (m) Depth (m) Depth (m) Description Legend	achine : Dando 2000 ethod : Cable Percussion	Casing Di 200n	iameter	W.gii.ie r ed to 0.70m		Level (mOD) 6.68	Bus Connect Detailed Stage 1 Lot 1 Client National Transport Authority		Job Numbe 9754-07-
CONCRETE. CONCRETE. <t< th=""><th></th><th></th><th>747.3 E</th><th>729851.9 N</th><th>Dates 06</th><th>/11/2020</th><th></th><th>Sheet 1/1</th></t<>			747.3 E	729851.9 N	Dates 06	/11/2020		Sheet 1/1	
3000 0.000 0.000 MADE GROUND. Brown sandy gravely Clay. 5.58 0.70 0.700 0.700	Depth (m) Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description		Legend
Remarks					5.98		MADE GROUND: Brown sandy gravelly Clay.		
	Remarks	GL due to pr	esence	of services				Scale	Logge

S	Grou	nd In		gations Ire /w.gii.ie	land	Ltc		Site Bus Connect Detailed Stage 1 Lot 1		Boreho Numbe R15-CF	er
		-			1						
Machine : D Method : C	ando 2000 able Percussion		Diamete Omm cas	r ed to 4.50m	Ground	Leve 10.67	. ,	Client National Transport Authority		Job Numbe 9754-07	
		Locatio	n		Dates			Project Contractor		Sheet	
				729671.7 N	05	/11/2	020	Ground Investigations Ireland		1/1	
Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	C (Thi	Depth (m) ckness)	Description		Legend	Water
0.50	EN				10.57 10.37 10.27		0.10 (0.20) 0.30 0.40 (0.40)	CONCRETE. MADE GROUND: Grey very sandy angular to sub-ar fine to coarse Gravel.	ngular		
					9.87		0.80	CONCRETE. MADE GROUND: Grey very sandy angular to sub-ar	ngular		
1.00-1.45 1.00 1.00	SPT(C) N=23 B T			2,2/3,4,5,11			(0.90)	fine to coarse Gravel. MADE GROUND: Brownish grey slightly sandy grave			
1.50	EN				9.07		1 70	Clay with occasional fragments of glass.			
					8.97		1.70	Stiff brown slightly sandy gravelly CLAY with occasion subangular to subrouded cobbles.	nal	0 <u>.0.0</u> 0 <u>.0</u> 0	
2.00-2.45 2.00 2.00	SPT(C) N=19 B T			1,3/3,5,5,6							
2.50	EN									0 <u>.0</u> 0 0 <u>.0</u> 0	
3.00-3.45 3.00	SPT(C) N=17 B			1,2/3,3,5,6			(2.30)			0 <u>0</u> 00	
3.00 3.50	T EN									0 <u>.0</u> .0 <u>0.0</u> 0.0	
						Ē				<u>0.0</u> 0	
4.00-4.45 4.00 4.00	SPT(C) 50/295 B T			2,3/5,6,7,32	6.67 6.57		4.00 4.10	Very stiff brown slightly sandy gravelly CLAY with occasional subangular to subrounded cobbles. Obstruction: Large boulder or rockhead		<u>, , , , , , , , , , , , , , , , , , , </u>	
								Refusal at 4.50m			
Remarks	mplete at 4.50mBGL					Ē.		 	Scale	Logge By	d
No groundwa	ater encountered. ckfilled and footpath om 4.50m to 4.50m f		ł					(a	approx) 1:50	ву Tmcl	
									Figure N		

Achine : Dando 2000 ethod : Cable Percussion Depth (m) Sample / Tests	Location	er sed to 4.50m		Level (mOD)	Client	1
Depth (m) Sample / Tests			:	22.98	National Transport Authority	Job Numbe 9754-07
Depth (m) Sample / Tests	/219/6.2 E	728860.3 N	Dates 30	/10/2020	Project Contractor Ground Investigations Ireland	Sheet 1/1
	Casing Water Depth Depth (m) (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend
50 EN 00-1.15 SPT(C) 50/0 B 7 50 EN 00-2.15 SPT(C) 50/0 B 7 1 1 1 1 1 1 1 1 1 1 1 1 1		19,6/50 25/50	22.38	(1.50)	TOPSOIL Stiff brown very gravelly CLAY with angular cobbles of Imestone Obstruction: Large boulder or rockhead Refusal at 2.10m	
emarks prehole complete at 2.10m Bo groundwater encountered.	GL.	1		<u> </u>	Scal (appro	e Logge bx) By
iselling from 2.00m to 2.10m	n for 1 hour.				1:50	JD

Location 719872.2 E 730641.6 N Dates 04/11/2020 Depth (Thickness) Project Grout Depth (m) Sample / Tests Casing (m) Water (m) Field Records Level (m) Depth (Thickness) Brown (0.80) Depth (Thickness) Brown (0.80) Depth (Thickness) Brown (0.80) Depth (Thickness) Brown (0.80) Depth (1.80) Depth (Thickness) Brown (0.80) Depth (1.80) Depth (1.	Description Legend I slightly sandy slightly gravelly TOPSOIL. Image: Comparison of the provided strength of the provided strengt of the provided strength of the provided stren	Number 9754-07 Sheet 1/1 d angle and angle
Depth (m) Sample / Tests Casing (m) Weter (m) Field Records Level (m) Depth (Thickness) Ground Ground 0.50 EN 1	d Investigations Ireland Description Legend slightly sandy slightly gravelly TOPSOIL. Image: Comparison of the structure of the struct	1/1
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	slightly sandy slightly gravelly TOPSOIL.	1 1 1 1 Water
0.50 EN (0.80) MADE slight 1.00-1.45 SPT(C) N=3 1,1/2,0,1,0 2.18 1.00 1.50 EN 1,1/2,0,1,0 2.18 1.00 2.00-2.45 SPT(C) N=2 1,0/0,1,0,1 (1.80) (1.80) 2.00 EN 1,0/0,1,0,1 0.38 2.80 Stiff good 2.00 EN 1,3/3,7,8,9 0.38 2.80 Stiff good 3.00 BT 1,3/3,7,8,9 0.38 2.80 Stiff good 3.00 BT 50/ -0.82 4.00 4.00 4.00 A00 BT 50/ -0.82 4.00 4.00 BT 50/ -0.82 4.00 4.00 BT 50/ -0.82 4.00 4.00 Febuse A.00 BT A.00	GROUND: Greyish brown slightly sandy y gravelly Clay with fragments of red brick.	
	rey slightly sandy gravelly silty CLAY with and angular cobbles.	
Remarks iorehole completed at 4.30m BGL. lo groundwater encountered. itandpipe intalled. Slotted pipe withgravel surround from 3.8m BGL to 2.3m BGL. Plain pipe with bentoni	Scale (approx)) Logge By
handpipe intened. Solide pipe with graver surround from 5.6m BGL to 2.5m BGL. Plain pipe with bencom inshed with a raised cover. chiselling from 4.00m to 4.30m for 1.5 hours.	resurround from 2 3m B(2) to (2)	Tmcl

	ando 2000 able Percussion		Diamete Omm cas	r ed to 3.80m		Level (mOD) 3.32	Client National Transport Authority		1	ob umber 54-07-2
		Location 719		730567.8 N	Dates 24	/09/2020	Project Contractor Ground Investigations Ireland		SI	neet 1/1
Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Insti
0.50 0.50 1.00 1.20-1.65 1.50 2.00-2.45 2.50 3.00 3.00-3.45 3.50 3.50	B SPT(C) N=4 B N SPT(C) N=3 B N B SPT(C) N=14 B N			3,3/1,1,1,1 1,1/1,1,0,1 Water strike(1) at 3.00m, rose to 2.50m in 20 mins. 1,2/2,3,4,5	0.72		MADE GROUND: Brown slightly sandy gravelly Clay with red brick, yellow brick and mortar fragments Firm dark greyish brown slightly gravelly sandy clayey SILT with some organics and shell fragments. Obstruction: Large boulder or rockhead Refusal at 3.80m		∑1	
Remarks	stalled. Slotted nine	with pea c	aravel su	round from 3 80m to	2 50m BG	Plain nine v	vith bentonite surround from 2.50m BGL to GL,	Scale (approx)	L	oggeo y

Location Dates 720007.7 E 730606.6 N	02 9/2020 Depth (m) Fhickness) - (1.10) (0.50) -	National Transport Authority Project Contractor Ground Investigations Ireland	Job Numb 9754-07 Sheet 1/1 Legend
Depth (m) Sample / Tests Casing Depth (m) Water Depth (m) Field Records Level (mOD) .50 B .00 B .20-1.65 SPT(C) N=17	Depth (m) Fhickness) 	Ground Investigations Ireland Description MADE GROUND: Brown slightly sandy gravelly Clay with occasional sub-angular to sub-rounded cobbles and mortar, wood, rootlets and red brick fragments MADE GROUND: Brown slightly sandy gravelly Clay with mortar and red brick fragments. Obstruction: Large boulder or rockhead	1/1 Legend
50 B 00 B 20-1.65 SPT(C) N=17 3,2/4,4,5,4	- (1.10) - 1.10 (0.50)	MADE GROUND: Brown slightly sandy gravelly Clay with occasional sub-angular to sub-rounded cobbles and mortar, wood, rootlets and red brick fragments MADE GROUND: Brown slightly sandy gravelly Clay with mortar and red brick fragments.	
00 B 1.92 20-1.65 SPT(C) N=17 3,2/4,4,5,4	1.10 (0.50)	occasional sub-angular to sub-rounded cobbles and mortar, wood, rootlets and red brick fragments MADE GROUND: Brown slightly sandy gravelly Clay with mortar and red brick fragments. Obstruction: Large boulder or rockhead	
Remarks Borehole completed at 1.60m BGL. Io groundwater encountered.		Scale (approx)	Logge By
hiselling from 1.60m to 1.60m for 1 hour.		1:50	JS

Open Part Instruction Cathon of the part Instruction Cathon of the part Instruction Comparison Description League of the part Instruction Instruction 8:00 B B Instruction	Machine : D	ando 2000	Casing		vw.gii.ie ^r	Ground	Level (mOD)	Client		Jo	
Description 225/09/2020 Cound Investigations Indiand Image: count investigations Indiand Image: coun	Method : Ca	able Percussion	200	Omm cas	ed to 7.50m		3.07	National Transport Authority			
Base Image: Section of the					730610.1 N	Dates 25	6/09/2020			Sh	1/1
1.80 B Image: Cley with consistent sub-angular cobbies, red 1.00 B 120-166 SPT(C) N=11 1.22-2.3.4 1.77 1.30 1.50 B Image: Cley with consistent sub-angular cobbies, red Soft grey slightly sandy gravely Clay (possible made ground) Image: Cley with comparison sub-angular cobbies, red 2.00-2.46 SPT(C) N=6 1.11.1.2.2 Image: Cley with comparison sub-angular cobbies, red 2.250 S SPT(C) N=6 1.11.1.2.2 Soft grey slightly sandy gravely Clay (possible made ground) 3.00-3.46 SPT(C) N=8 2.33.2.2.1 Image: Cley with comparison slightly gravely clay (possible made ground) 3.00 E	Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
Remarks Seate Seate Loss	D.50 1.00 1.20-1.65 1.50 2.00-2.45 2.00 2.50 3.00-3.45 3.50 4.00-4.45 4.00 4.50 5.00-5.45 5.00 3.50 3.50 4.50 5.00-5.45 5.50 3.50 3.50 5.50 5.50 5.50 5.70 5.70 5.70 5.70	EN B SPT(C) N=11 B SPT(C) N=6 B SPT(C) N=8 B SPT(C) N=35 B SPT(C) N=35 B SPT(C) N=50 B SPT(C) SO/200 B SPT(C) 50/200			1,1/1,1,2,2 Water strike(1) at 2.50m, no rise after 20 mins. 2,3/3,2,2,1 5,6/7,8,9,11 Water strike(2) at 4.10m. 6,8/11,14,16,9 9,11/14,17,19	0.57 0.37 -0.83 -3.43	(1.30) (1.30) (1.20) (0.20) 2.70 (0.20) 2.70 (1.20) (1.20) (2.60) (2.60) (1.00)	Clay with occasional sub-angular cobbles, red brick and mortar fragments. Soft grey slightly sandy gravelly Clay (possible made ground) Soft to firm greyish brown slightly gravelly sandy clayey SILT Loose greyish brown silty fine to coarse SAND with some shells. Very stiff grey slightly sandy gravelly CLAY. Very stiff slightly sandy gravelly CLAY with occasional sub-rounded cobbles and boulders. Obstruction: Large boulder or roackhead		▼1 ¹ 222	
Slotted standpipe with pea gravel surround from 7.50m to 4.00m BGL, plain pipe with bentonite seal from 2.50m BGL to GL, finished with a raised (approx) By	Slotted stand	tpipe with pea grave	l surround	from 7.8	50m to 4.00m BGL, pl	ain pipe w		eal from 2.50m BGL to GL, finished with a raised	Scale (approx)	LoBy	ggec

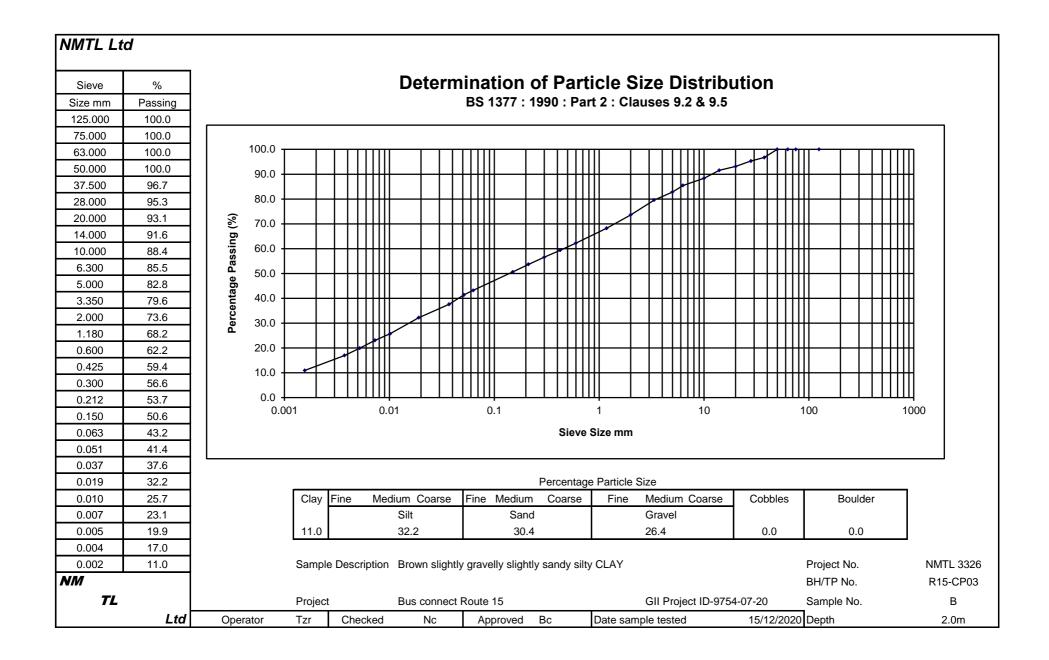
APPENDIX 4 – Laboratory Testing

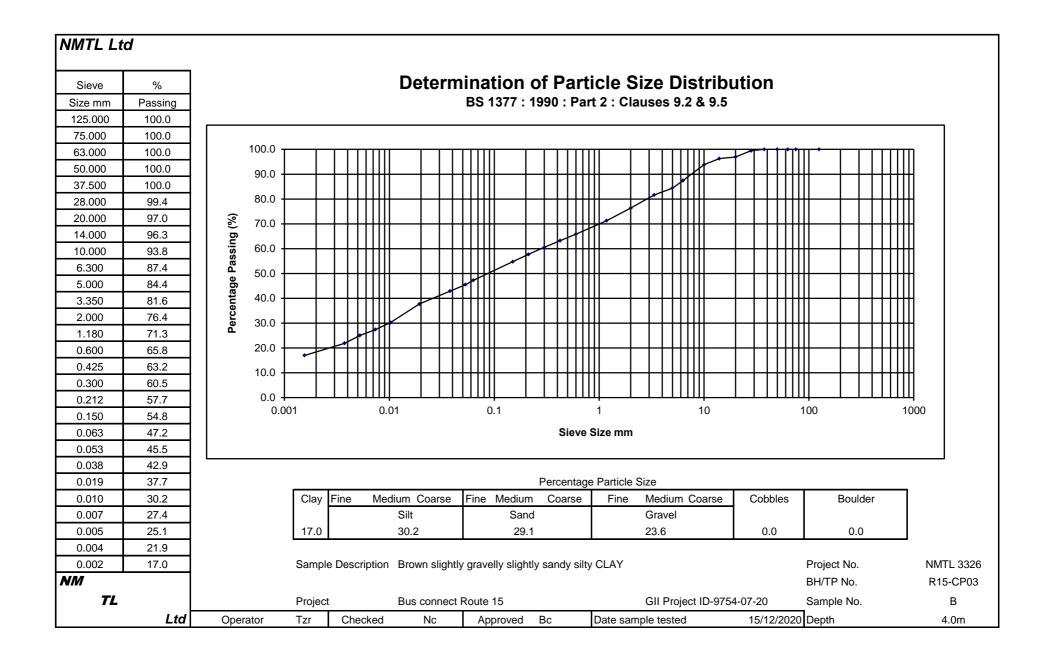


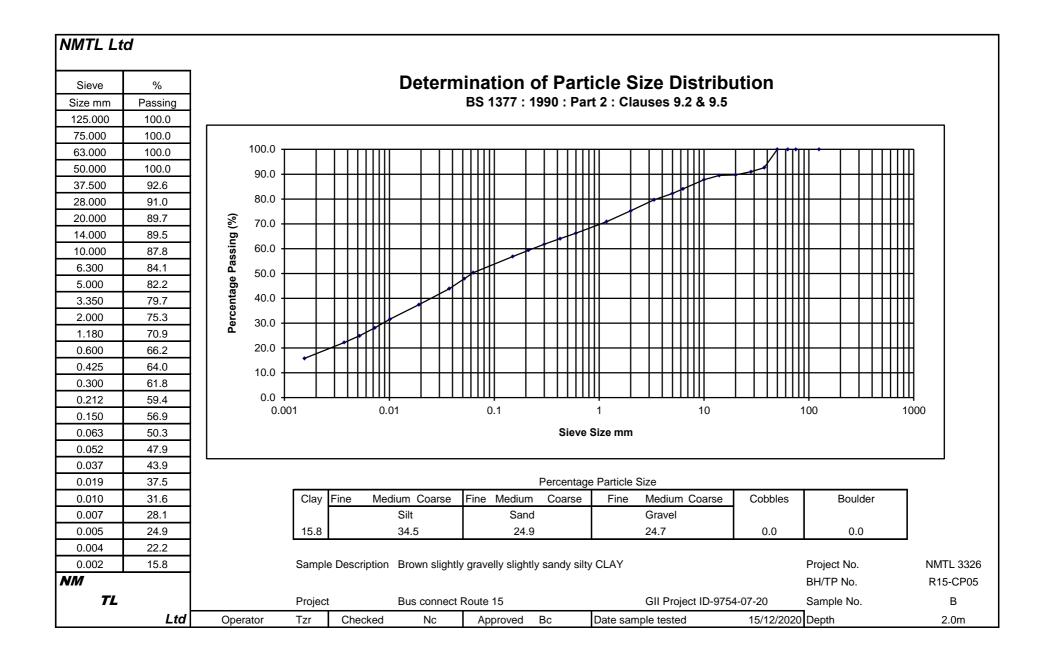
National Materials Testing Laboratory Ltd.

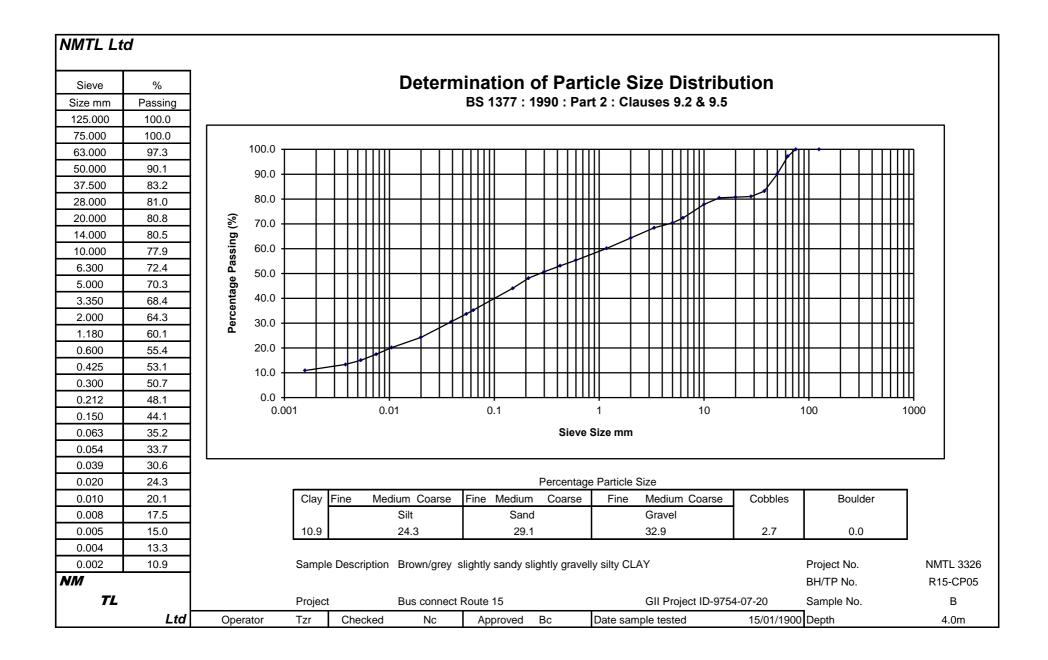
							001111		120110					
				Particle			Index Pro	perties	Bulk	Cell	Undrained Tria:	xial Tests	Lab	
BH/TP	Depth	sample	Moisture	Density	<425um	LL	PL	PI	Density	Presssure	Compressive	Strain at	Vane	Remarks
No	m	No.	%	Mg/m3	%	%	%	%	Mg/m3	kPa	Stress kPa	Failure %	kPa	
R15-CP03	2.0	В	14.5		59.4	33	19	14						
R15-CP03	4.0	В	14.6		63.2	35	18	17						
R15-CP05	2.0	В	16.9		64.0	35	21	14						
R15-CP05	4.0	В	12.8		53.1	31	16	15						
R15-CP06	2.5	В	24.9		54.2	38	28	10						
R15-CP06	3.0	В	42.9		66.8	44	31	13						
R15-CP07A	2.5	В	26.8		67.8	43	30	12						
R15-CP07A	3.5	В	19.1		46.0	28	Non Plast							
R15-CP07A	4.5	В	10.9		61.0	29	16	13						
R15-CP07A	7.0	В	12.6		43.9	25	15	10						
														0754 07 00
IMTL		Notes :									Job ref No.	NMTL 3326	GII Project ID:	9754-07-20
			1. All BS te	ests carried	l out using p	referred	(definitive) r	nethod ur	nless otherw	ise stated.	Location	Bus Conne	ect Routes	

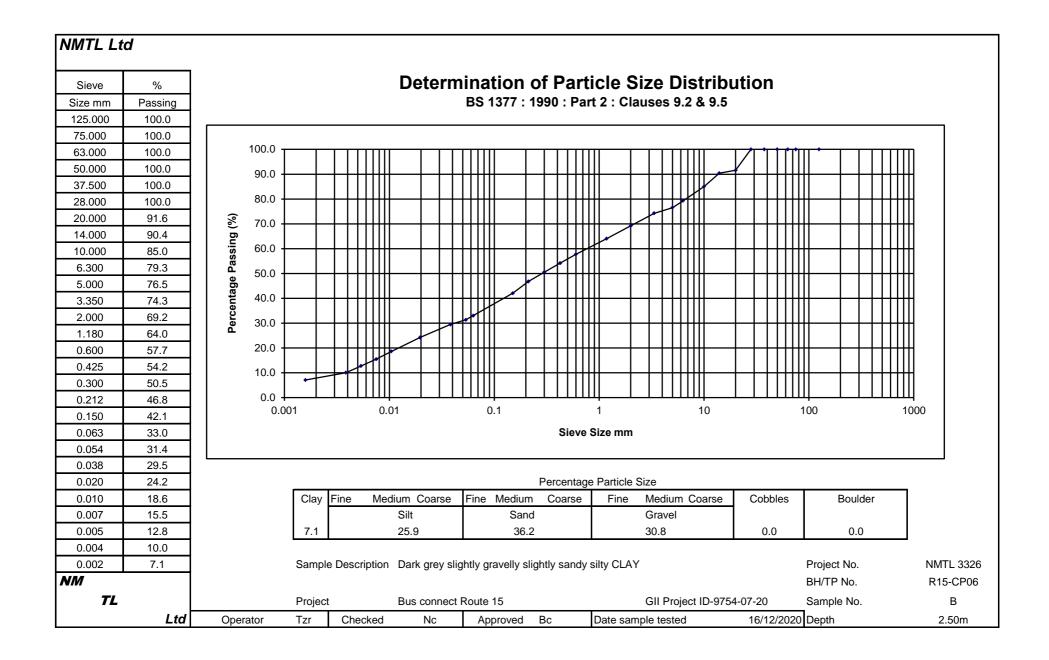
SUMMARY OF TEST RESULTS

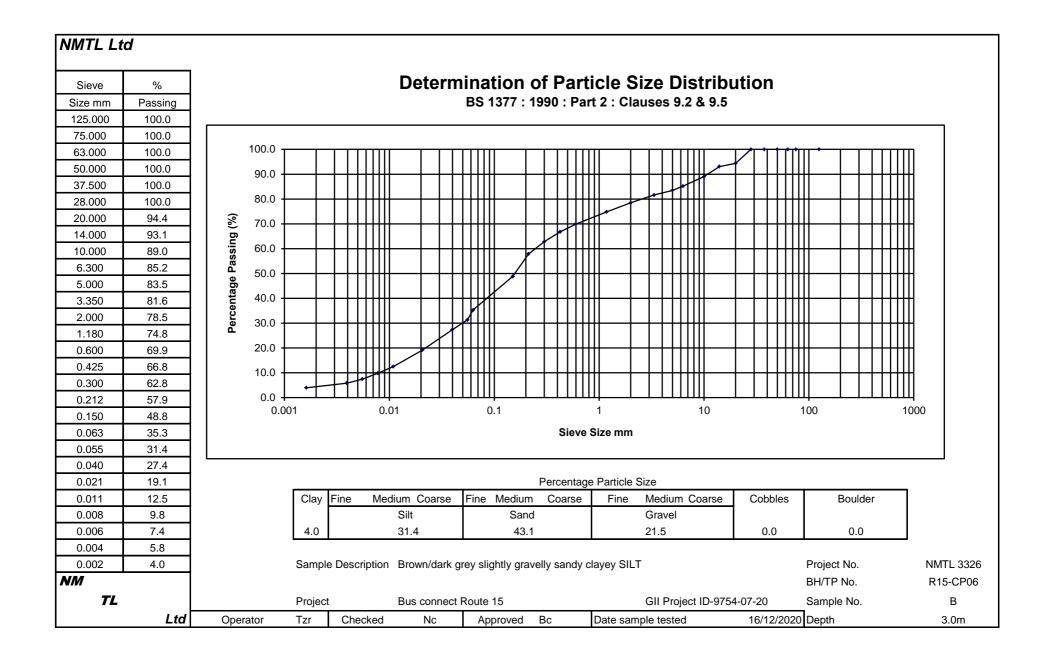


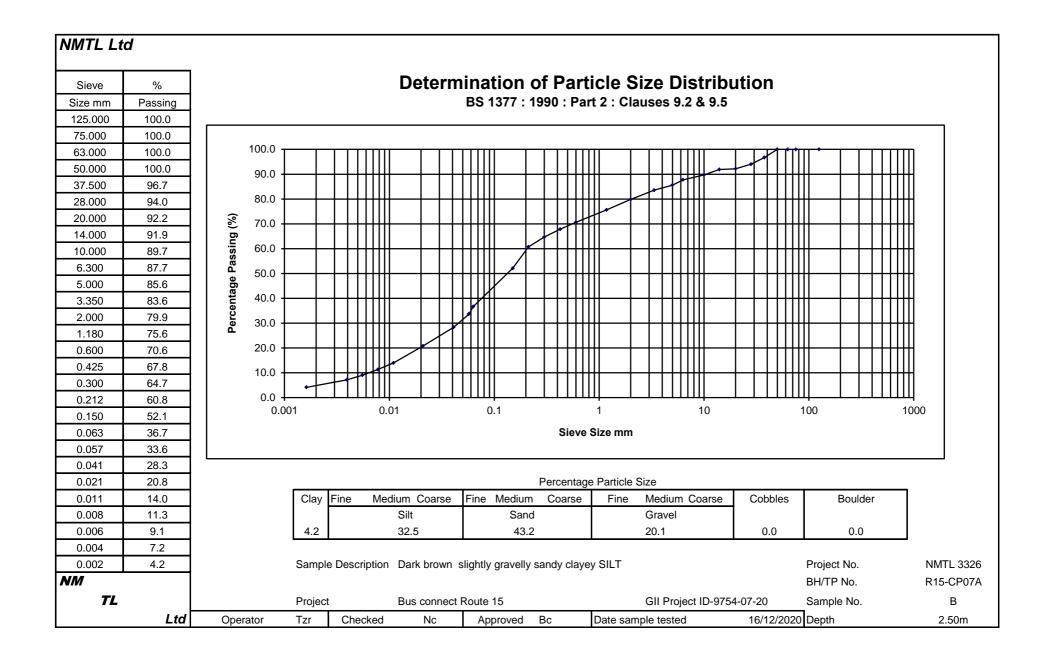


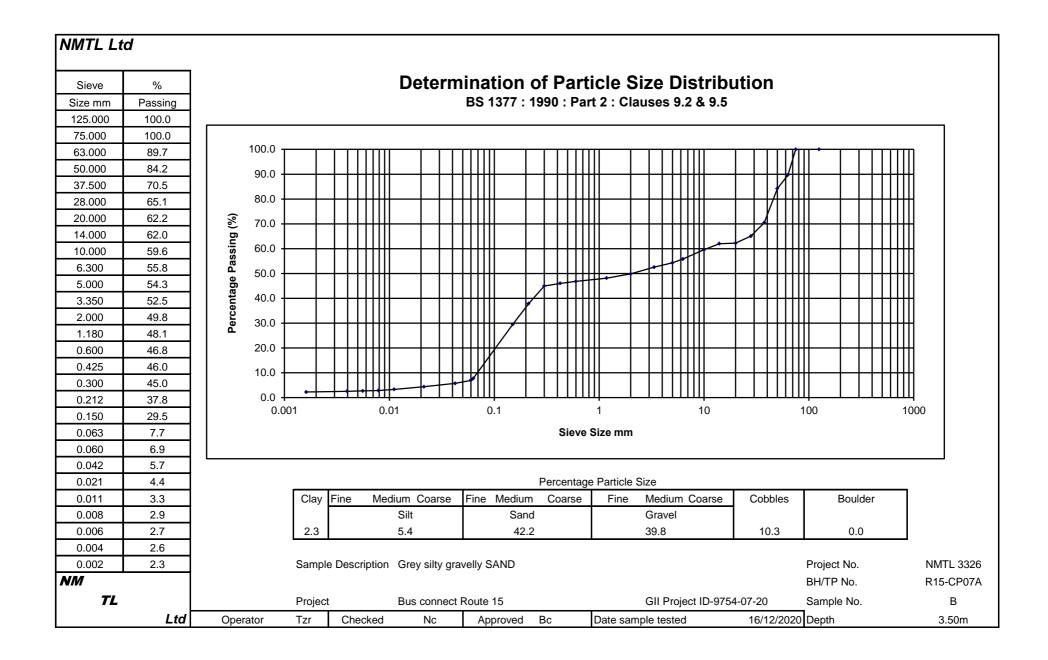


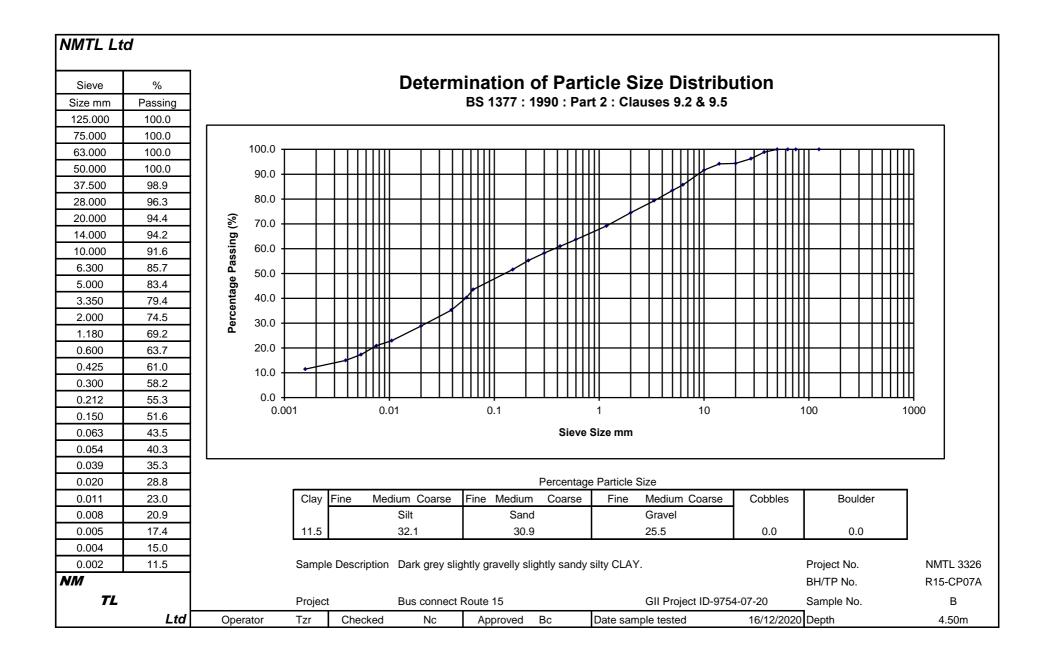


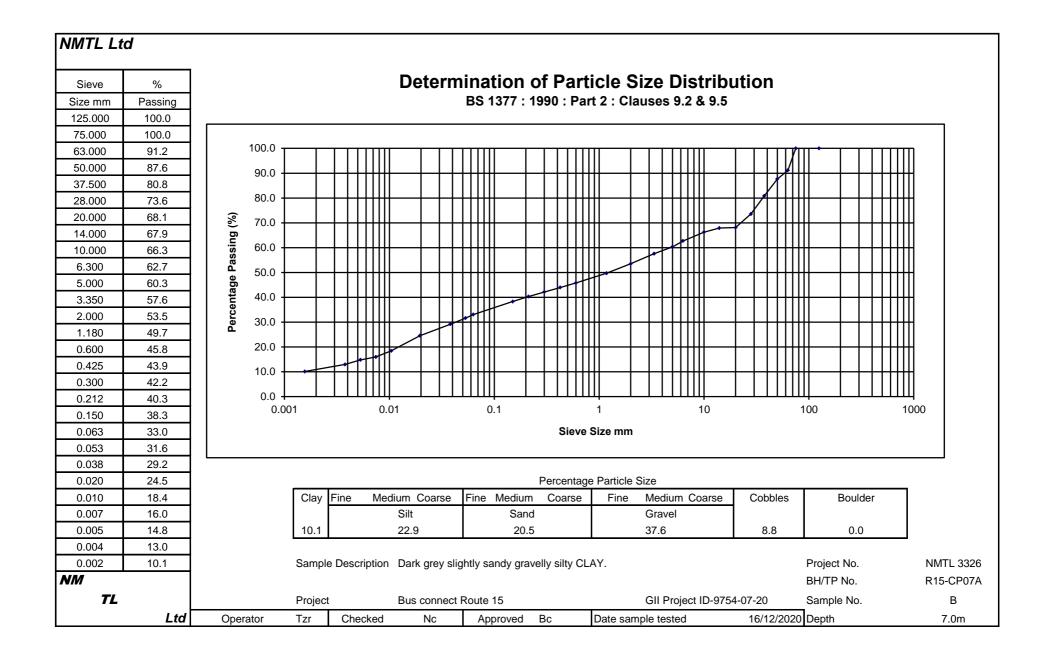














Issue :

Element Materials Technology Unit 3 Deeside Point Zone 3 **Deeside Industrial Park** Deeside CH5 2UA

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W: www.element.com

Ground Investigations Ireland Catherinestown House Hazelhatch Road Newcastle Co. Dublin Ireland ac-MR Attention : John Duggan Date : 21st October, 2020 Your reference : 9754-07-20 Our reference : Test Report 20/13374 Batch 1 Bus Connects Route 15 Location : Date samples received : 30th September, 2020 Status : Final report 1

Eight samples were received for analysis on 30th September, 2020 of which eight 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:

b. June

Bruce Leslie Project Manager

Please include all sections of this report if it is reproduced

Element Materials Technology



Ground Investigations Ireland 9754-07-20 Bus Connects Route 15 John Duggan 20/13374

Report : Solid

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

7-9	IT Sample No. 1-3	10-12	13-15	16-18	19-21	22-24				
R15 - CP06	Sample ID R15 - CP06	R15 - CP06	R15 - CP07	R15 - CP07	R15 - CP07	R15 - CP07				
2.50	Depth 0.50	3.50	0.50	1.50	2.50	3.50		Disease		
	COC No / misc								e attached n ations and a	
VJT	Containers VJT	VJT	VJT	VJT	VJT	VJT				
	Sample Date 25/09/2020			25/09/2020						
Soil	Sample Type Soil	Soil	Soil	Soil	Soil	Soil				
1	Batch Number 1	1	1	1	1	1		LOD/LOR	Units	Method
30/09/2020	ate of Receipt 30/09/2020	30/09/2020	30/09/2020	30/09/2020	30/09/2020	30/09/2020				No.
2	2	<1	1	3	2	<1		<1	mg/kg	TM30/PM15
12.2	12.5	9.5	14.6	15.3	11.2	7.1		<0.5	mg/kg	TM30/PM15
128	97	60	123	164	62	26		<1	mg/kg	TM30/PM15
1.9	1.8	0.7	1.3	1.3	1.5	0.2		<0.1	mg/kg	TM30/PM15
55.3	46.9	46.4	52.6	46.7	56.5	63.3		<0.5	mg/kg	TM30/PM15
66	43	13	40	34	27	6		<1	mg/kg	TM30/PM15
100	71	29	88	226	41	11		<5	mg/kg	TM30/PM15
<0.1	<0.1	<0.1	0.1	<0.1	<0.1	<0.1		<0.1	mg/kg	TM30/PM15
4.8	4.9	3.5	4.6	4.5	4.9	4.2		<0.1	mg/kg	TM30/PM15
30.9	33.7	14.5	39.3	29.9	26.6	10.2		<0.7	mg/kg	TM30/PM15
1	2	<1	1	<1	1	<1		<1	mg/kg	TM30/PM15
164	117	79	118	134	69	26		<5	mg/kg	TM30/PM15
<0.04	0.07	<0.04	0.27	0.13	<0.04	<0.04		<0.04	mg/kg	TM4/PM8
<0.03	0.05	<0.03	0.17	0.05	<0.03	<0.03		<0.03	mg/kg	TM4/PM8
<0.05	0.09	<0.05	0.25	0.07	<0.05	<0.05		<0.05	mg/kg	TM4/PM8
<0.04	0.08	<0.04	0.19	0.06	<0.04	<0.04		<0.04	mg/kg	TM4/PM8
0.20	0.42	0.12	2.08	0.62	<0.03	<0.03		<0.03	mg/kg	TM4/PM8
0.09	0.14	<0.04	0.49	0.15	<0.04	<0.04		<0.04	mg/kg	TM4/PM8
0.88	0.71	0.27	3.03	1.06	0.05	<0.03		<0.03	mg/kg	TM4/PM8
0.72	0.60	0.22	2.82	0.94	0.04	<0.03		<0.03	mg/kg	TM4/PM8
0.56	ene [#] 0.33	0.15	1.60	0.82	<0.06	<0.06		<0.06	mg/kg	TM4/PM8
0.49	0.33	0.15	1.62	0.87	0.04	<0.02		<0.02	mg/kg	TM4/PM8
1.00	nthene [#] 0.56	0.27	3.20	1.87	<0.07	<0.07		<0.07	mg/kg	TM4/PM8
0.55	# 0.32	0.12	1.83	1.20	<0.04	<0.04		<0.04	mg/kg	TM4/PM8
0.41	rrene 0.22	0.11	1.37	0.78	<0.04	<0.04		<0.04	mg/kg	TM4/PM8
0.07	racene # <0.04	<0.04	0.25	0.19	<0.04	<0.04		<0.04	mg/kg	TM4/PM8 TM4/PM8
0.39	ene [#] 0.22	0.11	1.50	0.68	<0.04	<0.04		<0.04	mg/kg	TM4/PM8
0.05 5.41	<0.04	<0.04 1.52	0.26 20.93	0.09 9.58	<0.04 <0.64	<0.04 <0.64		<0.04 <0.64	mg/kg mg/kg	TM4/PM8 TM4/PM8
0.72	4.14 hene 0.40	0.19	20.93	9.58	<0.64	<0.64		<0.64	mg/kg	TM4/PM8
0.72	hene 0.16	0.19	0.90	0.52	<0.05	<0.03		<0.03	mg/kg	TM4/PM8
99	6 Recovery 94	100	93	95	99	96		<0.02	%	TM4/PM8
		100	50	50	55	50		~0	70	
175	C40) <30	32	90	<30	<30	<30		<30	mg/kg	TM5/PM8/PM16
								Image: state stat	Image: state stat	Image: state stat



Ground Investigations Ireland 9754-07-20 Bus Connects Route 15 John Duggan 20/13374

Report : Solid

EMI JOD NO:	20/13374									_				
EMT Sample No.	1-3	4-6	7-9	10-12	13-15	16-18	19-21	22-24]				
Sample ID	R15 - CP06	R15 - CP06	R15 - CP06	R15 - CP06	R15 - CP07	R15 - CP07	R15 - CP07	R15 - CP07						
Depth	0.50	1.50	2.50	3.50	0.50	1.50	2.50	3.50						
	0.00	1.00	2.00	0.00	0.00	1.00	2.00	0.00			e attached r ations and a			
COC No / misc														
Containers	VJT	VJT	VJT	VJT	VJT	VJT	VJT	VJT						
Sample Date	25/09/2020	25/09/2020	25/09/2020	25/09/2020	25/09/2020	25/09/2020	25/09/2020	25/09/2020						
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil						
Batch Number	1	1	1	1	1	1	1	1				Method		
Date of Receipt	30/09/2020	30/09/2020	30/09/2020	30/09/2020	30/09/2020	30/09/2020	30/09/2020	30/09/2020		LOD/LOR	Units	No.		
TPH CWG														
Aliphatics														
- >C5-C6 [#]	<0.1	<0.1 ^{sv}	<0.1 ^{SV}	<0.1 ^{sv}	<0.1 ^{sv}	<0.1	<0.1 ^{sv}	<0.1		<0.1	mg/kg	TM36/PM12		
>C6-C8 [#]	<0.1	<0.1 ^{sv}	<0.1 ^{SV}	<0.1 ^{SV}	<0.1 ^{sv}	<0.1	<0.1 ^{sv}	<0.1		<0.1	mg/kg	TM36/PM12		
>C8-C10	<0.1	<0.1 ^{SV}	<0.1 ^{SV}	<0.1 ^{SV}	<0.1 ^{SV}	<0.1	<0.1 ^{SV}	<0.1		<0.1	mg/kg	TM36/PM12		
>C10-C12#	<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 [#]	<4	<4	<4	<4	<4	<4	<4	<4		<4	mg/kg	TM5/PM8/PM16		
>C16-C21 [#]	<7	<7	12	<7	11	<7	<7	<7		<7	mg/kg	TM5/PM8/PM16		
>C21-C35 [#]	15	22	126	22	64	25	<7	<7		<7	mg/kg	TM5/PM8/PM16		
>C35-C40	<7	<7	37	10	15	<7	<7	<7		<7	mg/kg	TM5/PM8/PM16		
Total aliphatics C5-40	<26	<26	175	32	90	<26	<26	<26		<26	mg/kg	TM5/TM36/PM8/PM12/PM16		
>C6-C10	<0.1	<0.1 ^{SV}	<0.1 ^{SV}	<0.1 ^{SV}	<0.1 ^{SV}	<0.1	<0.1 ^{SV}	<0.1		<0.1	mg/kg	TM36/PM12		
>C10-C25	<10	<10	46	<10	17	<10	<10	<10		<10	mg/kg	TM5/PM8/PM16		
>C25-C35	13	18	102	25	55	24	<10	<10		<10	mg/kg	TM5/PM8/PM16		
Aromatics >C5-EC7 [#]	<0.1	<0.1 ^{sv}	<0.1 ^{SV}	<0.1 ^{SV}	<0.1 ^{sv}	<0.1	<0.1 ^{sv}	<0.1		<0.1	mg/kg	TM36/PM12		
>EC7-EC8 [#]	<0.1	<0.1 <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	TM36/PM12		
>EC8-EC10 [#]	<0.1	<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		
>EC10-EC12#	<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 [#]	<4	<4	<4	<4	12	<4	<4	<4		<4	mg/kg	TM5/PM8/PM16		
>EC16-EC21 #	16	27	11	10	231	14	<7	<7		<7	mg/kg	TM5/PM8/PM16		
>EC21-EC35 [#]	91	144	176	82	980	105	<7	<7		<7	mg/kg	TM5/PM8/PM16		
>EC35-EC40	34	27	64	20	142	44	<7	<7		<7	mg/kg	TM5/PM8/PM16		
Total aromatics C5-40	141	198	251	112	1365	163	<26	<26		<26	mg/kg	TM5/TM36/PM8/PM12/PM16		
Total aliphatics and aromatics(C5-40)	141	198	426	144	1455	163	<52	<52		<52	mg/kg	TM5/TM36/PM8/PM12/PM16		
>EC6-EC10 [#]	<0.1	<0.1 ^{SV}	<0.1 ^{SV}	<0.1 ^{SV}	<0.1 ^{SV}	<0.1	<0.1 ^{sv}	<0.1		<0.1	mg/kg	TM36/PM12		
>EC10-EC25	30	65	42	29	579	38	<10	<10		<10	mg/kg	TM5/PM8/PM16		
>EC25-EC35	71	108	155	69	665	87	<10	<10		<10	mg/kg	TM5/PM8/PM16		
	. F	<5 ^{sv}	<5 ^{SV}	<5 ^{SV}	<5 sv	.	<5 ^{sv}					TM26/DM40		
MTBE [#]	<5 <5	<5 ⁵⁰	<5 ⁵⁰	<5 ⁵⁰	<5 ⁵⁰	<5 <5	<5 ⁵⁰	<5		<5 <5	ug/kg	TM36/PM12 TM36/PM12		
Benzene [#] Toluene [#]	<5 <5	<5 ^{SV}	<5 ⁵⁰	<5 ^{SV}	<5 ^{SV}	<5	<5 ^{sv}	<5 <5		<5	ug/kg ug/kg	TM36/PM12 TM36/PM12		
Ethylbenzene [#]	<5	<5 <5 SV	<5 <5 SV	<5 <5 ^{SV}	<5 <5	<5	<5 <5 ^{SV}	<5		<5	ug/kg	TM36/PM12		
m/p-Xylene [#]	<5	<5 ^{SV}	<5 ^{SV}	<5 ^{SV}	<5 <5 ^{sv}	<5	<5 ^{SV}	<5		<5	ug/kg	TM36/PM12		
o-Xylene [#]	<5	<5 ^{sv}	<5 ^{sv}	<5 ^{sv}	<5 ^{sv}	<5	<5 ^{sv}	<5		<5	ug/kg	TM36/PM12		
PCB 28 #	<5	<5	<5	<5	<5	<5	<5	<5		<5	ug/kg	TM17/PM8		
PCB 52 [#]	<5	<5	<5	<5	<5	<5	<5	<5		<5	ug/kg	TM17/PM8		
PCB 101 #	<5	<5	<5	<5	<5	<5	<5	<5		<5	ug/kg	TM17/PM8		
PCB 118 [#]	<5	<5	<5	<5	<5	<5	<5	<5		<5	ug/kg	TM17/PM8		
PCB 138 [#]	<5	<5	<5	<5	<5	<5	<5	<5		<5	ug/kg	TM17/PM8		
PCB 153 [#]	<5	<5	<5	<5	<5	<5	<5	<5		<5	ug/kg	TM17/PM8		
PCB 180 [#]	<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	ug/kg	TM17/PM8		

Client Name:
Reference:
Location:
Contact:
EMT Job No:

Ground Investigations Ireland 9754-07-20 Bus Connects Route 15 John Duggan 20/13374

Report : Solid

EMT Job No:	20/13374									_		
EMT Sample No.	1-3	4-6	7-9	10-12	13-15	16-18	19-21	22-24				
Sample ID	R15 - CP06	R15 - CP06	R15 - CP06	R15 - CP06	R15 - CP07	R15 - CP07	R15 - CP07	R15 - CP07				
Depth	0.50	1.50	2.50	3.50	0.50	1.50	2.50	3.50		Please se	e attached n	otes for all
COC No / misc											ations and a	
Containers	VJT											
Sample Date	25/09/2020	25/09/2020	25/09/2020	25/09/2020	25/09/2020	25/09/2020	25/09/2020	25/09/2020				
Sample Type	Soil											
Batch Number	1	1	1	1	1	1	1	1				Method
Date of Receipt	30/09/2020	30/09/2020	30/09/2020	30/09/2020	30/09/2020	30/09/2020	30/09/2020	30/09/2020		LOD/LOR	Units	No.
Natural Moisture Content	13.9	17.3	24.6	24.6	9.3	17.6	28.9	22.1		<0.1	%	PM4/PM0
Moisture Content (% Wet Weight)	12.2	14.7	19.8	19.7	8.5	15.0	22.4	18.1		<0.1	%	PM4/PM0
Hexavalent Chromium [#]	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3		<0.3	mg/kg	TM38/PM20
Chromium III	46.9	49.1	55.3	46.4	52.6	46.7	56.5	63.3		<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	mg/kg	TM89/PM45
Total Organic Carbon #	1.18	1.43	1.68	0.69	1.53	1.68	1.72	0.30		<0.02	%	TM21/PM24
Loss on Ignition #	2.8	3.2	4.5	1.7	3.8	3.7	3.6	<1.0		<1.0	%	TM22/PM0
рН#	7.93	7.89	7.45	7.68	8.28	8.12	7.64	7.84		<0.01	pH units	TM73/PM11
Mass of raw test portion Mass of dried test portion	0.1035	0.1048	0.1154	0.1231	0.099	0.1065	0.1109	0.1118			kg kg	NONE/PM17 NONE/PM17
mass of thet test portion	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03			Ng	



Ground Investigations Ireland 9754-07-20 Bus Connects Route 15 John Duggan 20/13374

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				
Sample ID	R15 - CP06	R15 - CP06	R15 - CP06	R15 - CP06	R15 - CP07	R15 - CP07	R15 - CP07	R15 - CP07				
Depth	0.50	1.50	2.50	3.50	0.50	1.50	2.50	3.50		Please se	e attached n	otes for all
COC No / misc											ations and a	
Containers	VJT											
Sample Date	25/09/2020	25/09/2020	25/09/2020	25/09/2020	25/09/2020	25/09/2020	25/09/2020	25/09/2020				
Sample Type	Soil											
Batch Number	1	1	1	1	1	1	1	1				Mathead
Date of Receipt	30/09/2020	30/09/2020	30/09/2020	30/09/2020	30/09/2020	30/09/2020	30/09/2020	30/09/2020		LOD/LOR	Units	Method No.
Dissolved Antimony [#]	< 0.002	<0.002	0.008	0.005	0.005	0.005	0.009	< 0.002		<0.002	mg/l	TM30/PM17
Dissolved Antimony (A10) #	<0.02	<0.02	0.08	0.05	0.05	0.05	0.09	<0.02		<0.02	mg/kg	TM30/PM17
Dissolved Arsenic [#]	<0.0025	<0.0025	0.0040	0.0091	0.0057	0.0063	0.0056	0.0038		<0.0025	mg/l	TM30/PM17
Dissolved Arsenic (A10) [#]	<0.025	<0.025	0.040	0.091	0.057	0.063	0.056	0.038		<0.025	mg/kg	TM30/PM17
Dissolved Barium [#]	0.020	0.031	0.076	0.053	0.011	0.023	0.046	0.013		< 0.003	mg/l	TM30/PM17
Dissolved Barium (A10)#	0.20	0.31	0.76	0.53	0.11	0.23	0.46	0.13		<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	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	mg/kg	TM30/PM17
Dissolved Chromium [#]	<0.0015	<0.0015	<0.0015	<0.0015	0.0047	0.0017	<0.0015	<0.0015		<0.0015	mg/l	TM30/PM17
Dissolved Chromium (A10) #	<0.015	<0.015	<0.015	<0.015	0.047	0.017	<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	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	mg/kg	TM30/PM17
Dissolved Lead [#]	<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	mg/kg	TM30/PM17
Dissolved Molybdenum #	0.018	0.021	0.036	0.019	0.011	0.007	0.018	0.010		<0.002	mg/l	TM30/PM17
Dissolved Molybdenum (A10) #	0.18	0.21	0.36	0.19	0.11	0.07	0.18	0.10		<0.02	mg/kg	TM30/PM17
Dissolved Nickel [#]	<0.002	<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	<0.02	<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	<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	<0.03	<0.03		<0.03	mg/kg	TM30/PM17
Dissolved Zinc [#]	<0.003	<0.003	0.004	<0.003	0.003	<0.003	<0.003	<0.003		<0.003	mg/l	TM30/PM17
Dissolved Zinc (A10) #	<0.03	<0.03	0.04	<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	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	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	mg/l	TM26/PM0
Total Phenols HPLC	<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	0.4	0.4	<0.3	<0.3		<0.3	mg/l	TM173/PM0
Fluoride	<3	<3	<3	<3	4	4	<3	<3		<3	mg/kg	TM173/PM0
Sulphate as SO4 [#]	69.8	29.2	58.3	37.7	1.3	5.2	38.2	21.4		<0.5	mg/l	TM38/PM0
Sulphate as SO4 #	698	292	583	377	13	52	382	214		<5	mg/kg	TM38/PM0
Chloride [#]	<0.3	<0.3	0.4	2.1	0.8	1.9	0.5	0.4		<0.3	mg/l	TM38/PM0
Chloride #	<3	<3	4	21	8	19	5	4		<3	mg/kg	TM38/PM0
Dissolved Organic Carbon	3	3	5	4	5	4	4	2		<2	mg/l	TM60/PM0
Dissolved Organic Carbon	30	30	50	40	50	40	40	<20		<20	mg/kg	TM60/PM0
Total Dissolved Solids [#]	170	132	220	143	59	68	172	96		<35	mg/l	TM20/PM0
Total Dissolved Solids #	1700	1320	2199	1430	590	680	1720	960		<350	mg/kg	TM20/PM0

Client Name: Ground Investigations Ireland Reference: Location: Contact: EMT Job No: John Duggan 20/13374

9754-07-20 Bus Connects Route 15

Report : EN12457_2

EMT Job No:	20/13374														
EMT Sample No.	1-3	4-6	7-9	10-12	13-15	16-18	19-21	22-24							
Sample ID	R15 - CP06	R15 - CP06	R15 - CP06	R15 - CP06	R15 - CP07	R15 - CP07	R15 - CP07	R15 - CP07							
Depth	0.50	1.50	2.50	3.50	0.50	1.50	2.50	3.50					Please se	e attached n	otes for all
COC No / misc														ations and a	
Containers	VJT	VJT	VJT	VJT	VJT	VJT	VJT	VJT							
Sample Date	25/09/2020			25/09/2020	25/09/2020	25/09/2020	25/09/2020	25/09/2020							
-				Soil											
Sample Type	Soil	Soil	Soil		Soil	Soil	Soil	Soil					-		Т
Batch Number	1	1	1	1	1	1	1	1		Inert	Stable Non- reactive	Hazardous	LOD LOR	Units	Method No.
Date of Receipt	30/09/2020	30/09/2020	30/09/2020	30/09/2020	30/09/2020	30/09/2020	30/09/2020	30/09/2020							
Solid Waste Analysis			1.00	0.00	4.50	1.00	4 70	0.00			-				THOUDHOU
Total Organic Carbon # Sum of BTEX	1.18 <0.025	1.43 <0.025 ^{sv}	1.68 <0.025 ^{sv}	0.69 <0.025 ^{sv}	1.53 <0.025 ^{sv}	1.68 <0.025	1.72 <0.025 ^{sv}	0.30 <0.025		3	- 5	6	<0.02 <0.025	% mg/kg	TM21/PM24 TM36/PM12
Sum of 7 PCBs#	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025		1	-	-	<0.025	mg/kg	TM17/PM8
Mineral Oil	<30	<30	175	32	90	<30	<30	<30		500	-	-	<30	mg/kg	TM5/PM8/PM16
PAH Sum of 17	4.14	10.50	5.41	1.52	20.93	9.58	<0.64	<0.64		100	-	-	<0.64	mg/kg	TM4/PM8
CEN 10:1 Leachate															
Arsenic #	<0.025	<0.025	0.040	0.091	0.057	0.063	0.056	0.038		0.5	2	25	<0.025	mg/kg	TM30/PM17
Barium #	0.20	0.31	0.76	0.53	0.11	0.23	0.46	0.13		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		0.04	1	5	<0.005	mg/kg	TM30/PM17 TM30/PM17
Chromium [#] Copper [#]	<0.015	<0.015 <0.07	<0.015 <0.07	<0.015 <0.07	0.047 <0.07	0.017 <0.07	<0.015 <0.07	<0.015 <0.07		0.5	10 50	70 100	<0.015 <0.07	mg/kg mg/kg	TM30/PM17 TM30/PM17
Mercury#	<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 #	0.18	0.21	0.36	0.19	0.11	0.07	0.18	0.10		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		0.4	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		0.5	10	50	<0.05	mg/kg	TM30/PM17
Antimony#	<0.02	<0.02	0.08	0.05	0.05	0.05	0.09	<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		0.1	0.5	7	<0.03	mg/kg	TM30/PM17
Zinc#	<0.03	<0.03	0.04	<0.03	0.03	<0.03	<0.03	<0.03		4	50	200	<0.03	mg/kg	TM30/PM17
Total Dissolved Solids#	1700	1320	2199	1430	590	680	1720	960		4000	60000	100000	<350	mg/kg	TM20/PM0
Dissolved Organic Carbon	30	30	50	40	50	40	40	<20		500	800	1000	<20	mg/kg	TM60/PM0
Mass of raw test portion	0.1035	0.1048	0.1154	0.1231	0.099	0.1065	0.1109	0.1118		-	-	-		kg	NONE/PM17
Dry Matter Content Ratio	87.4	85.6	77.8	73.3	90.6	84.3	80.9	80.4		-	-	-	<0.1	%	NONE/PM4
Leachant Volume	0.887	0.885	0.874	0.867	0.891	0.883	0.879	0.878		-	-	-		I	NONE/PM17
Eluate Volume	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8		-	-	-		I	NONE/PM17
рН#	7.93	7.89	7.45	7.68	8.28	8.12	7.64	7.84		-	-	-	<0.01	pH units	TM73/PM11
Fluoride	<3	<3	<3	<3	4	4	<3	<3		-	-	-	<3	mg/kg	TM173/PM0
Sulphate as SO4 #	698	292	583	377	13	52	382	214		1000	20000	50000	<5	mg/kg	TM38/PM0
Chloride #	<3	<3	4	21	8	19	5	4		800	15000	25000	<3	mg/kg	TM38/PM0
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Client Name:	Ground Investigations Ireland
Reference:	20/07/9754
Location:	Bus Connects Route 15
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
20/13374	1	R15 - CP06	0.50	2	19/10/2020	General Description (Bulk Analysis)	soil-stones
					19/10/2020	Asbestos Fibres	NAD
					19/10/2020	Asbestos ACM	NAD
					19/10/2020	Asbestos Type	NAD
					19/10/2020	Asbestos Level Screen	NAD
20/13374	1	R15 - CP06	1.50	5	19/10/2020	General Description (Bulk Analysis)	Soil/Stones
					19/10/2020	Asbestos Fibres	NAD
					19/10/2020	Asbestos ACM	NAD
					19/10/2020	Asbestos Type	NAD
					19/10/2020	Asbestos Level Screen	NAD
20/13374	1	R15 - CP06	2.50	8	19/10/2020	General Description (Bulk Analysis)	Soil/Stones
					19/10/2020	Asbestos Fibres	NAD
					19/10/2020	Asbestos ACM	NAD
					19/10/2020	Asbestos Type	NAD
					19/10/2020	Asbestos Level Screen	NAD
20/13374	1	R15 - CP06	3.50	11	19/10/2020	General Description (Bulk Analysis)	Soil/Stones
					19/10/2020	Asbestos Fibres	NAD
					19/10/2020	Asbestos ACM	NAD
					19/10/2020	Asbestos Type	NAD
					19/10/2020	Asbestos Level Screen	NAD
20/13374	1	R15 - CP07	0.50	14	19/10/2020	General Description (Bulk Analysis)	Soil/Stones
					19/10/2020	Asbestos Fibres	NAD
					19/10/2020	Asbestos ACM	NAD
					19/10/2020	Asbestos Type	NAD
					19/10/2020	Asbestos Level Screen	NAD
20/13374	1	R15 - CP07	1.50	17	17/10/2020	General Description (Bulk Analysis)	soil-stones
					17/10/2020	Asbestos Fibres	NAD
					17/10/2020	Asbestos ACM	NAD
					17/10/2020	Asbestos Type	NAD
					17/10/2020	Asbestos Level Screen	NAD
20/13374	1	R15 - CP07	2.50	20	19/10/2020	General Description (Bulk Analysis)	soil-stones
					19/10/2020	Asbestos Fibres	NAD
					19/10/2020	Asbestos ACM	NAD

Client Name:
Reference:
Location:

Ground Investigations Ireland 20/07/9754 Bus Connects Route 15

Contact	:		John Dug	ggan			
EMT Job No.	Batch	Sample ID	Depth	EMT Sample No.	Date Of Analysis	Analysis	Result
20/13374	1	R15 - CP07	2.50	20	19/10/2020	Asbestos Type	NAD
					19/10/2020	Asbestos Level Screen	NAD
20/13374	1	R15 - CP07	3.50	23	10/10/2020	General Description (Bulk Analysis)	soil-stones
20/13374	1	R15-CF07	3.50	23		Asbestos Fibres	NAD
						Asbestos ACM	NAD
						Asbestos Type	NAD
						Asbestos Level Screen	NAD

Client Name:Ground Investigations IrelandReference:9754-07-20Location:Bus Connects Route 15Contact:John Duggan

Batch	Sample ID	Depth	EMT Sample No.	Analysis	Reason
				No deviating sample report results for job 20/13374	
			Satisfie ib Depin	No. N	No.

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.: 20/13374

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.

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
ТМЗО	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 co- elutes with 3-methylpentane if present and therefore can give a false positive. Positive MTBE re	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 co- elutes with 3-methylpentane if present and therefore can give a false positive. Positive MTBE re	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

EMT Job No: 20/13374

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	

Method Code Appendix



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W: www.element.com

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



Attention :	John Duggan
Date :	16th November, 2020
Your reference :	9754-07-20
Our reference :	Test Report 20/15137 Batch 1
Location :	Bus Connects Route 15
Date samples received :	2nd November, 2020
Status :	Final report
Issue :	1

Two samples were received for analysis on 2nd 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:

Phil Sommerton BSc Senior Project Manager

Please include all sections of this report if it is reproduced



Ground Investigations Ireland 9754-07-20 Bus Connects Route 15 John Duggan 20/15137

Report : Solid

EMT Sample No.	1-3	4-6							
Sample ID	R15-CP04	R15-CP04							
Depth	0.50	1.50					Please see	e attached n	otes for all
COC No / misc							abbrevia	ations and a	cronyms
Containers	VJT	VJT							
Sample Date	30/10/2020	30/10/2020							
	Soil	Soil							
Sample Type									1
Batch Number	1	1					LOD/LOR	Units	Method
Date of Receipt	02/11/2020	02/11/2020							No.
Antimony	<1	<1					<1	mg/kg	TM30/PM15
Arsenic [#]	5.2	5.5					<0.5	mg/kg	TM30/PM15
Barium [#]	27	27					<1	mg/kg	TM30/PM15
Cadmium [#]	5.3	0.9					<0.1	mg/kg	TM30/PM15
Chromium [#]	26.6	38.4					<0.5	mg/kg	TM30/PM15
Copper [#]	12	13					<1	mg/kg	TM30/PM15
Lead [#]	5	9					<5	mg/kg	TM30/PM15
Mercury [#]	<0.1 13.7	<0.1 2.9					<0.1 <0.1	mg/kg mg/kg	TM30/PM15 TM30/PM15
Molybdenum [#] Nickel [#]	18.3	18.3					<0.7	mg/kg	TM30/PM15
Selenium [#]	<1	<1					<1	mg/kg	TM30/PM15
Zinc [#]	113	49					<5	mg/kg	TM30/PM15
									11100/111110
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 <0.02	<0.05 <0.02					<0.05 <0.02	mg/kg	TM4/PM8 TM4/PM8
Benzo(k)fluoranthene PAH Surrogate % Recovery	<0.02 88	<0.02 94					<0.02	mg/kg %	TM4/PM8
PAIT Suffogate % Recovery	00	54					<0	76	TIVIH/FIVIO
Mineral Oil (C10-C40) (EH_CU_1D_Total)	<30	<30					<30	mg/kg	TM5/PM8/PM16
								35	



Ground Investigations Ireland 9754-07-20 Bus Connects Route 15 John Duggan 20/15137

Report : Solid

EMT Sample No.	1-3	4-6						1		
Sample ID	R15-CP04	R15-CP04								
Depth	0.50	1.50						Ploase se	e attached n	otos for all
COC No / misc									ations and a	
Containers	VJT	VJT								
Sample Date	30/10/2020	30/10/2020								
Sample Type	Soil	Soil								
Batch Number	1	1								
Date of Receipt	02/11/2020	02/11/2020						LOD/LOR	Units	Method No.
	02/11/2020	02/11/2020								
TPH CWG										
Aliphatics	<0.1	<0.1						<0.1	mg/kg	TM36/PM12
>C5-C6 (HS_1D_AL) [#] >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
>C12-C18 (EH_1D_AL)	<7	<7						<7	mg/kg	TM5/PM8/PM16
>C21-C35 (EH_1D_AL)*	<7	<7	l	l	l			<7	mg/kg	TM5/PM8/PM16
>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	TMS/TM36/PM8/PM12/PM16
>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)	<26	<26						<26	mg/kg	TMS/TM36/PM8/PM12/PM16
Total aliphatics and aromatics(CS-40) (EH+HS_CU_1D_Total)	<52	<52						<52	mg/kg	TMS/TM36/PMM/PM12/PM16
>EC6-EC10 (HS_1D_AR)#	<0.1	<0.1						<0.1	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 [#]	20	<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 28" PCB 52 [#]	<5	<5						<5	ug/kg	TM17/PM8 TM17/PM8
PCB 52 ⁻ PCB 101 [#]	<5	<5						<5	ug/kg	TM17/PM8
PCB 101* PCB 118 [#]	<5	<5						<5	ug/kg	TM17/PM8
PCB 118 PCB 138 [#]	<5	<5						<5	ug/kg	TM17/PM8
PCB 153 [#]	<5	<5						<5	ug/kg	TM17/PM8
PCB 153 PCB 180 [#]	<5	<5						<5	ug/kg	TM17/PM8
Total 7 PCBs [#]	<35	<35						<35	ug/kg	TM17/PM8



Ground Investigations Ireland 9754-07-20 Bus Connects Route 15 John Duggan 20/15137

Report : Solid

EMT Sample No.	1-3	4-6							
Sample ID	R15-CP04	R15-CP04							
Depth	0.50	1.50					Please se	e attached n	otes for all
COC No / misc								ations and ad	
Containers	VJT	VJT							
Sample Date	30/10/2020	30/10/2020							
Sample Type	Soil	Soil							
	1	1							
Batch Number							LOD/LOR	Units	Method No.
Date of Receipt									
Natural Moisture Content	17.0	7.3					<0.1	%	PM4/PM0
Moisture Content (% Wet Weight)	14.5	6.8					<0.1	%	PM4/PM0
Hexavalent Chromium [#]	<0.3	<0.3					<0.3	mg/kg	TM38/PM20
Chromium III	26.6	38.4					<0.5	mg/kg	NONE/NONE
Total Cyanide [#]	<0.5	<0.5					<0.5	mg/kg	TM89/PM45
Total Organic Carbon #	0.19	0.29					<0.02	%	TM21/PM24
Loss on Ignition [#]	<1.0	1.1					<1.0	%	TM22/PM0
pH [#]	8.48	8.82					<0.01	pH units	TM73/PM11
pri									
Mass of raw test portion	0.1023	0.098						kg	NONE/PM17
Mass of dried test portion	0.09	0.09						kg	NONE/PM17



Ground Investigations Ireland 9754-07-20 Bus Connects Route 15 John Duggan 20/15137

Report : CEN 10:1 1 Batch

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

EMT Sample No.	1-3	4-6							
Sample ID	R15-CP04	R15-CP04							
Depth	0.50	1.50					Please se	e attached n	otes for all
COC No / misc							abbrevia	ations and a	cronyms
Containers	VJT	VJT							
Sample Date		30/10/2020							
Sample Type	Soil	Soil							
Batch Number	1	1					LOD/LOR	Units	Method
Date of Receipt	02/11/2020	02/11/2020						-	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#	<0.003	<0.003					<0.003	mg/l	TM30/PM17
Dissolved Barium (A10)#	<0.03	<0.03					<0.03	mg/kg	TM30/PM17
Dissolved Cadmium#	<0.0005	<0.0005					<0.0005	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#	<0.002	0.004					<0.002	mg/l	TM30/PM17
Dissolved Molybdenum (A10)#	<0.02	0.04					<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	ma/l	TM26/PM0
Total Phenois HPLC	<0.05	<0.05					<0.05	mg/l	TM26/PM0
	<0.5	<0.5					<0.5	mg/kg	
Fluoride	0.4	<0.3					<0.3	mg/l	TM173/PM0
Fluoride	4	<3					<3	mg/kg	TM173/PM0 TM173/PM0
Sulphate as SO4 [#]	0.5	0.7					<0.5	mg/l	TM38/PM0
Sulphate as SO4	5	7					<5	mg/kg	TM38/PM0
Chloride [#]	<0.3	0.7					<0.3	mg/l	TM38/PM0
Chloride [#]	<3	7					<3	mg/kg	TM38/PM0
Dissolved Organic Carbon	4	3					<2	mg/l	TM60/PM0
Dissolved Organic Carbon	40	30					<20	mg/kg	TM60/PM0
Total Dissolved Solids#	52	<35					<35	mg/l	TM20/PM0
Total Dissolved Solids#	520	<350					<350	mg/kg	TM20/PM0

Element Materia	ls Tech	nology	,											
Client Name: Reference:	Ground Ir 9754-07-2	vestigatio	ns Ireland		Report :	EN12457	_2							
Location: Contact: EMT Job No:		nects Route	e 15		Solids: V=	⊧60g VOC j	ar, J=250g	glass jar, T=	-plastic tub					
EMT Sample No.	1	4-6												
Ewr Sample No.	1-3	4-0												
Sample ID	R15-CP04	R15-CP04												
Depth	0.50	1.50										Please se	e attached n	otes for all
COC No / misc												abbrevia	ations and a	cronyms
Containers	VJT	VJT												
Sample Date	30/10/2020	30/10/2020												
Sample Type	Soil	Soil												
Batch Number	1	1								Stable Non-				Method
Date of Receipt	02/11/2020	02/11/2020							Inert	reactive	Hazardous	LOD LOR	Units	No.
Solid Waste Analysis														
Total Organic Carbon#	0.19	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 # Mineral Oil	<0.035 <30	<0.035 <30							1 500	-	-	<0.035 <30	mg/kg mg/kg	TM17/PM8 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 [#]	<0.03 <0.005	<0.03 <0.005							20 0.04	100	300 5	<0.03 <0.005	mg/kg mg/kg	TM30/PM17 TM30/PM17
Cadmium" Chromium"	<0.005	<0.005							0.5	10	70	<0.005	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 #	<0.02	0.04							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 <0.02	<0.05							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							0.06	0.7	7	<0.02	mg/kg	TM30/PM17
Zinc [#]	0.03	<0.03							4	50	200	<0.03	mg/kg	TM30/PM17
Total Dissolved Solids"	520	<350							4000	60000	100000	<350	mg/kg	TM20/PM0
Dissolved Organic Carbon	40	30							500	800	1000	<20	mg/kg	TM60/PM0
	0.4000	0.000												NONE/PM17
Mass of raw test portion Dry Matter Content Ratio	0.1023 87.9	0.098 91.8							-	-	-	<0.1	kg %	NONE/PM17
Leachant Volume	0.888	0.892							-	-	-	40.1	1	NONE/PM17
Eluate Volume	0.8	0.6							-	-	-		T	NONE/PM17
pH#	8.48	8.82							-	-	-	<0.01	pH units	TM73/PM11
Fluoride	4	<3							-	-	-	<3	mg/kg	TM173/PM0
	-												9/109	
Sulphate as SO4 #	5	7							1000	20000	50000	<5	mg/kg	TM38/PM0
Chloride "	<3	7							800	15000	25000	<3	mg/kg	TM38/PM0

Asbestos Analysis

Element Materials Technology

Client Name:	Ground Investigations Ireland
Reference:	20/07/9754
Location:	Bus Connects Route 15
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
20/15137	1	R15-CP04	0.50	2	12/11/2020	General Description (Bulk Analysis)	Soil/Stones
					12/11/2020	Asbestos Fibres	NAD
					12/11/2020	Asbestos ACM	NAD
					12/11/2020	Asbestos Type	NAD
					12/11/2020	Asbestos Level Screen	NAD
20/15137	1	R15-CP04	1.50	5	12/11/2020	General Description (Bulk Analysis)	Soil/Stones
					12/11/2020	Asbestos Fibres	NAD
					12/11/2020	Asbestos ACM	NAD
					12/11/2020	Asbestos Type	NAD
					12/11/2020	Asbestos Level Screen	NAD

Client Name:Ground Investigations IrelandReference:9754-07-20Location:Bus Connects Route 15Contact:John Duggan

EMT Job No.	Batch	Sample ID	Depth	EMT Sample No.	Analysis	Reason
					No deviating sample report results for job 20/15137	

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.: 20/15137

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.

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 B Indicates analyte found in associated method blank. DR Dilution required. M MCERTS accredited. NA Not applicable NAD No Asbestos Detected. ND None Detected (usually refers to VOC and/SVOC TICs). NDP No Detected (usually refers to VOC and/SVOC TICs). NDP No Detected (usually refers to VOC and/SVOC TICs). NDP No Detected (usually refers to VOC and/SVOC TICs). NDP No 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 Matorials T		
B Indicates analyte found in associated method blank. DR Dilution required. M 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. >> Results above calibration range, the result should be considered the minimum value. The actual result could be significantly higher; this result is not accredited. >> Results above calibration range, the result should be considered the minimum value. The actual result could be significantly higher; this result is not accredited. >> Results above calibration range, the result should be considered the minimum value. The actual result could be significantly higher; this result is not accredited. >> Results above calibration range,	#	ISO17025 (UKAS Ref No. 4225) accredited - UK.
DR Dilution required. M MCERTS accredited. NA Not applicable NAD No Asbestos Detected. ND None Detected (usually refers to VOC and/SVOC TICs). NDP No Elemination 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. + ACC 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 TB Trip Blank Sample<	SA	ISO17025 (SANAS Ref No.T0729) accredited - South Africa
M 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 LODLOR 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 N Client Sample	В	Indicates analyte found in associated method blank.
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 TB Tip Blank Sample	DR	Dilution required.
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 TB Trip Blank Sample	М	MCERTS accredited.
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 TB Trip Blank Sample	NA	Not applicable
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 TB Trip Blank Sample	NAD	No Asbestos Detected.
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 TB Trip Blank Sample	ND	None Detected (usually refers to VOC and/SVOC TICs).
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 TB Trip Blank Sample	NDP	No Determination Possible
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 TB Trip Blank Sample	SS	Calibrated against a single substance
+ 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 TB Trip Blank Sample	SV	Surrogate recovery outside performance criteria. This may be due to a matrix effect.
>> 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 TB Trip Blank Sample	W	Results expressed on as received basis.
>> 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 TB Trip Blank Sample	+	AQC failure, accreditation has been removed from this result, if appropriate, see 'Note' on previous page.
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 TB Trip Blank Sample	>>	
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 TB Trip Blank Sample	*	Analysis subcontracted to an Element Materials Technology approved laboratory.
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 TB Trip Blank Sample	AD	Samples are dried at 35°C ±5°C
ME Matrix Effect NFD No Fibres Detected BS AQC Sample LB Blank Sample N Client Sample TB Trip Blank Sample	со	Suspected carry over
NFD No Fibres Detected BS AQC Sample LB Blank Sample N Client Sample TB Trip Blank Sample	LOD/LOR	Limit of Detection (Limit of Reporting) in line with ISO 17025 and MCERTS
BS AQC Sample LB Blank Sample N Client Sample TB Trip Blank Sample	ME	Matrix Effect
LB Blank Sample N Client Sample TB Trip Blank Sample	NFD	No Fibres Detected
N Client Sample TB Trip Blank Sample	BS	AQC Sample
TB Trip Blank Sample	LB	Blank Sample
	N	Client Sample
OC Outside Calibration Range	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 co-elutes 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 co-elutes 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	
ТМ73	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	



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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 20/15509 Batch 1
Location :	Bus Connects Route 15
Date samples received :	9th November, 2020
Status :	Final report
Issue :	1

Nine samples were received for analysis on 9th 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.

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



Ground Investigations Ireland 9754-07-20 Bus Connects Route 15 John Duggan 20/15509

Report : Solid

EMT Job No:	20/15509									_		
EMT Sample No.	1-3	4-6	7-9	10-12	13-15	16-18	19-21	22-24	25-27			
Sample ID	R15-CP02	R15-CP03	R15-CP03	R15-CP03	R15-CP03	R15-CP05	R15-CP05	R15-CP05	R15-CP05			
Depth	0.50	0.50	1.50	2.50	3.50	0.50	1.50	2.50	3.50	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	06/11/2020	05/11/2020	05/11/2020	05/11/2020	05/11/2020	04/11/2020	04/11/2020	04/11/2020	04/11/2020	i i		
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			09/11/2020	09/11/2020				09/11/2020	09/11/2020	LOD/LOR	Units	Method No.
Antimony	1	7	2	2	2	2	2	2	<1	<1	mg/kg	TM30/PM15
Arsenic [#]	6.4	14.6	12.2	11.2	9.5	9.9	10.6	11.5	7.1	<0.5	mg/kg	TM30/PM15 TM30/PM15
Barium [#]	53	65	57	70	53	90	92	83	54	<1	mg/kg	TM30/PM15
Cadmium [#]	0.7	1.0	2.1	1.8	1.9	1.9	2.2	3.1	1.5	<0.1	mg/kg	TM30/PM15
Chromium [#]	53.4	46.7	35.5	33.1	35.2	43.5	39.8	38.5	32.8	<0.5	mg/kg	TM30/PM15
Copper [#]	19	75	32	25	26	28	32	29	18	<1	mg/kg	TM30/PM15
Lead [#]	10	300	22	16	18	23	20	19	14	<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 [#]	3.1	3.3	4.0	4.2	3.7	4.3	4.7	4.4	3.1	<0.1	mg/kg	TM30/PM15
Nickel #	16.8	28.0	38.6	33.4	30.9	33.7	39.7	37.8	22.4	<0.7	mg/kg	TM30/PM15
Selenium [#]	<1 48	<1 73	1 89	<1 73	2 92	1 86	2 92	2 82	2 58	<1 <5	mg/kg	TM30/PM15
Zinc [#]	40	73	09	13	92	00	92	02	50	<5	mg/kg	TM30/PM15
PAH MS												
Naphthalene [#]	<0.04	0.06	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	mg/kg	TM4/PM8
Acenaphthylene	<0.03	0.09	0.14	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	mg/kg	TM4/PM8
Acenaphthene#	<0.05	0.07	<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	0.09	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	mg/kg	TM4/PM8
Phenanthrene#	<0.03	0.66	1.10	<0.03	<0.03	0.16	<0.03	<0.03	<0.03	<0.03	mg/kg	TM4/PM8
Anthracene#	<0.04	0.24	0.35	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	mg/kg	TM4/PM8
Fluoranthene [#]	<0.03 <0.03	1.65 1.69	1.64 1.38	<0.03 <0.03	<0.03 <0.03	0.31	<0.03 <0.03	<0.03 <0.03	<0.03 <0.03	<0.03 <0.03	mg/kg mg/kg	TM4/PM8 TM4/PM8
Pyrene [#] Benzo(a)anthracene [#]	<0.03	1.09	0.81	<0.03	<0.03	0.26	<0.03	<0.03	<0.03	<0.03	mg/kg	TM4/PM8
Chrysene [#]	<0.02	1.14	0.76	<0.02	<0.02	0.21	<0.00	<0.02	<0.02	<0.00	mg/kg	TM4/PM8
Benzo(bk)fluoranthene [#]	<0.07	2.71	1.18	<0.07	<0.07	0.31	< 0.07	<0.07	<0.07	<0.07	mg/kg	TM4/PM8
Benzo(a)pyrene [#]	<0.04	1.69	0.65	<0.04	<0.04	0.17	<0.04	<0.04	<0.04	<0.04	mg/kg	TM4/PM8
Indeno(123cd)pyrene	<0.04	1.25	0.39	<0.04	<0.04	0.09	<0.04	<0.04	<0.04	<0.04	mg/kg	TM4/PM8
Dibenzo(ah)anthracene [#]	<0.04	0.19	0.10	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	mg/kg	TM4/PM8
Benzo(ghi)perylene [#]	<0.04	1.35	0.36	<0.04	<0.04	0.11	<0.04	<0.04	<0.04	<0.04	mg/kg	TM4/PM8
Coronene	<0.04	0.27	0.07	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	mg/kg	TM4/PM8
PAH 17 Total	<0.64	14.08	9.02	<0.64	<0.64	1.84	<0.64	<0.64	<0.64	<0.64	mg/kg	TM4/PM8
Benzo(b)fluoranthene	<0.05	1.95	0.85	<0.05	<0.05	0.22	<0.05	<0.05	<0.05	<0.05	mg/kg	TM4/PM8
Benzo(k)fluoranthene PAH Surrogate % Recovery	<0.02 91	0.76 87	0.33 96	<0.02 87	<0.02 86	0.09 90	<0.02 89	<0.02 91	<0.02 86	<0.02 <0	mg/kg %	TM4/PM8 TM4/PM8
PAR Surlogate % Recovery	91	07	90	07	00	90	69	91	00	<0	70	1 11/4/ 17 11/10
Mineral Oil (C10-C40) (EH_CU_1D_Total)	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	mg/kg	TM5/PM8/PM16



Ground Investigations Ireland 9754-07-20 Bus Connects Route 15 John Duggan 20/15509

Report : Solid

EMT Job No:	20/15509									 _		
EMT Sample No.	1-3	4-6	7-9	10-12	13-15	16-18	19-21	22-24	25-27			
Sample ID	R15-CP02	R15-CP03	R15-CP03	R15-CP03	R15-CP03	R15-CP05	R15-CP05	R15-CP05	R15-CP05			
Depth	0.50	0.50	1.50	2.50	3.50	0.50	1.50	2.50	3.50	Please se	e attached n	otes for all
COC No / misc											ations and a	
Containers	VJT	VJT	VJT	VJT	VJT	VJT	VJT	VJT	VJT	i		
Sample Date	06/11/2020	05/11/2020	05/11/2020	05/11/2020	05/11/2020	04/11/2020	04/11/2020	04/11/2020	04/11/2020			
	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil			
Sample Type												
Batch Number	1	1	1	1	1	1	1	1	1	LOD/LOR	Units	Method No.
Date of Receipt	09/11/2020	09/11/2020	09/11/2020	09/11/2020	09/11/2020	09/11/2020	09/11/2020	09/11/2020	09/11/2020			NO.
TPH CWG												
Aliphatics		0.4	0.4		0.4	0.4			sv			
>C5-C6 (HS_1D_AL)*	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1 ^{SV}	<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 <0.1	<0.1 <0.1	<0.1 ^{SV}	<0.1 <0.1	mg/kg mg/kg	TM36/PM12 TM36/PM12
>C10-C12 (EH_CU_1D_AL) *	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	mg/kg	TM5/PM8/PM16
>C10-C12 (EH_CU_1D_AL) >C12-C16 (EH_CU_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-C10 (EH_CU_1D_AL) *	<7	<7	<7	<7	<7	<7	<7	<7	<7	<7	mg/kg	TM5/PM8/PM16
>C21-C35 (EH_CU_1D_AL)#	<7	26	<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	TMS/TM36/PMM/PM12/PM16
>C6-C10 (HS_1D_AL)	<0.1	<0.1	<0.1	<0.1	0.1	<0.1	<0.1	<0.1	<0.1 ^{SV}	<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	25	<10	<10	<10	<10	<10	<10	<10	<10	mg/kg	TM5/PM8/PM16
Aromatics												
>C5-EC7 (HS_1D_AR)#	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<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	<0.1	<0.1	<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	<0.1	<0.1	<0.1	<0.1 ^{SV}	<0.1	mg/kg	TM36/PM12
>EC10-EC12 (EH_CU_1D_AR)*	<0.2 <4	<0.2 <4	<0.2 <4	<0.2 <4	<0.2 <4	<0.2 <4	<0.2 <4	<0.2 <4	<0.2 <4	<0.2 <4	mg/kg mg/kg	TM5/PM8/PM16 TM5/PM8/PM16
>EC12-EC16 (EH_CU_1D_AR) * >EC16-EC21 (EH_CU_1D_AR) *	<7	27	24	<7	<7	<7	<7	<7	<7	<7	mg/kg	TM5/PM8/PM16
>EC21-EC35 (EH_CU_1D_AR) *	<7	203	101	<7	<7	<7	<7	<7	<7	<7	mg/kg	TM5/PM8/PM16
>EC35-EC40 (EH_1D_AR)	<7	36	17	<7	<7	<7	<7	<7	<7	<7	mg/kg	TM5/PM8/PM16
Total aromatics C5-40 (EH+HS_1D_AR)	<26	266	142	<26	<26	<26	<26	<26	<26	<26	mg/kg	TMS/TM36/PM8/PM12/PM16
Total aliphatics and aromatics(C5-40) (EH+HS_CU_1D_Total)	<52	292	142	<52	<52	<52	<52	<52	<52	<52	mg/kg	TMS/TM36/PMM/PM12/PM16
>EC6-EC10 (HS_1D_AR) [#]	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1 ^{SV}	<0.1	mg/kg	TM36/PM12
>EC10-EC25 (EH_1D_AR)	<10	71	50	<10	<10	<10	<10	<10	<10	<10	mg/kg	TM5/PM8/PM16
>EC25-EC35 (EH_1D_AR)	<10	161	75	<10	<10	<10	<10	<10	<10	<10	mg/kg	TM5/PM8/PM16
									C 1/			
MTBE [#]	<5	<5	<5	<5	<5	<5	<5	<5	<5 ^{SV}	<5	ug/kg	TM36/PM12
Benzene#	<5	<5	<5	<5	<5	<5 9	<5	<5	<5 ^{sv} 9 ^{sv}	<5	ug/kg	TM36/PM12
Toluene [#]	<5 <5	<5 <5	<5 <5	<5 <5	<5 <5	9 <5	<5 <5	<5 <5	9 ⁵ <5 ^{SV}	<5 <5	ug/kg ug/kg	TM36/PM12 TM36/PM12
Ethylbenzene [#] m/p-Xylene [#]	<5	<5	<5	<5	<5	<5	<5	<5	<5 <5 SV	<5	ug/kg	TM36/PM12 TM36/PM12
o-Xylene [#]	<5	<5	<5	<5	<5	<5	<5	<5	<5 <5 SV	<5	ug/kg	TM36/PM12
	-	-	-					-	~5		5.5	
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:
Reference:
Location:
Contact:
EMT Job No:

Ground Investigations Ireland 9754-07-20 Bus Connects Route 15 John Duggan 20/15509

Report : Solid

EMT Job No:	20/15509												
EMT Sample No.	1-3	4-6	7-9	10-12	13-15	16-18	19-21	22-24	25-27				
Sample ID	R15-CP02	R15-CP03	R15-CP03	R15-CP03	R15-CP03	R15-CP05	R15-CP05	R15-CP05	R15-CP05				
Depth	0.50	0.50	1.50	2.50	3.50	0.50	1.50	2.50	3.50		Please se	e attached n	otes for all
COC No / misc												ations and a	
Containers	VJT		1										
Sample Date	06/11/2020	05/11/2020	05/11/2020	05/11/2020	05/11/2020	04/11/2020	04/11/2020	04/11/2020	04/11/2020				
Sample Type	Soil												
Batch Number	1	1	1	1	1	1	1	1	1				Method
Date of Receipt	09/11/2020	09/11/2020	09/11/2020	09/11/2020	09/11/2020	09/11/2020	09/11/2020	09/11/2020	09/11/2020		LOD/LOR	Units	No.
Natural Moisture Content	13.1	17.5	13.9	11.7	12.9	11.9	16.3	17.7	17.2		<0.1	%	PM4/PM0
Moisture Content (% Wet Weight)	11.6	14.9	12.2	10.5	11.4	10.7	14.0	15.0	14.7		<0.1	%	PM4/PM0
Hexavalent Chromium [#] Chromium III	<0.3 53.4	<0.3 46.7	<0.3 35.5	<0.3 33.1	<0.3 35.2	<0.3 43.5	<0.3 39.8	<0.3 38.5	<0.3 32.8		<0.3 <0.5	mg/kg mg/kg	TM38/PM20 NONE/NONE
	55.4	40.7	55.5	55.1	55.2	40.0	55.0	50.5	32.0		<0.5	iiig/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 #	0.21	0.92	0.41	0.30	0.31	0.68	0.57	0.56	0.54		<0.02	%	TM21/PM24
Loss on Ignition [#]	4.5	2.4	2.3	1.7	1.3	2.8	2.8	2.6	1.2		<1.0	%	TM22/PM0
рН [#]	11.96	11.13	9.16	8.72	8.76	8.40	8.34	7.89	8.21		<0.01	pH units	TM73/PM11
Mass of raw test portion	0.1017	0.1058	0.104	0.1009	0.1018	0.107	0.1057	0.1061	0.1064			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
		1	(1	1	I	1	1		1



Ground Investigations Ireland 9754-07-20 Bus Connects Route 15 John Duggan 20/15509

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	R15-CP02	R15-CP03	R15-CP03	R15-CP03	R15-CP03	R15-CP05	R15-CP05	R15-CP05	R15-CP05			
Depth	0.50	0.50	1.50	2.50	3.50	0.50	1.50	2.50	3.50	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	06/11/2020	05/11/2020	05/11/2020	05/11/2020	05/11/2020	04/11/2020	04/11/2020	04/11/2020	04/11/2020			
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		09/11/2020	09/11/2020	09/11/2020	09/11/2020	09/11/2020	09/11/2020	09/11/2020	09/11/2020			
Dissolved Antimony#	<0.002	<0.002	<0.002	< 0.002	<0.002	<0.002	<0.002	<0.002	0.006	<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	0.06	<0.02	mg/kg	TM30/PM17
Dissolved Arsenic [#]	0.0068	<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)#	0.068	< 0.025	<0.025	< 0.025	< 0.025	< 0.025	< 0.025	< 0.025	< 0.025	< 0.025	mg/kg	TM30/PM17
Dissolved Barium [#]	0.007	0.024	<0.003 <0.03	<0.003	0.005	0.003 <0.03	0.003 <0.03	0.032	0.031	<0.003 <0.03	mg/l	TM30/PM17 TM30/PM17
Dissolved Barium (A10) [#]	<0.007	<0.0005	<0.03	<0.003	<0.005	<0.003	<0.003	<0.0005	<0.0005	<0.003	mg/kg mg/l	TM30/PM17 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/kg	TM30/PM17 TM30/PM17
Dissolved Cadmium (A10) [#]	0.0094	0.0662	<0.005	<0.0015	<0.005	<0.0015	<0.0015	<0.005	<0.003	<0.003	mg/l	TM30/PM17
Dissolved Chromium [#]	0.0094	0.662	<0.015	<0.015	<0.0015	<0.0015	<0.015	<0.015	<0.015	<0.015	mg/kg	TM30/PM17
Dissolved Chromium (A10)* Dissolved Copper*	0.032	< 0.002	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007	mg/l	TM30/PM17
Dissolved Copper (A10) #	0.32	<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	0.002	0.012	0.010	0.018	0.010	0.012	0.011	0.014	<0.002	mg/l	TM30/PM17
Dissolved Molybdenum (A10) #	0.06	<0.02	0.12	0.10	0.18	0.10	0.12	0.11	0.14	<0.02	mg/kg	TM30/PM17
Dissolved Nickel [#]	<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 Nickel (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 Selenium#	<0.003	< 0.003	<0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	0.009	< 0.003	mg/l	TM30/PM17
Dissolved Selenium (A10)#	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	0.09	<0.03	mg/kg	TM30/PM17
Dissolved Zinc#	<0.003	0.003	0.004	0.004	0.004	0.004	0.004	0.003	0.003	<0.003	mg/l	TM30/PM17
Dissolved Zinc (A10)#	<0.03	<0.03	0.04	0.04	0.04	0.04	0.04	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 Phenols 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	0.4	0.4	0.3	<0.3	<0.3	mg/l	TM173/PM0
Fluoride	<3	<3	<3	<3	<3	4	4	3	<3	<3	mg/kg	TM173/PM0
Sulphate as SO4 [#]	7.6	16.3	7.1	0.8	2.2	0.9	1.1	11.3	32.5	<0.5	mg/l	TM38/PM0
Sulphate as SO4 [#]	76	163	71	8	22	9	11	113	325	<5	mg/kg	TM38/PM0
Chloride [#]	2.7	9.7	1.1	1.2	1.3	<0.3	0.3	0.4	0.8	<0.3	mg/l	TM38/PM0
Chloride [#]	27	97	11	12	13	<3	<3	4	8	<3	mg/kg	TM38/PM0
Dissolved Organic Carbon	4	<2	3	3	3	3	2	3	3	<2	mg/l	TM60/PM0
Dissolved Organic Carbon	40	<20	30	30	30	30	<20	30	30	<20	mg/kg	TM60/PM0
Total Dissolved Solids#	179	308	68	<35	43	55	47	77	91	<35	mg/l	TM20/PM0
Total Dissolved Solids [#]	1790	3079	680	<350	430	550	470	770	910	<350	mg/kg	TM20/PM0

Mass of sample taken (kg)	-	Dry Matter Content Ratio (%) =		88.2	
Mass of dry sample (kg) =	0.09	Leachant Volume (I)		-	
Particle Size <4mm =	>95%				
EMT Job No		20/15509	Land	fill Waste Ac	ceptance
Sample No		3		Criteria Lin	nits
Client Sample No		R15-CP02			
Depth/Other		0.50			
Sample Date		06/11/2020	Inert	Stable Non-reactive	Hazardous
Batch No		1			
Solid Waste Analysis					
Total Organic Carbon (%)	0.21		3	5	6
Sum of BTEX (mg/kg)	<0.025		6	-	-
Sum of 7 PCBs (mg/kg)	<0.035		1	-	-
Mineral Oil (mg/kg) (EH_CU_1D_Total)	<30		500	-	-
PAH Sum of 6 (mg/kg)	-		-	-	-
PAH Sum of 17 (mg/kg)	<0.64		100	-	-
Eluate Analysis	10:1 concn leached A10		le	values for co eaching test I 12457-2 at	using
	mg/kg			mg/kg	
Arsenic	0.068		0.5	2	25
Barium	0.07		20	100	300
Cadmium	< 0.005		0.04	1	5
Chromium	0.094		0.5	10	70
Copper	0.32		2	50	100
Mercury	< 0.0001		0.01	0.2	2
Molybdenum	0.06		0.5	10	30
Nickel	<0.02		0.4	10	40
Lead	<0.05		0.5	10	50
Antimony	<0.02		0.06	0.7	5
Selenium	<0.03		0.1	0.5	7
Zinc	<0.03		4	50	200
Chloride	27		800	15000	25000
Fluoride	<3		10	150	500
Sulphate as SO4	76		1000	20000	50000
Total Dissolved Solids	1790		4000	60000	100000
Phenol	-		1	-	-
Dissolved Organic Carbon	40		500	800	1000

Mass of sample taken (kg)	-	Dry Matter Content Ratio (%) =		85.1	
Mass of dry sample (kg) =	0.09	Leachant Volume (I)		-	
Particle Size <4mm =	>95%				
EMT Job No		20/15509	Land	fill Waste Ac	•
Sample No		6		Criteria Lin	nits
Client Sample No		R15-CP03			
Depth/Other		0.50			
Sample Date		05/11/2020	Inert	Stable Non-reactive	Hazardous
Batch No		1			
Solid Waste Analysis					
Total Organic Carbon (%)	0.92		3	5	6
Sum of BTEX (mg/kg)	<0.025		6	-	-
Sum of 7 PCBs (mg/kg)	<0.035		1	-	-
Mineral Oil (mg/kg) (EH_CU_1D_Total)	<30		500	-	-
PAH Sum of 6 (mg/kg)	-		-	-	-
PAH Sum of 17 (mg/kg)	14.08		100	-	-
Eluate Analysis	10:1 concn leached A10		le	values for co eaching test I 12457-2 at	using
	mg/kg			mg/kg	
Arsenic	<0.025		0.5	2	25
Barium	0.24		20	100	300
Cadmium	< 0.005		0.04	1	5
Chromium	0.662		0.5	10	70
Copper	<0.07		2	50	100
Mercury	< 0.0001		0.01	0.2	2
Molybdenum	<0.02		0.5	10	30
Nickel	<0.02		0.4	10	40
Lead	<0.05		0.5	10	50
Antimony	<0.02		0.06	0.7	5
Selenium	<0.03		0.1	0.5	7
Zinc	<0.03		4	50	200
Chloride	97		800	15000	25000
Fluoride	<3		10	150	500
Sulphate as SO4	163		1000	20000	50000
Total Dissolved Solids	3079		4000	60000	100000
Phenol	-		1	-	-
Dissolved Organic Carbon	<20		500	800	1000

Mass of sample taken (kg)	-	Dry Matter Content Ratio (%) =		86.9	
Mass of dry sample (kg) =	0.09	Leachant Volume (I)		-	
Particle Size <4mm =	>95%				
EMT Job No		20/15509	Land	fill Waste Ac	ceptance
Sample No		9		Criteria Lin	•
Client Sample No		R15-CP03			
Depth/Other		1.50	-		
Sample Date		05/11/2020	Inert	Stable Non-reactive	Hazardous
Batch No		1		Non-reactive	
Solid Waste Analysis					
Total Organic Carbon (%)	0.41		3	5	6
Sum of BTEX (mg/kg)	<0.025		6	-	-
Sum of 7 PCBs (mg/kg)	<0.035		1	-	-
Mineral Oil (mg/kg) (EH_CU_1D_Total)	<30		500	-	-
PAH Sum of 6 (mg/kg)	-		-	-	-
PAH Sum of 17 (mg/kg)	9.02		100	-	-
Eluate Analysis	10:1 concn leached A10		le	values for co eaching test I 12457-2 at I	using
	mg/kg			mg/kg	
Arsenic	<0.025		0.5	2	25
Barium	< 0.03		20	100	300
Cadmium	<0.005		0.04	1	5
Chromium	<0.015		0.5	10	70
Copper	<0.07		2	50	100
Mercury	< 0.0001		0.01	0.2	2
Molybdenum	0.12		0.5	10	30
Nickel	<0.02		0.4	10	40
Lead	<0.05		0.5	10	50
Antimony	<0.02		0.06	0.7	5
Selenium	<0.03		0.1	0.5	7
Zinc	0.04		4	50	200
Chloride	11		800	15000	25000
Fluoride	<3		10	150	500
Sulphate as SO4	71		1000	20000	50000
Total Dissolved Solids	680		4000	60000	100000
Phenol	-		1	-	-
Dissolved Organic Carbon	30		500	800	1000

Mass of sample taken (kg)	-	Dry Matter Content Ratio (%) =	88.9			
Mass of dry sample (kg) =	0.09	Leachant Volume (I)		-		
Particle Size <4mm =	>95%					
EMT Job No		20/15509	20/15509Landfill Waste Acceptance12Criteria Limits			
Sample No		12				
Client Sample No		R15-CP03				
Depth/Other	2.50 05/11/2020 1		Inert	Stable Non-reactive	Hazardous	
Sample Date						
Batch No						
Solid Waste Analysis						
Total Organic Carbon (%)	0.30		3	5	6	
Sum of BTEX (mg/kg)	<0.025		6	-	-	
Sum of 7 PCBs (mg/kg)	<0.035		1	-	-	
Mineral Oil (mg/kg) (EH_CU_1D_Total)	<30		500	-	-	
PAH Sum of 6 (mg/kg)	-		-	-	-	
PAH Sum of 17 (mg/kg)	<0.64		100	-	-	
Eluate Analysis	10:1 concn leached A10		Limit values for compliance leaching test using BS EN 12457-2 at L/S 10 l/kg			
	mg/kg			mg/kg		
Arsenic	<0.025		0.5	2	25	
Barium	< 0.03		20	100	300	
Cadmium	< 0.005		0.04	1	5	
Chromium	<0.015		0.5	10	70	
Copper	<0.07		2	50	100	
Mercury	< 0.0001		0.01	0.2	2	
Molybdenum	0.10		0.5	10	30	
Nickel	<0.02		0.4	10	40	
Lead	<0.05		0.5	10	50	
Antimony	<0.02		0.06	0.7	5	
Selenium	<0.03		0.1	0.5	7	
Zinc	0.04		4	50	200	
Chloride	12		800	15000	25000	
Fluoride	<3		10	150	500	
Sulphate as SO4	8		1000	20000	50000	
Total Dissolved Solids	<350		4000	60000	100000	
Phenol	-		1	-	-	
Dissolved Organic Carbon	30		500	800	1000	

Mass of sample taken (kg)	-	Dry Matter Content Ratio (%) =	88.6			
Mass of dry sample (kg) =	0.09	Leachant Volume (I)		-		
Particle Size <4mm =	>95%					
EMT Job No		20/15509	Landfill Waste Acceptance			
Sample No		15	Criteria Limits			
Client Sample No		R15-CP03		1		
Depth/Other		3.50	-			
Sample Date	05/11/2020 1		Inert	Stable Non-reactive	Hazardous	
Batch No						
Solid Waste Analysis						
Total Organic Carbon (%)	0.31		3	5	6	
Sum of BTEX (mg/kg)	<0.025		6	-	-	
Sum of 7 PCBs (mg/kg)	< 0.035		1	-	-	
Mineral Oil (mg/kg) (EH_CU_1D_Total)	<30		500	-	-	
PAH Sum of 6 (mg/kg)	-		-	-	-	
PAH Sum of 17 (mg/kg)	<0.64		100	-	-	
Eluate Analysis	10:1 concn leached A10		Limit values for compliance leaching test using BS EN 12457-2 at L/S 10 l/kg			
	mg/kg			mg/kg		
Arsenic	<0.025		0.5	2	25	
Barium	0.05		20	100	300	
Cadmium	< 0.005		0.04	1	5	
Chromium	<0.015		0.5	10	70	
Copper	<0.07		2	50	100	
Mercury	<0.0001		0.01	0.2	2	
Molybdenum	0.18		0.5	10	30	
Nickel	<0.02		0.4	10	40	
Lead	<0.05		0.5	10	50	
Antimony	<0.02		0.06	0.7	5	
Selenium	<0.03		0.1	0.5	7	
Zinc	0.04		4	50	200	
Chloride	13		800	15000	25000	
Fluoride	<3		10	150	500	
Sulphate as SO4	22		1000	20000	50000	
Total Dissolved Solids	430		4000	60000	100000	
Phenol	-		1	-	-	
Dissolved Organic Carbon	30		500	800	1000	

Mass of sample taken (kg)	-	Dry Matter Content Ratio (%) =		84.2					
Mass of dry sample (kg) =	0.09	Leachant Volume (I)		-					
Particle Size <4mm =	>95%								
EMT Job No		20/15509	Landfill Waste Acceptance						
Sample No		18		Criteria Lin	nits				
Client Sample No		R15-CP05							
Depth/Other		0.50							
Sample Date		04/11/2020	Inert	Stable Non-reactive	Hazardous				
Batch No		1							
Solid Waste Analysis		_							
Total Organic Carbon (%)	0.68		3	5	6				
Sum of BTEX (mg/kg)	<0.025		6	-	-				
Sum of 7 PCBs (mg/kg)	<0.035		1	-	-				
Mineral Oil (mg/kg) (EH_CU_1D_Total)	<30		500	-	-				
PAH Sum of 6 (mg/kg)	-		-	-	-				
PAH Sum of 17 (mg/kg)	1.84		100	-	-				
Eluate Analysis	10:1 concn leached A10		Limit values for compliance leaching test using BS EN 12457-2 at L/S 10 l/kg						
	mg/kg			mg/kg					
Arsenic	< 0.025		0.5	2	25				
Barium	< 0.03		20	100	300				
Cadmium	< 0.005		0.04	1	5				
Chromium	<0.015		0.5	10	70				
Copper	<0.07		2	50	100				
Mercury	<0.0001		0.01	0.2	2				
Molybdenum	0.10		0.5	10	30				
Nickel	<0.02		0.4	10	40				
Lead	<0.05		0.5	10	50				
Antimony	<0.02		0.06	0.7	5				
Selenium	<0.03		0.1	0.5	7				
Zinc	0.04		4	50	200				
Chloride	<3		800	15000	25000				
Fluoride	4		10	150	500				
Sulphate as SO4	9		1000	20000	50000				
Total Dissolved Solids	550		4000	60000	100000				
Phenol	-		1	-	-				
Dissolved Organic Carbon	30		500	800	1000				

Mass of sample taken (kg)	-	Dry Matter Content Ratio (%) =		85.0				
Mass of dry sample (kg) =	0.09	Leachant Volume (I)		-				
Particle Size <4mm =	>95%							
EMT Job No		20/15509	Landfill Waste Acceptance					
Sample No		21	Criteria Limits					
Client Sample No		R15-CP05	_					
Depth/Other		1.50	_	Stable				
Sample Date		04/11/2020	Inert	Non-reactive	Hazardous			
Batch No		1						
Solid Waste Analysis								
Total Organic Carbon (%)	0.57		3	5	6			
Sum of BTEX (mg/kg)	<0.025		6	-	-			
Sum of 7 PCBs (mg/kg)	<0.035		1	-	-			
Mineral Oil (mg/kg) (EH_CU_1D_Total)	<30		500	-	-			
PAH Sum of 6 (mg/kg)	-		-	-	-			
PAH Sum of 17 (mg/kg)	<0.64		100	-	-			
Eluate Analysis	10:1 concn leached A10		Limit values for compliance leaching test using BS EN 12457-2 at L/S 10 l/kg					
	mg/kg		-	mg/kg				
Arsenic	< 0.025		0.5	2	25			
Barium	< 0.03		20	100	300			
Cadmium	< 0.005		0.04	1	5			
Chromium	<0.015		0.5	10	70			
Copper	<0.07		2	50	100			
Mercury	<0.0001		0.01	0.2	2			
Molybdenum	0.12		0.5	10	30			
Nickel	<0.02		0.4	10	40			
Lead	<0.05		0.5	10	50			
Antimony	<0.02		0.06	0.7	5			
Selenium	<0.03		0.1	0.5	7			
Zinc	0.04		4	50	200			
Chloride	<3		800	15000	25000			
Fluoride	4		10	150	500			
Sulphate as SO4	11		1000	20000	50000			
Total Dissolved Solids	470		4000	60000	100000			
Phenol	-		1	-	-			
Dissolved Organic Carbon	<20		500	800	1000			

Mass of sample taken (kg)	-	Dry Matter Content Ratio (%) =		84.5				
Mass of dry sample (kg) =	0.09	Leachant Volume (I)		-				
Particle Size <4mm =	>95%							
EMT Job No		20/15509	Landfill Waste Acceptance					
Sample No		24		Criteria Lin	nits			
Client Sample No		R15-CP05	-					
Depth/Other		2.50	-	Stable				
Sample Date		04/11/2020	Inert	Non-reactive	Hazardous			
Batch No		1						
Solid Waste Analysis								
Total Organic Carbon (%)	0.56		3	5	6			
Sum of BTEX (mg/kg)	<0.025		6	-	-			
Sum of 7 PCBs (mg/kg)	<0.035		1	-	-			
Mineral Oil (mg/kg) (EH_CU_1D_Total)	<30		500	-	-			
PAH Sum of 6 (mg/kg)	-		-	-	-			
PAH Sum of 17 (mg/kg)	<0.64		100	-	-			
Eluate Analysis	10:1 concn leached A10		Limit values for compliance leaching test using BS EN 12457-2 at L/S 10 l/kg					
	mg/kg			mg/kg				
Arsenic	< 0.025		0.5	2	25			
Barium	0.32		20	100	300			
Cadmium	< 0.005		0.04	1	5			
Chromium	<0.015		0.5	10	70			
Copper	<0.07		2	50	100			
Mercury	< 0.0001		0.01	0.2	2			
Molybdenum	0.11		0.5	10	30			
Nickel	<0.02		0.4	10	40			
Lead	<0.05		0.5	10	50			
Antimony	<0.02		0.06	0.7	5			
Selenium	<0.03		0.1	0.5	7			
Zinc	0.03		4	50	200			
Chloride	4		800	15000	25000			
Fluoride	3		10	150	500			
Sulphate as SO4	113		1000	20000	50000			
Total Dissolved Solids	770		4000	60000	100000			
Phenol	-		1	-	-			
Dissolved Organic Carbon	30		500	800	1000			

Mass of sample taken (kg)	-	Dry Matter Content Ratio (%) =		84.2					
Mass of dry sample (kg) =	0.09	Leachant Volume (I)		-					
Particle Size <4mm =	>95%								
EMT Job No		20/15509	Landfill Waste Acceptance						
Sample No		27		Criteria Lin	nits				
Client Sample No		R15-CP05							
Depth/Other		3.50		Stable					
Sample Date		04/11/2020	Inert	Non-reactive	Hazardous				
Batch No		1							
Solid Waste Analysis									
Total Organic Carbon (%)	0.54		3	5	6				
Sum of BTEX (mg/kg)	<0.025		6	-	-				
Sum of 7 PCBs (mg/kg)	<0.035		1	-	-				
Mineral Oil (mg/kg) (EH_CU_1D_Total)	<30		500	-	-				
PAH Sum of 6 (mg/kg)	-		-	-	-				
PAH Sum of 17 (mg/kg)	<0.64		100	-	-				
Eluate Analysis	10:1 concn leached A10		Limit values for compliance leaching test using BS EN 12457-2 at L/S 10 l/kg						
	mg/kg			mg/kg					
Arsenic	<0.025		0.5	2	25				
Barium	0.31		20	100	300				
Cadmium	< 0.005		0.04	1	5				
Chromium	<0.015		0.5	10	70				
Copper	<0.07		2	50	100				
Mercury	< 0.0001		0.01	0.2	2				
Molybdenum	0.14		0.5	10	30				
Nickel	<0.02		0.4	10	40				
Lead	<0.05		0.5	10	50				
Antimony	0.06		0.06	0.7	5				
Selenium	0.09		0.1	0.5	7				
Zinc	<0.03		4	50	200				
Chloride	8		800	15000	25000				
Fluoride	<3		10	150	500				
Sulphate as SO4	325		1000	20000	50000				
Total Dissolved Solids	910		4000	60000	100000				
Phenol	-		1	-	-				
Dissolved Organic Carbon	30		500	800	1000				

Client Name:	Ground Investigations Ireland
Reference:	20/07/9754
Location:	Bus Connects Route 15
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	Result
No.				No.	Analysis		
20/15509	1	R15-CP02	0.50	2	11/12/2020	General Description (Bulk Analysis)	soil/stones
					11/12/2020	Asbestos Fibres	NAD
					11/12/2020	Asbestos ACM	NAD
					11/12/2020	Asbestos Type	NAD
					11/12/2020	Asbestos Level Screen	NAD
20/15509	1	R15-CP03	0.50	5	11/12/2020	General Description (Bulk Analysis)	soil/stones
					11/12/2020	Asbestos Fibres	NAD
					11/12/2020	Asbestos ACM	NAD
					11/12/2020	Asbestos Type	NAD
					11/12/2020	Asbestos Level Screen	NAD
20/15509	1	R15-CP03	1.50	8	11/12/2020	General Description (Bulk Analysis)	Soil/Stones
					11/12/2020	Asbestos Fibres	NAD
					11/12/2020	Asbestos ACM	NAD
					11/12/2020	Asbestos Type	NAD
					11/12/2020	Asbestos Level Screen	NAD
20/15509	1	R15-CP03	2.50	11	11/12/2020	General Description (Bulk Analysis)	Soil/Stones
					11/12/2020	Asbestos Fibres	NAD
					11/12/2020	Asbestos ACM	NAD
					11/12/2020	Asbestos Type	NAD
					11/12/2020	Asbestos Level Screen	NAD
20/15509	1	R15-CP03	3.50	14	11/12/2020	General Description (Bulk Analysis)	Soil/Stones
					11/12/2020	Asbestos Fibres	NAD
					11/12/2020	Asbestos ACM	NAD
					11/12/2020	Asbestos Type	NAD
					11/12/2020	Asbestos Level Screen	NAD
20/15509	1	R15-CP05	0.50	17	11/12/2020	General Description (Bulk Analysis)	Soil/Stones
					11/12/2020	Asbestos Fibres	NAD
					11/12/2020	Asbestos ACM	NAD
					11/12/2020	Asbestos Type	NAD
					11/12/2020	Asbestos Level Screen	NAD
20/15509	1	R15-CP05	1.50	20	11/12/2020	General Description (Bulk Analysis)	Soil/Stone
					11/12/2020	Asbestos Fibres	NAD
					11/12/2020	Asbestos ACM	NAD

Client N Referen Locatio Contact	nce: on:		Ground I 20/07/97 Bus Con John Dug	54 nects Ro	ions Ireland ute 15		
EMT Job No.	Batch	Sample ID	Depth	EMT Sample No.	Date Of Analysis	Analysis	Resul
20/15509	1	R15-CP05	1.50	20	11/12/2020	Asbestos Type	NAD
					11/12/2020	Asbestos Level Screen	NAD
20/15509	1	R15-CP05	2.50	23	11/12/2020	General Description (Bulk Analysis)	Soil/Stone
					11/12/2020	Asbestos Fibres	NAD
					11/12/2020	Asbestos Fibres (2)	NAD
					11/12/2020	Asbestos ACM	NAD
					11/12/2020	Asbestos ACM (2)	NAD
						Asbestos Type	NAD
					11/12/2020	Asbestos Type (2)	NAD
					11/12/2020	Asbestos Level Screen	NAD
20/15509	1	R15-CP05	3.50	26	11/12/2020	General Description (Bulk Analysis)	Soil/Stones
					11/12/2020	Asbestos Fibres	NAD
					11/12/2020	Asbestos ACM	NAD
					11/12/2020	Asbestos Type	NAD
					11/12/2020	Asbestos Level Screen	NAD
					11/12/2020		

Client Name:Ground Investigations IrelandReference:9754-07-20Location:Bus Connects Route 15Contact:John Duggan

EMT Job No.	Batch	Sample ID	Depth	EMT Sample No.	Analysis	Reason
20/15509	1	R15-CP02	0.50	1-3	Cyanide, EPH, GRO, LOI, PAH, PCB, pH, TOC	Sample holding time exceeded
20/15509	1	R15-CP03	0.50	4-6	Cyanide, EPH, GRO, LOI, PAH, PCB, pH, TOC	Sample holding time exceeded
20/15509	1	R15-CP03	1.50	7-9	Cyanide, EPH, GRO, LOI, PAH, PCB, pH, TOC	Sample holding time exceeded
20/15509	1	R15-CP03	2.50	10-12	Cyanide, EPH, GRO, LOI, PAH, PCB, pH, TOC	Sample holding time exceeded
20/15509	1	R15-CP03	3.50	13-15	Cyanide, EPH, GRO, LOI, PAH, PCB, pH, TOC	Sample holding time exceeded
20/15509	1	R15-CP05	0.50	16-18	Cyanide, EPH, GRO, LOI, PAH, PCB, pH, TOC	Sample holding time exceeded
20/15509	1	R15-CP05	1.50	19-21	Cyanide, EPH, GRO, LOI, PAH, PCB, pH, TOC	Sample holding time exceeded
20/15509	1	R15-CP05	2.50	22-24	Cyanide, EPH, GRO, LOI, PAH, PCB, pH, TOC	Sample holding time exceeded
20/15509	1	R15-CP05	3.50	25-27	Cyanide, EPH, GRO, LOI, PAH, PCB, pH, TOC	Sample holding time exceeded

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.

Notification of Deviating Samples

Matrix : Solid

NOTES TO ACCOMPANY ALL SCHEDULES AND REPORTS

EMT Job No.: 20/15509

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 $35^{\circ}C \pm 5^{\circ}C$ unless otherwise stated. Moisture content for CEN Leachate tests are dried at $105^{\circ}C \pm 5^{\circ}C$.

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.

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.
ISO17025 (SANAS Ref No.T0729) accredited - South Africa
Indicates analyte found in associated method blank.
Dilution required.
MCERTS accredited.
Not applicable
No Asbestos Detected.
None Detected (usually refers to VOC and/SVOC TICs).
No Determination Possible
Calibrated against a single substance
Surrogate recovery outside performance criteria. This may be due to a matrix effect.
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.
Samples are dried at 35°C ±5°C
Suspected carry over
Limit of Detection (Limit of Reporting) in line with ISO 17025 and MCERTS
Matrix Effect
No Fibres Detected
AQC Sample
Blank Sample
Client Sample
Trip Blank Sample
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
ТМЗО	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
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	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 co-elutes 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 co-elutes 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	
ТМ73	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	



Issue :

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 ac-MR Attention : John Duggan Date : 3rd December, 2020 Your reference : 9754-07-20 Our reference : Test Report 20/16406 Batch 1 **BusConnects Route 15** Location : Date samples received : 23rd November, 2020 Status : Final report

Six samples were received for analysis on 23rd November, 2020 of which six 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.

1

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:

b. June

Bruce Leslie Project Manager

Please include all sections of this report if it is reproduced



Ground Investigations Ireland 9754-07-20 BusConnects Route 15 John Duggan 20/16406

Report : Solid

EMT Job No:	20/16406								_		
EMT Sample No.	1-3	4-6	7-9	10-12	13-15	16-18					
Sample ID	R15 TP01	R15 TP01	R15 TP01	R15 TP02	R15 TP02	R15 TP02					
Depth	0.50	1.50	2.30	0.50	1.50	2.40			Please se	e attached n	otes for all
COC No / misc										ations and a	
Containers	VJT	VJT	VJT	VJT	VJT	VJT					
Sample Date	19/11/2020	19/11/2020	19/11/2020	19/11/2020	19/11/2020	19/11/2020					
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil					
Batch Number	1	1	1	1	1	1					
Date of Receipt					23/11/2020				LOD/LOR	Units	Method No.
Antimony	2	9	4	3	6	8			<1	mg/kg	TM30/PM15
Arsenic [#]	- 11.1	11.4	16.3	19.0	21.5	29.6			<0.5	mg/kg	TM30/PM15
Barium [#]	89	81	283	240	358	445			<1	mg/kg	TM30/PM15
Cadmium [#]	2.0	1.8	1.4	1.2	1.2	2.0			<0.1	mg/kg	TM30/PM15
Chromium #	23.8	21.0	32.8	40.2	40.1	39.7			<0.5	mg/kg	TM30/PM15
Copper [#]	24	26	40	97	114	129			<1	mg/kg	TM30/PM15
Lead [#]	30	55	381	268	364	508			<5	mg/kg	TM30/PM15
Mercury [#]	<0.1	<0.1	0.2	0.2	0.4	0.3			<0.1	mg/kg	TM30/PM15
Molybdenum [#]	2.7 33.3	2.4 29.9	1.9 27.3	2.7 35.3	2.4 32.8	4.4 43.8			<0.1 <0.7	mg/kg mg/kg	TM30/PM15 TM30/PM15
Selenium [#]	2	<1	<1	1	1	43.0			<1	mg/kg	TM30/PM15
Zinc [#]	104	83	637	230	355	886			<5	mg/kg	TM30/PM15
PAH MS											
Naphthalene #	<0.04	<0.04	0.07	0.30	<0.20 _{AA}	0.11			<0.04	mg/kg	TM4/PM8
Acenaphthylene	0.04	<0.03	0.12	0.45	1.17 _{AA}	0.58			<0.03	mg/kg	TM4/PM8
Acenaphthene #	<0.05	<0.05	0.14	0.52	<0.25 _{AA}	0.14			<0.05	mg/kg	TM4/PM8
Fluorene [#]	<0.04 0.20	<0.04	0.12	0.40 5.67	<0.20 _{AA}	0.15 1.71			<0.04 <0.03	mg/kg	TM4/PM8 TM4/PM8
Phenanthrene [#] Anthracene [#]	0.20	0.23	0.34	1.32	0.74 _{AA} 1.30 _{AA}	1.71			<0.03	mg/kg mg/kg	TM4/PM8
Fluoranthene [#]	0.42	0.38	3.30	10.95	13.84 _{AA}	8.21			<0.03	mg/kg	TM4/PM8
Pyrene [#]	0.39	0.33	3.06	9.16	17.53 _{AA}	8.61			<0.03	mg/kg	TM4/PM8
Benzo(a)anthracene#	0.25	0.19	1.46	5.03	17.59 _{AA}	8.48			<0.06	mg/kg	TM4/PM8
Chrysene [#]	0.28	0.19	1.95	5.63	15.14 _{AA}	7.87			<0.02	mg/kg	TM4/PM8
Benzo(bk)fluoranthene #	0.52	0.34	3.06	9.49	29.71 _{AA}	14.14			<0.07	mg/kg	TM4/PM8
Benzo(a)pyrene [#]	0.27	0.18	1.58	4.97	13.92 _{AA}	7.10			<0.04	mg/kg	TM4/PM8
Indeno(123cd)pyrene Dibenzo(ah)anthracene [#]	0.22	0.14 <0.04	1.06 0.29	3.38 0.81	11.03 _{AA} 2.90 _{AA}	4.99 1.46			<0.04 <0.04	mg/kg mg/kg	TM4/PM8 TM4/PM8
Benzo(ghi)perylene [#]	0.05	0.15	1.23	3.80	11.46 _{AA}	5.16			<0.04	mg/kg	TM4/PM8
Coronene	0.04	<0.04	0.19	0.64	2.35 _{AA}	0.75			<0.04	mg/kg	TM4/PM8
PAH 17 Total	3.02	2.21	19.18	62.52	138.68 _{AA}	70.64			<0.64	mg/kg	TM4/PM8
Benzo(b)fluoranthene	0.37	0.24	2.20	6.83	21.39 _{AA}	10.18			<0.05	mg/kg	TM4/PM8
Benzo(k)fluoranthene	0.15	0.10	0.86	2.66	8.32 _{AA}	3.96			<0.02	mg/kg	TM4/PM8
PAH Surrogate % Recovery	88	74	84	88	87 AA	86			<0	%	TM4/PM8
Mineral Oil (C10-C40) (EH_CU_1D_Total)	41	70	71	72	184	69			<30	mg/kg	TM5/PM8/PM16



Ground Investigations Ireland 9754-07-20 BusConnects Route 15 John Duggan 20/16406

Report : Solid

EMT Job No:	20/16406								_		
EMT Sample No.	1-3	4-6	7-9	10-12	13-15	16-18]		
Sample ID	R15 TP01	R15 TP01	R15 TP01	R15 TP02	R15 TP02	R15 TP02					
Depth	0.50	1.50	2.30	0.50	1.50	2.40					
COC No / misc	0.50	1.50	2.50	0.50	1.50	2.40				e attached r ations and a	
Containers	VJT	VJT	VJT	VJT	VJT	VJT					
Sample Date	19/11/2020	19/11/2020	19/11/2020	19/11/2020	19/11/2020	19/11/2020					
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil					
Batch Number	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			LOD/LOIX	Onits	No.
TPH CWG											
Aliphatics											
>C5-C6 (HS_1D_AL) [#]	<0.1	<0.1	<0.1	<0.1	<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	<0.1 ^{SV}			<0.1	mg/kg	TM36/PM12
>C8-C10 (HS_1D_AL)	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1 ^{sv}			<0.1	mg/kg	TM36/PM12 TM5/PM8/PM16
>C10-C12 (EH_1D_AL) [#] >C12-C16 (EH_1D_AL) [#]	<0.2 <4	<0.2 <4	<0.2 <4	<0.2 <4	<0.2 <4	<0.2 <4			<0.2 <4	mg/kg mg/kg	TM5/PM8/PM16 TM5/PM8/PM16
>C12-C16 (EH_1D_AL) >C16-C21 (EH_1D_AL) [#]	<7	<4 9	<7	<7	23	10			<7	mg/kg	TM5/PM8/PM16
>C21-C35 (EH_1D_AL)*	41	51	62	61	143	59			<7	mg/kg	TM5/PM8/PM16
>C35-C40 (EH_1D_AL)	<7	10	9	11	18	<7			<7	mg/kg	TM5/PM8/PM16
Total aliphatics C5-40 (EH+HS_1D_AL)	41	70	71	72	184	69			<26	mg/kg	TM5/TM36/PM8/PM12/PM18
>C6-C10 (HS_1D_AL)	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1 ^{SV}			<0.1	mg/kg	TM36/PM12
>C10-C25 (EH_1D_AL)	18	23	25	21	63	26			<10	mg/kg	TM5/PM8/PM16
>C25-C35 (EH_1D_AL)	30	41	46	48	107	43			<10	mg/kg	TM5/PM8/PM16
Aromatics						6 1/					
>C5-EC7 (HS_1D_AR)*	<0.1	<0.1	<0.1	<0.1	<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 <0.1	<0.1	<0.1	<0.1 ^{sv} <0.1 ^{sv}			<0.1 <0.1	mg/kg	TM36/PM12 TM36/PM12
>EC8-EC10 (HS_1D_AR)	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1			<0.1	mg/kg mg/kg	TM5/PM8/PM16
>EC12-EC16 (EH_1D_AR) #	<4	<4	<4	21	19	<4			<4	mg/kg	TM5/PM8/PM16
>EC16-EC21 (EH_1D_AR) #	9	9	17	125	251	46			<7	mg/kg	TM5/PM8/PM16
>EC21-EC35 (EH_1D_AR) *	41	66	119	421	1285	364			<7	mg/kg	TM5/PM8/PM16
>EC35-EC40 (EH_1D_AR)	12	22	25	67	151	49			<7	mg/kg	TM5/PM8/PM16
Total aromatics C5-40 (EH+HS_1D_AR)	62	97	161	634	1706	459			<26	mg/kg	TM5/TM36/PM8/PM12/PM16
Total aliphatics and aromatics(C5-40) (EH+HS_CU_1D_Total)	103	167	232	706	1890	528			<52	mg/kg	TM5/TM36/PM8/PM12/PM18
>EC6-EC10 (HS_1D_AR)*	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1 ^{SV}			<0.1	mg/kg	TM36/PM12
>EC10-EC25 (EH_1D_AR)	16	19	45	265	652	146			<10	mg/kg	TM5/PM8/PM16
>EC25-EC35 (EH_1D_AR)	34	57	93	302	902	265			<10	mg/kg	TM5/PM8/PM16
MTBE [#]	<5	<5	<5	<5	<5	<5 ^{\$V}			<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	<5 ^{sv}			<5	ug/kg	TM36/PM12
Ethylbenzene [#]	<5	<5	<5	<5	<5	<5 ^{\$V}			<5	ug/kg	TM36/PM12
m/p-Xylene [#]	<5	<5	<5	<5	<5	<5 ^{\$V}			<5	ug/kg	TM36/PM12
o-Xylene [#]	<5	<5	<5	<5	<5	<5 ^{sv}			<5	ug/kg	TM36/PM12
	_	_	_	_		_			_		-
PCB 28 [#]	<5	<5	<5	<5	<5	<5			<5	ug/kg	TM17/PM8
PCB 52 [#] PCB 101 [#]	<5 <5	<5 <5	<5 <5	<5 <5	<5	<5 <5			<5 <5	ug/kg	TM17/PM8 TM17/PM8
PCB 101 PCB 118 [#]	<5 <5	<5 <5	<5 <5	<5	<5 <5	<5			<5 <5	ug/kg ug/kg	TM17/PM8 TM17/PM8
PCB 138 [#]	<5	<5	<5	<5	<5	<5			<5	ug/kg	TM17/PM8
PCB 153 [#]	<5	<5	<5	<5	<5	<5			<5	ug/kg	TM17/PM8
PCB 180 [#]	<5	<5	<5	<5	<5	<5			<5	ug/kg	TM17/PM8
Total 7 PCBs [#]	<35	<35	<35	<35	<35	<35			<35	ug/kg	TM17/PM8

Client Name:
Reference:
Location:
Contact:
EMT Job No:

Ground Investigations Ireland 9754-07-20 BusConnects Route 15 John Duggan 20/16406

Report : Solid

EMT Job No:	20/16406										
EMT Sample No.	1-3	4-6	7-9	10-12	13-15	16-18					
Sample ID	R15 TP01	R15 TP01	R15 TP01	R15 TP02	R15 TP02	R15 TP02					
Depth	0.50	1.50	2.30	0.50	1.50	2.40			Please se	e attached n	otes for all
COC No / misc										ations and a	
Containers	VJT	VJT	VJT	VJT	VJT	VJT					
Sample Date	19/11/2020	19/11/2020	19/11/2020	19/11/2020	19/11/2020	19/11/2020					
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil					
Batch Number	1	1	1	1	1	1					Method
Date of Receipt	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	8.4	14.4	24.4	21.1	26.2	25.5			<0.1	%	PM4/PM0
Moisture Content (% Wet Weight)	7.8	12.6	19.6	17.4	20.8	20.3			<0.1	%	PM4/PM0
				0.0							TH 400 /DI 400
Hexavalent Chromium * Chromium III	<0.3 23.8	<0.3 21.0	<0.3 32.8	<0.3 40.2	<0.3 40.1	<0.3 39.7			<0.3 <0.5	mg/kg mg/kg	TM38/PM20 NONE/NONE
	20.0	21.0	02.0	70.2		00.1			-0.0	y/ny	- ISHENONE
Total Cyanide [#]	<0.5	<0.5	<0.5	<0.5	1.0	2.1			<0.5	mg/kg	TM89/PM45
	0				a						
Total Organic Carbon [#]	0.68	0.91	1.88	5.58	3.57	5.71			<0.02	%	TM21/PM24
Loss on Ignition [#]	2.3	2.4	4.7	8.4	6.3	7.4			<1.0	%	TM22/PM0
рН [#]	8.53	8.01	7.88	8.40	8.26	8.38			<0.01	pH units	TM73/PM11
Mass of raw test portion	0.0989	0.1024	0.129	0.1045	0.12	0.1185				kg	NONE/PM17
Mass of dried test portion	0.09	0.09	0.09	0.09	0.09	0.09				kg	NONE/PM17



Ground Investigations Ireland 9754-07-20 BusConnects Route 15 John Duggan 20/16406

Report : CEN 10:1 1 Batch

EMT Job No:	20/16406						 	 			
EMT Sample No.	1-3	4-6	7-9	10-12	13-15	16-18					
Sample ID	R15 TP01	R15 TP01	R15 TP01	R15 TP02	R15 TP02	R15 TP02					
Depth	0.50	1.50	2.30	0.50	1.50	2.40			Plaasa sa	e attached n	otes for all
COC No / misc										ations and a	
Containers	VJT	VJT	VJT	VJT	VJT	VJT					
Sample Date	19/11/2020	19/11/2020	19/11/2020	19/11/2020	19/11/2020	19/11/2020					
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil					
Batch Number	1	1	1	1	1	1			LOD/LOR	Units	Method No.
Date of Receipt			23/11/2020								
Dissolved Antimony#	<0.002	0.005	0.014	0.014	0.006	0.012			<0.002	mg/l	TM30/PM17
Dissolved Antimony (A10) #	<0.02	0.05	0.14	0.14	0.06	0.12			<0.02	mg/kg	TM30/PM17
Dissolved Arsenic [#]	<0.0025	0.0042	0.0059	0.0072	0.0072	0.0054			<0.0025	mg/l	TM30/PM17 TM30/PM17
Dissolved Arsenic (A10) # Dissolved Barium #	<0.025 0.008	0.042	0.059	0.072	0.072	0.054			<0.025 <0.003	mg/kg	TM30/PM17 TM30/PM17
Dissolved Barium (A10) #	0.008	0.051	0.63	0.013	0.027	0.014			<0.003	mg/l mg/kg	TM30/PM17 TM30/PM17
Dissolved Cadmium [#]	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005			<0.0005	mg/l	TM30/PM17
Dissolved Cadmium (A10) #	<0.0005	<0.005	<0.0005	<0.0005	<0.0005	<0.005			<0.005	mg/kg	TM30/PM17
Dissolved Chromium [#]	<0.0015	<0.0015	<0.0015	0.0027	0.0107	0.0104			<0.0015	mg/l	TM30/PM17
Dissolved Chromium (A10) #	<0.015	<0.015	<0.015	0.027	0.107	0.104			<0.015	mg/kg	TM30/PM17
Dissolved Copper [#]	<0.007	<0.007	<0.007	0.008	0.011	<0.007			<0.007	mg/l	TM30/PM17
Dissolved Copper (A10) [#]	<0.07	<0.07	<0.07	0.08	0.11	<0.07			<0.07	mg/kg	TM30/PM17
Dissolved Lead [#]	<0.005	<0.005	<0.005	<0.005	0.010	<0.005			<0.005	mg/l	TM30/PM17
Dissolved Lead (A10) #	<0.05	<0.05	<0.05	<0.05	0.10	<0.05			<0.05	mg/kg	TM30/PM17
Dissolved Molybdenum #	0.012	0.031	0.056	0.004	0.004	0.009			<0.002	mg/l	TM30/PM17
Dissolved Molybdenum (A10) #	0.12	0.31	0.56	0.04	0.04	0.09			<0.02	mg/kg	TM30/PM17
Dissolved Nickel [#]	<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	<0.02	<0.02			<0.02	mg/kg	TM30/PM17
Dissolved Selenium [#]	<0.003	<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			<0.03	mg/kg	TM30/PM17
Dissolved Zinc [#]	<0.003	0.003	0.008	0.008	0.011	0.007			<0.003	mg/l	TM30/PM17
Dissolved Zinc (A10) [#] Mercury Dissolved by CVAF [#]	<0.03 <0.00001	<0.03 <0.00001	0.08	0.08	0.11	<0.00001			<0.03 <0.00001	mg/kg	TM30/PM17 TM61/PM0
Mercury Dissolved by CVAF	<0.0001	<0.0001	<0.0001	0.0001	0.0004	<0.0001			<0.0001	mg/l mg/kg	TM61/PM0
Total Phenols HPLC	<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	mg/kg	TM26/PM0
										0.0	
Fluoride	<0.3	<0.3	0.3	0.4	<0.3	<0.3			<0.3	mg/l	TM173/PM0
Fluoride	<3	<3	3	4	<3	<3			<3	mg/kg	TM173/PM0
Sulphate as SO4 #	17.4	10.7	8.0	1.3	8.3	13.6			<0.5	mg/l	TM38/PM0
Sulphate as SO4 [#]	174	107	80	13	83	136			<5	mg/kg	TM38/PM0
Chloride [#]	0.8	2.6	2.3	<0.3	0.5	0.6			<0.3	mg/l	TM38/PM0
Chloride [#]	8	26	23	<3	5	6			<3	mg/kg	TM38/PM0
Dissolved Organic Carbon	<2	4	6	5	4	5			<2	mg/l	TM60/PM0
Dissolved Organic Carbon	<20	40	60	50	40	50			<20	mg/kg	TM60/PM0
Total Dissolved Solids #	73	114	126	88	95	90			<35	mg/l	TM20/PM0
Total Dissolved Solids #	730	1139	1261	880	950	900			<350	mg/kg	TM20/PM0

 Client Name:
 Ground Invest

 Reference:
 9754-07-20

 Location:
 BusConnects

 Contact:
 John Duggan

 20/16406

Ground Investigations Ireland 9754-07-20 BusConnects Route 15 Report : EN12457_2

	John Dug 20/16406	gan		-	-	-		-						
EMT Sample No.	1-3	4-6	7-9	10-12	13-15	16-18								
Sample ID	R15 TP01	R15 TP01	R15 TP01	R15 TP02	R15 TP02	R15 TP02								
Depth	0.50	1.50	2.30	0.50	1.50	2.40							e attached r	
COC No / misc												abbrevi	ations and a	cronyms
Containers	VJT	VJT	VJT	VJT	VJT	VJT								
Sample Date	19/11/2020	19/11/2020	19/11/2020	19/11/2020	19/11/2020	19/11/2020								
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil								
Batch Number	1	1	1	1	1	1				Stable Non-				Method
Date of Receipt	23/11/2020	23/11/2020	23/11/2020	23/11/2020	23/11/2020	23/11/2020			Inert	reactive	Hazardous	LOD LOR	Units	No.
Solid Waste Analysis														
Total Organic Carbon #	0.68	0.91	1.88	5.58	3.57	5.71			3	5	6	<0.02	%	TM21/PM24
Sum of BTEX	<0.025	<0.025	<0.025	<0.025	<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			1	-	-	<0.035	mg/kg	TM17/PM8
Mineral Oil PAH Sum of 17	41 3.02	70 2.21	71 19.18	72 62.52	184 138.68 _{BA}	69 70.64			500 100	-	-	<30 <0.64	mg/kg mg/kg	TM5/PM8/PM16 TM4/PM8
	0.02	2.61		02.02	100.00BA				.00			-3.04	9/109	
CEN 10:1 Leachate														
Arsenic#	<0.025	0.042	0.059	0.072	0.072	0.054			0.5	2	25	<0.025	mg/kg	TM30/PM17
Barium [#]	0.08	0.51	0.63	0.13	0.27	0.14			20	100	300	<0.03	mg/kg	TM30/PM17
Cadmium #	<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	0.027	0.107	0.104			0.5	10 50	70	<0.015 <0.07	mg/kg	TM30/PM17 TM30/PM17
Copper # Mercury #	<0.07 <0.0001	<0.007	<0.001	0.0001	0.0004	<0.007			2	0.2	100 2	<0.001	mg/kg mg/kg	TM30/PM17 TM61/PM0
Molybdenum #	0.12	0.31	0.56	0.04	0.04	0.09			0.5	10	30	<0.02	mg/kg	TM30/PM17
Nickel [#]	<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	0.10	<0.05			0.5	10	50	<0.05	mg/kg	TM30/PM17
Antimony#	<0.02	0.05	0.14	0.14	0.06	0.12			0.06	0.7	5	<0.02	mg/kg	TM30/PM17
Selenium #	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03			0.1	0.5	7	<0.03	mg/kg	TM30/PM17
Zinc#	<0.03	<0.03	0.08	0.08	0.11 950	0.07 900			4 4000	50 60000	200 100000	<0.03	mg/kg	TM30/PM17 TM20/PM0
Total Dissolved Solids # Dissolved Organic Carbon	730 <20	40	60	50	40	50			500	800	100000	<350 <20	mg/kg mg/kg	TM20/PM0 TM60/PM0
Bibbonod organio odrbon	-20	10		00	10	00			000	000	1000	-20	mgmg	11100/11110
Mass of raw test portion	0.0989	0.1024	0.129	0.1045	0.12	0.1185			-	-	-		kg	NONE/PM17
Dry Matter Content Ratio	90.6	87.8	69.6	86.4	75.1	76.2			-	-	-	<0.1	%	NONE/PM4
Leachant Volume	0.891	0.887	0.861	0.886	0.87	0.872			-	-	-		1	NONE/PM17
Eluate Volume	0.8	0.8	0.8	0.8	0.8	0.8			-	-	-		I	NONE/PM17
рН #	8.53	8.01	7.88	8.40	8.26	8.38			-	-	-	<0.01	pH units	TM73/PM11
Fluoride	<3	<3	3	4	<3	<3			-	-	-	<3	mg/kg	TM173/PM0
	474	407		40		400			4000	00000	50000	-		THOSE
Sulphate as SO4 #	174 8	107 26	80 23	13	83	136			1000 800	20000 15000	50000 25000	<5	mg/kg	TM38/PM0 TM38/PM0
Chloride #	U	20	23	~3	5	0			000	13000	23000	<0	mg/kg	110130/1-1010
														1
				I	I	I	I			I	I	1		1

Client Name:	Ground Investigations Ireland
Reference:	20/07/9754
Location:	BusConnects Route 15
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
20/16406	1	R15 TP01	0.50	2	01/12/2020	General Description (Bulk Analysis)	soil/stones
					01/12/2020	Asbestos Fibres	NAD
					01/12/2020	Asbestos ACM	NAD
					01/12/2020	Asbestos Type	NAD
					01/12/2020	Asbestos Level Screen	NAD
20/16406	1	R15 TP01	1.50	5	01/12/2020	General Description (Bulk Analysis)	soil/stones
					01/12/2020	Asbestos Fibres	NAD
					01/12/2020	Asbestos ACM	NAD
					01/12/2020	Asbestos Type	NAD
					01/12/2020	Asbestos Level Screen	NAD
20/16406	1	R15 TP01	2.30	8	01/12/2020	General Description (Bulk Analysis)	soil/stones
					01/12/2020	Asbestos Fibres	NAD
					01/12/2020	Asbestos ACM	NAD
					01/12/2020	Asbestos Type	NAD
					01/12/2020	Asbestos Level Screen	NAD
20/16406	1	R15 TP02	0.50	11	01/12/2020	General Description (Bulk Analysis)	soil/stones
					01/12/2020	Asbestos Fibres	NAD
					01/12/2020	Asbestos ACM	NAD
					01/12/2020	Asbestos Type	NAD
					01/12/2020	Asbestos Level Screen	NAD
20/16406	1	R15 TP02	1.50	14	01/12/2020	General Description (Bulk Analysis)	soil/stones
					01/12/2020	Asbestos Fibres	NAD
					01/12/2020	Asbestos ACM	NAD
					01/12/2020	Asbestos Type	NAD
					01/12/2020	Asbestos Level Screen	NAD
20/16406	1	R15 TP02	2.40	17	01/12/2020	General Description (Bulk Analysis)	soil/stones
					01/12/2020	Asbestos Fibres	NAD
					01/12/2020	Asbestos ACM	NAD
					01/12/2020	Asbestos Type	NAD
					01/12/2020	Asbestos Level Screen	NAD

Client Name:Ground Investigations IrelandReference:9754-07-20Location:BusConnects Route 15Contact:John Duggan

EMT Job No.	Batch	Sample ID	Depth	EMT Sample No.	Analysis	Reason
					No deviating sample report results for job 20/16406	

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.: 20/16406

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.

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

# 1	ISO17025 (UKAS Ref No. 4225) accredited - UK.
	15017025 (UKAS Kel NO. 4225) accieulleu - UK.
SA I	ISO17025 (SANAS Ref No.T0729) accredited - South Africa
ВИ	Indicates analyte found in associated method blank.
DR [Dilution required.
M	MCERTS accredited.
NA M	Not applicable
NAD M	No Asbestos Detected.
ND M	None Detected (usually refers to VOC and/SVOC TICs).
NDP N	No Determination Possible
SS (Calibrated against a single substance
SV S	Surrogate recovery outside performance criteria. This may be due to a matrix effect.
W F	Results expressed on as received basis.
+ 4	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.
* 4	Analysis subcontracted to an Element Materials Technology approved laboratory.
AD S	Samples are dried at 35°C ±5°C
CO S	Suspected carry over
LOD/LOR L	Limit of Detection (Limit of Reporting) in line with ISO 17025 and MCERTS
ME	Matrix Effect
NFD N	No Fibres Detected
BS A	AQC Sample
LB E	Blank Sample
N C	Client Sample
тв 1	Trip Blank Sample
OC (Outside Calibration Range
AA ×	x5 Dilution

Please include all sections of this report if it is reproduced All solid results are expressed on a dry weight basis unless stated otherwise.

BA x5 Dilution	
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EMT Job No: 20/16406

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

Method Code Appendix

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
ТМЗО	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
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	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 co- elutes 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 co- elutes 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	



Issue :

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W: www.element.com

Ground Investigations Ireland Catherinestown House Hazelhatch Road Newcastle Co. Dublin Ireland ac-MR Attention : John Duggan Date : 4th December, 2020 Your reference : 9754-07-20 Our reference : Test Report 20/16727 Batch 1 Bus Connect Route 15 Location : Date samples received : 27th November, 2020 Status : Final report

One sample was received for analysis on 27th November, 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.

1

Authorised By:

Phil Sommerton BSc Senior Project Manager

Please include all sections of this report if it is reproduced

Client Name:
Reference:
Location:
Contact:
EMT Job No:

Ground Investigations Ireland 9754-07-20 Bus Connect Route 15 John Duggan 20/16727 Report : Solid

EMT Job No:	20/16727					_		
EMT Sample No.	1							
Sample ID	R15-CP06							
Denth	0.50							
Depth						Please se abbrevi	otes for all cronyms	
COC No / misc							2	
Containers	Т							
Sample Date								
Sample Type	Soil							
Batch Number	1					LOD/LOR	Units	Method No.
Date of Receipt								
Chloride (2:1 Ext BRE)#	0.020					<0.002	g/l	TM38/PM20
Sulphate as SO4 (2:1 Ext) #	0.2184					<0.0015	g/l	TM38/PM20
Organic Matter	2.4					<0.2	%	TM21/PM24
рН#	7.74					<0.01	pH units	TM73/PM11
		 	 	 l	 	 		ļ

Client Name:Ground Investigations IrelandReference:9754-07-20Location:Bus Connect Route 15

Contact: John Duggan

EMT Job No.	Batch	Sample ID	Depth	EMT Sample No.	Analysis	Reason
20/16727	1	R15-CP06	2.50	1	Chloride, pH, Sulphate	Sample holding time exceeded prior to receipt

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.

Matrix : Solid

NOTES TO ACCOMPANY ALL SCHEDULES AND REPORTS

EMT Job No.: 20/16727

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.

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
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.			AD	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		AD	Yes
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



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Ground Investigations Ireland Bus Connect Detailed Stage 1 Lot 1 Route 14 National Transport Authority Ground Investigation Report

March 2021



Directors: Fergal McNamara (MD), James Lombard, Conor Finnerty, Aisling McDonnell & Barry Sexton Ground Investigations Ireland Limited | Registered in Ireland Company Regsitration No.: 405726



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DOCUMENT CONTROL SHEET

Project Title	Bus Connect Detailed Stage 1 Lot 1
Engineer	Arup
Client	National Transport Authority
Project No	9754-07-20 R14
Document Title	Ground Investigation Report

Rev.	Status	Author(s)	Reviewed By	Approved By	Office of Origin	Issue Date
А	Draft	P. Cochran	J. Duggan	A. McDonnell	Dublin	30 November 2020
В	Final	P. Cochran	J. Duggan	A. McDonnell	Dublin	21 January 2021
С	Final	P. Cochran	M. Sutton	A. McDonnell	Dublin	08 March 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.





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GROUND INVESTIGATIONS IRELAND

Geotechnical & Environmental

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APPENDICES

Appendix 1	Site Location Plan
Appendix 2	Trial Pit Records
Appendix 3	Laboratory Testing



1.0 Preamble

On the instructions of Arup, a site investigation was carried out by Ground Investigations Ireland Ltd., in October 2020 at the site of the proposed bus corridor along Route 14: UCD Ballsbridge to Dublin 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 14 is a main commuter route from UCD Ballsbridge to Dublin city centre with high pedestrian, cyclists, and vehicular flows.

2.2. Purpose and Scope

The purpose of the site investigation was to investigate subsurface conditions utilising trial pitting 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 3 No. Trial Pits to a maximum depth of 2.90m BGL
- 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 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.

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. R14-TP02 was not excavated due to the proposed location being within the bounds of an active construction site.

3.3. Surveying

The exploratory hole locations have been recorded using a Trimble R10 GNSS 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. It was not possible to record the location of R14-TP04 due to the tree canopy.

3.4. 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 page the Engineers Ireland Suite E, organic matter content, pH, chloride, and sulphate testing was carried out by Element Materials Technology Laboratory in the UK.

Geotechnical testing consisting of moisture content, Atterberg limits, Particle Size Distribution (PSD), hydrometer was carried out in NMTL's Geotechnical Laboratory in Carlow.

The results of the laboratory testing are included in Appendix 3 of this Report.

4.0 Ground Conditions

4.1. General

The ground conditions encountered during the investigation are summarised below with reference to 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
- Made Ground
- Cohesive Deposits
- Granular Deposits

TOPSOIL: Topsoil was encountered in all the exploratory holes and was present to a maximum depth of 0.30m BGL.

MADE GROUND: Made Ground deposits were encountered beneath the Topsoil in TP01 and TP04 and were present to a depth of between 1.80m and 2.00m BGL. These deposits were described generally as brown or dark brownish grey slightly sandy gravelly Clay or light brown gravelly clayey fine to coarse Sand with occasional or some cobbles and boulders and contained occasional fragments of concrete, red brick, glass, plastic, and wood.

COHESIVE DEPOSITS: Cohesive deposits were encountered beneath the Topsoil in TP03 and were described as *brown sandy gravelly CLAY with occasional cobbles and boulders*. The secondary sand and gravel constituents varied with depth, with granular lenses occasionally present in the glacial till matrix. These deposits had occasional, some or frequent cobble and boulder content where noted on the exploratory hole logs.

GRANULAR DEPOSITS: The granular deposits were encountered below the base of the Made Ground deposits in TP01 and were described as *brownish grey very gravelly fine to coarse SAND with some subangular to subrounded cobbles.* It should be noted that in the trial pit where granular deposits were encountered, experienced instability.

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.

4.3. Laboratory Testing

4.3.1. Geotechnical Laboratory Testing

The geotechnical testing carried out on soil samples recovered generally confirm the descriptions on the logs with the primary constituent of the cohesive deposits found to be a CLAY of low to intermediate plasticity. The Particle Size Distribution tests confirm that the cohesive deposits are well-graded with percentages of sands and gravels of 57.6% with fines contents of 42.5%.

The Particle Size Distribution tests confirm that generally the granular deposits are well-graded with percentages of sands and silt/clay typically between 3.1% and 32.60% with a gravel content of typically 44.4% to 62.4%.

4.3.2. Chemical Laboratory Testing

The pH and sulphate testing carried out in TP01 indicate that pH results are near neutral and that the watersoluble sulphate results is low when compared to the guideline values from BRE Special Digest 1:2005. The sample tested classify the soil as a Design Sulphate Level DS-1.

4.3.3. Environmental Laboratory Testing

A number of samples were analysed for a suite of parameters which allows for the assessment of the sampled material in terms of total pollutant content for classification of materials as *hazardous* or *non-hazardous*. The suite also allows for the assessment of the sampled material in terms of suitability for placement at licenced landfills (inert, stable non-reactive, hazardous etc.). The parameter list for the suite includes analysis of the solid samples for arsenic, barium, cadmium, chromium, copper, cyanide, lead, nickel, mercury, zinc, speciated aliphatic and aromatic petroleum hydrocarbons, pH, sulphate, sulphide, moisture content, soil organic matter and an asbestos screen.

The suite also includes those parameters specified in the EU Council Decision establishing criteria for the acceptance of waste at Landfills (Council Decision 2003/33/EC), which for the solid samples are total organic carbon (TOC), speciated aliphatic and aromatic petroleum hydrocarbons, BTEX, phenol, polychlorinated biphenyls (PCB) and PAH.

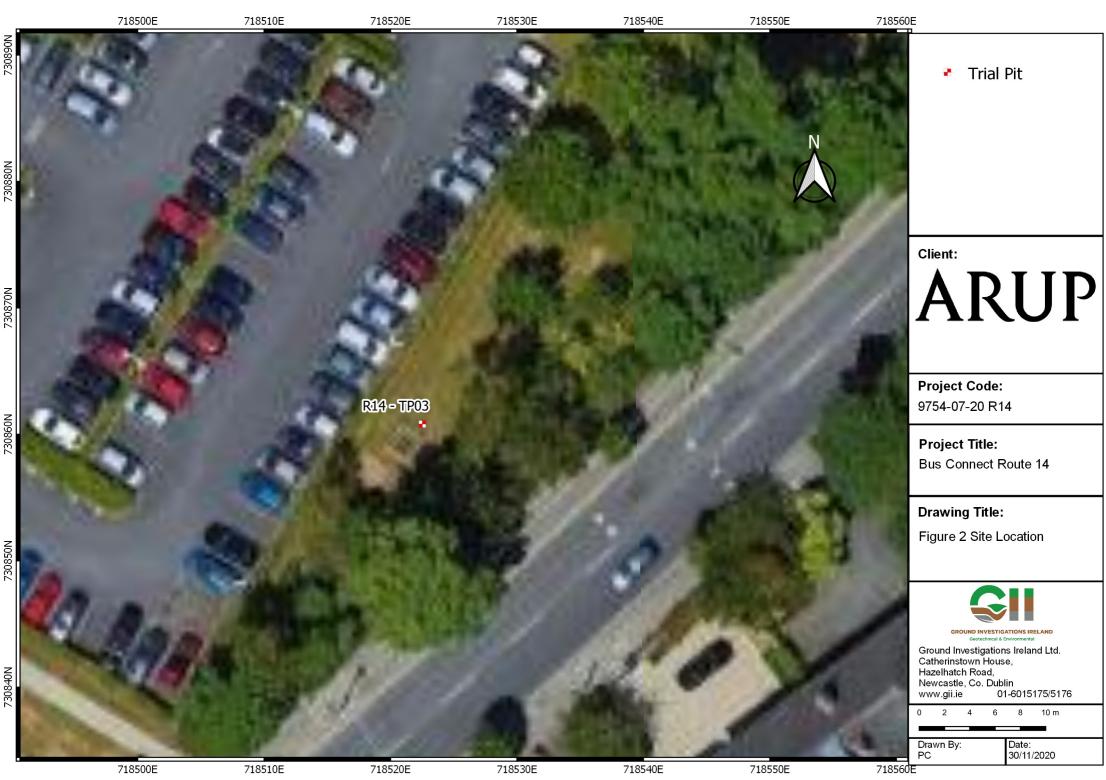
As part of the suite a leachate is generated from the solid sample, which is analysed for antimony, arsenic, barium, cadmium, chromium, copper, lead, mercury, molybdenum, nickel, selenium, zinc, chloride, fluoride, soluble sulphate, sulphide, phenols, dissolved organic carbon (DOC) and total dissolved solids (TDS). While the laboratory report provides a comparison with the waste acceptance criteria limits it does not provide a waste classification of the material sampled nor does it comment on any potentially hazardous properties of the materials tested. 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. A waste classification report is recommended to be carried out to provide an interpretation of the laboratory data should any material be required to be disposed of off-site.

The results from the completed laboratory testing are included in Appendix 3 of this report.

APPENDIX 1 - Site Location Plan









APPENDIX 2 – Trial Pit Records



Machine : 3	T Tracked Excavator	Dimensio	www.gii.ie	Ground	Level (mOD)	Bus Connect Detailed Stag		R14-TI	P0 ⁻	
Method :⊤		Billionere) x 0.40m (W) x 2.90m (D)	Ground	5.45	National Transport Authori	ty	Numb 9754-07		
		Location		Dates	1/10/2020	Project Contractor		Sheet		
	1	7182	292.9 E 732116.4 N			Ground Investigations Irela	and	1/1		
Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	D	escription	Legend	Wator	
					 (0.30)	Brown slightly sandy slight occasional rootlets	tly gravelly TOPSOIL with			
				5.15	-	gravelly Clay with some ar occasional rootlets and oc	ownish grey slightly sandy slightly ngular to subangular cobbles, casional fragments of concrete,			
.50 .50 .50	B ES T			4.05	- (0.50) 	red brick and wood			~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	
.00	B			4.65	- 0.80 (0.50)	MADE GROUND: Brown s Clay with occasional angu rootlets and occasional fra	slightly sandy slightly gravelly lar to subangular cobbles, Igments of wood.			
.00	Т			4.15		MADE GROUND: Light br	own gravelly clayey fine to coarse			
.50 .50	B ES				- (0.70)		subrounded cobbles, occasional			
					(0.70) 					
.00 .00	B T			3.45	2.00	Brownish grey very gravel subangular to subrounded subrounded fine to coarse	ly fine to coarse SAND with some cobbles. Gravel is subangular to	0.0.0	0.00 0.00 0.00	
.50	B ES				(0.90)					
.90 .90	В			2.55	 2.90	Complete at 2.90m		0.00	-	
					- - - -					
Plan					<u> </u> F	Remarks				
•				•		Trial pit terminated at 2.90m Trial pit unstable	BGL due to side wall instability			
·				•		No groundwater encountere Trial pit backfilled upon com	d during excavation pletion			
•				•						
·					•••					
·		·		•	•••					
•				•	 s	cale (approx)	Logged By Figur	e No.		

Produced by the GEOtechnical DAtabase SYstem (GEODASY) © all rights reserved

718522.5 E 730860.8 N 06/10/2020 Ground Investigations Ireland 1/*	Machine:3 ⁻ Method :⊤	Tracked Excavtor	Dimension 2.60m (L)	WWW.gii.ie s x 0.40m (W) x 1.30m (D)		Level (mOD) 14.39	Client National Transport Authority	Job Numbe 9754-07-
1:00 B 13.84 (0.25) One to come sliphtly sandy slightly gravely CLAY with frequent to subconduct the to coarse 1:00 B 13.84 0.05 1:00 B 0.05 1:00 B .00 B				22.5 E 730860.8 N	Dates 06	/10/2020	-	Sheet 1/1
100 B 13.89 0.02 13.80 0.03 300 B 300 B 300 B 300 B 300 B 300 Construction B 13.09 Construction Construction Constructi	Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend
Trial pit terminated at 1.30m BGL due to an obstruction on boulders Trial pit stable No groundwater encountered during excavation Trial pit backfilled upon completion	.50 .00 .30 .30	В			13.89		frequent rootlets Firm brown slightly sandy slightly gravelly CLAY with occasional rootlets. Gravel is angular to subrounded fir coarse Stiff brown slightly sandy slightly gravelly CLAY with occasional angular to subangular cobbles, occasional rootlets and occasional shell fragments. Gravel is angu to subrounded fine to coarse Very stiff brown slightly sandy gravelly CLAY with some angular to subangular cobbles and occasional boulder: Gravel is angular to subrounded fine to coarse Obstruction: Boulders Refusal at 1.30m	he to δ. <u>100 σ</u> δ. <u>100 σ</u>
No groundwater encountered during excavation Trial pit backfilled upon completion						•	Trial pit terminated at 1.30m BGL due to an obstruction o	n boulders
· · · · · · · · · ·							No groundwater encountered during excavation	
	•	· ·		· · ·	· ·			

Produced by the GEOtechnical DAtabase SYstem (GEODASY) © all rights reserved

			vestigations Ire www.gii.ie	land	Ltd	Site Bus Connect Detailed Stage 1 Lot 1	Trial Pit Number R14-TP(
Machine:37 Method:Tr	「Tracked Excavator ial Pit		ons .) x 0.40m (W) x 1.80m (D)	Ground	Level (mOD)	Client National Transport Authority	Job Number 9754-07-2
		Location		Dates 06	6/10/2020	Project Contractor Ground Investigations Ireland	Sheet 1/1
Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend
0.50 0.50 1.00 1.50	B B B ES				(0.25) 0.25 (1.55) 1.80	Dark brown slightly sandy slightly gravelly TOPSOI frequent rootlets MADE GROUND: Brown slightly sandy gravelly Cla some angular to subangular cobbles, occasional bo occasional rootlets and occasional fragments of co glass, plastic and red brick Obstruction: Boulders Refusal at 1.80m	av with
Plan					E	Remarks	
						Trial pit terminated at 1.80m BGL due to obstruction of Trial pit stable No groundwater encountered during excavation Trial pit backfilled upon completion Unable to survey trial pit due to tree canopy	on boulders
•							
	· ·		· · ·		· ·		
. .						cale (approx) Logged By	Figure No.

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R14 - TP03





Bus Connect Detailed Stage 1 Lot 1 – Trial Pit Photographs





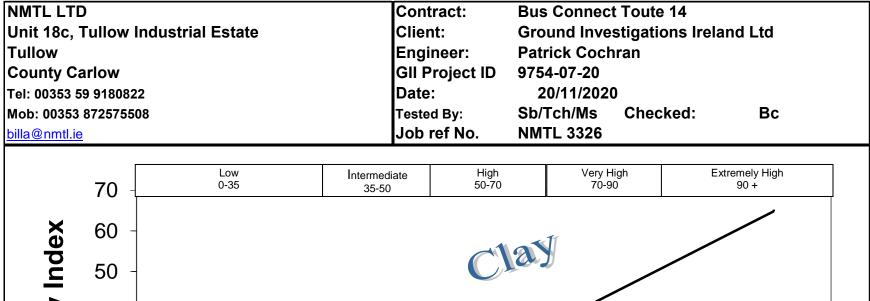
APPENDIX 3 – Laboratory Testing

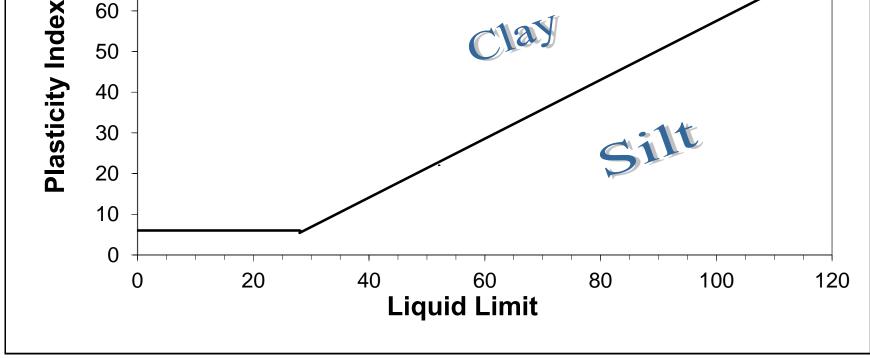


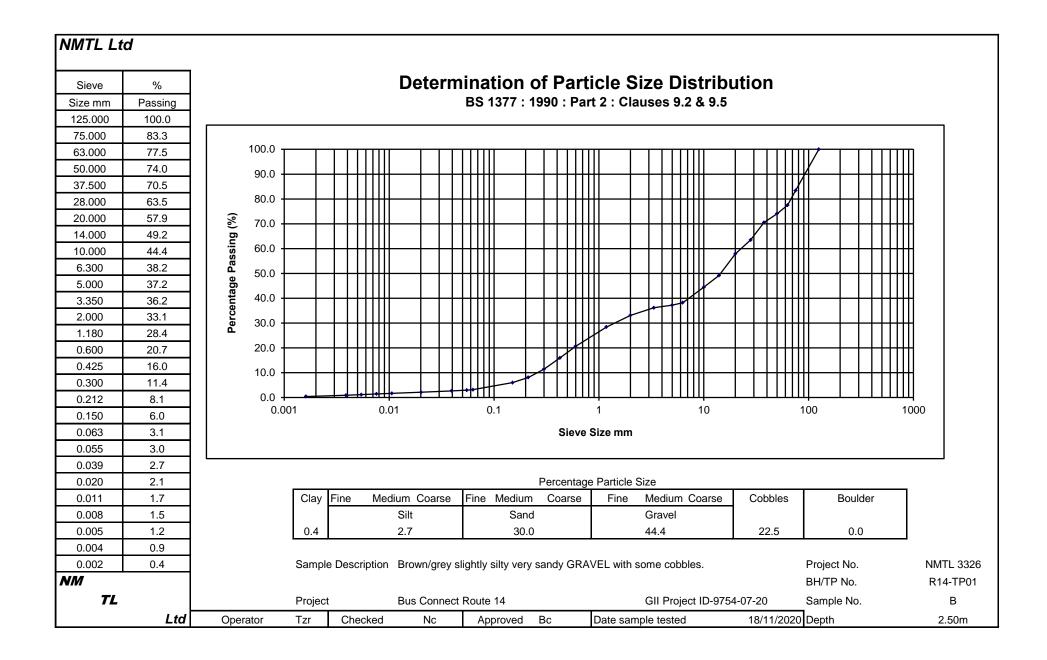
National Materials Testing Laboratory Ltd.

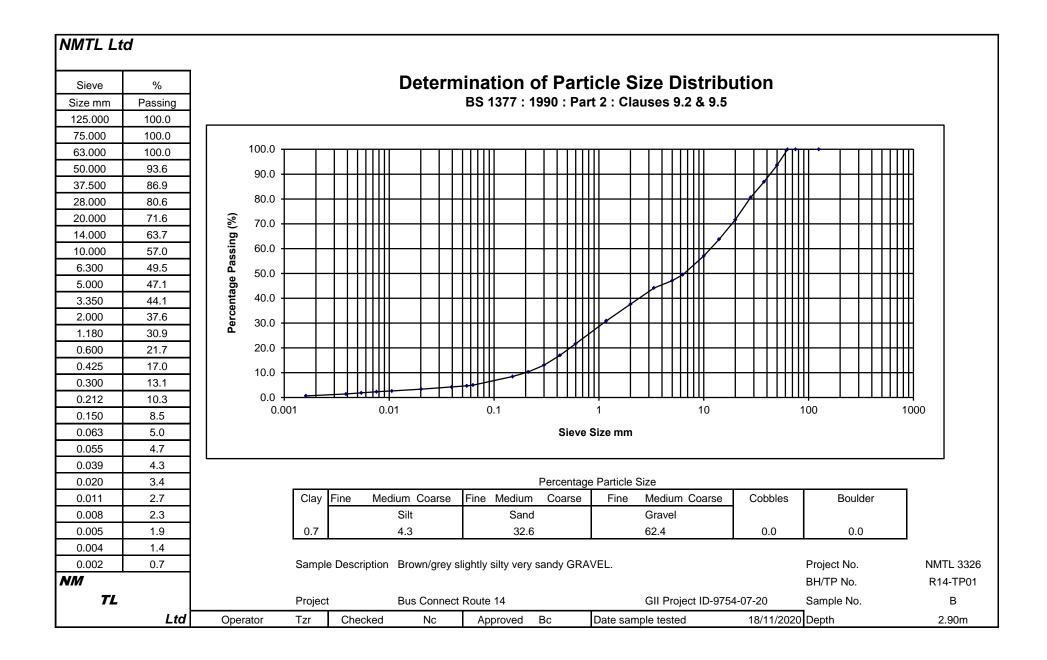
							0011111			-00210				
				Particle			Index Pro	perties	Bulk	Cell	Undrained Tria	xial Tests	Lab	
BH/TP	Depth	sample	Moisture	Density	<425um	LL	PL	PI	Density	Presssure	Compressive	Strain at	Vane	Remarks
No	m	No.	%	Mg/m3	%	%	%	%	Mg/m3	kPa	Stress kPa	Failure %	kPa	
R14-TP01	2.00	В	5.4		25.8	29	Non Plasti	C						
R14-TP01	2.90	В	6.0		16.0	32	Non Plasti	с						
									_		ļ			
											ļ			
NMTL	4	Notes :									Job ref No.	NMTL 3326	GII Project ID:	9754-07-20
			1. All BS to	ests carried	d out using p	oreferred (definitive) r	nethod ur	nless otherw	ise stated.	Location	Bus Conn	ect Toute 14	

SUMMARY OF TEST RESULTS





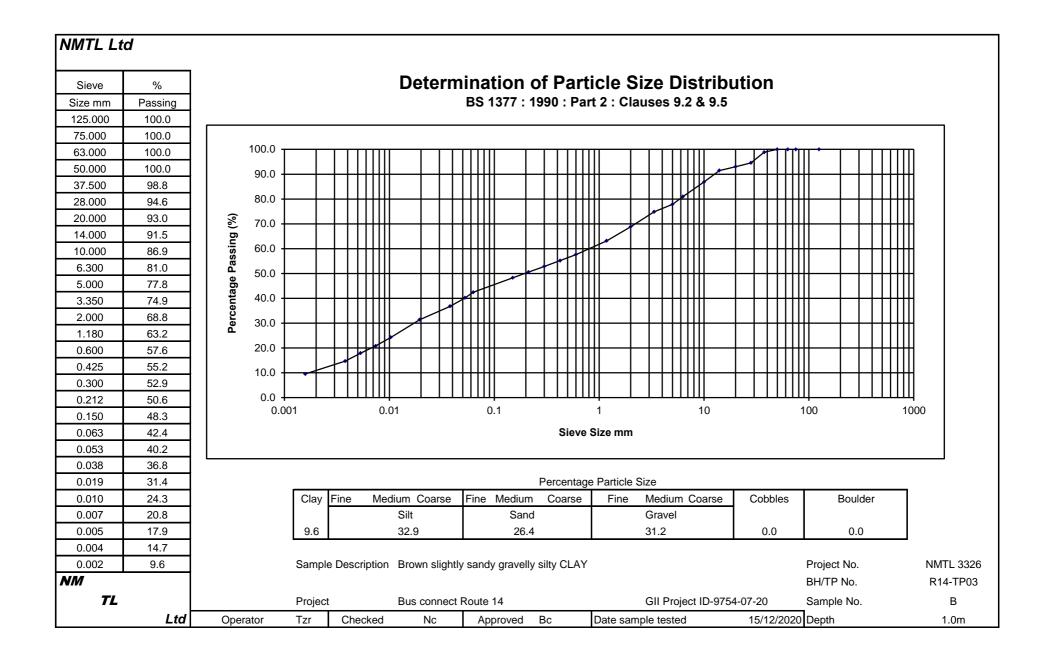




National Materials Testing Laboratory Ltd.

							•••							
				Particle			Index Pro	perties	Bulk	Cell	Undrained Triax	xial Tests	Lab	
BH/TP	Depth	sample	Moisture	Density	<425um	LL	PL	PI	Density	Presssure	Compressive	Strain at	Vane	Remarks
No	m	No.	%	Mg/m3	%	%	%	%	Mg/m3	kPa	Stress kPa	Failure %	kPa	
R14-TP03	0.5	В	25.0		74.9	44	28	16						
R14-TP03	1.0	В	11.8		55.2	41	24	17						
R14-TP03	1.3	В	12.2		62.3	32	21	11						
NMTL		Notes :	I	1				I	1	1	Job ref No.	NMTL 3326	GII Project ID:	9754-07-20
	1		1. All BS te	ests carried	d out using p	oreferred (definitive) r	method ur	nless otherw	vise stated.	Location		ect Routes	

SUMMARY OF TEST RESULTS





Issue :

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 ac-MR Attention : John Duggan Date : 21st October, 2020 Your reference : 9754-07-20 Our reference : Test Report 20/13792 Batch 1 Bus Connect Route 14 Location : Date samples received : 8th October, 2020 Status : Final report 1

Four samples were received for analysis on 8th October, 2020 of which four 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:
Reference:
Location:
Contact:
EMT Job No:

Ground Investigations Ireland 9754-07-20 Bus Connect Route 14 John Duggan 20/13792

Report : Solid

EMT Job No:	20/13792							 					
EMT Sample No.	1-3	4-6	7-9	10-12									
Sample ID	R14-TP03	R14-TP03	R14-TP04	R14-TP04						Please see attached notes for all			
Depth	0.50	1.30	0.50	1.30					Disses				
COC No / misc										ations and a			
Containers	VJT	VJT	VJT	VJT									
Sample Date	06/10/2020	06/10/2020	06/10/2020	06/10/2020									
Sample Type	Soil	Soil	Soil	Soil									
Batch Number	1	1	1	1							Marthaud		
Date of Receipt				08/10/2020					LOD/LOR	Units	Method No.		
Antimony	2	2	3	2					<1	mg/kg	TM30/PM15		
Arsenic [#]	20.5	11.8	18.4	23.0					<0.5	mg/kg	TM30/PM15		
Barium [#]	144	70	116	94					<1	mg/kg	TM30/PM15		
Cadmium [#]	2.8	2.3	2.1	2.6					<0.1	mg/kg	TM30/PM15		
Chromium #	70.8	38.1	57.6	51.7					<0.5	mg/kg	TM30/PM15		
Copper [#]	40	35	46	37					<1	mg/kg	TM30/PM15		
Lead [#]	50	20	104	47					<5	mg/kg	TM30/PM15		
Mercury#	<0.1	<0.1	<0.1	<0.1					<0.1	mg/kg	TM30/PM15		
Molybdenum [#]	7.3	4.5	5.3	5.4					<0.1	mg/kg	TM30/PM15		
Nickel [#]	54.3	42.8	44.1	49.7					<0.7	mg/kg	TM30/PM15		
Selenium [#]	1	1	1	<1					<1	mg/kg	TM30/PM15		
Zinc [#]	121	96	144	108					<5	mg/kg	TM30/PM15		
PAH MS													
Naphthalene #	0.17	<0.04	<0.04	<0.04					<0.04	mg/kg	TM4/PM8		
Acenaphthylene	<0.03	<0.03	0.14	<0.03					<0.03	mg/kg	TM4/PM8		
Acenaphthene #	<0.05	<0.05	0.07	<0.05					<0.05	mg/kg	TM4/PM8		
Fluorene [#]	<0.04	<0.04	0.05	<0.04					<0.04	mg/kg	TM4/PM8		
Phenanthrene [#]	0.13	0.20	0.57	0.11					<0.03	mg/kg	TM4/PM8		
Anthracene #	0.05	0.05	0.24	<0.04					<0.04	mg/kg	TM4/PM8		
Fluoranthene #	0.10	0.04	1.68	0.17					<0.03	mg/kg	TM4/PM8		
Pyrene [#]	0.08	0.04	1.44	0.14					<0.03	mg/kg	TM4/PM8		
Benzo(a)anthracene #	<0.06	<0.06	0.90	0.11					<0.06	mg/kg	TM4/PM8		
Chrysene [#]	0.05	0.03	0.90	0.10					<0.02	mg/kg	TM4/PM8		
Benzo(bk)fluoranthene [#]	<0.07	<0.07	1.98	0.14					<0.07	mg/kg	TM4/PM8		
Benzo(a)pyrene *	<0.04	<0.04	1.10	0.08					<0.04	mg/kg	TM4/PM8		
Indeno(123cd)pyrene	<0.04	<0.04	0.83	0.06					<0.04	mg/kg	TM4/PM8		
Dibenzo(ah)anthracene #	<0.04	<0.04	0.15	<0.04					<0.04	mg/kg	TM4/PM8		
Benzo(ghi)perylene [#]	<0.04	<0.04	0.78	0.06					<0.04	mg/kg	TM4/PM8		
Coronene PAH 17 Total	<0.04 <0.64	<0.04 <0.64	0.12	<0.04 0.97					<0.04 <0.64	mg/kg	TM4/PM8 TM4/PM8		
Benzo(b)fluoranthene	<0.04	<0.04	1.43	0.97					<0.04	mg/kg mg/kg	TM4/PM8		
Benzo(k)fluoranthene	<0.02	<0.03	0.55	0.04					<0.02	mg/kg	TM4/PM8		
PAH Surrogate % Recovery	92	94	93	101					<0.02	%	TM4/PM8		
	02			101						70			
Mineral Oil (C10-C40)	<30	<30	<30	<30					<30	mg/kg	TM5/PM8/PM16		
		I	I	1		1	1				1		

Client Name:
Reference:
Location:
Contact:
EMT Job No:

Ground Investigations Ireland 9754-07-20 Bus Connect Route 14 John Duggan 20/13792

Report : Solid

EMT Job No:	20/13792							_		
EMT Sample No.	1-3	4-6	7-9	10-12]		
Sample ID	R14-TP03	R14-TP03	R14-TP04	R14-TP04						
Depth	0.50	1.30	0.50	1.30					e attached n	
COC No / misc								abbrevi	ations and a	cronyms
Containers	VJT	VJT	VJT	VJT						
Sample Date	06/10/2020	06/10/2020	06/10/2020	06/10/2020						
Sample Type	Soil	Soil	Soil	Soil						
Batch Number	1	1	1	1						Method
Date of Receipt	08/10/2020	08/10/2020	08/10/2020	08/10/2020				LOD/LOR	Units	No.
TPH CWG										
Aliphatics										
>C5-C6 [#]	<0.1	<0.1	<0.1	<0.1				<0.1	mg/kg	TM36/PM12
>C6-C8 [#]	<0.1	<0.1	<0.1	<0.1				<0.1	mg/kg	TM36/PM12
>C8-C10	<0.1	<0.1	<0.1	<0.1				<0.1	mg/kg	TM36/PM12
>C10-C12#	<0.2	<0.2	<0.2	<0.2				<0.2	mg/kg	TM5/PM8/PM16
>C12-C16 [#]	<4	<4	<4	<4				<4	mg/kg	TM5/PM8/PM16
>C16-C21 #	<7	<7	<7	<7				<7	mg/kg	TM5/PM8/PM16
>C21-C35 [#] >C35-C40	<7	<7	<7	<7 <7				<7	mg/kg	TM5/PM8/PM16 TM5/PM8/PM16
>C35-C40 Total aliphatics C5-40	<7 <26	<7 <26	<7 <26	<26				<7 <26	mg/kg mg/kg	TMS/PM0/PMT0
>C6-C10	<0.1	<0.1	<0.1	<0.1				<0.1	mg/kg	TM36/PM12
>C10-C25	<10	<10	<10	<10				<10	mg/kg	TM5/PM8/PM16
>C25-C35	<10	<10	<10	<10				<10	mg/kg	TM5/PM8/PM16
Aromatics										
>C5-EC7#	<0.1	<0.1	<0.1	<0.1				<0.1	mg/kg	TM36/PM12
>EC7-EC8 [#]	<0.1	<0.1	<0.1	<0.1				<0.1	mg/kg	TM36/PM12
>EC8-EC10 [#]	<0.1	<0.1	<0.1	<0.1				<0.1	mg/kg	TM36/PM12
>EC10-EC12#	<0.2	<0.2	<0.2	<0.2				<0.2	mg/kg	TM5/PM8/PM16
>EC12-EC16 [#] >EC16-EC21 [#]	<4	<4	<4	<4				<4	mg/kg	TM5/PM8/PM16 TM5/PM8/PM16
>EC16-EC21 >EC21-EC35 [#]	<7 <7	<7 <7	11 75	<7 <7				<7 <7	mg/kg mg/kg	TM5/PM8/PM16
>EC35-EC40	<7	<7	12	<7				<7	mg/kg	TM5/PM8/PM16
Total aromatics C5-40	<26	<26	98	<26				<26	mg/kg	TM5/TM36/PM8/PM12/PM16
Total aliphatics and aromatics(C5-40)	<52	<52	98	<52				<52	mg/kg	TM5/TM36/PM8/PM12/PM16
>EC6-EC10 [#]	<0.1	<0.1	<0.1	<0.1				<0.1	mg/kg	TM36/PM12
>EC10-EC25	<10	<10	29	<10				<10	mg/kg	TM5/PM8/PM16
>EC25-EC35	<10	<10	56	<10				<10	mg/kg	TM5/PM8/PM16
*	_	_	_	_						
MTBE [#]	<5 <5	<5 <5	<5 <5	<5 <5				<5 <5	ug/kg	TM36/PM12 TM36/PM12
Benzene [#] Toluene [#]	<5 <5	<5 <5	<5	<5 <5				<5	ug/kg ug/kg	TM36/PM12 TM36/PM12
Ethylbenzene [#]	<5	<5	<5	<5				<5	ug/kg	TM36/PM12
m/p-Xylene [#]	<5	<5	<5	<5				<5	ug/kg	TM36/PM12
o-Xylene [#]	<5	<5	<5	<5				<5	ug/kg	TM36/PM12
PCB 28 [#]	<5	<5	<5	<5				<5	ug/kg	TM17/PM8
PCB 52 [#]	<5	<5	<5	<5				<5	ug/kg	TM17/PM8
PCB 101 #	<5	<5	<5	<5				<5	ug/kg	TM17/PM8
PCB 118 [#]	<5	<5	<5	<5				<5	ug/kg	TM17/PM8
PCB 138 [#] PCB 153 [#]	<5 <5	<5 <5	<5 <5	<5 <5				<5 <5	ug/kg ug/kg	TM17/PM8 TM17/PM8
PCB 153	<5	<5	<5	<5				<5	ug/kg	TM17/PM8
Total 7 PCBs [#]	<35	<35	<35	<35				<35	ug/kg	TM17/PM8

Client Name:
Reference:
Location:
Contact:
EMT Job No:

Ground Investigations Ireland 9754-07-20 Bus Connect Route 14 John Duggan 20/13792

Report : Solid

EMT Job No:	20/13792							_		
EMT Sample No.	1-3	4-6	7-9	10-12						
Sample ID	R14-TP03	R14-TP03	R14-TP04	R14-TP04						
Depth	0.50	1.30	0.50	1.30				Diagon on	e attached n	otoo for all
COC No / misc									ations and a	
Containers		VJT	VJT	VJT						
Sample Date										
Sample Type	Soil	Soil	Soil	Soil						
Batch Number	1	1	1	1						— — – – – – – – – – – – – – – – – – – – –
								LOD/LOR	Units	Method No.
Date of Receipt									0 (PM4/PM0
Natural Moisture Content Moisture Content (% Wet Weight)	19.5 16.3	9.8 8.9	12.5 11.1	10.8 9.8				<0.1 <0.1	%	PM4/PM0 PM4/PM0
Hexavalent Chromium #	<0.3	<0.3	<0.3	<0.3				<0.3	mg/kg	TM38/PM20
Chromium III	70.8	38.1	57.6	51.7				<0.5	mg/kg	NONE/NONE
Total Quanida #	<0.5	-0.5	-0.5	<0.5				-0 F	ma/l	TM89/PM45
Total Cyanide [#]	<0.5	<0.5	<0.5	<0.5				<0.5	mg/kg	1109/11045
Total Organic Carbon #	2.40	0.58	2.32	0.96				<0.02	%	TM21/PM24
Loss on Ignition #	6.9	2.8	5.7	3.9				<1.0	%	TM22/PM0
рН [#]	8.26	8.60	8.40	8.59				<0.01	pH units	TM73/PM11
Mass of raw test portion	0.1092	0.0982	0.1033	0.0997					kg	NONE/PM17
Mass of dried test portion	0.09	0.09	0.09	0.09					kg	NONE/PM17



Ground Investigations Ireland 9754-07-20 Bus Connect Route 14 John Duggan 20/13792

Report : CEN 10:1 1 Batch

EMT Sample No.	1-3	4-6	7-9	10-12						
Sample ID	R14-TP03	R14-TP03	R14-TP04	R14-TP04						
Depth	0.50	1.30	0.50	1.30				Blassa as	e attached n	otoo for all
COC No / misc									ations and a	
Containers	VJT	VJT	VJT	VJT						
Sample Date	06/10/2020	06/10/2020	06/10/2020	06/10/2020						
Sample Type	Soil	Soil	Soil	Soil						
Batch Number	1	1	1	1						
								LOD/LOR	Units	Method No.
Date of Receipt			08/10/2020					0.000		TM00/DM47
Dissolved Antimony [#]	<0.002	<0.002	0.003	<0.002				<0.002	mg/l	TM30/PM17 TM30/PM17
Dissolved Antimony (A10) # Dissolved Arsenic #	<0.02 <0.0025	<0.02 <0.0025	0.03 <0.0025	<0.02 <0.0025				<0.02 <0.0025	mg/kg	TM30/PM17 TM30/PM17
	<0.025	<0.0025	<0.0025	<0.0025				<0.0025	mg/l mg/kg	TM30/PM17
Dissolved Arsenic (A10) [#] Dissolved Barium [#]	0.004	<0.023	0.007	0.003				<0.023	mg/l	TM30/PM17
	0.004	<0.003	0.007	<0.03				<0.003		TM30/PM17 TM30/PM17
Dissolved Barium (A10) [#]	< 0.0005	<0.003	<0.0005	<0.003				<0.003	mg/kg mg/l	TM30/PM17 TM30/PM17
Dissolved Cadmium (A10) [#]	<0.005	<0.005	<0.005	<0.005				<0.0005	mg/kg	TM30/PM17
Dissolved Chromium #	<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	mg/kg	TM30/PM17
Dissolved Copper [#]	<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	mg/kg	TM30/PM17
Dissolved Lead [#]	<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	mg/kg	TM30/PM17
Dissolved Molybdenum #	0.006	0.006	0.010	0.013				<0.002	mg/l	TM30/PM17
Dissolved Molybdenum (A10) #	0.06	0.06	0.10	0.13				<0.02	mg/kg	TM30/PM17
Dissolved Nickel [#]	<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	mg/kg	TM30/PM17
Dissolved Selenium#	<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	mg/kg	TM30/PM17
Dissolved Zinc [#]	0.005	<0.003	0.005	0.003				<0.003	mg/l	TM30/PM17
Dissolved Zinc (A10) #	0.05	<0.03	0.05	<0.03				<0.03	mg/kg	TM30/PM17
Mercury Dissolved by CVAF #	<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	mg/kg	TM61/PM0
Total Phenols HPLC	<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	mg/kg	TM26/PM0
Fluoride	0.7	0.3	0.4	0.4				<0.3	mg/l	TM173/PM0
Fluoride	7	3	4	4				<3	mg/kg	TM173/PM0
Sulphate as SO4 [#]	<0.5	<0.5	0.6	5.8				<0.5	mg/l	TM38/PM0
Sulphate as SO4 [#]	<5	<5	6	58				<5	mg/kg	TM38/PM0
Chloride [#]	0.6	<0.3	1.4	3.3				<0.3	mg/l	TM38/PM0
Chloride [#]	6	<3	14	33				<3	mg/kg	TM38/PM0
Dissolved Organic Carbon	5	2	6	5				<2	mg/l	TM60/PM0
Dissolved Organic Carbon	50	20	60	50				<20	mg/kg	TM60/PM0
Total Dissolved Solids [#]	83	62	98	87				<35	mg/l	TM20/PM0
Total Dissolved Solids [#]	830	620	980	870				<350	mg/kg	TM20/PM0

Client Name:	Ground In		is Ireland			Report :	EN12457	_2							
Reference: Location: Contact: EMT Job No:	9754-07-2 Bus Conn John Dugg 20/13792	ect Route	14					r, J=250g gla	ass jar, T=p	astic tub					
EMT Sample No.	1-3	4-6	7-9	10-12											
Sample ID	R14-TP03	R14-TP03	R14-TP04	R14-TP04											
Depth	0.50	1.30	0.50	1.30										e attached n ations and a	
COC No / misc	VIT	VIT	VIT	VIT											
	V J T	V J T	V J T	V J T											
Sample Date	06/10/2020	06/10/2020 Soil	06/10/2020 Soil	06/10/2020 Soil											
Sample Type	Soil														1
Batch Number	1	1	1	1						Inert	Stable Non- reactive	Hazardous	LOD LOR	Units	Method No.
Date of Receipt Solid Waste Analysis	08/10/2020	08/10/2020	08/10/2020	08/10/2020											
Total Organic Carbon [#]	2.40	0.58	2.32	0.96						3	5	6	<0.02	%	TM21/PM2
Sum of BTEX	<0.025	<0.025	<0.025	<0.025						6	-	-	<0.025	mg/kg	TM36/PM1
Sum of 7 PCBs#	<0.035	<0.035	<0.035	<0.035						1	-	-	<0.035	mg/kg	TM17/PM
Mineral Oil	<30	<30	<30	<30						500	-	-	<30	mg/kg	TM5/PM8/PM1
PAH Sum of 17	<0.64	<0.64	10.95	0.97						100	-	-	<0.64	mg/kg	TM4/PM8
CEN 10:1 Leachate															
Arsenic#	<0.025	<0.025	<0.025	<0.025						0.5	2	25	<0.025	mg/kg	TM30/PM1
Barium [#]	0.04	<0.03	0.07	<0.03						20	100	300	<0.03	mg/kg	TM30/PM1
Cadmium #	<0.005	<0.005	<0.005	<0.005						0.04	1	5	<0.005	mg/kg	TM30/PM1
Chromium #	<0.015 <0.07	<0.015 <0.07	<0.015 <0.07	<0.015 <0.07						0.5 2	10 50	70 100	<0.015 <0.07	mg/kg	TM30/PM1 TM30/PM1
Copper [#] Mercury [#]	<0.0001	<0.0001	<0.0001	<0.0001						2	0.2	2	<0.0001	mg/kg mg/kg	TM61/PM
Molybdenum #	0.06	0.06	0.10	0.13						0.5	10	30	<0.02	mg/kg	TM30/PM1
Nickel [#]	<0.02	<0.02	<0.02	<0.02						0.4	10	40	<0.02	mg/kg	TM30/PM1
Lead [#]	<0.05	<0.05	<0.05	<0.05						0.5	10	50	<0.05	mg/kg	TM30/PM1
Antimony [#]	<0.02	<0.02	0.03	<0.02						0.06	0.7	5	<0.02	mg/kg	TM30/PM1
Selenium [#]	<0.03 0.05	<0.03 <0.03	<0.03	<0.03 <0.03						0.1 4	0.5 50	7 200	<0.03 <0.03	mg/kg mg/kg	TM30/PM1 TM30/PM1
Total Dissolved Solids #	830	620	980	870						4000	60000	100000	<350	mg/kg	TM20/PM
Dissolved Organic Carbon	50	20	60	50						500	800	1000	<20	mg/kg	TM60/PM
Mass of raw test portion	0.1092	0.0982	0.1033	0.0997						-	-	-		kg	NONE/PM1
Dry Matter Content Ratio	82.2	91.5	86.8	90.3						-	-	-	<0.1	%	NONE/PM
Leachant Volume	0.881	0.892	0.886	0.89						-	-	-			NONE/PM1
Eluate Volume	0.8	0.8	0.8	0.8						-	-	-		I	NONE/PM1
pH [#]	8.26	8.60	8.40	8.59						-	-	-	<0.01	pH units	TM73/PM1
Fluoride	7	3	4	4						-	-	-	<3	mg/kg	TM173/PM
Sulphate as SO4 #	<5	<5	6	58						1000	20000	50000	<5	mg/kg	TM38/PM
Chloride [#]	6	<3	14	33						800	15000	25000	<3	mg/kg	TM38/PM
											1				1

Client Name:	Ground Investigations Ireland
Reference:	20/07/9754
Location:	Bus Connect Route 14
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.

20/13792 1	R14-T		Depth	Sample No.	Date Of Analysis	Analysis	Result
		P03	0.50	2	19/10/2020	General Description (Bulk Analysis)	Soil/Stone
					19/10/2020	Asbestos Fibres	NAD
					19/10/2020	Asbestos ACM	NAD
					19/10/2020	Asbestos Type	NAD
					19/10/2020	Asbestos Level Screen	NAD
20/13792 1	R14-T	P03	1.30	5	19/10/2020	General Description (Bulk Analysis)	Soil/Stone
					19/10/2020	Asbestos Fibres	NAD
					19/10/2020	Asbestos ACM	NAD
					19/10/2020	Asbestos Type	NAD
					19/10/2020	Asbestos Level Screen	NAD
20/13792 1	R14-T	P04	0.50	8	19/10/2020	General Description (Bulk Analysis)	Soil/Stone
					19/10/2020	Asbestos Fibres	NAD
					19/10/2020	Asbestos ACM	NAD
					19/10/2020	Asbestos Type	NAD
					19/10/2020	Asbestos Level Screen	NAD
20/13792 1	R14-T	P04	1.30	11	19/10/2020	General Description (Bulk Analysis)	Soil/Stone
					19/10/2020	Asbestos Fibres	NAD
					19/10/2020	Asbestos ACM	NAD
					19/10/2020	Asbestos Type	NAD
					19/10/2020	Asbestos Level Screen	NAD

Client Name:Ground Investigations IrelandReference:9754-07-20Location:Bus Connect Route 14Contact:John Duggan

EMT Job No.	Batch	Sample ID	Depth	EMT Sample No.	Analysis	Reason
					No deviating sample report results for job 20/13792	
L						

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.: 20/13792

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.

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
ТМЗО	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 co- elutes with 3-methylpentane if present and therefore can give a false positive. Positive MTBE re	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 co- elutes with 3-methylpentane if present and therefore can give a false positive. Positive MTBE re	PM12	Modified US EPA method 5021A v2:2014. Preparation of solid and liquid samples for GC headspace analysis.	Yes		AR	Yes
ТМЗ8	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	



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



John Duggan
5th November, 2020
9754-07-20
Test Report 20/14655 Batch 1
Bus Connect Route 14
23rd October, 2020
Final report
1

Three samples were received for analysis on 23rd October, 2020 of which three 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

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Ground Investigations Ireland 9754-07-20 Bus Connect Route 14 John Duggan 20/14655

Report : Solid

EWIT JOD NO:	20/14000						_		
EMT Sample No.	1-3	4-6	7-9						
Sample ID	R14-TP01	R14-TP01	R14-TP01						
Depth	0.50	1.50	2.50						
	0.50	1.50	2.50					e attached n ations and a	
COC No / misc									
Containers	VJT	VJT	VJT						
Sample Date	21/10/2020	21/10/2020	21/10/2020						
Sample Type	Soil	Soil	Soil						
Batch Number	1	1	1				LOD/LOR	Units	Method
Date of Receipt	23/10/2020	23/10/2020	23/10/2020				LOD/LOK	Onits	No.
Antimony	3	1	<1				<1	mg/kg	TM30/PM15
Arsenic [#]	29.2	14.1	8.3				<0.5	mg/kg	TM30/PM15
Barium [#]	95	45	28				<1	mg/kg	TM30/PM15
Cadmium#	1.2	1.0	0.8				<0.1	mg/kg	TM30/PM15
Chromium [#]	167.7	38.1	65.0				<0.5	mg/kg	TM30/PM15
Copper [#] Lead [#]	54 117	19 40	14 11				<1 <5	mg/kg	TM30/PM15 TM30/PM15
Lead [*] Mercury [#]	0.6	<0.1	<0.1				<0.1	mg/kg mg/kg	TM30/PM15 TM30/PM15
Molybdenum [#]	2.3	1.5	0.9				<0.1	mg/kg	TM30/PM15
Nickel #	34.4	25.7	16.8				<0.7	mg/kg	TM30/PM15
Selenium [#]	2	1	<1				<1	mg/kg	TM30/PM15
Zinc [#]	113	59	48				<5	mg/kg	TM30/PM15
PAH MS									
Naphthalene [#]	0.05	<0.04	<0.04				<0.04	mg/kg	TM4/PM8
Acenaphthylene	<0.03	<0.03	<0.03				<0.03	mg/kg	TM4/PM8
Acenaphthene [#]	<0.05	<0.05	<0.05				<0.05	mg/kg	TM4/PM8 TM4/PM8
Fluorene [#]	<0.04	<0.04 0.04	<0.04 <0.03				<0.04 <0.03	mg/kg mg/kg	TM4/PM8
Phenanthrene [#]	0.06	<0.04	<0.03				<0.03	mg/kg	TM4/PM8
Fluoranthene [#]	0.71	0.07	0.04				<0.03	mg/kg	TM4/PM8
Pyrene [#]	0.65	0.06	0.04				<0.03	mg/kg	TM4/PM8
Benzo(a)anthracene#	0.60	0.09	<0.06				<0.06	mg/kg	TM4/PM8
Chrysene [#]	0.53	0.06	0.03				<0.02	mg/kg	TM4/PM8
Benzo(bk)fluoranthene [#]	0.96	0.08	<0.07				<0.07	mg/kg	TM4/PM8
Benzo(a)pyrene [#]	0.47	<0.04	<0.04				<0.04	mg/kg	TM4/PM8
Indeno(123cd)pyrene	0.33	<0.04	<0.04				<0.04	mg/kg	TM4/PM8
Dibenzo(ah)anthracene#	0.09	<0.04	<0.04				<0.04	mg/kg	TM4/PM8
Benzo(ghi)perylene [#]	0.37	<0.04	<0.04				<0.04	mg/kg	TM4/PM8 TM4/PM8
Coronene PAH 17 Total	0.09 5.24	<0.04 <0.64	<0.04 <0.64				<0.04 <0.64	mg/kg mg/kg	TM4/PM8
Benzo(b)fluoranthene	0.69	0.06	<0.04				<0.04	mg/kg	TM4/PM8
Benzo(k)fluoranthene	0.27	0.02	<0.02				<0.02	mg/kg	TM4/PM8
PAH Surrogate % Recovery	87	88	84				<0	%	TM4/PM8
Mineral Oil (C10-C40)	<30	<30	<30				<30	mg/kg	TM5/PM8/PM16

Client Name: Reference: Location: Contact: EMT Job No: Ground Investigations Ireland 9754-07-20 Bus Connect Route 14 John Duggan 20/14655

Report : Solid

EMT Job No:	20/14655			 	 				_		
EMT Sample No.	1-3	4-6	7-9								
Sample ID	R14-TP01	R14-TP01	R14-TP01								
Depth	0.50	1.50	2.50						Disease		
COC No / misc									3	e attached n ations and a	
Containers	VJT	VJT	VJT								
Sample Date			21/10/2020								
Sample Type	Soil	Soil	Soil								
Batch Number	1	1	1						LOD/LOR	Units	Method No.
Date of Receipt	23/10/2020	23/10/2020	23/10/2020								NO.
TPH CWG											
Aliphatics	.0.4	.0.4	.0.4						.0.1		Th 40.0 /Dh 44.0
>C5-C6 [#]	<0.1 <0.1	<0.1 <0.1	<0.1 <0.1						<0.1 <0.1	mg/kg mg/kg	TM36/PM12 TM36/PM12
>C6-C8 [#] >C8-C10	<0.1	<0.1	<0.1						<0.1	mg/kg	TM36/PM12
>C10-C12 [#]	<0.2	<0.2	<0.2						<0.2	mg/kg	TM5/PM8/PM16
>C12-C16 [#]	<4	<4	<4						<4	mg/kg	TM5/PM8/PM16
>C16-C21#	<7	<7	<7						<7	mg/kg	TM5/PM8/PM16
>C21-C35#	22	<7	<7						<7	mg/kg	TM5/PM8/PM16
>C35-C40	<7	<7	<7						<7	mg/kg	TM5/PM8/PM16
Total aliphatics C5-40	<26	<26	<26						<26	mg/kg	TMS/TM36/PM8/PM12/PM16
>C6-C10	<0.1	<0.1	<0.1						<0.1	mg/kg	TM36/PM12
>C10-C25	<10	<10	<10						<10	mg/kg	TM5/PM8/PM16
>C25-C35 Aromatics	26	<10	<10						<10	mg/kg	TM5/PM8/PM16
>C5-EC7 [#]	<0.1	<0.1	<0.1						<0.1	mg/kg	TM36/PM12
>C5-EC7 >EC7-EC8 [#]	<0.1	<0.1	<0.1						<0.1	mg/kg	TM36/PM12
>EC8-EC10 [#]	<0.1	<0.1	<0.1						<0.1	mg/kg	TM36/PM12
>EC10-EC12#	<0.2	<0.2	<0.2						<0.2	mg/kg	TM5/PM8/PM16
>EC12-EC16 [#]	<4	<4	<4						<4	mg/kg	TM5/PM8/PM16
>EC16-EC21#	10	<7	<7						<7	mg/kg	TM5/PM8/PM16
>EC21-EC35 [#]	77	<7	<7						<7	mg/kg	TM5/PM8/PM16
>EC35-EC40	10	<7	<7						<7	mg/kg	TM5/PM8/PM16
Total aromatics C5-40	97	<26	<26						<26	mg/kg	TMS/TM36/PMM/PM12/PM16
Total aliphatics and aromatics(C5-40)	97 <0.1	<52 <0.1	<52 <0.1						<52 <0.1	mg/kg	тистискимиринарине ТМЗ6/РМ12
>EC6-EC10 [#] >EC10-EC25	32	<10	<10						<0.1	mg/kg mg/kg	TM5/PM8/PM16
>EC25-EC35	64	<10	<10			[[[<10	mg/kg	TM5/PM8/PM16
MTBE [#]	<5	<5	<5						<5	ug/kg	TM36/PM12
Benzene [#]	<5	<5	<5						<5	ug/kg	TM36/PM12
Toluene [#]	<5	<5	<5						<5	ug/kg	TM36/PM12
Ethylbenzene [#]	<5	<5	<5						<5	ug/kg	TM36/PM12
m/p-Xylene [#]	<5	<5	<5						<5	ug/kg	TM36/PM12
o-Xylene [#]	<5	<5	<5						<5	ug/kg	TM36/PM12
DOD 00#	<5	<5	<5						<5	ua/ka	TM17/PM8
PCB 28 [#] PCB 52 [#]	<0 <5	<5 <5	<5						<5 <5	ug/kg ug/kg	TM17/PM8 TM17/PM8
PCB 52 PCB 101 [#]	<5	<5	<5						<5	ug/kg	TM17/PM8
PCB 118 [#]	<5	<5	<5						<5	ug/kg	TM17/PM8
PCB 138 [#]	<5	<5	<5						<5	ug/kg	TM17/PM8
PCB 153 [#]	<5	<5	<5						<5	ug/kg	TM17/PM8
PCB 180 [#]	<5	<5	<5						<5	ug/kg	TM17/PM8
Total 7 PCBs [#]	<35	<35	<35						<35	ug/kg	TM17/PM8

Client Name:
Reference:
Location:
Contact:
EMT Job No:

Ground Investigations Ireland 9754-07-20 Bus Connect Route 14 John Duggan 20/14655

Report : Solid

EMT Job No:	20/14655								
EMT Sample No.	1-3	4-6	7-9						
Sample ID	R14-TP01	R14-TP01	R14-TP01						
Depth	0.50	1.50	2.50				Please se	e attached n	otes for all
COC No / misc								ations and a	
Containers	VJT	VJT	VJT				Ì		
Sample Date	21/10/2020	21/10/2020	21/10/2020				1		
Sample Type	Soil	Soil	Soil						
Batch Number	1	1	1						Method
Date of Receipt	23/10/2020	23/10/2020	23/10/2020				LOD/LOR	Units	No.
Natural Moisture Content	22.6	11.9	3.7				<0.1	%	PM4/PM0
Moisture Content (% Wet Weight)	18.5	10.7	3.6				<0.1	%	PM4/PM0
									TH 400 (DI 400
Hexavalent Chromium [#] Chromium III	<0.3 167.7	<0.3 38.1	<0.3 65.0				<0.3 <0.5	mg/kg mg/kg	TM38/PM20 NONE/NONE
								.99	
Total Cyanide [#]	<0.5	<0.5	<0.5				<0.5	mg/kg	TM89/PM45
	0.44	0.70	0.00				.0.00	0/	The difference
Total Organic Carbon #	3.11	0.72	0.22				<0.02	%	TM21/PM24
Loss on Ignition [#]	7.3	2.5	<1.0				<1.0	%	TM22/PM0
pH [#]	8.36	8.51	8.97				<0.01	pH units	TM73/PM11
Mass of raw test portion Mass of dried test portion	0.1094	0.1025	0.0933					kg kg	NONE/PM17 NONE/PM17
mass of their test portion	0.09	0.09	0.09					ĸġ	NONE/FINIT/



Ground Investigations Ireland 9754-07-20 Bus Connect Route 14 John Duggan 20/14655

Report : CEN 10:1 1 Batch

	10	10	7.0						
EMT Sample No.	1-3	4-6	7-9						
Sample ID	R14-TP01	R14-TP01	R14-TP01						
Depth	0.50	1.50	2.50				Plassa sa	e attached n	otes for all
COC No / misc								ations and a	
Containers		VJT	VJT						
Sample Date									
Sample Type	Soil	Soil	Soil				 		
Batch Number	1	1	1				LOD/LOR	Units	Method
Date of Receipt	23/10/2020	23/10/2020	23/10/2020						No.
Dissolved Antimony#	0.002	<0.002	<0.002				<0.002	mg/l	TM30/PM17
Dissolved Antimony (A10)#	<0.02	<0.02	<0.02				<0.02	mg/kg	TM30/PM17
Dissolved Arsenic [#]	0.0030	<0.0025	<0.0025				<0.0025	mg/l	TM30/PM17
Dissolved Arsenic (A10)#	0.030	<0.025	<0.025				<0.025	mg/kg	TM30/PM17
Dissolved Barium#	< 0.003	<0.003	<0.003				<0.003	mg/l	TM30/PM17
Dissolved Barium (A10)#	<0.03	<0.03	<0.03				<0.03	mg/kg	TM30/PM17
Dissolved Cadmium [#]	<0.0005	<0.0005	<0.0005				<0.0005	mg/l	TM30/PM17
Dissolved Cadmium (A10)#	<0.005	<0.005	<0.005				<0.005	mg/kg	TM30/PM17
Dissolved Chromium#	<0.0015	<0.0015	<0.0015				<0.0015	mg/l	TM30/PM17
Dissolved Chromium (A10)#	<0.015	<0.015	<0.015				<0.015	mg/kg	TM30/PM17
Dissolved Copper [#]	<0.007	<0.007	<0.007				<0.007	mg/l	TM30/PM17
Dissolved Copper (A10) #	<0.07	<0.07	<0.07				<0.07	mg/kg	TM30/PM17
Dissolved Lead #	<0.005	<0.005	<0.005				<0.005	mg/l	TM30/PM17
Dissolved Lead (A10)#	<0.05	<0.05	<0.05				<0.05	mg/kg	TM30/PM17
Dissolved Molybdenum [#]	0.003	0.006	0.003				<0.002	mg/l	TM30/PM17
Dissolved Molybdenum (A10) #	0.03	0.06	0.03				<0.02	mg/kg	TM30/PM17
Dissolved Nickel [#]	<0.002	<0.002 <0.02	<0.002 <0.02				<0.002	mg/l	TM30/PM17
Dissolved Nickel (A10)#	<0.02	<0.02	<0.02				<0.02 <0.003	mg/kg mg/l	TM30/PM17 TM30/PM17
Dissolved Selenium#	<0.003	<0.003	<0.003				<0.003	mg/kg	TM30/PM17 TM30/PM17
Dissolved Selenium (A10) [#] Dissolved Zinc [#]	<0.003	<0.003	<0.003				<0.003	mg/l	TM30/PM17
Dissolved Zinc (A10) [#]	<0.03	<0.03	<0.03				<0.03	mg/kg	TM30/PM17
Mercury Dissolved by CVAF [#]	0.00001	<0.00001	<0.00001				<0.00001	mg/l	TM61/PM0
Mercury Dissolved by CVAF [#]	<0.0001	<0.0001	<0.0001				<0.0001	mg/kg	TM61/PM0
Total Phenols HPLC	<0.05	<0.05	<0.05				<0.05	mg/l	TM26/PM0
Total Phenols HPLC	<0.5	<0.5	<0.5				<0.5	mg/kg	TM26/PM0
Fluoride	<0.3	<0.3	<0.3				<0.3	mg/l	TM173/PM0
Fluoride	<3	<3	<3				<3	mg/kg	TM173/PM0
Sulphate as SO4 [#]	<0.5	<0.5	<0.5				<0.5	mg/l	TM38/PM0
Sulphate as SO4 [#]	<5	<5	<5				<5	mg/kg	TM38/PM0
Chloride [#]	<0.3	<0.3	<0.3				<0.3	mg/l	TM38/PM0
Chloride [#]	<3	<3	<3				<3	mg/kg	TM38/PM0
Dissolved Organic Carbon	3	<2	7				<2	mg/l	TM60/PM0
Dissolved Organic Carbon	30	<20	70				<20	mg/kg	TM60/PM0
Total Dissolved Solids [#]	58	43	<35				<35	mg/l	TM20/PM0
Total Dissolved Solids [#]	580	430	<350				<350	mg/kg	TM20/PM0

Element Materials Technology Ground Investigations Ireland Client Name: Report : EN12457 2 Reference: 9754-07-20 Solids: V=60g VOC jar, J=250g glass jar, T=plastic tub Bus Connect Route 14 Location: John Duggan Contact: 20/14655 EMT Job No: EMT Sample No 4-6 7-9 1-3 Sample ID R14-TP01 R14-TP01 R14-TP01 Depth 0.50 1.50 2.50 Please see attached notes for all abbreviations and acronyms COC No / mis Containers VJT VJT VJT Sample Date 1/10/202 /10/202 /10/202 Sample Type Soil Soil Soil Batch Numbe 1 1 1 Method Stable Nor LOD LOR Units Inert Hazardous No Date of Receipt 23/10/2020 23/10/2020 23/10/202 Solid Waste Analysis Total Organic Carbon* 3.11 0.72 0.22 3 5 6 <0.02 % TM21/PM2 Sum of BTEX <0.025 <0.025 <0.025 <0.025 mg/kg FM36/PM 6 TM17/PM Sum of 7 PCBs < 0.035 < 0.035 < 0.035 < 0.035 mg/kg Mineral Oil <30 <30 <30 500 <30 mg/kg /5/PM8/PM PAH Sum of 17 TM4/PM8 5.24 <0.64 <0.64 100 <0.64 mg/kg CEN 10:1 Leachate Arsenic # < 0.025 <0.025 <0.025 TM30/PM1 0.030 0.5 2 25 mg/kg TM30/PM1 Barium# <0.03 <0.03 <0.03 20 100 300 <0.03 mg/kg <0.005 <0.005 <0.005 0.04 5 <0.005 mg/kg TM30/PM1 Cadmium * TM30/PM1 <0.015 <0.015 < 0.015 <0.015 0.5 10 70 Chromium¹ mg/kg Copper # <0.07 < 0.07 < 0.07 2 50 100 < 0.07 mg/kg TM30/PM1 <0.0001 <0.0001 <0.0001 0.01 0.2 2 <0.0001 mg/kg TM61/PM0 Mercury TM30/PM1 0.03 0.06 0.03 0.5 10 < 0.02 mg/kg Molybdenum 30 TM30/PM1 Nickel # <0.02 < 0.02 <0.02 04 10 40 <0.02 mg/kg Lead # <0.05 <0.05 <0.05 0.5 10 50 <0.05 mg/kg TM30/PM1 TM30/PM1 <0.02 <0.02 <0.02 0.06 0.7 <0.02 5 mg/kg Antimonv Selenium " <0.03 < 0.03 < 0.03 0.1 0.5 7 < 0.03 mg/kg TM30/PM1 <0.03 <0.03 <0.03 50 200 <0.03 TM30/PM1 Zinc # 4 mg/kg Total Dissolved Solids 430 <350 4000 60000 100000 <350 mg/kg TM20/PM 580 Dissolved Organic Carbon 30 <20 70 500 800 1000 <20 mg/kg TM60/PM0 NONE/PM1 Mass of raw test portion 0.1094 0.1025 0.0933 kg Dry Matter Content Ratio 82.0 88.2 96.4 <0.1 % NONE/PM eachant Volume 0.88 0.888 0.897 NONE/PM1 I Eluate Volume 0.85 NONE/PM1 0.8 0.8 T pH units pH″ 8.36 8.51 8.97 <0.01 FM73/PM1 Fluoride <3 <3 <3 <3 mg/kg TM173/PM 20000 50000 TM38/PM0 Sulphate as SO4 <5 <5 <5 1000 <5 mg/kg Chloride # <3 <3 <3 800 15000 25000 <3 mg/kg TM38/PM0

Client Name:	Ground Investigations Ireland
Reference:	20/07/9754
Location:	Bus Connect Route 14
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
20/14655	1	R14-TP01	0.50	2	03/11/2020	General Description (Bulk Analysis)	Soil/Stones
					03/11/2020	Asbestos Fibres	NAD
					03/11/2020	Asbestos ACM	NAD
					03/11/2020	Asbestos Type	NAD
					03/11/2020	Asbestos Level Screen	NAD
20/14655	1	R14-TP01	1.50	5	03/11/2020	General Description (Bulk Analysis)	Soil/Stones
					03/11/2020	Asbestos Fibres	NAD
					03/11/2020	Asbestos ACM	NAD
					03/11/2020	Asbestos Type	NAD
					03/11/2020	Asbestos Level Screen	NAD
20/14655	1	R14-TP01	2.50	8	03/11/2020	General Description (Bulk Analysis)	Soil/Stone
					03/11/2020	Asbestos Fibres	NAD
					03/11/2020	Asbestos ACM	NAD
					03/11/2020	Asbestos Type	NAD
					03/11/2020	Asbestos Level Screen	NAD

Client Name:Ground Investigations IrelandReference:9754-07-20Location:Bus Connect Route 14Contact:John Duggan

EMT Job No.	Batch	Sample ID	Depth	EMT Sample No.	Analysis	Reason
					No deviating sample report results for job 20/14655	

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.: 20/14655

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.: 20/14655

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
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.	Yes		AD	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	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
ТМ36	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 co-elutes 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
ТМ36	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 co-elutes 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
ТМ38	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
ТМ38	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	



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W: www.element.com

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



John Duggan
17th November, 2020
9754-07-20
Test Report 20/15510 Batch 1
Bus Connect Route 14
9th November, 2020
Final report
1

One sample was received for analysis on 9th November, 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:

Phil Sommerton BSc Senior Project Manager

Please include all sections of this report if it is reproduced

Client Name:
Reference:
Location:
Contact:
EMT Job No:

Ground Investigations Ireland 9754-07-20 Bus Connect Route 14 John Duggan 20/15510

Report : Solid

						-		
EMT Sample No.	1							
Sample ID	R14-TP01							
Depth	2.00					Please se	e attached n	otes for all
COC No / misc						abbrevi	ations and a	pronyms
Containers	т							
Sample Date	21/10/2020							
Sample Type	Soil							
Batch Number	1					LOD/LOR	Units	Method
Date of Receipt								No.
Chloride (2:1 Ext BRE)#	0.008					<0.002	g/l	TM38/PM20
Sulphate as SO4 (2:1 Ext) [#]	0.0059					<0.0015	g/l	TM38/PM20
Organic Matter	0.5					<0.2	%	TM21/PM24
рН [#]	8.74					<0.01	pH units	TM73/PM11
P11	0.17						p anno	

Client Name:Ground Investigations IrelandReference:9754-07-20Location:Bus Connect Route 14Contact:John Duggan

EMT Job No.	Batch	Sample ID	Depth	EMT Sample No.	Analysis	Reason
					No deviating sample report results for job 20/15510	

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.: 20/15510

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.

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 B Indicates analyte found in associated method blank. DR Dilution required. M MCERTS accredited. NA Not applicable NAD No Asbestos Detected. ND None Detected (usually refers to VOC and/SVOC TICs). NDP No Detected (usually refers to VOC and/SVOC TICs). NDP No Detected (usually refers to VOC and/SVOC TICs). NDP No Detected (usually refers to VOC and/SVOC TICs). NDP No Detected (usually refers to VOC and/SVOC TICs). 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 Matorials Technology approved laboratory. AD		
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ME Matrix Effect NFD No Fibres Detected BS AQC Sample LB Blank Sample N Client Sample TB Trip Blank Sample	со	Suspected carry over
NFD No Fibres Detected BS AQC Sample LB Blank Sample N Client Sample TB Trip Blank Sample	LOD/LOR	Limit of Detection (Limit of Reporting) in line with ISO 17025 and MCERTS
BS AQC Sample LB Blank Sample N Client Sample TB Trip Blank Sample	ME	Matrix Effect
LB Blank Sample N Client Sample TB Trip Blank Sample	NFD	No Fibres Detected
N Client Sample TB Trip Blank Sample	BS	AQC Sample
TB Trip Blank Sample	LB	Blank Sample
	N	Client Sample
OC Outside Calibration Range	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
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.			AD	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		AD	Yes
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



Issue :

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 ac-MR Attention : John Duggan Date : 4th December, 2020 Your reference : 9754-07-20 Our reference : Test Report 20/16726 Batch 1 Bus Connect Route 14 Location : Date samples received : 27th November, 2020 Status : Final report 1

One sample was received for analysis on 27th November, 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:

Phil Sommerton BSc Senior Project Manager

Please include all sections of this report if it is reproduced

Client Name:
Reference:
Location:
Contact:
EMT Job No:

Ground Investigations Ireland 9754-07-20 Bus Connect Route 14 John Duggan 20/16726 Report : Solid

ENIT JOD NO:	20/16/26								
EMT Sample No.	1								
Sample ID	R14-TP03								
Depth	1.00								
COC No / misc						Please see attached notes for al abbreviations and acronyms			
Containers									
Sample Date									
Sample Date									
Batch Number									
Date of Receipt						LOD/LOR	Units	Method No.	
Chloride (2:1 Ext BRE) [#]	0.009					<0.002	g/l	TM38/PM20	
Sulphate as SO4 (2:1 Ext) [#]	0.0200					<0.0015	g/l	TM38/PM20	
Organic Matter	1.1					<0.2	%	TM21/PM24	
рН [#]	8.56					<0.01	pH units	TM73/PM11	
P	5.00					-0.01	Privillo		

Client Name:Ground Investigations IrelandReference:9754-07-20Location:Bus Connect Route 14

Contact: John Duggan

EMT Job No.	Batch	Sample ID	Depth	EMT Sample No.	Analysis	Reason
20/16726	1	R14-TP03	1.00	1	Chloride, pH, Sulphate	Sample holding time exceeded prior to receipt

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.

Notification of Deviating Samples

Matrix : Solid

NOTES TO ACCOMPANY ALL SCHEDULES AND REPORTS

EMT Job No.: 20/16726

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.

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
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М	MCERTS accredited.
NA	Not applicable
NAD	No Asbestos Detected.
ND	None Detected (usually refers to VOC and/SVOC TICs).
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SS	Calibrated against a single substance
SV	Surrogate recovery outside performance criteria. This may be due to a matrix effect.
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+	AQC failure, accreditation has been removed from this result, if appropriate, see 'Note' on previous page.
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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

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Appendix E

Historical Ground Investigation Data

(IRACI Cramptons, Li on No. 4. <u>for</u> Ove, Arup & P	artne	rs.		B	OREHOLE Order				a e e e	
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PENETR TION TESTS RESULTS.

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as sample recovered: Hes/No	Is bole "Blowing"L Yes/No
is Sampte recovered; res/NO	Was sample recovered: Yes/No
ter level at time	Water level at time
of test:	of test:
NIL.	
natration Blows per 3"	Penetration Blows per 3"
0" - 0'3"	Penetration Blows per 3" O'O" - O'3"
2	00 - 00
3" - 0'6" 1	013" - 016"
i6" - 0'9" 2	01611 - 01911
	** ************************************
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1311 - 11611 3	
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14.1 - 1 ičii	7162 7100
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ps of test: Holdew-shoe/Solid	Type of test: Hollow shee/folid cone
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n an	D	epth		1	5	Samples	1		
Description of Strata	From	To	Thickness	Ref No.	Туре	Depth			
Concrete and filling.	-	5'0"	510"						
19. 01 (1 9.			<u> </u>				-	-	
Si v sand and gravel.	5101	10'0"	5'0"	12360	J	5101-6161			
Gravel.	10'0"			<u> </u>	J	10'0"-11'6"			· •
1		15'0"	51011	12361 12362	Ĵ	15'0"-16'6"			
Firm black boulder clay.	1510"			12363 12364	J	20'0"-21'6"			
- 3		25'0"	10'0"	12364	J	20101-21161 25101			
Boulders.	25'0"	2516"	6"				· · ·		
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2.4 Notes suggesting to a second						· · · · · · · · · · · · · · · · · · ·			
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	- 				1		ł	l.	

	Difficit a Dignature.	Date.	F - ``
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This form to be returned to Head	I Office immediately the borehole is complete	ed.	l i
			È.
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PETETRAL	TION TESTS RESULTS. In 1D: 54114
1 - h	
Cramptons.	BORTHOLE NO: 5.
f test: 510" to 616"	Dept' of test:
test: Hollow stoe/Solid Cone	Type of test: Hellow-shoe/Solid Cone Is hole "Blowing"L - Yes/No Was sample recovered: Yes/No-
"Blowing": Yee/No	Is 'ole "Blowing"L Yes/No
mple recovered: Yes/No	Was sample recovered: 465/20-
evel at time of test: NIL.	Water level at time of test: NIL.
tion Blows per 3"	Penetration Blows per 3"
Blows per 3" 0'3" 3 0'6" 3	
3	0'0" - 0'3" <u>5</u> 0'3" - 0'6" 8
s 0101 S	0'3" - 0'0"
. 019 ¹¹ 2	016" - 019" 13
- 1 ^{°On} 3	0'9" - 1'0" 20
113" 3	1'0" - 1'3" 18
· 1 ⁷ 6" 3	
	1'3" - 1'6" 27
ំ ៍ ខ្មែរ	116" 119"
- 2 MM	1.10.1
12 UDBS steberson to to	Deput of test: 25:00 To25:2"
I tust: Hellon-erce/Sulid	Type of test: Hellow-shoe/Colid cone
"Elouing": Yes/No	Is bole "Blowing": ¥95/No
The recovered: Yes	Was sample recovered: Yes/No
ut time NIL	Water sample at time
<u>Blows per 3ⁿ</u>	of test: NIL Penetration Blows per 3"
	mijan kana kana maa maa ka k
0121 2	$B_{1}C_{1} - C_{1}B_{1} - C_{2}$
0161 4	013" - 016" Refusal
0 103	0167 - 0191
<u>1 10¹¹ 7</u>	0101 - 0101
12 1/31 12	110" - 113"
136 10	113" - 116"
197	116" - 119"
S 10a	7 19"** 2 10"
t test: 2010" to.21.'6"	Depth of test
f test: Hollow-sheo/Solid cone	Type of test: Hollow s'oe/ olid cone
e "Blowing": -¥es/No	Is "old "Blowing": Yes/No
aple recovered: Yes/No-	Was sample recovered: Yes/No
loval at time	Waterlevel at time
	of test:
Blows rur 3"	Penetration Blows per 3"
. 931 7	0'0"
······································	0131 - 0161
n 0199 23	0:6: - 0:9:
.್ರು ³ 40	0:51 - 7.10"
- <u>2/3</u> ° <u>45</u>	1:0" - 1'3"
- 1°6' 37	
***************************************	116" ~ 219"
- 119° - 2°0°	
orm to be completed and returned wit retole in which tests have been made	by Boring immediately after completion of
	Datessessesses Driller
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R263

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THE CEMENT	OIL INVESTIGA		JUAND,	m	v 10: 5411	3	
BC	RING REC	CORD		•	,		
TRACT Cramptons, Limit	ed.	В	OREHOL	E No	. 4.		and the second se
gt No. 2.			Ord	er No).		
d for Ove Arup & Partne	ers.						
Address Hammersmith Work	s, Pembroke Roa	ad.					
ig Commenced 26/10/64.		Boring (Completed	27/	10/64		
of Boring Shell & Aug	er.	Diameter	of Bore	hole	191	ins.	
and Level O.D.							
r Struck (1) (2)	(3)						
ling Water Level							
arks Dry Soreho	Le.						
Description of Strata	Depth From To	Thickness	Ref No.	Type	Samples		
Correte and filling.					Depth		
	3'0"	3'0"					
Very soft silty sand.	31011					-	
an an a guran an a	12'0"	9'0"			and the second sec		
Firm black boulder	12'0"		12352	J	15'0"-16'6"		
clay.	25'0"	13'0"	12353	U	2010"-2116"		
· · · · · · · · · · · · · · · · · · ·							
8) Westerne andere andere en de service de service de service de la service de service de la service de la serv	╺╺┨╧┵┶┶╧┝╕╕┱┱┲┲┱						
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an Manakatan di Manakatan Indonesia di Kanggan Jala a sa Manakagi mga sa sa kata kata kata kata kata kata ka				<u>↓</u> .		-	
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and There is a second of the second			<u> </u>			-	
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Filler a

A STATE OF A

U-- Undisturbed Sample D-- Large Disturbed Sample J-- Jar Sample W-Water Sample R263

	- Maistai Oca	Sample D Lat	ge Distarted Dampie 5 - 541	sample in water sample					
by :		Date:	Driller's Signature:	Date:					
<u></u>	This form w he returned to Wood Office town it of a finite the first of the								

PULLISUE mound DENTRY PROTAGE

1

Inv 10: 54113

1

R263

cramptons.	BORTHOLE NO: 1
of test: 15.0" to.16.4" of test: Hollow-e-ee/Solid Cone clo "Blowing": Yes/No sceple recovered: Hes/No level at time	Depth of test:
T∦ T T ♥	
tration Blows per 3"	Penetration Blows per 3"
013 ^a 5	010" - 013"
- 0 ¹ 6 ¹¹ 10	013" - 016"
<u>2 0°911 20</u>	016" - 019"
- 1'tö ^{tt} 14	0 ¹ 9 ⁱ - 1 ¹ 0 ¹
~ 1 ¹ 3 ¹ 12	1'0" - 1'3"
	1')" - 1'6"
<u> </u>	1 ^{16¹⁷} - 1 ¹⁹ "
- of tool secondossess to sea	Deptr of test:
of tost: Hollow she /Solid ole "Blowing": Yes/No part" a recovered: Yes/No r 1 at time	Type of test: Hollow shoe/Solid cone Is hole "Blowing": Yes/No Mater sample at time
Of Sects NIL.	of test:
DLOWS per 3"	Penetration Blows per 3"
<u>013</u> " <u>5</u>	<u> 3'0" - 0'3"</u>
<u>- 016" 23</u> - 016" 40	013" - 016"
	0161 - 0191 0161 - 0191
- 210 ² Refusal.	
- 115	115" 116"
- 1 isa] 1611 - 11912
· - 2 · 0 ·	1,6 5,0.
to of vest; Hollow shee/Solid cone of test: Hollow shee/Solid cone of "Blowing": Yes/No sample recovered: Yes/No The of at time test	Depth of test Type of test: Hollow Boe/Solid cone Is bole "Blowing": Yes/No Was sample recovered: Yes/No Waterrevel at time of test.
Con Blows per 3"	Penetration Blows per 3"
. 031	010" 4. 0.3"
* 0 2 1	0:6" - 1:0"
• <u>•</u> <u>•</u>	1'0" - 1'3"
- <u>1</u> :31	1133 - 116"
<u>. 1</u> 3ª	1 ¹ 0" - 1 ¹ 9"
	1 1/93 - 2:03
bere to be completed and returned wit	Boring immediately after completion of
	Date: Driller

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BO	RING	REC	ORD	γn		54112	
NTRACT Cramptons, Limite	ed.		В	DREHOL			
ort No. 1.				Orde	r No	•	
d for Ove, Arup & Ptns.							
Address Hammersmith Works	, Balls	sbridge			2		
ng Commenced 29/10/64. e of Boring Shell & Auger						0/10/64.	ina
und Level $2 \ge 2$ O.D.	- 4.0	m mah	Diameter	of Borel.	10:6	1.7.	iņs.
er Struck (1) 10'0" (2)	10	(3)				,	
ding Water Level		2012	0.1(1)				
water level at star Water level at end			0"₿•G				
Description of Strata	From	enth To	Thickness	Ref No.		amples Depth	
Silty sand and gravel.	0	10'0"	10'0"				
Cavel.	1.0 · 0 [·]						
		12'0"	2101	12356	J	10 10"	
Lirm black boulder clay.	12'0"	2] ' 6"	91611	12357 12358	J J	15'0" 20'0"	
Large boulders.	21.6"	2510"	31611	12359	Л	2510	
				halmand at a	<u>v</u>		
			1 m 40 mm 1000 40 mm 100 mm	·			
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R263

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State 1 willing

This form to be returned to Head Office immediately the barehole is completed.

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SUIL Inv ID: 5 PENTRATION TESTS RESULTS. BORTHOLE NO: 2. Cramptons. to. 15'0" to. 16'6" Depth of test: to test: Hellew-ebee/Solid Cone Type of test: Hollow shoe/Solid Cone "Blowing": Yos/No Is 'ole "Blowing"L Yes/No ple recovered: Yes/No Was sample recovered: Yes/No level at time Water level at time of test: of test: NIL Blows per 3" Blows per 3" stration Penetration 0'0" - 0'3" ···· - 0'3" <u>5</u> 9 013" - 016" ··· ·· 016" 12 016" - 019" - 1'0" 🖓 🖌 110⁸ 0:01 18 - - 1137 1:0" - 1'3" 18 134 - 1361 1'0" - 1'6" 23 1 - 1 Sigit 1:5" - 119" 1.129 2151 2 '0" to of lost tourseese tourseese Depch of test: To ... Type of test: S of tast: Hollow shoe/Solid Hollow shee/colid cone ho? "Blowing": b recovered: Yee/No To hole "Blowing": Yes/No Yas/No Was sample recovered: Yes/No Water sample at time NIL. ______ of test: cobratilen. Blows per 3" Penetration Blows per 3" B'O" - 013" ST 14 0131 12. 013" - 016" 21 - 2161 10 0161 - 0191 5" ... U 15" 10 01511 - 1011 24 - LICH 12 - 1194 1'0" - 1'3" 18 34 - 1161 34 - 1154 113" - 116" 116" - 119" 31 719" -- 210" Depth of test Site Digit 12:0".... to. . 15:2". WH ON TOBUS to bo of test: Hellow-ebeo/Sulid cone Type of test: Hollow shoe/ olid cone tole "Blowing": Yes/No Is "ole "Bloring": Yes/No serple resovered: " Yes/No Was comple recovered: Yes/No Waterlevel at time of test 20101 B.G.L of test: Blows per 3" ictration Penetration Blows per 3" 01011 4. 01311 2" 37 0157 -- 0169 Refusal. a 0.98 1.02 - 1.12a 1.02 - 1.13a <u>ه زان م</u> 1:0" - 1:9" 1:9" - 2:0" " <u>5</u> 7.19" - 2. jo? s form to be completed and returned with Boring immediately after completion of bore-ole in which tests have been made. Date: association to one. Driller....

R263



THE CEMENTATION CO., (IRELAND) LTD.

SOIL INVESTIGATION

BORING RECORD

A.	CONTRACT	G.	&	T.	Crampton	Ltd.,
	Report No.	4				

G. & T. Crampton, Ltd.,

Shell & Auger

Hammersmith Works, Ballsbridge.

BOREHOLE No. 4

Order No.

Inv

Boring Completed 9/7/63

(3)

Diameter of Borehole 15

ins.

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1D: 54111

Standing Water Level

Water Struck (1) 10'0"

Boring Commenced 9/7/63

226

Bored for

Site Address

Type of Boring

Ground Level

Remarks Water level at end of day 10'0" below surface.

O.D.

(2)

Description of Strata		From	pth To	To		Ref No. Type Depth		
· · · · · · · · · · · · · · · · · · ·	<u>.</u>	0		······································				
Concrete and filling	14. 1		216"	216"	9040		0.404 0.404	
concrete and filling	19.5		2 • b • •	2.0	3943	J	2'6"-3'0"	
Very soft silty sand	13	2*6*	9″0″	6*6*	3944	т	5"0"-6"0"	
		9*0**		· · · · · · · · · · · · · · · · · · ·		·	······································	
Silty sand, gravel and	= tones		10104	1.0**	3945	J	9'0"-10'0"	
anna an an t-airt a chuir ann an ann ann ann ann ann ann ann ann	12						en han an beite mennen per versen en de sen de La manuel de la manuel de sen de s	
1999 1997 1997 1997 1997 1997 1997 1997								
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ar a tualing a la company a substant an anna a substant a substant a substant anna anna an anna an anna an ann				-				
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nen stån stang av en verde flygter opproces et syn ^a t det i blev ennet et holdt stånde om overade de bære bet des at fik ter en en ver		┠┼┼┼┼┼┼		· · · · · · · · · · · · · · · · · · ·			ana ana amin'ny fisiana amin'ny fisiana amin'ny fisiana amin'ny fisiana amin'ny fisiana amin'ny fisiana amin'ny	
gener (y to be y to the set of the							9 alla - da 68 a 1993 alla falla (kala da 1993) a 1984 a anna 1993 a anna 1993 a anna 1993 a anna 1993 a 1993	
an an an san an a							1996 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 -	
1924 - 4 January 1979 - 1977 - 1977 - 1977 - 1977 - 1978 - 1977 - 1977 - 1977 - 1977 - 1977 - 1977 - 1977 - 197	.			da 1 dayan darahkaran da ana ang da ang d		ļ	n ar mara an ant a thaile dhalada a sa ga da an an an ang balan ang 17-17-170.0	
ау да, на на насном полото попата подата спората спора по со на пола на и се у се у селу насе да селу и насе и								
			$\left \begin{array}{c} \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\$					
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			╋╕╧┿╧					

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	THE CEMENTATIO	TEST RESULTS	Inv 1D: 54111
	in and the second s	1 <u>051 [63001/10</u>	BOREHOLE NO: 4
NTRACT: Crampton	الالون المرتبي والمستعمر والروج ومرجبا وبنزور وموسع مستعال فالموزور فسيتنج المراز فروا فيروز ومنهد	A Martin State and a state of the	· · · · · · · · · · · · · · · · · · ·
-	0'0" to 11.6"	•	to
	AXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX	- V 1	ow shoe/Solid Cone Yes/No
Is hole "Blowing":		Is hole "blowing":	
Was sample recover Nater level at tim		Was semple recovered Water level at time	I: IES/NO
of test:	"B	of test:	
	10:0"	Develophic	Blows per 3"
Penetration	Blows per 3"	Penetrction	Brows ber 2.
01011 - 01311	1	$\frac{010^{11} - 012^{11}}{013^{11} - 016^{11}}$	
)13" - 016"	2		
$16^{11} - 019^{11}$	1	$\frac{0!6!!}{0!9!!} - \frac{0!9!!}{1!0!!}$	
$10^{10^{11}} - 1^{10^{11}}$	· 3 1	1'0'' - 1'3''	
1311 - 11611		113" - 116"	
1611 - 11911		116'' - 19'' 119'' - 20''	
[1911 - 21011		1.3" = 2.0"	
Dopth of test:		Depth of test:	to
Type of test: H		Type of test: Ho	ollow shoe/Solid cone
ts hole "blowing":	conc Yes/No	Is hole "blowing":	Yes/No
Vas sample recover		Was sample recovered	
Noter level at tin		Water Level at time	
of test:		of test:	والمحافظ المالية المراجع المراجع المراجع المراجع والمراجع المراجع والمراجع والمراجع والمراجع والمراجع والمراجع
Penetration	Blows per 3"	Penetration	Blows per 3"
010" - 013"		010" - 013"	
01311 - 01611	والمرابقة والمرابقة والمرابعة والمرابعة والمتعاولين والمتعادية والمرابع والمرابع والمرابع والمرابع والمرابع	013" - 016"	
0161 - 01911	ĸĸĸĔĬĔĸŔġĸġġĊĸĬĬĬĬĸġĔĊĸĬġĸĸġĔĊŎġĸĸĸĸĸĸġĬĸġĔĬĬĬĸĔĬĬŔġĬŔĸĔĬŔġŎġĊŎĸŎĬŎĿġĬĬĬŔĸĔĬŔĔ	0161 - 0191	
019" - 110"	والاعتراب المحادث والمعادية والمحادث والمعادية والمحادث والمحادث والمحادث والمحادث والمحادث	019" - 110"	
L'O" - 1'3"	۱۹۰۰ - ۲۰۰۰ - ۲۰۰۰ - ۲۰۰۰ - ۲۰۰۰ - ۲۰۰۰ - ۲۰۰۰ - ۲۰۰۰ - ۲۰۰۰ - ۲۰۰۰ - ۲۰۰۰ - ۲۰۰۰ - ۲۰۰۰ - ۲۰۰۰ - ۲۰۰۰ - ۲۰۰۰	7.101 - 1131	
113" - 116"	, 	11311 - 21611	
116" - 119"	************************************	116" - 119"	
	- الجواريين والمرسان من يسير المركوماتين وفار من المركوماتين وفيدولي المركز المركز المركز المركز المركومات وفر		nen Traditalaristysette allenanse allen de sterate allenanse, header alger erene allen
1911 - 21011		119" - 210"	
Depth of test:	to	Depth of test:	to
•	ollow shoe/Solid cone	Type of test:	Collow shoe/Solid cone
Is hole "blowing":		Is hole "blowing":	Yes/No
Was sample recove:	red: Yes/No	Was sample recovered	1: Yes/No
Nater level at tim	De	Water level at time	
of test		of test:	
Penetrotion	Blows per 3"	Penetration	Blows per 3"
010" - 013"		01011 - 01311	
013" - 016"		01311 - 01611	
0161 - 0191		0161 - 0191	
019" - 110"	and the second s	01911 - 11011	
1'0" - 1'3"		110" - 113"	
113" - 116"	**************************************	1:3" - 1:6"	
1161 - 1191		116" - 119"	
1'9" - 2'0"		119" - 210"	
	· ·		
This form to be	completed and returned y borehole is which to	d with Boring Record	immedictely ofter

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R263

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•	THE CEMENTATION	CO., (IRELAND) LTD.
•	SOIL INVEST	IGATION
	BORING I	RECORD
. *	CONTRACT G. & T. Crampton, Ltd.,	BOREHOLE No. 2
	Report No. 2	Order No.
	Bored for G. & T. Crampton, Ltd.,	
	Site Address Hammersmith Works, Ballsbridge	3.
	Boring Commenced 6/7/63	Boring Completed 6/7/63
	Type of Boring Shell & Auger	Diameter of Borehole 15 ins.
	Ground Level 22 E DO.D.	
•	Water Struck (1) LO'O" (2)	(3) INV 10: 54109
	Standing Water Level	ynv i 🔾 –

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R263

12

March Che

Remarks Water level at end of day 10'0" below surface.

Description of Strata		Depth		Thickness	Samples			
		From	To	_	Ref No.	Type	Depth	
	22	0						
Concrete and filling	18		4.0.	4*0*	3937	U	5*0*6*6*	
	18	4"0"						
Soft sand with clay	14		8"0"	4"0"	3938	J	9*0**-10*0**	
	14	8"0"						
Clay, sand and gravel.	12		10'0"	2"0"				
	•							
							a she tar	
man na mangan tahun kana yangan yang yang yang kanang yang kanang yang kanang yang mangang mangang kanang yang Man	· · · · · · · · · · · · · · · · · · ·	a fan fan de fan fan de fan F		a affi first a standard a first an a decaração bases	an a		an an a' su a' suite ann an	
			alanda a kanda ada ada ada ada a					
inna a channa an ann an Anna ann an Anna ann an Anna an		ti datata ka ka ka ka		1 81 97 1 1010 10 10 10 10 10 10 10 10 10 10 10	analisation a constant of the second seco		······································	
			ain dianta di cinata dan			1.1		
nanar a sanahin amini kapit hini turi masa arta menangkan katang tahun turu katang dari katang dari kanar kapa							1997-1997-1997-1997-1997-1997-1998 day uniqui 1997-1977-1988 (uniqui uniter del 1987-1987-1987-1987-1987-1987-	
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an ang ang ang ang ang ang ang ang ang a				1997 - 1977 - 1984 - 1984 - 1975 - 1975 - 1984 - 1984 - 1985 - 19			ne versenagen, arbeiten in 14 dage i i 18 mehreter viz istinde i 15 d	
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				a na 198 mili don a se so na managana ana ina ana	m a nag Merri I adastr menink ti ta		name and a second s	
er in som fils men som				100 / 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1			-	
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na ang na pang na								
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ode: UUndisturbed Sample	·	arge Distu	l		ar Samp		W– Water Sa	

THE GEMENTATION COMPANY LIMITED

R263

2

	PENETRATION	TEST RESULTS	Vnv ID/ SHOY
ONTRACT: Crampto)ns		BOREHOLE NO: 2
-	10'0". to .11'6"	•	to
• •	Solid Cone		
Is hole "Blowing"		Is hole "blowing":	Yes/No
Was sample recove		Wes sample recovered	: Yes/No
Weter level at ti	.me	W: ter level st time	
, of test:	100"	of test:	
Penetrction	Blows per 3"	Penetr _{ tion	Blows per 3"
01011 - 01311	2	01011 - 01311	
01311 - 01611	•	013" - 016"	
01611 _ 01911	2	01611 - 01911	
019" - 110"	3	019" - 1'0"	
110" - 113"	4	110" - 113"	
113" - 116"	7	<u>1131 - 1161</u>	
1'6" - 1'9"		116" - 119"	
113" - 2101	a fann an	11911 - 21011	
Depth of test: Type of test:	+o Hollow skoe/Solid	Depth of test: Type of test: Ho	bllow shoe/Solid cone
Is hole "blowing"	cone : Yes/No	Is hole "blowing":	Yes/No
Was sample recove		Was sample recovered	l: Yes/No
Woter level at ti		Water level at time	· · · · · · · ·
of test:		of test:	
Penetration	Blows per 3"	Penetration	Blows per 3"
0'0" - 0'3"	and a second	010" - 013"	
013" - 016"	۵۰۰۰ ۵۰۰۰ ۵۶ ۵۰۰ ۵۲ ۵۰۰ ۵۰۰ ۵۰۰ ۵۰۰ ۵۰۰ ۵۰۰ ۵۰۰ ۵۰۰	013" - 016"	
0161 - 0191	an dan kerangkan di kana dan di kana dan dan dan dan dan dan dan dan dan	0161 - 0191	
019" - 1'0"	₩₩₩₩₽₩₩₩₽₩₩₩₩₩₩₩₩₩₩₩₩₩₩₩₩₩₩₩₩₩₩₩₩₩₩₩₩	019" - 110"	
1'0" - 1'3"		1.10" - 113"	
1131 - 1161		$113^{11} - 216^{11}$	
1161 - 1191		1'6" - 1'9"	,
119" - 210"		119" - 210"	
Depth of test:	to	Depth of test:	to
-	Hollow shoe/Solid cone		Hollow shoe/Solid cons
Is hole "blowing"		Is hole "blowing":	Yes/No
Was sample recove		Was sample recovered	· .
Water level at ti	•	Water level at time	
of test	-UK3	of test:	
Penetration	Blows per 3"	Penetration	Blows per 3"
0101 - 0131	<u> </u>	01011 - 01311	
01311 - 0161		0131 - 0161	······································
0161 - 0191	· · · · · · · · · · · · · · · · · · ·	016" - 019"	
0191 - 1101		0191 - 1101	an a
1'0" - 1'3"	·	110" - 113"	
113" - 116"	· · · · · · · · · · · · · · · · · · ·	1.13" - 116"	
1:6" - 1:9"	·	1161 - 1191	
119" - 210"		119" - 210"	

D te.....Driller.....

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MURPHY INTERNATIC	NAL	BOREHOL			
CONTRACT A.I.B. Ballsbridge			REPORT No.		
Borod for J. McCullouch & Fartners	3•		Ground Level	1	
ite Address Merrion Road.			Buring Comm Buring Compl	enced 3.12	
Type and Dis. 10" Digmeter, Shell ar	nd Auger.	Nx dismond	coring.		
Water Strikes	Water Levels	Recorded During 6	loring		
1.17*0" Hole Depth 2. Cesing Depth 3. Water Level		-			
Remarke FVC casing insected for d Total obstructions noted.		ill.			
Description	Scale Depth		Sampi 1. No. Type	les & S.P.T. Depth	
Nade ground with traces of top soil and cinders, brack, clay et Sand, gravel, cobbles and boulde	71 6"				
Dark brown, black silty very stoney clay with coelles and boulders.	2210"				
Politics: 5.	2810"				
Broken and shattered rock, gray Limestone.	58±0.n		coring from		

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R331

R331

ONTRACT				RING	REU		OREHOL	E No	1	j.
eport No.	A.I.B.	H	4•			Đ		er No.	ł	<i>i</i>
ored for	Joseoh	Mri	<u></u>	ugh & P	artners.		010	ci 100.		
te Address				ublin 4						
oring Commenced	23/1/1		3-, -		•	Boring (Completed		25/1/1	1974.
pe of Boring	Percus		_			-	r of Boreh	ole	15	ins.
round level	PALCOS		D.D.							
ater Struck (1)	14' B.	G.I. ¹	(2)		(3)					
anding Water Level	14' 8.					-				
marks	All le	vel	s are	a relate	d to gr	ound lev	vel.	(NV	(D	
······································									4957	l
Description	of Strate			De From	pth To	Thickness	Ref No.		mples Depth	
				D						
Top Soil.					2'0"	2'0"	8718	0	0 -	2'
Filling of cla	y brick	et et	с.	2101						
		610	8'0"	6'0"	8719		2'-	81		
Brown/gray sand	y silt.	,		810" 24 t.3						
Firm/stiff ver	v sandy	, si	1 t.		13'0".	510"	8720	0	8'-	131
with traces of				13:0"	16'0"		8721		13'-	
Compact fine t			andy	16'0"				┟╙╌┼╴		<u> </u>
gravel with sc	ome clay	′		4.377	18'0"	2*0"	8722	D	1b'-	18'
Compact medium gravel with la				the second second		r F				
_some_sand				5486	20'0"	2'0"	8723	C C	18'-	201
Stiff black si with cobbles a				20'0"	2610"	6'0"	8 7 24		20'-	251
· · · · · · · · · · · · · · · · · · ·	<u> </u>	,		26'0"	2010	0.0	0124	0	Z49. –	
Final level Rock or Boulde	85.			790,4	2616"	016#				
					ELTY					
STANDARD PENET	PATION	TEC	TS							
								+		{
at 5 56" 15 at 10'6" 15	blows blows	to to	12" 12"	L		1)			
at 15'6" 48	blows	to	12"	<u> </u>						
at 19'0" 50	blows			Refusal	•					
							1		ning and in the generation	
						:				
an ann an Alban ann an t-rinn a tre ann an				<u></u>	h	a thu i shaara				1

R331

SITE INVESTIGATIONS LTD. SOIL INVESTIGATION

BORING RECORD

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i RACT	A. I	. 1	В.	H	Q			В	OREHOL	.E2 No.	2
port No.									Ord	er No.	
ored for	ിറടെല	nh	Mic	r.	սիյն	ugh & Pa	rtners.				
e Address						ublin 4.	•				
ring Commenced	28/1			-	, 2.	GDIII -•		Boring C	Completed		1/2/1974
pe of Boring	Perc							-	r of Borel		1/2/15/4
round level	FOLU		310).D.						10
ater Struck (1)	14'8	C	1.		(2)		(3)			INV	. D
anding Water Leve						31/1/197				Su	1958
marks	Chis	el	lin	ð.	7÷ h	ours. Ov	structi				
					•	All leve	oth	1			amples
Descript	tion of St	Lrota	! 		~~~~	From	To	Thickness	Ref No.	Type	Depth
Top Soil,						D	1'0"	1.04			
illing of cl	av br	ic	k e	tc		1'0"					
	ີ′ <u>ງັ</u> ້		·) ~		•	T. O.	4'0"	3'0"	9651	D	1'6"
ine to very						4'0"					
ith cobbles (Chise)	and b	ou: 3±	lde .ho	rs. ur	a)	12/1	14'0"	10'0"	9653	D	8'0"
airly compac	-	-				14'0"	• • • • • • • • • • • • • • • • • • •				
sand.						426	18'0"	4'0"	9655	D	14' - 18'
airly coarse	sand	ω	ith	s	ດແອ	18'0"					
ravel,						74200	20104	2'0"			
ark grey sil	ty cl	ay	ωi	th	an	20'0"					
occasional la	min	of	fi	ne	san	d. 2016	21'0"	1'0"	9656	0	2010"
airly compac	t fin	8	to ;	ភាមា	dium Name	21'0"			9657 9658		23' - 24'
ravel with c (chisallin	<u>p 2</u>	s hoi	4 D UIS) -	TOEL		27'0"	6'0"	9020	D	24' - 25'
lock or bould						27'0"	.				
niselling 2	hours	•)				ada ti	2716"	016"	9559	0	27'0"
							2				
STANDARD PEN	ETRAT	<u>ı 0</u> f	<u>v</u> I	E :5	<u>rs</u> .	-					
t 516" 16 t 1016" 14	blo blo		t: ti		12" 12"						n,
t 15'6" 13 t 22'6" 19	blo blo		t: ti		12" 12"						
											a (22) - Labor - Naton <mark>anagananyana</mark> ng La
			•••••		_	+		k		+	an a sana a na ang ang ang ang ang ang ang ang
	ang na aga an									• ••••	n, s s angebrange hard a s
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						1	*				

THE CEMENTATION CO. (IRELAND) LTD. SOIL INVESTIGATION

BORING RECORD

TRACT	Baggot Street.
No.	C. H. Clifton Esq.,
Address	Dublin.
Comme	nced 18.5.71.

BOREHOLE No.	Ŋ:
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Order No.

1D: 58706

Boring Completed 20.5.71.

Diameter of Borchole 15.

ins.

R453

nge of Boring Percussive.

ground level struck (1) 23" (Seepage.) (2)

(3) moting Water Level 9'6" B.G.L. on the 25.5.71.

m

7.6

Ma

Failed to recover undisturbed samples at 10' & 18'. B.G.L. imurks All levels are related to ground level.

0.D.

26 24'0' 14'3" 22740 J 10'0" 25 25'0" 1'0" 22741 D 25'0" 25 10'0" 10'0" 22741 D 25'0" 25 10'0" 10'0" 22741 D 25'0" 25 10'0" 10'0" 22741 D 25'0" 10'0" 10'0" 10'0" 10'0" 10'0" 10'0" 10'0" 10'0" 10'0" 10'0" 10'0" 10'0" 10'0" 10'0" 10'0" 10'0" 10'0" 10'0" 10'0" 10'0" 10'0" 10'0" 10'0" 10'0" 10'0" 10'0" 10'0" <t< th=""><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th></t<>								
olay. 407 407 3100 3100 22737 D 31 Drown boulder olay. 40 3100 6100 22738 D 5160-5160 511ff brown very gravelly olay, 9101 40 23 9100 6100 22738 D 9100-9190 40 23 9100 14130 22740 J 10100 24 100 14130 22740 J 10100 25 10 24 100 14130 22740 J 10100 25 10 25100 140 22741 D 25100 100 200 100 200			From	To	T MICKNESS	Ref No.	Туре	Pepth
Arrown boulder olay. 47 310" 310" 22[3] J 3" At brown boulder olay. 41 910" 610" 22739 U 5"6"-6"6". Stiff brown very gravelly olad, 910" 0"9" 22738 D 9"0"-919". Hard black boulder olay. 40 M 919" 0"9". 22738 D 9"0"-919". Hard black boulder olay. 40 M 919". 14".3" 22740 J 10" Presumed Rock. (chiselling 2 hrm) 24".0" 14".3" 22741 D 25".0" Standard Penetration Tooto. 25".0" 1"0" 22741 D 25".0" Hard Standard Penetration Tooto. 1".0" 22741 D 25".0" Hard Standard Penetration Tooto. 1".0" 22".0" 1.0".0" Hard Standard Penetration Tooto. 1".0" 1.0".0" 1.0".0" Hard Standard Penetration Tooto. 1.0".0" 1.0".0" 1.0".0" Hard Standard Penetration Tooto. 1.0".0".0" 1.0".0".0" 1.0".0".0" Hard Standard Penetration Tooto. 1.0".0".0".0".0".0".0" 1.0".0".0".0".0"	Made ground-top soil and s	andy	0					
4i 9'0" 6'0" 22739 U 5'6"-6'6" 3tiff brown very gravelly olay, 40'30 9'0" 0'9" 22738 D 9'0"-9'9" lard black boulder olay. 40'20 9'19" 0'9" 22740 J 10'0" 'resumed Rock. (chiselling 2 hrs) 24'0" 14'3" 22740 J 10'0" 'resumed Rock. (chiselling 2 hrs) 24'0" 1'0" 22741 D 25'0" 'standard Penetration Teste 1 1'0" 22741 D 25'0" 'standard Penetration Teste 1 1'0" 22741 D 25'0" 'standard Penetration Teste 1 1'1" 1'1" 1'1" 1'1" 'standard Penetration Teste 1 1'1" 1'1" 1'1" 1'1" 'standard Penetration Teste 1 1'1" 1'1" 1'1" 1'1" 1'1" 'standard Penetration Teste 1'1" 1'1" 1'1" 1'1" 1'1" 1'1" 'standard Penetration Teste 1'1" 1'1" 1'1" 1'1" 1'1" 1'1"	01ay •	47		3101	3101	22737	D	31
Stiff brown very gravelly olay, (o 3) 9:01 1111 9:91 22738 D 9:01-9:91 lard black boulder olay. 40 20 9:91 24:00 14'31 22740 J 10'101 Presumed Rock. (ohiselling 2 girs) 24:00 14'31 22741 D 25'0' Standard Penetration Tests. 10'101 10'101 10'101 10'101 Standard Penetration Tests. 10'101 10'101 10'101 10'101 111111 11111 11111 10'101 10'101 111111 11111 10'101 10'101 10'101 111111 11111 11111 10'101 10'101 111111 11111 11111 11111 10'101 111111 11111 11111 11111 11111 111111 111111 11111 11111 11111 11111 111111 111111 111111 11111 11111 11111 11111 11111 11111 11111 11111 11111 11111 111111 111111 111111 11111	🕥 prown boulder clay.	47	3101					,
4/2 U 111111 0'9' 22738 D 9'0'-9!9' iard black boulder clay. 40 of 9'9' 0'9' 22738 D 9'0'-9!9' iard black boulder clay. 40 of 9'9' 24'0' 14'3' 22740 J 10'0' 'ressumed Rook. (chiselling 2 frs) 24'0' 14'3' 22741 D 25'0' 'standard Penetration Tests. 10'1' 25'0' 1'0' 22741 D 25'0' 'standard Penetration Tests. 10'1' 10'1' 10'1' 10'1' 10'1' 'standard Penetration Tests. 10'1' 10'1' 10'1' 10'1' 10'1' 10'1' 'standard Penetration Tests. 10'1''' 10'1'''''				9101	6101	22739	U	5161-6161
iard black boulder olay. 40 af 9194 9194 14134 22740 J 10105 Presumed Rook. (a)iselling 2 frag 24107 14134 22740 J 10105 Standard Penetration Tests. 11 25107 100 22741 D 25107 Standard Penetration Tests. 11 11 100 22741 D 25107 11 10 10 10 10 10 10 10 10 11	Stiff brown very gravelly	olay	9101					
Add black bounded of y: 26 24'0" 14'3" 22740 J 10'0" Presumed Rook. (ohiselling 2 hrs) 24'0" 10'0" 22741 D 25'0" 35 10'0" 22741 D 25'0" 10'0" 10'0" 22741 D 10'0" 10'0" 10'0" 25'0" 10'0" 10'0" 10'0" 10'0" 10'0" 10'0" 10'0" 10'0" 11'10" 10'0" 10'0" 10'0" 11'10" 10'0" 10'0" 10'0" 11'10" 10'0" 10'0" 10'0" 11'10" 10'0" 10'0" 10'0" 11'10" 10'0" 10'0" 10'0" 11'10" 10'0" 10'0" 10'0" 10'0"		40.25		9191	0191	22738	D	9101-9191
Presumed Rook. (ohiselling 2 hrs) 24 m 1'0" 22741 D 25'0' 25 1'0" 22741 D 25'0' 100 100" 100" 22741 D 25'0' 100 100" 100" 100" 100" 100" 1100 100" 100" 100" 100" 100" 1100 100" 100" 100" 100" 100" 1100 100" 100" 100" 100" 100" 1100 100" 100" 100" 100" 100" 1100 100" 100" 100" 100" 100" 1100 100" 100" 100" 100" 100" 1100 100" 100" 100" 100" 100" 1100 100" 100" 100" 100" 100" 100" 1100 100" 100" 100" <td< th=""><th>lard black boulder clay.</th><th>40:25</th><th>9191</th><th></th><th></th><th></th><th></th><th></th></td<>	lard black boulder clay.	40:25	9191					
25 25'0' 1'0' 22741 D 25'0' IIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIII	و با مواد به با من الله و من و المان بالي و الم الله و المان و الم الله و الله و الله و الله و الله و	26		24 0	1413"	22740	J	10101
Bitandard Penetration Toets. It 3'6" 1. blows to 12" B'6" 44 " 12" 13'6" 85 " 1.2" 13'6" 108 " 12"	Presumed Rook. (obiselling	2 251) 24101					
Standard Penetration Teets. IIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIII		25		25104	1'0"	22741	D	25101
Standard Penetration Tosto. 3t 3 16" 11 10 Dows to 12" 12" 13"6" 13"6" 13"6" 13"6" 13"6" 10" 13"6" 10" 13"6" 10" 13"6" 10" 11" 11" 11" 11" 12" 11"								
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Standard Penetration Tests. it 3'6" 1. blows to 12" '8'6" 44 " " 12" '13'6" 85 " " 12" '19'6" 108 " " 12" '10'100 " " 12"								
Standard Penetration Toots. it 3'6'' 1. blows to 12" B'6'' 44 13'6'' 1. blows to 12" 10'' 1. blows to 12" <t< th=""><th>\frown</th><th></th><th></th><th></th><th></th><th></th><th></th><th></th></t<>	\frown							
Standard Penetration Tests.				·				
Jaranard Pentration Petts. it 3'6" 1. blows to 12" 8'6" 44 " " 12" 13'6" 85 " " 12" 19'6" 108 " " 12" IIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIII			·					
it 3 '6'' 1. blows to 12'' B'6'' 44 '' '' 12'' 13 '6'' 85 '' 1. 2'' 19'6'' 108 '' '' 12'' IIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIII	tandard Penetration Tests							
1316n 85 n 12n 19'6'' 108 " 12n 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 100 1	t 3'6" li blows to 12"	-						-
de: U – Undisturbed Sample D – Large Disturbed Sample J – Jar Sample W – Water Sam	13161 85 H H 12H		· · ·					
de: U – Undisturbed Sample D – Large Disturbed Sample J – Jar Sample W – Water Sam	19'6" 108 " " 12"		, [,,,					
de: U – Undisturbed Sample D – Large Disturbed Sample J – Jar Sample W – Water Sam								
de: U – Undisturbed Sample D – Large Disturbed Sample J – Jar Sample W – Water Sam	·							
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	-	<i></i>	- Large Dist	ui UCO. 34II	rhic 1	- Jar Samj	pic -	w water sam

THE CEMENTATION CO. (IRELAND) LTD. SOIL INVESTIGATION BORING RECORD

MTRACT Baggot Street.

No. C. H. Clifton Esq., and for

Address Dublin.

Commenced 11.5.71.

e of Boring Percussive.

iround level

Boring Completed 13.5.71. Diameter of Borehole 15 7.4 mod mehin

BOREHOLE No. 71/3.

Order No.

1D: 58704

ins.

R453

ster Struck (1) -(2) unding Water Level 8'B.G.L. on morning of 18.5.71.

O.D.

mark: Borehole dry on evening of the 12th and on the morning of the 13th water was standing at 14' below ground level.

(3)

	De	pt ^{1.}	'i nickness	li	5	Samples
Description of Strata	From	То	Inickness	Ref No.	Туре	Depth
de ground. The state of the second	0					
2		3101	31011			
ft/firm brown stony clay. 47	3*0**			22728	J	3101
<u> </u>		10 01	7'0"	22729	U	5101-6161
iff black boulder clay with	10101					
bbles & boulders (chiselling		18'0"	8104	22730	J	10*
esumed Rock (chiselling 3 hrs.	16'0"					
33		1910	1104	00721		18'0"-19'0"
, , , ,			T. O .	22731	2	10.010.0.
n shanna tiran ƙwala ƙwala ƙwala ƙasar 1993 a ta						
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tandard Penetration Tests.						
t'8'0" 32 blows to 12"						· · · · · · · · · · · · · · · · · · ·
" 16'6'61 " " 12"						÷
	mmm					
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le: U — Undisturbed Sample D —	Larga Di-	hund flam		Tan 6	.1.	
· · · · · · · · · · · · · · · · · · ·	- Large Dist	stoed Sam	ipie J-	Jar Sam	, ie	W — Water Sar
cked by: Date:						

SUB SOIL SURVEYS LTD.

MANCHESTER.

BOREHOLE No. 66/1

ID:58779

EXPLORATORY BORING RECORD R453

SITE Baggot Street, Dublin

66/1 Ref.:-

DATE	DIA. OF CASING & DEPTH BELOW G.L.	WATER LEVEL MORNING & EVENING	DEPTH OF STRATA BELOW G.L		RATA	NO. OF Samp	TYPE OF SAMP	0	RATION MPLER B BARREL	NO. OF BLOWS	CORE RECOVER
lJan	8"	Nil		APPROX. SCALE	FT. TO ONE INCH		<u> </u>	FROM	то		
10 611	0	39	310"		with plaster tones	2	U o	5 ! 0 6 ! 6	616	15	
	Ти	34	5'0"	Soft brown cl		3	υ	7'0	8'6	25	
				Stiff brown a stone inclusi			o x	816 916	10!6	15	
		30.5	816" 910"	of sand Compact Grave	ol (Clay cont	$\frac{1}{1}$ 6 tent)7		10'6 11'6	11'6	40	
		30 29.5	916"	Loose small f Firm blue/gre stone in	gravel			14'0	15'6	50	
<u>lJan</u> Feb		29 Nil	10'0"				x	15'6 19'0 22'0	19'9	79	
ren				Very stiff I clay with s	-	12	x	22'0	22'1	50	
lFeb	22'0	16.5 15'0	22 16'' 2216 165	Hard black la Limestone (b	aminated sna edrock or Boy	<u>ley</u> uli					
											-
Sa	imples st		NUS: Di		WATER ADDED AT	dard Pen.			cased/un	Bulk	B.
	RUCK AT THE	WR.	EN SEALED -NOT SEALE	ESTIMATED SEEPAGE D)	FOLLOWING DEPTHS TO ASSIST BORING	DATE	BOI		LEVEL		OF CASING
	8'6	10	10	Fast	<u>├</u> ────┤	1.2.66		-151			
2. <i>;</i> 3.	210		NS	Fast	· · · · · · · · · · · · · · · · · · ·			· · · · · · · · · · · · · · · · · · ·	· · · · · · · · · · · · · · · · · · ·		••••••••••
4. 5.	•••••		····			,	•••••		·····	· · · · · · · · · · · · · · · · · · ·	· · · · · · · · · · · · · · · · · · ·
6. REMA	RKS:	1		<u> </u>	1		·]		<u> </u>		<u></u>
			•								

R509

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			In	ID: 59156
RECORD	OF	BOREHOLE	NO. 3	

Type of bo	oring : Rotary	and Aug Percus	sive D	rilling		15in to 16ft 6in Lining tubes: 2in to 43ft
Daily	Samples	r	Cł	nange of S	itrata	Description of Strata
Progress	Depth	Туре	Legend	Depth	O.D. Level	Description of Strata
	2'0"	D		2'6"	44.1	FILL (clay, gravel and brick fragments)
	2*6* - 4*9*	U(4)				
	6'6"	D				
	00	U				Very stiff dark brown sandy silty CLAY with to ccarse gravel (Boulder Clay)
	B'6" - 10'0"	U(4)			05.6	
	11'0" 11'6" - 12'3"	80 C(81)	07	11'0"	35.6	•
30.8.66	14*0*	BD	\mathcal{D}^{-1}			
31.8.66						
/1.0.00	16"6" - 16"9"	C(29)				
			日本			
	21'0"	D	国情			
	24*0"	D				
	44 °0″	U	C			Vary stiff to hand dark and sounds attends
	27 ' 0 "	D	国际			Very stiff to hard dark grey sandy slity CL with fine to coarse gravel, cobbles and boulders; large boulder between 33ft and 36
		-		4		Sector of the politice between 2511 BNO 30
2.9.66	30.0.	D	ĒŪ			
· · · · ·	33*0*	D				
			RE			
	36*0*	D.				
	39*0*	D	Kap ber		· ·	
	0″ ولا	U		43.0.	3.6	5.5
	45'0"	D		1		
			日日			Black LIMESTONE
13.9.65	48 * 0 "	D	<u> </u>	48*0"	-1.4	
			-			
						· · ·
	•	•				
			į			
			1		.	
						· · · · · · · · · · · · · · · · · · ·
			•			
Key to type	of sample :	<u> </u>	Rem	arks · //	Obcerveri	ons on ground-water, etc.)
U(4) = 4 U(14) = 4	in. dia. undisturbed					encountered during boring.
BD _	disturbed sample. bulk disturbed samp	vi e.		- ounu- wa	algi was (succentered ouring poring.
() = ()	ane test. Itandard penetratior) test.			**	·
figure in brac	dynamic cone peneti	ration	}			



file of bor	ing:Rotary		1			Lining tubes : 2in to 33ft
Or ly	Samples		+	lange of S	1	Description of Strata
Pr 23 5813	Depth	Туре	Legend	Depth	O.D. Level	
	6°6"	D		6°6"	31.7	FILL (rubble, sand)
	10°0"	D		13'6"	24.7	Brown medium to coarse SAND with fine to coar gravel
· · ·	17°0"	Ç	$\begin{array}{c} 0 \cdot 0 \cdot 0 \\ 0 \cdot 0 \cdot 0 \\ 0 \cdot 0 \end{array}$			····
	21'0"	D	00000000000000000000000000000000000000			
1	25*0	D	00000000000000000000000000000000000000			Black clayey fine to coarse SAND with fine to coarse grave: (Presumed Boulder Clay)
	30"0"	D	01-101-101-0 01-101-01-0 01-101-01-0			· · · ·
	33'0"	D	0.0.0	33°0"	5.2	5.2
	35'0"	D.		σ		/ Black fine to coarse fragments of LIMESTONE (Presumed Bedrock)
20.7.66	39°0*	D		40*0"	-1.8	w
	·			ĸ		
						· ·
Key to type o			Rem	arks : ((Observatio	ons on ground-water, etc.)
$\begin{array}{c} \mathbf{D} (1_{2}) = -1_{2} \\ \mathbf{D} -\mathbf{dit} \\ \mathbf{BD} -\mathbf{bu} \\ \mathbf{V} -\mathbf{val} \\ \mathbf{S} () = sta \\ \mathbf{C} () = -\mathbf{dy} \\ \mathbf{f}_{1} \mathbf{t} \mathbf{y} \mathbf{t}_{2} \\ \mathbf{f}_{2} \mathbf{t} \mathbf{y} \mathbf{t}_{3} \\ \mathbf{f}_{3} \mathbf{t} \mathbf{y} \mathbf{t}_{3} \end{array}$	iturbed sample. Ik disturbed samp ne test. Indard penetration namic cone penetr	le. test.	Wate	r was us	sed as a i	circulating fluid whilst boring and the depth was first encountered could not be determined

R519 THE CEMENTATION CO. (IRELAND) LTD. SOIL INVESTIGATION BORING RECORD CONTRACT Revenstore Securities BOREHOLE No. Report No. Order No. Bored for Die Kenn, charlin O'Hercha. In D: 59291 Site Address Dubli Boring Completed 18/1/74 Boring Commenced 17/11/44 Type of Boring freesine. **Diameter of Borehole** 15 ins. 141 Est . O.D. = 3 1 Malin Ground level Water Struck (1) 7' B. C. L. (2) 21' B. C. ((3) Standing Water Level 6'6" B.C.L. on Completin. Remarks Failed & recover indistentiel senfle of 7'B. C. L. all land one related to groce of land. Chindly: 2 hs. n. this barchele. - Description of Strata Thickness Ref No. Type From То Depth Ð Concette 9 9 9 (cenders, clay, ste 6'3 4 0 7'0 5'0 7025 D 7'0 BC story clay 7026 7027 7028 12 0 D 9'0 4 ist -16.6 12' 11'0 Prevenuel rock (chenely 24) 7024 D 6 300 916 standard Partic IS Code: U - Undisturbed Sample D - Large Disturbed Sample J - Jar Sample W - Water Sample Checked by: Date: Driller's Signature : Date: This form to be returned to Head Office immediately the borehole is completed.

CONTRACT Kavenston	DRING And and C			OREHOI	LE No	. 6	
Report No.				Ord	ler No).	
Bored for	5	,		hw	ID:	59294	
lite Address / R.I.	, 0.00						
Boring Commenced 22/1/74 Fype of Boring				completed		4/1/	
Type of Boring forenties Ground level 19' Gl O.D	, 2,/	m mil			0016	, 0	ins
Water Struck (1) 6'6 B.6L. (2)		(3)	•••				
landing Water Level							
Failed to Rec	ain u	4 08	7'6	B. G.	く.		
Description of Strata	De From	pth To	Thickness	Ref No.	<u> </u>	Samples Depth	{
Comerce E.	0'				1		
		6	·6	 			
Filling Josh hick	6	6'6	60				
Some, fine silt sonting	8 6 6			 	<u>{</u>	1	
man forgen here		13'0	66	7038	a	12-150	
Black silf Rych.	130-	170-	46				
Prend Pock :	17'0-	17 6	0'6				
Stand 1. Labor T. 5							
× 56 16 hbs × 12							
-17'562"Ff							
						•	
				1			
	_						
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				-			
			•				
••••••••••••••••••••••••••••••••••••••			ple J	¥	I		J

R519 • THE CEMENTATION CO. (IRELAND) LTD. SOIL INVESTIGATION **BORING RECORD** · CONTRACT & charstone Locenster. BOREHOLE No. 5 Order No. Report No. Bored for De Level Chachiel O'Healer. In 10: 59293 Site Address Duth Boring Commenced 19/1/74 Boring Completed 21/ 1/ 7 4 191 850. = 3 1 M. Malin Type of Boring ins. Ground level Water Struck (1) $7^{\prime}B.C.G.$ (2) (3) Standing Water Level 666 B. C. C. Remarks derelly 2 hrs in the barchle Depth Sample Description of Strata Thickness From То Ref No. Typ Depth 6 iles stars she 6.6 7'0 710 7'0 - 36 ill 4 7031 Be. 5'0 7032 D. 7.0 12'0 Falat 120 120 703) 7034 6.6 Ð Ð 186 by quant with some by. 6 190 7035 19'6" 6~ D des fintal 21 ilin_ 39 17'6 35 U - Undisturbed Sample Code: D - Large Disturbed Sample J — Jar Sample W --- Water Sample Checked by: Date: Driller's Signature : Date:

THE CEMENTATION CO. (IRELAND) LTD. SOIL INVESTIGATION BORING RECORD CONTRACT Romestare Securitis. BOREHOLE No. 4 Order No. Report No. chadrick O'Hendre. Bored for De Leve hu 1D: 59292 Site Address Dahlin Boring Completed 2 8/1/74 Boring Commenced 25/1/74-Type of Boring Precession Diameter of Borehole ins. = 3.1 Ma 14 est O.D. Ground level 6'678.(2) Water Struck (1) (3) Standing Water Level 66 B GL-

Remarks

Description of Strata	Depth		Thickness	Samples			
	From	То		Ref No.	Туре	Depth	
11 . **	0						
Concrete		6 -					
- 10: 11 A RIG it	6"						1
Fally of brock rubbly ite	6.	4'0-					
	4'0-						1
ich some cl, & shall frogend		6.0~	:				
Fire to med silt sond by a	16.00						1
hid elle		11'0					
	11'B	<u>// //</u>					┦
Black landle Cly	1/ 5	210		•	u	14-156-	·
		210					-
Pour Kush	21'0						
· · · · · · · · · · · · · · · · · · ·		21'6					-
,			•				
							4
SPTS							
		· · · · · · · · ·					
at 6'5 12 16 51							
				•			
- 12' 102ll 89	R.L.].
						•	
						,	
· · · · · · · · · · · · · · · · · · ·							
							1
							1
					<u>+</u>		+
				-			
						ļ	-
				l	L		J
ode: U Undisturbed Sample D	- Large Dist	urbed San	iple J -	- Jar Sam	ple	W — Water Sam	ple
becked by: Date:	- - 		ler's Signatu			Date:	-

THE CEMENTATION CO. (IRELAND) LTD. R519 SOIL INVESTIGATION BORING RECORD CONTRACT RAVENSTONE SECURITIES BOREHOLE No. 7 Report No. Order No. 1 1 Dennie Marine In 1D: 59289 Bored for $0 \\ \mathcal{Q}$ Site Address Boring Commenced 9/1/7 4 Boring Completed 1/1/174 Type of Boring Purce ie. Diameter of Borehole 15 ins. 19' Ert Ground level **O**.D. Ξ Water Struck (1) 813. G.L. (2) (3) Standing Water Level 14'6 B.C.L. an 11/1/74 gh, a it's bouchale all lack are relief to Remarks Chipelle Reci Depth Samples Description of Strate Thickness Ta Ref No. Type Depth 2'0" Ó 0 1 core 26 1'6 5'0' 7013 ${\tt D}$ 0 4'0 Mid. to coon 0 0 00 τŬ, 7014 2'0 D 10 0 12 Il 0 1516 D 2'0 7015 36 120 ΒÇ 7016 40 D 20 0 24:0 25 2 " resen D 7017 S '0 Protect 5'6 l la 15 (1 39 U 20'6-42 Code: U -- Undisturbed Sample D -- Large Disturbed Sample W --- Water Sample J — Jar Sample Checked by: Driller's Signature : Date: Date: This form to be returned to Head Office immediately the borehole is completed.

THE CEMENTATION CO. (IRELAND) LTD. R519 SOIL INVESTIGATION BORING RECORD

pe of Boring Parecessing		no ci l	Boring C	completed r of Boreh	15 Iole	11/74
pe of Boring Parensine ound level [9' lest O.I). = 3 ·	1 Mal	n.			
ater Struck (1) 0° [3, 0, 1,, (2))	(3)				
marks chiselle 4 to his	a their	hard d	. 11 26	, la .	£.	
group hil.	on cos		. un			e hour
Description of Strata	Prom	pth To	Thickness	Ref No.	S Type	Depth
	0					
(morete & hardcore)		2'0"	2'0			
Filly fulls ander day	, 4 2.0	12.0-	10'0	7018	9	5'0'
R had silt stan clay un	A 100		 	70 20	.) 4	100-136
B but silf stay clay in alles,		24'0"	12'0	7012	Р Р Р	
presend rock (chisilly 2 h). 24'0	25'0-	1'0"	7024	_D	2510
		230			 	
		•				
			•			
			•			
and the second						
Standa / Partich 1	ers					
1						•
at 5'6' 4than to	E .12 -			<u> </u>		
4 17 6 38 " "				<u> </u>		
· 22'6 42 · ·	12-					
				∦		
		<u> </u>				

THE CEMENTATION CO. (IRELAND) LTD.	
SOIL INVESTIGATION	1	5001 -
BORING RECORD	IN ID:	227262

BORING RECORD

(3)

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BOREHOLE	No.	6.
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Order No.

Report No.	
Bored for C. H. Clift	ton Bag.,
Site Address Dublin.	
Boring Commenced 24	5.71.
Type of Boring rercus	sive.
Ground level	ع 0.D.
Water Struck (1) 9'0"B.	G.L. (2)
Standing Water Level	
Remarks	

Baggot Street.

R525

1

 \bigcirc

CONTRACT

Boring Completed	25.5	5.71.
Diameter of Boreho	le	15:

ins.

	Depth		(0) 1 1	Samples		
Description of Strata 43	From	То	Thickness	Ref No.	Type	Depth
Eado ground - olay, brick etc.	0					
		4.0.	4'0"	22742	J	
Fire brown boulder clay. 27	4.00	· ; ! :				•
34		9101	5101	22743	U.	5101-616
Leaium to coarse gravel, 34	9:01					
32		11.01	2101	22744	D	11.00
Hard black boulder clay. 32	11.01	:		22746	U	13'0"-14°0
24.5		18:61	7161	22745		
rrosumed Rock.(chiselling 2 hr	<u>s) 18.64</u>					
23.5		19.6"	1101	22747	D	19:61
			1			
	<u> </u>	·				<u> </u>
Standard Panatzation Fosta	: : :					ı
At 9'6" 34 blows to 12"			···_···			
" 15'6'71 " " 12"						
· · ·			•			
			:			
						<u> </u>

BO	RING	REC	ORÐ	11	4 V	10: 59	5+
NACT New Hotel - Merri	on Rd.		B	OREHOL	E No	. 2	
No.				Ord	er No	le de la companya de	
Nor Leinster Homes Lt	γ Ω ⊕ 11 1. 1. 1. 1. 1. 1. 1.	n na sana Na sana		 	14. 1		• • • • • •
diess Dublin		a a a	an di sua Angla angla		21/	s Isa	
Commenced 19/5/69 W Boring Percussive. Wagon	Drill	n general Maria e en		completed			
i level 20 O.D.	~~	2.4	Diamete M N	r of Boreh	ole		i
Struck (15 ° Q" E.G.L. (2)		(3)	10			3m	m
"g Water Level - 3'3" B.G.L.	i terretaria. A constructione de la construcción d						
ks All levels are re used from 16'0" to		o groun	d level	L. Wago	n di	cill was	
used from 16'0" to	o final	level	•				
Description of Strata	Der		Thickness			amples	
illing of clay, brick,	From O*O#	To		Ref No.	Туре	Depth	<u></u>
etc.		4'6"	4'6"				
ECK Clayey Bilt with	4 6 *						. <u> </u>
cheta of fine sand.		5*5*	1.04	17888	J	5'0"	
ith shells, cubiles a	5.0"	9'6"	4108	17000	÷		
tiff black silt, stony	9*6*	- 9° 0°	4.0	17889		5*0*	
lay with coobles and		15*6"	6.0	17890 17891	- J J	10'0" 14'9"	•
Capact Very fine silty	15*6*						
sand.		15.0"	0164	17592	Ð	15*6*	
bok.	16*0*						 2
		22+0#	9°0#				
Inal level. Rock.	25.04						
AUSK							
standard Constr tion Test							
t 5'6"-14 blows to 12"	·•						
7*6*-103 * * *				2			
10*6"-102 " " "							
1419*-60 ** * 2"Re	funal						
16*0*-65 " " 3 ¹ "	39					1	
				 		• .	
							- <u></u>
						•.	
	_ <u></u>						
		<u></u>					÷ *
e: U Undisturbed Sample D	– Large Dist	urbed Sam	ple J -	- Jar Samj	alė	W - Water	Same
ked by: Date	-	•	er's Signatu		ene s	Date:	-
This form to be returned	to Head Offi		- 17 		oted		.'

n Ara

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THE	CEMENTATION CO. (IRELAND)	LTD.	R528
	SOIL INVESTIGATION	10: 59370	
	BORING RECORD	10. 71710	

RACT Aus in Lol- subring hd. BOREHOLE No. 1

: No. for

Order No.

Lublin ddress Commenced 15/5, 59 f Boring -erouserve. 20¹ 0.D. d level Struck (1) ?' ?" B. 4. . . (2)

Leinster Mus Ald.

> Boring Completed 19/5/69 Diameter of Borehole 15

ins. 34 malie 00 18 Ft 9 in Oblool 2 3 m Molin.

by Water Level an Carlet on - 6'6" S. .. L.

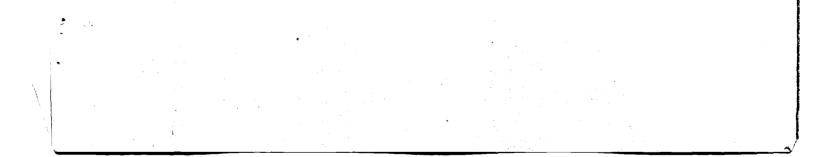
as ill love clare related to grand level.

(3)

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Description of Strata	De	pth	Thickness			Samples	
	From	То	Linekness	Ref No.	Туре	Depth	
filling of clay, brick,	0.0.						
etc.		4.2.	4*6*				
by and bandy gravel with	h 4'5"					· · · ·	
hells & wuldels.		<u>्रि</u> कं दुम	1.10"	17004	Ξ.	4164	
and and fine to clarge	5100						
b.ulders.		10104	5. ○ · · · 	1-885	* *	6‡0#	
This black silty stony.	10.0.						<u></u>
lay with boulders		1419	2.*Q#	17886 17887	JJ	10*6*	
ing hre. chiselling) ingl lovel. Stiff Slack	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1			· · · · · · · · · · · · · · · · · · ·			
tity story clay with						ан Ал	
0000 de 28.							
			•			· .	
						· .	
					•		
tendard lenetration leat	e.						
t 3 *6*-50 block to 10*							
7*6*-85 * * *							
11*0"-102 ** * **							
14.34-00 4 4 54 4	efusal						
							•
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· · · · · · · · · · · · · · · · · · ·		/					
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				I=	I	¥	·
Li Lindistuched Semule D	 Large Dist 	urbed Sam	ple J —	Jar Samp	ole	W Water	Samp
U — Undisturbed Sample D —	0			sγ) -			

	ND: 536 NO: 25		R
•		IN 10: 59419	
INV ID	: 59419		
· · · · · · · · · · · · · · · · · · ·	(1)		
	Matt T. Wron, Esg.,		
	Consulting Engineer, 8, Wellington Road,		
•	Dublin 4.	15th March, 1968	
		/	
	re: Site Investigatio Ballsbrid	ons at Granite House, dge	
	1		
	Dear Sir,		
	T increased +	his site on 14th March	
	with Mr. O'Connell.	HIN SICE ON IACH MALCH	
	A trial pit w	as opened near the south	
	boundary wall and the soil		• •
	Ground level to 2'0"	Topsoil 564	Mali
	2'0" to 7'0"	Soft/Firm sandy silt	
	7'0" to 8'6"	Stiff stony boulder clay	
	Some small amount of 8'6".	water coming in to the hole at	
	similar soil profile was d	from Mr. O'Connell that a isclosed in the trial pit on , had been filled in before my	
		itself is probably founded on s by no means certain; it appears t for some small cracks.	to
	place the foundations/ on t silt, at about 7'6" below bearing capacity of 2 tsf.	r the proposed two storey buildin he stiff stratum below the pandy ground level. Allow a safe Settlement should not exceed gh preconsolidation loading of th	
	Y Y	ours faithfully,	
i i i i i i i i i i i i i i i i i i i			
		R. W. KIRWAN	
		ALL THE AND INTERNE	
	. *		
			· •



THE CEME		/ESTIGAT	-			1 10:597
•	BORING				(j w	110 - 797
CONTRACT Irish & Inte	roontinental H			REHOLI	E No.	5
Report No. C.661.	•			Orde	r No.	
. Bored for		•				
	ge, Dublin.	-				
	ebruary, 1961.		Boring Cor			nd March, 196
Type of Boring Ground Level	O.D .	, I	Diameter o	DI DOTEN	Ole	in
Water Struck (1)	(2)	(3)				
	water.	(0)				
Remarks	ML3 MCT.0					
·)	·					·
Description of Strats	From	Depth To	Thickness	Ref No.		mples Depth
Top soil & roots.	0					····
		51-0"	51-01	1	J	51-0#
Firm brown stoney clay	51-	11'-6"	61-61	2	J	61_Ou
Very stiff stoney black	k 11'-	·		~		
boulder clay.			261-64	3	J	11'-6"
Rock (diamond drilling	<u> </u>	╤┯┥╤┹┵┶┶┷┷┙				
			51-0 [#]	4	J	121-61
				5	J	14*-0*
			1	6	J	191-01
		· · · · · · · · · · · · · · · · · · ·		ļ		-7·-V·
				7	J	24*-6*
	·					·
		· · ·	:			
						an an an <mark>dhabha bhainn ann an ann an ann an ann an ann an an</mark>
			······································			
						•
a a ar an an an ann an ann an ann an ann an						a mit a fan de seu en a sector mom a false mit fil fil fil fil manager a das se se a fa anc
			1 .			

Driller's Signature: Date: Ghecked by: Date: This form to be returned to Head Office immediately the borchole is completed.

Inv 10: 59872

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erana ana, and a sportplan an a colo o subles, a KINDY &

and the second second

ξ		Dodder	Valley	Drainage	Scheme.
i.	s Is Riter	Canal .	A		Total Casing

is even 11) terrement 🔰 🖊	tolet sausnif
od Level: 23.0' OD.	Total Depth of Hole (γ^*, ψ) .
and Augur/D mandant	Date Starting 19/2/22.
a	

Diameter of Hole: 6".

1.752. Date Finishing 24/1967.

Brasca Description		Depth	So.1 Sample	W chroat Fault	Dally Progress	S.PAT. Malas
P-6 ⁿ Topsoil.	j t	1'-6	1	21.5		
i'-0" wown <mark>clay wi</mark> th sand & grave	ol.)	2'-6		20.51		
199 Mottled brown silty clay with send & gravel.	S. C. H	4'- 3		() .7 51		
201-21 Flock very hard clay co ntai get well and boulders with sand und some silt (boulder cloy).	ning State				22/5/6	
• • • •						iX .
•		g Sanata Marana (, s. sana), ya S	n - otopiatoriale algundo ano internet como			eren inneren inneren 17. 4 Nom
			and a second			
		l Song Song Age S Song Song Age Song Song Song Song Song Song Song Song		**************************************	· · · · · · · · · · · · · · · · · · ·	· · · · · · · · · · · · · · · · · · ·
				, , , , ,		
			and the activity of the second s	,		
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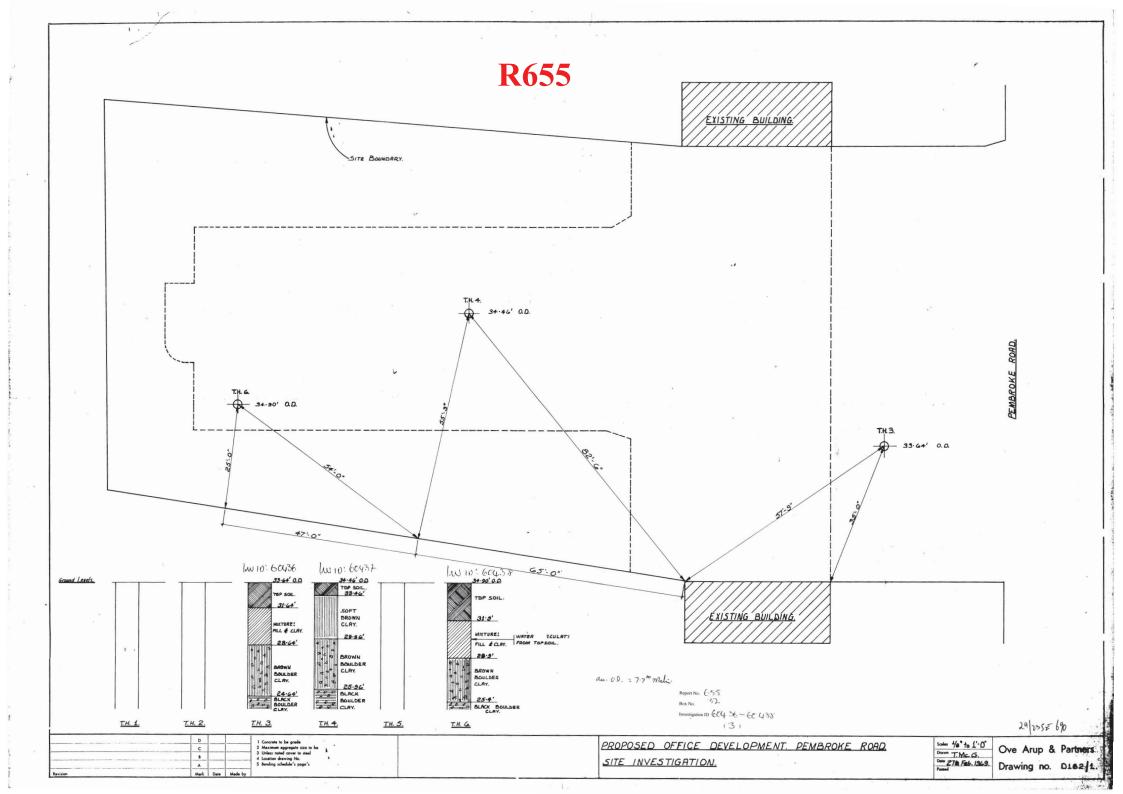
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•	Columnet: Deleter Valley Drainage Sch	ieme				~	· · ,	.1
	esertado Veferences - 2	Total C:	asing	-		573		1 • 1
-	Cround Level: 37.0'0.D	Tetal D	opth of I	iole :	i și și	•		
	South with the party of the transferred	Data Sh	uting		5 5 57			
	Die der of Kole: 8"	Date Fi	nishing		1315.47			
	Strata Description		Depth	Sed	l Rođenst Lezel	Daily Program	S.IV.I. volue = N	
	2' 6" Made Ground.	Ì	ş ;	1				
	Plan Unided sand and gravel.		<u>2' 6"</u> 3' 6"		(04.5) (03.5)	16.5.67		
	3' 6" Hard brown silty clay with gravel		30					
	and cobbles (probably boulder clay)	l ∦r ()mileta) 00.9'		21	
	n en		7' 0"	0				
_	of 0" News an ak clay containing appliers, cobbles, gravel and some	長次						
	silt (boulder clay).	600		6.987.0040		17.5.67		
				10-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-			+	
			15' 0"		22.0'		and a second	
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	· · · · · · · · · · · · · · · · · · ·	10-11-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1			e parte en la	1	r i	
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		a Maria a Maria	•	energi se er				
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RECORD OF BOREHOLE NO.6

Type of boring : Rotary Percussive Drilling

Lining tubes : 2in to 33ft

Daily	Samples	•	Ch	ange of S	trata	
Progress	Depth	Туре	Legend	Depth	O.D. Level	Description of Strata
				1-9	31.7	FILL (rubble, sand)
	6°6"	D	0.00	200	21.7	
	10'0"	D	0.0.0 0.0.0 0.0.0	41	•	Brown medium to coarse SAND with fine to coarse gravel
		L	0.0000	1.0"	24.7	
•••	17°0"	D				
	21*0*	D	0000			Black clayey fine to coarse SAND with fine to coarse gravel (Presumed Boulder Clay)
	25*0*	D		а. С		coarse gravel (Presumed Boulder Clay)
	30'0"	D	0000000	10-0		
	33°0"	D	. 0.0	3 3°0"	5.2	
	35°0"	D				Black fine to coarse fragments of LIMESTONE (Presumed Bedrock)
20.9.66	39*0*	D		40*0"	-1.8	
		· · ·				
	•			· · ·		
· ·					:	
Key to type	of sample :	<u> </u>	Par	arks : //		
U (4) - 4 U ($l_{\frac{1}{2}}$) - 1 D - c BD - b	in. dia. undisturbe	11	Wate	r was u	sed as a	ons on ground-water, etc.) circulating fluid whilst boring and the depth r was first encountered could not be determined.
′S ()−s C ()−d ti	tandard penetratio lynamic cone pener est. kets is No. of blows for	tration				

	;		Type of bo	oring : Rotary	Percus	sive Di り ニ	rilling <u>11.5 M</u>	mal	Lining tubes : 2in to 43ft	
R6	93		. Daily	Samples	•	Cł	nange of S	trata		
	• 5		Progress	Depth	Туре	Legend	Depth	O.D. Level	Description of Strata	
÷	•				- iype	AAAAA	Deptil	U.D. Level	606	68
	: ·			2*0*	D		2"6"	44.1	FILL (clay, gravel and brick fragme	ents)
				2°6" - 4°0"	U(4)					·
	:			6"6"	D				Very stiff dark brown sandy silty (NAY with find
	<u>.</u>							ŕ	to coarse gravel (Boulder Clay)	,CAS WITH THE
	.;			8'6" - 10'0"	U(4)		3.3	25.6		
				11'0" 11'6" - 12'3"	BD C(81)			35.6	· · · · · · · · · · · · · · · · · · ·	
			30.8.66	14*0"	BD					
	1	•	31.8.66							
		•		16°6" - 16°9"	C(29)					
	1 4 1						·			
	,			21'0"	D					*.
				24 ° 0 *	D					
•						***			Very stiff to hard dark grey sandy	silty CLAY
-				27°0*	D				with fine to coarse gravel, cobbles boulders; large boulder between 331	s and
	1	•	12.9.66	30'0"	D					
	ł	•		33'0"	D					
				36'0"	D					,
	·					Q.				
			-	39*0*	D		-1			
	ļ,						13.1			
,	: :-			43.04	D		48.0.	3.6		
				45°0"	D		ł		Black LIMESTONE	
•			13.9.66	48°0"	D		48'0"	-1.4		
* - 	:		19.9.00			h-54-	40 0			
•	;							•		
	:									•
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,	:									
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	+ 11 + +	. ·								
	1			e of sample : 4 in. dia, undisturbe		Ren	narks : (Observati	ons on ground-water, etc.)	
	. •		U (14) -	disturbed sample.	o sampre.	Nog	ground-wa	ater was	encountered during boring.	
• .	\sim	۰.	BD —	bulk disturbed sam vane test.						·
			C ()-	standard penetratio dynamic cone penet	n tes t . tration					
			Figure in bra	test. ckets is No. of blows for given in depth column						. '
			(see Notes, p	page 1).		L				Soits No :
•										SONS NO: S/5499
· .				•		DUBLI	N, BAC	GOT ST	RET	
	· ·						•			FIG. 3
- Ja			GEORGE V	WIMPEY 0.	, LTD.	<u> </u>		CE		<u>н</u>
é, j	· · · · .		i engligen en c		,			1		

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SITE	INVESTIGATIONS LIMITED	
	BOREHOLE RECORD	

				2011						
	CONTRACT Hotel at Simmonscourt CLIENT Ove Arup & Partners	- 	ی هو ≮یں ایفا ه	• • •	Boreh Sheet	ole No. 1 of	3 1	 6. E	22)3
_	Site Address Dublin	1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.		747 (2 CT) 4	· · ·	1990 - 1990 - 1990 - 1990 - 1990 - 1990 - 1990 - 1990 - 1990 - 1990 - 1990 - 1990 - 1990 - 1990 - 1990 - 1990 -	· · ·	• •	0 A	Ŭ
	Boring Commenced 12/9/88		• .		· .	.				
	Type of Boring Shell & Auger			. x		g Compl			88	
	Auger	. بيغند 1.		•	Diame	eter of B	orehole	2	00	n
	Description of Strata	Re- duced	Depth	Leg-		Sample	s/Tests		Ţ	Wat
	Ground Level	Level		end	Туре	Depth	Ref.	Casing	Date	
1	Hardcore		0.10	┝┯┯		m	No.	Depth		1 11
)		10.13	Ŕ	\$		1			1
721	Fill of silty clay, brick etc.		0.80	X	D	0.50	63565			
					D	0.80	63566			
	Firm brown sandy silty clay with	1		Ŀ	υ	1.00	63567			
	stones			· ·						
		<u> </u>	1.70	· • * *	D	1.65	63568			
		1875 b 477 s.	<u> </u>	0.00 101	D	1.80	63569			1
				001	C(57)	1.90	58377	~		
	Dense fine to coarse claybound sandy		Ē	5.0	_					1
3	gravel		-	0210	D C(103	2.50	63570		ĺ	1
			E	3.40						
-			4	0						1
-			••• -	0	C(104)	3.40				1 145
			4	0						ð
-			3					and a start		Har Hart
2			4.	2		4.00	578*			
			4.50	2. 0.		_	•		1	
		-	Ē	- ×	D 4	4.50	63571			
	Stiff grey silty stony clay with		-	° –	W.W.	5.00	63572			
	cobbles and boulders		-	<u>× 0</u>			05572			
_	(Chiselling 2 ² hrs)		-	•						
			3,	0 7						
J			4-	-	D	5.00	63573			
,			1	, i l'	D C(48)	6.00 6.15	7	1	3/9	5.7
			-	× ↓ -						
				- 1						
ľ	i de la companya de la		. -	a. 4.						
			1_		υ	7.35 5	3574		• • •	• .
			1.	50		ľ				
ا			Ē,	<u></u>	DZ	7.85 53	3575	- ** 		
				- j xhe	(5 0) 8	1.00	·**	-		
	Final level		8.30		1				3/9	7.15
	Remarks:		· · ·	-+-	KEY	- EXPLA			<u> </u>	
	Chiselling 27 hours			[+	- CAPLA	ita HON Strike			
	Failed to rocover U4 at 7.00mBGL At 4.15 86 blows to 105mm Refusal				D	- Disturb	ed Sampl	ie		
	Kerusai				B W	- Buik Di - Water S	sturbed S	Sample		
						- water S - Undistu		nole		
					P	- Piston S	Sample	-		
- 1					+ C(N) -	- Cone Pe	netration	Test		
					+S(N) - N -	Standard Blows /3	a Penetra 100mm	tion Te	st	
						Vane Te				
L			_		• -					

R723

	SITE INVEST	HOLI	E REC	OR	D D		20		R7	2
- Maria Maria Angelan	CONTRACT Hotel at Simmonscourt CLIENT Ove Arup & Partners Site Address Dublin Boring Commenced 7/9/88 Type of Boring Shell & Auger	1:			Boring	ole No. 1 of 9 Compl	leted	9/9/8	8	27
	Description of Strata	Re-	Depth	r	Diame	eter of B		e .	200	
	Ground Level	duced Level		Leg- end	Туре	Sample Depth		Casir	Date	
	Topsoil	m			Type	m	· No.	Dept	'8	1
	Firm brown sandy silty clay with stones		0.40	· + 0	D C(8)	0.50	6355	56	•	
	Very dense fine to coarse sandy gravel with cobbles and boulders		1.50		C(80)	1.50	63557	4 18 		
	(Chiselling 4t hrs)			Ő	D C(70) C(94)	- Constant	53558			
				0	D 4	5.00 6 515	3559			
	Stiff brown silty stony clay	5	.90		D 2(50)	5.90 6 5.15	3560		8/9	5.
	Stiff/hard grey silty stony clay with cobbles		65		U 7	7.00 6	3561	•		
R	emarks:			× j c	(62) 8					
CA	t 5.15 106 blows to 195mm Refusal	aris y	in the second		+ B W ∎U	- EXPLA - Water S - Disturb - Buik Di - Water S - Undistu - Piston S - Cone Pe	Strike ed Sam sturbed ampie urbed Sa Sampie	pie Sampie ampie		
		- 16° - ₹			+S(N) - N - V -	Standar Blows /3 Vane Te	d Penet 300mm	ration T	est	

SITE INVESTIGATIONS LIMITED BOREHOLE RECORD

998 M**A**

 $= \sum_{i=1}^{n} \mathbf{x}_{i,i}$

	of Boring She1	1 & Auger 		Re- duced	Depth	T			Borehole	9/9/	200
				Level		Leg- end		Depth	Ref.	hart	Dat
		Ground Level		m	m		Туре	m	No.	Casing Depth	
Sti Wit	ff/hard gre	y silty stony	clay		-	0 -	υ	9.00	63563		
			· · · • • • • • • • • • • • • • • • • •	P - 1 - 1 - 1	• • •	Ť,	D	9.45	63564		
					10.00	> ⊀ -	C(75)				B/9
Fin	l level				10.00	-*					9/9
					Ţ						- - -
The second			1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1	(1) Bellenger		المعرورية					المنتخذ والمراجع
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					1		化试验剂	3.40			
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lemarks				l_			KEY				
Chise	11ing 41 ho	ws to 195mm R		- A			+	- EXPLA - Water S	Strike	-	
		HO LY IZJUM K	erusa1				B	- Bulk Di	ed Samplesturbed S	le Sample	
							w ∎u	- Water S - Undistu	Sample urbed San	-	
							■ P + C(N)	- Piston (- Cone Po	Sample enetration	n Test	
		· .		*** : * * *	• • •	··· · •	4 S(N)	- Standar - Blows /:	d Penetra	ition Te	st

R723

SITE INVESTIGATIONS LTD.

BOREHOLE RECORD

R741

61357

mm.

		DOILLIO		
CONTRACT	Merrion Ros	ld	BOREHOLE No	10
Bored for	Mr. M. O'Xe	117		
Site Address	Dublin			
Boring Commenc	ed 25/11/8 1	L	Boring Completed	8/11/81
Type of Boring	Shell & Aug	50 7	Diameter of Borehole	200
Ground Level		O.D.		
Water Struck (1)	0.90m BGL	(2)	(3)	
Standing Water L	.evel			

Failed to recover U4 at All levels are related to ground level. Remarks Chiselling 61 hours. 3.25m BGL.

Depth in	Meters		[San	nples	
From	To	Thickness	Ref. No.	Type	Depth	Description of Strata
0.00						
	0.45	0.45				Topsoil
<u>بر</u> 0.45						Mottled grey and brown silty
	1.25	0.80				stony clay
1.25		0.00				
	2.00	- 0 .75	26319	D	1.50	Dense fine to coarse sandy gravel
		0.70			2.15-2.60	Firm/stiff grey silty stony
2.00			26320 26321		3.50	clay with cobbles and boulder
	4.50	2.50			·	(chiselling 2 hours) Stiff/hard grey silty stony
4.50			26332	Ď	5.00	clay with cobbles and boulder
	7.00	8.50	26323		6.50	(chiselling 4 hours)
7.00						Final level.
				·		· · · · · · · · · · · · · · · · · · ·
					· · · ·	
Ann						
`'yIIII						
hours						Standard Penetration Tests:
			ļ		·	
					•	At 1.65 37 blows to 12" At 3.90 93 " " 12"
						At 5.40 50 " 12" At 5.90 92 " " 12"
		1				
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11111			l		· · · ·	
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	<u>.</u>		₩	ŀ		
			ll			

D - Disturbed Sample P - Piston Sample W - Water Sample

SITE INVESTIGATIONS LTD.

BOREHOLE RECORD

BOREHOLE No. 1

61346

R741

	CONTRACT		r1 0)	n 1	toad	
,	Bored for	r .	X.	0	Kel	1 y
	Site Address D	ub:	lin			
,	Boring Comment	ed	11	8/1	1/8	1
	Type of Boring	81	hel]	LA	Au	ger
	Ground Level		-			O.D.
	Water Struck (1)	1.	3 01	B	GL	(2)
	Standing Water I	Jeve	əl	1.	00m	BGL

Merrion Road

Boring Completed 19/11/81 300 Diameter of Borehole

mm.

18

(3)

Remarks All levels lated to ground level. Chiselling 2 hours.

· · · · · · · · · · · · · · · · · · ·	Meters	Thickness		· · · ·	mples	Description of Strata
From	To		Ref. No.	Туре		
0.00			25476 25483	_	1.00 1.00	Fill of silty stony clay
	1.50	1.80	40103		1.00	rubble, brick, etc.
1.50			25477	Ū	3,00-3.45	Firm/stiff grey silty stony
	3.55	2.05		e -		clay
3.55			25478	D	3.60	Presumed rock or boulder
	3.70	0.15				(chiselling 2 hours)
						
11111						
				•		·
• • • • • • • • •						· ·
						Standard Penetration Tests:
1111111					· · · · · · · · · · · · · · · · · · ·	At 1.65 14 blows to 12"
<u>} ::::::</u>		,		L		At 3.70 Refusal
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	S S	ITE	IN	/E	:STIGA	ATIONS L'I'D. _{R7}
Ĩ.	r		E	30	REHOLE P	
CONTRAC	T Mer	rion Ro				BOREHOLE No. 1A 6134
Bored for	Mr.	X. O'K	elly			•
Site Addre	ss Dub	lin				
Boring Cor	nmenced	8/13/	B1			Boring Completed 9/13/81
Type of Bo	ring Sh	011 & A	lger			Diameter of Borehole 300 mm.
Ground Le	vel —	-	O.I	D		
Water Strue	ck (l) 1.0	DOE BGL	(2)		(3)
_		0.80m				
Remarks	A11 10 3.00m				to ground 3 hours.	level. Failed to recover U4 at
Depth is		r	1	-	mples	· · · · · · · · · · · · · · · · · · ·
From	То	Thickness	Ref. No.	Туре	*	Description of Strata
0.00						
	0.30	0.30			· · · · · · · · · · · · · · · · · · ·	Topsoil
		1		·		Fill of silty stony clay,
	1,00	0.70	 	 	<i>.</i>	brick, organic matter, etc.
1.00		-	ł		·	Fine to medium sandy gravel
	1.30	0.30	 	┣	 	
1.30			26335		1.50-1.95 2.00	Firm/stiff grey silty stony clay
3.25	3.25	1.95		–		
	3.40	0.15		1		Presumed rock or boulder (whiselling 2 hours)
			╫───	┞──		
		1				
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W - Water Sample.

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BOREHOLE RECORD

(3)

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CONTRACT	Merrica R	oad	
Bored for	Nr. N. O'	Kelly	
Site Address	Dublin -	• • • • • • •	
Boring Comme	nced 13/11	/81	
Type of Boring	81011 L	Auger	
Ground Level		O.D.	
Water Struck (1)	(2)	•
Standing Water	Level 1.45m	BGL	

BOREHOLE No. - 2

61348

Boring Completed 18/11/81 Diameter of Borehole 200

mm.

Line

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- THE

Remarks related to ground level. Chiselling 41 hours. All levels ATO

Depth in	Meters			Sai	mples	
From	To	Thickness	Ref. No.	Түре	Depth	Description of Strata
0.00						Fill of silty stony clay,
	1.35	1.35				rubble, traces of organic matter etc.
5.35			25479	D	1.50	Dense fine to coarse sandy
1	2.20	0,85		•		gravel
2.20		ł	25480 25481		2.35-2.80	Firm/stiff grey silty stony
	800	3,80	25482		5.00	clay
6.00			25484		8.50	Stiff/hard grey silty stony clay with cobbles and boulders. (chiselling 2jhr)
	9.95	3.95	25486		9.50	boulders. (chiselling 2jhr)
9.95		•	25487	D.	10.00	Presumed rock
	10.00		25488		9.10	(chiselling 2 hours)
11111111		<u> </u>				
		1				
		}	 			
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111111	111111		 			
¥ЩЦ					· · · · · · · · · · · · · · · · · · ·	
- 					N	Standard Penetration Tests:
1						At 1.65 37 blows to 12"
		•				At 5.50 14 " " 12"
						At 7.00 63 " " 12" At 8.50 113 " " 12"
						At 8.50 113 " " 12" At 9.85 Refusal
		1 1				
<u></u>						
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		4 1				

SITE	INVES	IIGAIIO	ND LID.	R741
	BOREH	IOLE RECORD)	R/41
CONTRACT Morrion			REHOLE No. 3	(71.8
Bored for Mr. N. C	'Xelly			61349
Site Address Dublin				-
Boring Commenced 18/1	1/81	Boring Con	npleted 18/11/81	•
Type of Boring Shell &	Auger	Diameter o	f Borehole	mm.
Ground Level	O.D.		•	•
Water Struck (1) 1.75n BC	L (2)	(3)		
Standing Water Level 1.40	n BGL			
Remarks All levels	re related to g	round level.		
· · · · · · · · · · · · · · · · · · ·	-			
Depth in Meters Thickne	Samples		Description of Strata	
From To	³³ Rel. No. Type	Depth		
		Rubble; matter	f silty stony of traces of org etc.	
3.30	25489 D 1.3 25494 W 1.4		grey and brown	a silty
1.75 0.45				

t	Depth in Meters	m 1 · · · ·		Sar	nples	
•	From To	Thickness	Rel. No.	Туре	Depth	Description of Strata
Ī	0.00	1.30				Fill of silty stony clay, Rubble_ traces of organic matter etc.
I	3.30	0.45	25489 25494	D W	1.30 1.40	Mottled grey and brown silty stony clay
	1.75	- Q.80	25490	D	2.00	Dense fine to coarse sandy gravel with cobbles
	2.55	4.45	25491 25492 25493	U D D	2.70-3.15 4.50 5.00	Firm/stiff grey silty stony clay
	5.00	2.00				Stiff/hard grey silty stony clay
	7.00					Final level
						Standard Penetration Tests:
						At 1.65 64 blows to 12" At 4.35 18 " " 12"
						At 5.88 63 ····· 13··
						•

	1	BORE	HOLE R	ECORD		R741
CONTRACT' Merrica Bo	ad			BOREHOLE No.	5	615"
Bored for Mr. N. O'K	elly					U
Site Address Dublin	• • ····					
Boring Commenced 20/11/	81			Boring Completed 21/	11/81	
Type of Boring Shell & A	uger			Diameter of Borehole	200	mm.
Ground Level —	O.I	D.				
Water Struck (1) 2.75m B	3L (2)	. •	(3)		
Standing Water Level						
Remarks All levels as	re rela	ated to	o ground 1	level.		
						·
Depth in Meters Thickness		Samples		Description	1 5	
From To	Rel No.	Туре	Depth	Description o		

E

1

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... 7 DITE THACOTTOMO TIO

From	10		Rel No.	rybe		
0.00						Fill of silty stony clay, rubble, traces of organic
	0.70	0.70				matter etc
9.70						Stiff mottled brown silty
	2,00	1.30	26301	U ·	1.50-1.95	stony clay
8.00		-	26302	D	2.50	Firm/stiff grey silty stony
	3.00	1.00			·	clay
3.00			26303 26304		3.80	Stiff/hard grey silty stony
	7.00	4.00	26305		8:88	clay
7.00					•	
			-			Final level
					•	
		1 ·			•	
^r 'i 🗍		1'				Standard Penetration Tests:
		•				At 3.30 18 blovs to 13"
		1				At 3.80 62 " " 12"
						At 5,30 105 " " 18"
		1				At 6.80 Rofusal
· · · · · · · · · · · · · · · · · · ·						
		1				
			1	t -		
		1				
<u> </u>			1	1 -		
				t		
		1				
C		adisturbed S	ample	<u>ה</u>	Disturbed Sample	P Piston Sample W Water Sample

Ft. - Hedisturbed Sample

D -- Disturbed Sample P -- Piston Sample

her Struck (1) 1.30m BGL (2) (3) hanks All levels are related to ground level. Failed to recover U4 st 2.50m BOL. Samples Description of Samta poph in Meters Tuckness Rei No. Type Depth 0.00 IIII 0.18 0.18 Topsoil 0.18 0.18 IIII Somples Description of Samta 1.30 1.05 38514 IIIIIII Topsoil 0.18 0.18 IIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIII	e of Boring						
Sund Level O.D. ser Struck (1) 1.20m BOL (2) (3) narks All levels are related to ground level. Failed to recover U4 at 2.60m BOL. Depth in Meters Thethasis From To Thethasis Rel No. Type Depth in Meters Thethasis From To Thethasis Rel No. Type Depth in Meters Thethasis To Thethasis To Thethasis To Thethasis Thethasis Samples To Thethasis To Thethasis To Thethasis To Thethasis To 0.18 O.10 28816 D To 28818 D To 200 1.20 Standard groy brown shity stony telay To 3.00	-						
anding Water Level (3) makes All levels are related to ground level. Failed to recover U4 at 2.800 BOL. Depth in Memer Somplex Toom To Dischass 0.00 100 1.10 0.18 0.10 100 1.20 1.06 38816 D 1.30 1.06 28816 D 1.30 1.06 28816 D 1.30 1.06 28816 D 2.80 1.80 1.30 1.00 28816 D 2.80 1.20 28816 D 2.80 1.20 28816 D 2.80 1.20 28817 D 2.80 1.20 3.80 1.20 28818 D 2.80 1.20 28818 D 2.800 1.20 28820 D 28820 D 288218 D		hell & A	•			Diameter of Borehole 200 mm.	
anding Water Level marks All levels are related to ground level. Failed to recover T4 at 2.80m B0L. Depth in Meter from Tockness Rei No. Type Depth Description of Smota 0.00 IIIIII IIIIIIIIIIIIIIIIIIIIIIIIIIIIII		1 00- 5).	~		
All levels are related to ground level. Failed to recover U4 Depth Memen Tuckness Samples Tom To Tuckness Rel No. Type Depth Description of Stote 0.00 1 1 1 1 0 Soft/firm silty clay 1.01 1.05 28516 D 1.00 Soft/firm silty clay 1.20 1.10 28516 D 1.50 Locase fine to medium sandy gravel 1.20 1.20 28516 D 2.00 Firm/stiff mottled grey and 1.20 1.20 28516 D 2.00 Firm/stiff mottled grey and 1.00 28520 D 2.00 Stiff/hard grey brown silty stony elay 1.00 28520 D 2.00 Stiff/hard grey silty stony 1.00	••		(2)	•	• (3		
at 2.60m BGL. Durbin Meters Samples Form To Thekness Samples Description of State form To Thekness Feel No. Type Depth Description of State 0.00 1.10 1.6 0.18 Topsoil Description of State 0.3 1.10 28814 D 1.00 Soft/firm silty clay 1.30 1.05 28816 D 1.50 Loose fine to medium sandy starts 1.40 0.60 28817 D 2.00 Firm/stiff mottled groy and brown silty stong that 3.00 1.20 28818 D 3.00 Statf/hard groy brown silty stong that 3.00 1.00 28818 D 3.00-3.45 Statf/hard groy brown silty stong 4.00 1.00 28820 D 4.00 Statf/hard groy silty stong 7.00 3.00 1.00 28820 D 4.00 7.00 3.00 28820 D 4.00 1.01 28820 D 4.00 Statf/hard groy silty stong <td< td=""><td>-</td><td></td><td></td><td></td><td></td><td></td><td></td></td<>	-						
Tom To Tokkass Ref No. Type Depth Description of State 0.00 0.15 0.15 0.16 Topsoil Topsoil 0.13 0.16 35516 D 1.00 Soft/firm silty clay 1.30 1.06 25515 D 1.50 Loose fine to medium samfy graval 1.30 25515 D 1.50 Loose fine to medium samfy graval 1.30 25515 D 1.50 Loose fine to medium samfy graval 1.30 25517 D 1.50 Loose fine to medium samfy graval 1.50 1.20 25517 D 1.50 Statif/hard grav brown silty stony elay 3.00 1.20 25517 D 3.00-3.45 Stif/hard grav brown silty stony elay 4.00 1.00 25525 D 4.00 Stif/hard grav silty stony elay 7.00 3.00 25525 D Stif/hard grav silty stony elay 7.00 1.00 25525 D Stif/hard grav silty stony <tr< td=""><td></td><td>.50m BGL</td><td></td><td></td><td>to ground .</td><td>evel. Jailed to redover US</td><td></td></tr<>		.50m BGL			to ground .	evel. Jailed to redover US	
Trom To Type Depth Topsoil 0.00 0.18 0.18 Topsoil 0.18 0.18 0.18 Topsoil 0.11 1.00 Soft/firs silty clay 1.20 1.05 25515 D 1.50 1.20 25515 D 1.50 Loose firs to medium sandy gravel 1.20 25517 D 2.50 Doors firs to medium sandy gravel 1.40 0.60 25517 D 2.00 Firs/stiff mostled grav sand brows clay with cobbles and brows clay with cobbles and boulders. (chiseling light) 3.00 1.20 25522 D 4.60 Stiff/hard grav silty store and boulders. (chiseling light) 4.00 1.00 25522 D 4.60 Stiff/hard grav silty store and boulders. (chiseling light) 4.00 1.00 25522 D 7.00 Stiff/hard grav silty store and boulders. (chiseling light) 4.00 1.00 25522 D 4.60 Stiff/hard grav silty store and boulders. (chiseling light) 4.00 1.00 25522 D 7.00 Stiff/hard grav silty store and boulders. (chiseling and boulders. (chiseli	Depth in Meters	Thickness					—
Image: Second system Topsoil Topsoil 0.18 0.18 1.00 Soft/firm silty clay 1.20 1.05 25815 D 1.00 Soft/firm silty clay 1.20 1.06 25815 D 1.80 Loose fine to medium sandy gravel 1.20 1.20 25816 D 2.00 Firm/stiff mottled gray and brown silty stoay clay 3.00 1.20 25816 D 2.00 Firm/stiff brown silty stoay clay 3.00 1.20 25816 D 2.00 Firm/stiff brown silty stoay clay 3.00 1.20 25818 U 3.00-3.45 Stiff/bard gray silty brown silty stoay 4.00 1.00 25520 D 4.60 Stiff/bard gray silty stoay 4.00 1.00 25520 D 4.60 Stiff/bard gray silty stoay 7.00 1.01 2.00 25520 D 4.60 Stiff/bard gray silty stoay 7.00 1.01 3.00 25523 D 7.00 Stiff/bard gray silty stoay 1.11 1.11 1.11 1.11 Stiff/bard gray silty stoay<		1 :	Rei No.	Туре	Depth	Description of Strata	
1 0.45 0.15 25814 D 1.00 Soft/firm silty clay 1.20 1.05 25815 D 1.50 Loose fine to medium sandy gravel 1.30 1.40 0.60 25815 D 1.50 Loose fine to medium sandy gravel 1.40 1.40 0.60 25815 D 1.50 Loose fine to medium sandy gravel 1.40 1.40 25816 D 2.00 Firs/stiff mottled grey and brown silty stoay elay 3.00 1.20 25817 D 2.00 Firs/stiff boots silty brown silty stoay elay 3.00 1.20 25830 D 4.00 Stoay first boots silty stoay elay 4.00 1.00 25530 D 4.00 Stoay first boots silty stoay elay 7.00 1.00 25530 D 4.00 Stoay first boots silty stoay elay 7.00 1.00 2.00 25530 D 4.00 7.00 1.00 2.00 25532 D 5.80 1.11 1.00 2.00 2.00 First sitty stoay 1.11 1.10 <td< td=""><td></td><td></td><td></td><td></td><td></td><td>Topsoll</td><td>- A.</td></td<>						Topsoll	- A.
1.20 1.05 1.50 Loose fine to medium sandy 1.20 1.10 25515 D 1.50 Loose fine to medium sandy 1.80 0.60 25517 D 2.00 Firm/stiff mottled gray and brown silty stony elay 3.00 1.20 25517 D 2.00 Firm/stiff mottled gray and brown silty stony elay 3.00 1.20 25517 D 3.00-3.45 Stiff/hard gray brown silty stony elay 4.00 1.00 25520 D 4.00 Stiff/hard gray slity stony elay 4.00 1.00 25520 D 4.00 Stiff/hard gray slity stony elay 7.00 3.00 25523 D 5.00 Stiff/hard gray slity stony elay 7.00 3.00 25523 D 7.00 Stiff/hard gray slity stony elay 7.00 100 25523 D 4.00 Stiff/hard gray slity stony elay 7.00 100 25523 D 4.00 Stiff/hard gray slity stony elay 7.00 100 25523 D 7.00 Stiff/hard gray slity stony elay 1000 25523 D 5.00 Stiff/hard gray slity slity slity 1000 100 100 Stiff/hard gray </td <td>0.1</td> <td>3 0.15</td> <td></td> <td></td> <td></td> <td></td> <td><u> </u></td>	0.1	3 0.15					<u> </u>
1.20 [[[]]] 1.60 25515 D 1.50 Loose fine to medium sandy 1.80 [[]]] 1.80 0.60 25515 D 1.50 Firm/stiff mottled grey and 1.80 [[]]] 3.00 1.20 25516 D 2.00 Firm/stiff mottled grey and 3.80 [[]]] 3.00 1.20 25517 D 3.00 Stiff/hard grey brown silty stony elay 3.00 1.00 25520 D 4.00 Stiff/hard grey silty stony elay 4.00 1.00 25520 D 4.00 Stiff/hard grey silty stony elay 4.00 1.00 25520 D 4.00 Stiff/hard grey silty stony elay 4.00 1.00 25520 D 4.00 Stiff/hard grey silty stony elay 4.00 1.00 25520 D 4.00 Stiff/hard grey silty stony elay 4.00 1.00 25523 D 7.00 Stiff/hard grey silty stony elay 1.11 1.00 25523 D 7.00 Stiff/hard grey silty stony elay 1.11 1.00 1.00 Stiff)	1.05	85514	D	1.00	Soft/firm silty clay	
1.80 0.60 28816 D 2.00 Firs/stiff mottled grey and brown silty stony elay 3.80 1.20 28816 D 2.00 Firs/stiff mottled grey and brown silty stony elay 3.00 1.20 28817 D 2.00 Firs/stiff mottled grey and brown silty stony elay 3.00 1.20 28818 D 2.00-3.45 Stiff/hard grey brown silty stony elay 4.00 1.00 28820 D 4.00 Stony clay Sitt cobbies and boulders. (obiselling light) 4.00 1.00 28820 D 4.00 Stiff/hard grey silty stony 4.00 1.00 28820 D 4.00 Stiff/hard grey silty stony 7.00 1000 28823 D 7.00 Stiff/hard grey silty stony 1000 28823 D 7.00 Stiff/hard grey silty stony 1000 28832 D 7.00 Stiff/hard grey silty stony 1000 28832 D 7.00 Stiff/hard grey silty stony 1000 28832 D Yinal level. Yinal level. 1000 Standard Penetration Testsi At 3.	L.20		25515	D.	1.50	Loose fine to medium sandy	
111111 25817 D 2.80 brows silty stony slay 3.00 1.20 25817 D 2.80 brows silty stony slay 3.00 1.10 25518 U 3.00-3.45 Stift/hard grey brown silty stony slay 4.00 1.00 25520 D 2500 Stift/hard grey silty stony slay 4.00 1.00 25520 D 2500 Stift/hard grey silty stony slay 11111 25525 D 7.00 Stift/hard grey silty stony slay 11111 25525 D 7.00 Stift/hard grey silty stony slay 11111 1.00 25525 D 7.00 7.00 1.01 25525 D 7.00 Standard grey silty stony slay 11111 1.00 1.00 25525 D Standard Penetration Tests: 11111 1.11 1.11 1.11 1.11 11111 1.11 1.11 1.12 1.12 11111 1.11 1.12 1.12 1.13 11111 1.13 1.13 1.12 1.13 11111 1.13 1.13 1.21 1.21 11111 1.13	1.8				• •		
1.20 3.00 1.20 3.00 1.10 35520 3.00-3.45 Stiff/hard grey brown silty mobbles and boulders. (chiselling light) 4.00 1.00 25520 3.00 Stiff/hard grey silty stony clay 4.00 1.00 25520 3.00 Stiff/hard grey silty stony clay 4.00 1.00 25520 3.00 Stiff/hard grey silty stony clay 11111 7.00 3.00 25523 D Stop 7.00 11111 7.00 Final level. Final level. 111111 11111 11111 Final level. Final level. 1111111 111111 111111			25516	D	2.00	Firm/stiff mottled grey and	
1111111 35518 0. 3.00-3.45 1001007.0107 Uit costsing in and bould ors. (ohiseling likr) 4.00 1.00 25520 0 4.00 Stift/hard grey silty stony elay 111111 25520 0 4.00 Stift/hard grey silty stony elay 111111 25520 0 4.00 Stift/hard grey silty stony elay 111111 7.00 10010000 Stift/hard grey silty stony elay 111111 7.00 Stift/hard grey silty stony Standard Penetration Tests: 111111 111111 111111 111111 111111 111111 111111 111111 111111 111111 111111 111111 111111 111111 111111 1111111 111111 111111 111111 1111111 1111111 1111111 1111111 1111111 1111111 1111111 1111111 1111111 1111111 1111111 1111111 1111111 1111111 1111111 11111111 11111111 1111111 11111111 11111111 111111111111111111111111111111111111	8.0	1.20	25517	ע	3.80	brown silty stony elay	
1 1 00 1.00 boulders. (chiselling likr) 4.00 1 25520 D 4.00 Stift/hard grey silty stony 1 7.00 3.00 25523 D 4.00 Stift/hard grey silty stony 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	.00		35518	U	3.00-3.45	Stiff/hard grey brown silty	
1111111 3.00 36831 B 8.88 Stiff/hard grey silty stony elay 7.00 111111 7.00 7.00 7.00 9.00 9.00 111111 111111 7.00 9.00 9.00 9.00 9.00 111111 111111 10.00 9.00 9.00 9.00 9.00 111111 111111 10.00 9.00 9.00 9.00 9.00 111111 111111 10.00 9.00 9.00 9.00 9.00 111111 111111 111111 111111 9.00 9.00 9.00 111111 111111 111111 111111 9.00 9.00 9.00 111111 111111 111111 111111 111111 9.00 9.00 9.00 111111 111111 111111 111111 111111 111111 111111 1111111 1111111 1111111 1111111 1111111 1111111 1111111 1111111 1111111 1111111 1111111 11111111 11111111 1111111111 11111111 111	4.0	1.00				boulders. (chiselling 1thr)	
Image: Standard Penetration Tests: Image: Standar	.00		25520			Stiff/hard grey silty stony	
IIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIII		3.00	25522				
1 1	1.00						•
Image: Standard Penetration Tests: Image: Standar					·		
Image: Standard Penetration Tests: Image: Standar					•		•
Image: second	<u>,</u>	T ::	∦				
Image: standard Penetration Tests: Image: standar							
At 1.15 6 blows to 12" At 3.15 13 " " 13" At 3.15 13 " " 13" At 3.65 78 " " 12" At 5.65 62 " " 12" At 6.65 68 " " 12"							
At 3.15 13 " " 13" At 3.65 75 " " 13" At 5.66 62 " " 13" At 6.65 68 " " 13"		<u>: </u>				Standard Fenetration Tests:	•
At 3.15 13 " " 13" At 4.65 75 " " 13" At 5.66 62 " " 13" At 6.65 68 " " 13"			╂────			At 1.15 6 blove to 18*	
At 4.65 78 " 12" At 5.68 62 " 13" At 6.65 68 " 13" Image: State of the st		<u>; </u>					
		<u></u>					
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			<u> </u>				
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SITE INVESTIGATIONS LID.

BOREHOLE RECORD

BOREHOLE No. 7

R741

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	i	Merrica Road	
	Bored for	Mr. N. O'Kell	J
1	Site Address	Dublin	
	Boring Comme	nced 23/11/81	
	Type of Boring	Shell & Auger	,
	Ground Level		O.D.
	Water Struck (1) 1.03m BGL	(2)
1	Standing Wate	Level 0.25m BG	L
1	Remarks		

NTRA

Boring Completed	24/11/81
Diameter of Borehole	800

mm.

(3)

Hemarks All levels are related to ground level.

	Depth in	Meters			San	nples	
	From	To	Thickness	Ref. No.	Туре	Depth	Description of Strata
	0.00						
		0.30	0.30				Topsoil
			0.00				
							Nottled brown silty stony
	لللأجمنا	1.00	0.70				Nottled brown silty stony
	1.99		÷	86314	ס	1.50	Fine to medium sandy gravel
		1.95	0.95		_		of medium compaction
Į	1.95			26315 26316 26317	0 0.	2.10-2.55 3.60-4.05	Firm/stiff grey silty stony
ľ		6,00	4.05	26317	D.	5.00	clay
	6.00			26318	D	6.50	Stiff/hard grey silty stony
					· ·	~. <i>~</i>	clay
		7.00	1.00			•	<u> </u>
	7.00					•	Final level
ALC: NO				-		·	
2	•						
والمعاركة والم							
						•	
	Π						
	·)				· · · ·		
				l[
		1:::::		 			
ľ							Standard Penetration Tests:
							
]				At 1.65 21 blows to 12"
5							At 5.25 20 " " 12"
				1			At 6.75 62 " " 12"
			1				
	<u> </u>						
			4		1		
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Code: I

	1415	I RIAL FII RECURD	K752		61448		
	Contract		Sheet No.		Trial Pit No.		6
			Excavation Method	Method			
<u>- lū</u>	Location		Ground Level	vel			
			Date	5.3	.83		
11	والمحتولة المحتولة المح		Π			Samples	
	Desc	Description •	Depth	Legend	Depth	Type	Ref. No.
L	Dark brown TOPSOIL Fill (contains ash; flayey ash tinning,	OTL Ash, clinker, silty ing, very loose with	01.0				
	Kravel)	· · · · · · · · · · · · · · · · · · ·		•	1.30	9	5564
Name and the second	Yellovish brown sa CLAY Vell-graded sub-an some sand Brown BOULDER CLAY	own sandy gravelly silty sub-angular GRAVEL with R CLAY	. 40 . 10 . 60	1			
	Black BOULDER C				3.10	Ω.	5565
					_		
		·	1	,			
			ll				
	Ground Water Conditions	Inflow at 2.50 m.	_				
	Remarks						

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Report No. 541	BORING RECORD	ap R	152		6141	2,	
			<u> </u>	Borehole No	o. 4		
			<u></u>	Sheet			
		Type and	Diar	S			
		Grou	evel	Tagny		IIIBTA	
		Date	8.3.	83 - 9	0.3.83		
Description	Reduced	Depth -egend	Ref.	Samples Type De	Field Records Depth And Tests	ecords	·
MADE GROUND, topsoil loose cinders, ash, c brick etc.	over lay		5501			10	
Stiff brown silty gra CLAY	avelly	himmin	5502	D 3	00 N = 1	41	
Stiff to hard black s very stony CLAY with and boulders	silty cobbles		5505	0 D	= <u>v</u> 000 000	61	
			5509	D 6.	• 00 • 1 = 1 • • • • • • • • • • • • • • • • • • •	46 for 150 mm .Ref.	
:	· · · · ·	1719	5511	D 8.	= <u>N</u>	8	
			5513	-6 -0	• 0	N 50 =	н 1 1 1 1
Grey LIMESTONE fragments		יייים <u>היי</u> יי שוייתיתיתייים	70 5514	D 12.	% KeI	• H	
		ucherryn de Gwe					
		<u>,,,,,,,,</u> ,,,,,,,,,,,,,,,,,,,,,,,,,,,,					
		<u>19. aburne</u>		.	**-@*989-9499- ₹-+6-,-,-		· ·
el Observation Casing T	asiduring Boring Depth to Remarks	Remarks	ks Chise	elling	t boulder	s in	
Depth Depth 83 3.30 3.00 83 9.70 9.50		Place Place	Chiselling Placed PVC	limeston pipe in	stone – 1 1 in borehol	1 1 hrs ole	•
		D-Dist W-Wat	Sample/Test key U-Tube Sample D-Disturbed Sample W-Water Sample	Tec	C-Cont Penetration T N-Blows/0.3 metres R-Refusal V-Vane	tion Test	

SH SOIL LABORATORIES I	.TD.	ВС	DREHC	DLĘ N	0.	3	61	562
P.A.WA. Baggot Str	eet,			R	EPORT N	10. S ·	117	
Joseph McCullough a	nd Partn	ers.		G	round Le	vel		
84/87 Baggot Stree	t			Bo	oring Cor oring Cor	nmenced npleted	23.9	.1975
200mm shell and aug	er							
Mr. Science and a second secon	Water Levels	Record	led Durir	g Boring	: 			
Image: Second					-			
:00mm P.V.C. pipe inserted	. on comp	leti	on of	borin	£•		÷	
Description	Scale					imples & S.	Р.Т.	
£	Depth	+	Legend	Ref. N	o. Type	De	pth	N blows/fe
And ground, tarmac, rubble, aboves, cobbles and clay.				2817	Q	1.00	1.50	17
	2.10	H	×	2818	D	2.50		
then to stiff grey brown slightl	у.	+	<u> </u>	2819	υ	3.00		
we cobles.	3.80	H		2820	D	3.60		
the to coarse gravel and coarse	4.10	Η		2821	D	4.00		
WITITLE fragments.	4.30	H		2822	D	4.20	4.30	/ 36
							1	for 50
		П				1.1		
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Undisturbed Sample D-Large D	isturbed S:	mple	l	J-Jar	Sample	v	V-Water	Sample
		•						
							•	

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結婚# SOIL LABORATORIES LT	D.	BOREHO	DLE No.	·	1	61	560
**************************************	ET	-	REPC	ORT No	. S1*	7	
Joseph McCullough and	l Partne	ers.		nd Leve			
e: to 87 Lower Baggot	t Stree	et.	Borin Borin	g Comr g Comp	nenced leted	18.9)•1974)•1974_
The second and auger	r						
W	ater Levels	Recorded Durin	ng Boring				
h and a size Depth a fin fin County Depth a fin fin Provide Level							
Manuse : Name ITC pipe inserted on co	ompleti	on of dril	ling.				
	Scale			Sam	ples & S.P.T		
	Depth	Legend	Ref. No.	Туре	Depth		N blows/ft
and ground, comprising clay, and, stones, timber, rubble etc.	0.90		2801 2802	ת ע	0•50 1•00		
Firm to stiff brown sandy clay			2603	a	2.00		
with siches and cobbles, somewhat fristic.	3.00	1 22	2604	υ	2.50		
		ΗÓ	2805	D	3.20		
tail to hard dark grey very every clay with numerous			2806	υ	3.50		
matter and boulders. (BOULDER CL)	AY)	HA	2807	ם	5.00		
		$H \rightarrow$				6.00	130
	6.60 6.70		2808	D W	6.70 Water	6.70	/56 ъ1
a toulders.							for 25
							:
		EL.					
- ²⁰							
		<u>μ</u>					
		. +++					
		H .					
	• .	HI					
U-Uncisturbed Sample D-Large Dis	sturbed Sa	mple	J-Jar Sai	mple	-W-	-Water	Sample
	-						
	•						4

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Same Market F.A.W.A. PAGGOT STREET				RC	ORT N	lo. S117		
Joseph McCullough and Pa				_				
Ga is an a second company and a second company and a second company and a second company and a second company a					ing Con		22.9.1	975
Sementary 31/37 Bargot. Street				Bor	ing Con	imenced ipleted	23.9.1	975
Services in Theory shell and auger								
	ater Levels	Record	led Durin	ng Boring				
1 1 1 1 1 1 5 1 Casing Depth 2 1 1 1 1 3 1 1 1 1								
Survey, Corr: P.V.C. Pipe inserted	in comp	lete	ed bor	ehole.		_		
Description	Scale				Sa	mples & S.P.	т	
n en	Depth		Legand	Ref. No.	Type	Dept	h	N blows/ft
Ante ground, tarnac, stones, brick Ante, traces of top soil.	, 1.40			2810	ם	1.00		
fire trown sandy stoney clay.		F	·	2811 2812	ש מ	1.50 2.00	0.0	
	3.60			2813	υ	3.10	2.	50 11
				2814	D	4.20	4.50	39
<pre>% Stiff (ark grey silty very stoney % star with cobbles and boulders. % Suffice CLAY)</pre>			$\left \begin{array}{c} \frac{\partial}{\partial r} \right\rangle$	2815	D	5.90	6.00	
	6.70	Н	Q			6		
Althantit fragments of bedrock or af large boulders.	7.00			2816	D	6.90	7.00	40 blow for 25 m
		-						
		Ħ						
		+						
		P						
		Н						
		H						
		H						
		Д						
		Н						
	· .	Ц						
		Ħ						
Conte U—Undisturbed Sample D—Large Dis	turbed Sa	<u> </u>		J-Jar S	ample		Water	Sample
	•							
						· · ·		

GEOTECHNIC	BORE						623			
LOCATION: E.S.B. East James's St.	CLIENT:		e & Pa			Borehole No. 1 Sheet 1 of 2				
EQUIPMENT: Pilcon Wayfarer 1500 & Wagon Drill	Boring Com Boring Com				<u> </u>	Coordinates Ground Level				
DESCRIPTION		Reduced Level	Log	Depth	Thickness	Depth		PLES/TES Sample	TS Test	
Concrete (Chiselling 23	Hours)		× 0	0.35	0.35					
Soft Black gravelly very Clay	y silty					0.60	D	3699		
					3.45	2.00	ם	3700	s.p.t. №±5	
	1		× × ×	-		3.10	D	370)		
Grey Clayey sandy grave cobbles	l with		000000000000000000000000000000000000000	3.80	1.20	4,00	ם	3702		
Soft Brown and grey grav	velly		×100	-5.00	-	5.20	D	3703		
silty clay with cobbles	-		x 0 0 x 0	-	3.20	6.00			s.p.t. N = 1	
				-		7.00	D	3704		
Very gravelly sandy sil	t with	· · ·	×°.Ox °×°×° °×°° ×°°°	8.20	1.80	9.00	D	3705		
GROUND WATER OBSERVATIONS:									. •	
SAMPLE/TEST KEYD Disturbed SampleS.P.TB Bulk SampleVW Water SampleC	Standard P Vane Test Core Recov			ARKS:						

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·	R	888	3					· · · · · · · · · · · · · · · · · · ·		
GEOTECHNIC.	AL CO BORE					SERV	ICE I	S L	TD.	
LOCATION:	CLIENT:				_	Borehole N	S		<u> </u>	
E.S.B. East James's St.	Ove Ar	up &	Partn	ers			^	of 2		
EQUIPMENT:	Boring Com	menced:	5.9.7	7		Coordinates	3			
Pilcon Wayfarer 1500 & Wagon Drill	Boring Com	pleted:	8.9.7	7		Ground Level				
		ced		th	sseu			LES/TES	TS	
DESCRIPTION		Reduced Level	Fog	Depth	Thickness	Depth	Type	ample No.	Test	
· · · · · · ·			× 0× × × × × × × × × × × × × × × × × ×	-10.00	1.80	<u>3.00</u>	0	3705		
Stiffish brown/grey grav slightly sandy clayey s			X o X o X o	-11.00	1.00	10.30	D	3707	s.p.t. N • 4	
Soft slightly gravelly of silt with cobbles (Chiselling 5 Hours) End of Borehole at 12.30			$\sum_{x=1}^{1} \sum_{x=1}^{1} \sum_{x$	14-30	3.30	12.30	D	3708		
Rock (Wagon Drill)				17-30	3.00					
Ind of Wagon Drilling										
GROUND WATER OBSERVATIONS:		<u> </u>								
B Bulk Sample V W Water Sample C	day 2.00 T. Standard P Vane Test Core Recov D. Rock Qual Designation	en. Test /ery (%) ity	REM Tot	ARKS: al c	hise	at 3.80 Elling 7 I from				

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Report No.	1611		BOF	RING	RECO	RD	_	6	23.	23	IG	iSL
Contract	BA	GGOT S	TREET						orehol heet	e No.	1	
_ocation	DU	BLIN						nd Diame				<u> </u>
lient							Ground	Level				
	DC	NNELLY	TROY	& A:	ssoc.		Date		22.	11.90	<u>_</u>	
						g	<u> </u>	s	amples		Elate o	
•	Descrip	tion			Reduced	egend	Depth	Ref. No.	Туре		Field R And Te	
Made gr			stones,		_evel							
							1.90	20193	D	1.00		
Soft mo stony c						1-	2.50	20194	D	2.00		
Stiff b CLAY (B				ony	·	1914		20195	D	2.60	2.60	N=23
Stiff t silty C boulder (Boulde	LAY wit s	th cobl				104 1 1 1 2 4×	4.20	20196 20197		4.20	4.50	N=37
Borehol	le comp	leted	<u>at 7.00</u>	<u> </u>		1 4 191 × 10	7.0	•			6.00	22/7 & re
Ö												
, v	Water Level	Observatio		oring	·	<u> </u>	Remark	<u>s</u>	<u>+</u>	<u> </u>		
Date	22.11.90 6.80 6.80 6.80 Wat				Remarks er no of b	ted	1]	sellir sellir				
							U-Tube D-Distu W-Wate	/Test key Sample rbed Sam r Sample ard Penet		N-Blo R-Re V-Va		

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Report No.	1611		BOR	ING REC	ORD		623	32 l	1	IG	SL		
Contract	BAG	GGOT S	TREET					orehol heet	e No.	2			
Location	DUE	BLIN					nd Diame						
Client	-					Ground		able Tool 200mm					
	DO	NBLLY	TROY &	ASSOC	Date			22.]	- 23.11.90				
	Description				egend		· · · ·	ample		Field Re	cords		
	Description	on		Reduced Level		Depth	Ref. No.	Туре	Depth	And Tes	ts		
	round - , timber		ravel,				20198	D	1.00				
FILL -	Brick ,	, clay	, stor	nes		1.20 2.40	20199		2 50	2.50	N-22		
Stiff with c	brown si obbles	ilty st	ony CI	YA.	100×.001 * 03		20199		2.30	2.50	N=32		
silty	to hard very sto er Clay	ony CLA			1 2 4 4 9 × 1	3.90	20200	D	4.20		50/150 & refu		
<u>Boreho</u>	<u>le comp</u>	<u>lete at</u>	<u> 6.00 </u>			6.00							
	Nater Level O	bservations	during Bo	 ring		Remark	11s	<u> </u>	L	<u> </u>			
Date 22.11.90	Hole		Depth to Water 3.80 S	Remark Remark Remark Remark Remark Remark Remark Remark Remark Remark Remark Remark Remark Remark Remark	seepag	e Chi		ng i	n bou	l = lh lders			
						U-Tube D-Distu W-Water	Test key Sample rbed Sam r Sample ard Penet		N-Blo R-Re V-Va				

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GEOTECHNIC.	AL CC					SERV	ICE	'S LT	D.
LOCATION: Baggot St.	CLIENT: MUIT	Wilso	n			Borehole No Sheet	o: 3 o	it [· .
Equipment: Pilcon Wayfarer 1500	Boring Com Boring Com		17/7/	180		Coordinates Ground Leve			
DESCRIPTION		Reduced	Log	Depth	Thickness	Depth	S	LES/TEST ample No.	Test
FILL (Brick, Gravel)				0.30		-	Туре	NU.	
Stiff brown gravelly san			× · v v · v × · v · v	-					
CL	LAY		x0 x x x	-	2.60		D	7368	5.P.T. N = 26
				2.90		2.50			S.P.T. N = 41
				2.90		3·00 3·50	D	7369	
Stiff dark grey gravelly s	ilty CLAY		· · · · · · · · · · · · · · · · · · ·	 -	2.10				5. <i>P.T</i> . N = 51
			0 1 0 1 0 1 ×	-5.00	1	4.50	D	7370	s.p.t. N = 50
Gravel and Broken Rock OBSTRUCTION - CHISELLI			0.00	5.40	0.40	5.40	D	7371	
•	j.W. Enc j.W. Sto		2.0	m l	<u>B.G.</u>		<u> </u>		
B Buik Sample V W Water Sample C	P.T. Standard P Vane Test Core Recov 2.D. Rock Qual Designation	very (%) llity		ARKS:	Tot	al Chise	lling	2 hrs	

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. FOTECHNIC,	<u> </u>			IN	G	SERV	CE		<i>~</i> .	
	BORE	HOLI	E RE	COR	RD		E	5232	8	
location: Baggot St.	client: Muir	Wilso	»n			Borehole No Sheet	o. 1	nt		
EQUIPMENT: Pilcon Wayfarer 1500	Boring Com Boring Com		11/7 14/7			Coordinates Ground Level				
		ef ced		ŧ	less	SAMPLES/TESTS				
DESCRIPTION		Reduced Level	Log	Depth	Thickness	Depth	Si Type	ample No.	Test	
FILL (Brick, Gravel)		+		0.30						
Firm to Stiff brown gro sondy silty Ci	-		<pre>c < 10 × 10 × 10 × 10 · 10 · 10 · 10 · 10 ·</pre>	2.10	1.80	1.50	D	7361	5.p.t, N = 23	
	CLAY				3.40	3.00	D	7362	5.P.T. N = 41	
with Cobbles CHISELLING 2 hrs	b					4.50	D	7363	s.p.t. N = 33	
OBSTRUCTION - CHISELLI	ING 2 hrs		.*()	5.50		5.50	D	7364		
						B.G.L.				
SAMPLE/TEST KEYD Disturbed SampleS.P.B Bulk SampleVW Water SampleC	T. Standard F Vane Test Core Reco I.D. Rock Qua Designation) Dvery (%) ality	REN	<u>) 11(</u> MARKS:		ital Chise	elling	4 hrs		
			<u> </u>					Vanessa P	ress Ltd.	

GEOTECHNIC		201			<u> </u>	SEDVI			891 rn
	BORE						CL		D.
LOCATION:	CLIENT:		Borehole No. 3						
67 Baggot Street, Dublin	Stepher	nson (Gibney	y As	soc.	• Sheet I of I			
EQUIPMENT:	Boring Com	menced:	5.8.	76		Coordinates			
Pilcon Wayfarer I500	Boring Com	pleted:	6.8.	76		Ground Level 623			
		ced		- ŧ	1ess			LES/TEST	'S
DESCRIPTION		Reduced Level	Log	Depth	Thickness	Depth	S Type	ample No.	Test
Brick and rubble FILL wi silt and clay.	th some			0.60	0.60	í.			
Black clayey SILT with s stones & some traces of brick.			ו ×××××××××××××××××××××××××××××××××××		1.22	1.00 1.50 - 1.20	Ð	3075	5.P.T
Firm brown and grey mott			x + 5x x + 5x + x x + x + x + x x + x + x + x + x +	1.82			-		N= //
clayey SILT with occasic stones.	onal		X X X X X X X X X X X X X X X X X X X	3.00	1.18	2.30 2.60 - 2.90	Ð	3076	S.P.T N=14
Medium to coarse grey ar SAND with some fine grav (borehole "blowing" cont	vel	7).			1.55	3.20 - 3.50 3.50	D	3077	S·P·T N= IC
Large limestone STONES a	and		000000000000000000000000000000000000000	A.55	0.60	4 .80	Ð	3078	
Stiff black silty very of CLAY with cobbles and bo (chiselling 2 hours).	_		0 1 0 1 × 1 × 0 × 1 × 0	· · · / Ə	1.85	6.00	Ð	3079	
End of borehole			0-0	7.00					
GROUND WATER OBSERVATIONS: Wat	er struc	ck at	3.00	m BG	L ar	nd rose i	capi	dly to	J. 2m
(very strong flow). Wate	er level	at I	.2m B	GL O	n co	mpletion	n.		
B Bulk Sample V W:Water Sample C	T. Standard P Vane Test Core Recov D. Rock Qual Designation	very (%) lity	Chise 2 hrs	s.f	ng v rom	vith heav 5.I5m to k in B.1	- - 7.	00m. S	Sand

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EQUIPMENT: Pilcon Wayfarer I500 DESCRIPTION Brick and rubble FILL w some clay and silt. Mottled brown and yello gravelly CLAY with some	Boring Comr Boring Com		29.7. 4.8.7		Thickness	Coordinates Ground Leve		623 PLES/TEST
Brick and rubble FILL w some clay and silt. Mottled brown and yello	/ith	Reduced Level	Po Po Po Po Po Po Po Po Po Po Po Po Po P	Depth	ckness		SAMP	LES/TEST
some clay and silt. Mottled brown and yello	vith		XXXX		Thi	Depth	S Type	ample No.
· · · · · · · · · · · · · · · · · · ·	1			0.0	0.76			
	-			1.52	0.76	1.10	Ð	0001
Dark brown silty sandy CLAY with some very sma traces of red brick.		-	x 0 x 0 10 10 x 0 10 x		1.60	2.30 2.25-2.55	Ð	0002
Hard black silty very g			0.5	3.12	0.53	3.12 - 3.60		0004
<u>CLAY with cobbles (glac</u> Fine subangular GRAVEL sand & slight traces of	with som		D.00 C	3.65 1.10	0.45	3.60	ת ד	0005
Dense coarse grey anglu with an occasional ston	ne.		1.0.5 	4.55	0.45	4.30	Ð	3066
Coarse grey angular SAN Large BOULDERS (chisell 5≵ hours).			00,0		1.05	4.70 - 5.80 5.10	D	3067
End of borehole.			<u>117 24</u>	5.40			~	

GEOTECHNIC	AL CC					SERVI	CE	:S L1	D.		
LOCATION: 67 Baggot Street, Dublin	CLIENT: S Gibney		enson sociat	es.		Borehole No. 2 Sheet I of I					
EQUIPMENT: Pilcon Wayfarer 1500	Boring Com Boring Com		4.8.7			Coordinates Ground Level 62330					
DESCRIPTION		Reduced Level	rog	Depth	Thickness	Depth		PLES/TEST Sample	S		
Brick and rubble FILL wi clay and silt.	th some	<u> </u>		0.0	ē.60		Туре	No.			
Soft silty slightly orga prown CLAY with some she		-		0.60	0.90	1.00	D	3069			
Brown & black very silty with some small stones a traces of brick.			1 x c 1 1 1 1 1 1 1 1 1	1.50	0.60	1.50 - 1.80 1.70	D	3070	5.P.T. N=21		
Brown very sandy slight SILT with some rounded g	1	,	× × × × × × ×	2.10	0.90	2.50 2.60 - 2.90	Ð	3071	5.P.T N=14		
Large limestone STONES a COBBLES with some angula				3.00 3.65	0.65	3.30 3.65-3.95	D	3072	S.P.T		
Fine to medium fairly co angluar SAND with some o at the bottom of the lay	gravel		6.8	4.85	1.20	4.50	Ð	3073	~ - 18		
Hard black silty gravel CLAY with cobbles and bo -boulder clay (chisellir 2% hours).	oulders		0 0 x 0 x 0 x 1 x 1 x 1		2.25	5.60 - 5.30 6.00	D	3074.	5.P.T N=89		
End of borehole.				7.10							
GROUND WATER OBSERVATIONS: Wa	ater stru	ıck a	t 3.00		GL.	Water ro	ose	to I.2	2m		
SAMPLE/TEST KEYD Disturbed SampleS.P.B Bulk SampleVW Water SampleC	T. Standard Pe Vane Test Core Recov D. Rock Quali Designation	ery (%) ity	Ch		ling	y with he n to 7.IC	-				

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Report No. 1621	TRIAL PIT RECORD	·				381						
		Sheet No.		Trial Pit	, <u>u <</u>							
Contract	0007											
BLACK	ROCK	1 Excavatio			8							
<u> </u>		Excavatio		1								
	ROAD, BLACKROCK	JCB										
Client		Ground Level										
O'CON	NOR SUTTON CRONIN	Date		10.12.90								
					Samples							
	Description	Depth	Legend	Ref. No.	Туре	Depth						
Grey black stony brick, masonry, fibres	CLAY FILL with red fill also roots and	-										
		, - -		23219	D	1.00						
		-										
Firm brown black occasional cobbl	silty stony CLAY, es and boulders	1.80 		23220	D	2.80						
Stiff black, sli bou lder-c lay	ghtly silty stony CLAY	3.10										
Ground Water Conditions	No water present											
Remarks	Pit stable											
,		•										

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Report No.	1621	TRIAL PIT RECORD					ßSL
Contract			Sheet No.		Trial Pit	No.	
	BLACK	ROCK				1	
		· · · · · · · · · · · · · · · · · · ·	Excavatio	n Methoo JCE			
Location	ROCK	ROAD, BLACKROCK			.		
Client	O'CON	NOR SUTTON CRONIN	Ground L	evel			
			Date	10.	.12.90		
						Samples	
	L	Description	Depth	Legend	Ref. No.	Туре	Depth
pieces of o	glass,	rey stony TOPSOIL, fill, root fibres	-				
Stiff black silty CLAY	k/brow with	n verystony, slightly frequent large boulders	-				
					23222	D	1.20
			1.50				
Hard black with large (boulder cl	bould	stony CLAY, very stiff ers and cobbles	- -		23223	D	1.90
			2.30				
			F				
			-				
			-				
			Γ				
Ground Water Con	ditions	No water prese	nt		-		
Remarks .		Pit stable					
 .							

Report No. 1621	TRIAL PIT RECORD					GSL		
Contract		Sheet No.		Trial Pit	No. 3			
BLACKROO	CK	Excavatio	n Methoc	_ <u>_</u>				
Location ROCK ROA	AD, BLACKROCK			JCB				
Client		Ground L	evel					
U'CONNOI	R SUTTON CRONIN	Date	-	10.12.90				
		+			Samples			
Description	n .	Depth	Legend	Ref. No.	Туре	Depth		
Grey-black silty stony with roots	y clayey TOPSOIL	-0.30						
Firm to stiff mottled very stonyfirm CLAY w boulders	grey brown silty ith cobbles and	-						
		-						
				23224	D	1.30		
		-						
 Stiff black slightly	silty story CIAV	2.20						
(boulder clay)	SILLY SCONY CLAI							
		3.20		23225	D.	3.00		
		 _						
· ·								
Ground Water Conditions	No water present	k	•		I			
Remarks	Pit stable		· .			<u> </u>		

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Report No. 1621	TRIAL PIT RECORD					ßSL					
Contract		Sheet No.		Trial Pit	No. 4						
BLA	CKROCK										
·		Excavatio	n Methoo								
	K ROAD, BLACKROCK	JCB									
Client		Ground Levei									
0'0	ONNOR SUTTON CRONIN	Date 10.12.90									
			+	10.12.							
C	Description	Depth	Legend	<u> </u>	Samples						
				Ref. No.	Туре	Depth					
Black brown ston brick and roots	y CLAY FILL with red	-									
		F									
		0.90									
possible old wal	masonry RUBBLE FILL 1										
-		-									
		1.60		23220	D	1.70					
Fine to medium 1	ight brown SAND, some			23220	ע	1.70					
gravel particles	and stones (Fill)										
		-									
		2.10									
Grey black damp	very stony silty CLAY pieces of brick and	-									
mortar. Lumps	of stiff brown black	L									
stony CLAY throu	gh it. (Fill)										
		-									
		F									
				23221	D	3.20					
					-						
		┝									
			1								
		Γ									
		\vdash									
				l							
Ground Water Conditions											
	No water present										
Remarks											
	Pit stable										
	TTA MARMIR										

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Report No. 1621	TRIAL PIT RECORD][ßSL				
Contract BLAC	KROCK	Sheet No.		Trial Pit	No. 5					
		Excavatio	n Method							
Location DOCE	ROAD, BLACKROCK	JCB								
Client		Ground Level								
0'00	NNOR SUTTON CRONIN	Date				_				
				0.12.9						
٥	escription	Depth	Legend		Samples					
Brown black silty with red brick, m	stony clayey FILL Nortar and rubble			Ref. No.	Туре	Depth				
Stiff mottled gre silty CLAY with r	y brown stony very coots and fibres	0.90		23223	D	1.00				
	slightly silty ston y cobbles and frequent er clay)	1.70		23229	D	1.80				
		- - 2.90								
		-								
Ground Water Conditions	No water pres	ent								
Remarks	Pit stable.									

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Report No. 1621	TRIAL PIT RECORD					3Sl				
Contract BLA	CKROCK	Sheet No.		Trial Pit						
		Excavatio	n Methoo	<u> </u>						
ocation ROC	K ROAD, BLACKROCK	JCB								
lient		Ground Level								
0'0	CONNOR SUTTON CRONIN	Date								
			— 1	10-12						
De	escription	Depth	Legend		Samples	r –				
				Ref. No.	Туре	Depth				
and mortar	FILL with concrete									
· · · · · · · · · · · · · · · · · · ·		0.40								
	or floor, unable to									
penetrate)		-								
		Γ								
•		-								
		F								
		F								
		-				1				
		L								
		+								
		Γ								
		F								
		-								
		L								
		-		- 						
		L			·					
Ground Water Conditions	No wator succes	-	-			<u></u>				
	No water present									
Remarks	·	·								
	Pit stable									
	Unable to excava	te beyon	d 0.40	Dm						
· ·										

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Report No. 1621	TRIAL PIT RECORD				.00	JSL			
Contract BLACE	KROCK	Sheet No.	_	Trial Pit	No. 7				
		Excavation	n Method						
	ROAD, BLACKROCK	JCB							
Client	NNOR SUTTON CRONIN	Ground Lo	evel						
		Date	<u>. </u>	10.12.	90				
					Samples				
	Description	Depth	Legend	Ref. No.	Туре	Depth			
red brick morta	yey stony FILL with r, slate, glass, etc. also roots and ut								
Firm to stiff da	ark brown/grey silty	1.70							
	cobbles and boulders,	-		203230	D	2.00			
				203231	D	3. 10			
Ground Water Conditions	No water presen	nt							
Remarks									
	Pit stable								

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Report No. 1621	TRIAL PIT RECORD					JSL
Contract	CKROCK	Sheet No.		Trial Pit	No. TP:	2
		Excavatio	n Method	t		
	K ROAD, BLACKROCK		J	СВ		_
Client	ONNOR SUTTON CRONIN	Ground L	evel			
		Date	10	0.12.90)	
					Samples	
	Description	Depth	Legend	Ref. No.	Туре	Depth
Black brown sil with root fibre	ty stony clayey TOPSOIL s		-			
		Ļ				
		0.80				
Light brown dus	ty slightly clayey silty RS, fill with red brick					
		1.20				
Stiff mottled b slightly silty cobbles and bou	rown grey stony CLAY with frequent lders	-				
		+				
				23227	D	2.00
		-				
		2.90				
		F				
		ت				·
	÷					
Ground Water Conditions	No water present	•				
Remarks	Pit stable					
				<u> </u>		<u> </u>

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Blackrock	CLIENT: Rooney Mo	C.Lougi	nlin	·		Borehole N Sheet		3 of	1		
EQUIPMENT: Pilcon Wayfarer 1500	Boring Com Boring Com		18.5.	.82		Coordinates Ground Level					
DESCRIPTION		Reduced Level	Log	Depth	Thickness	Depth	S	PLES/TES	TS Test		
Topsoil		ě –		.30	. £ .30		Туре	No.			
Stiff brown gravelly silt with cobbles	y clay			-		1.00	D	9956			
			· · · ·	-	2.6				N = 19		
			; .	2.9		2.50	D	9957			
Stiff black gravelly silt with cobbles and boulders (1 ¹ / ₂ hrs. chiselling)					3.00			N = 26		
					3.6	4.50	D	9958	N = 27		
			·	- 6.5 -		6.00 6.20	D	9959	N = 35		
				- - -							
BROUND WATER OBSERVATIONS:	Slight seep	age at	2.90m	sea]	Led o	ff	<u></u>	<u></u>	<u> </u>		

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LOCATION:	CLIENT:				Τ	Borehole No	. 2		
Blackrock	Rooney	Mc.Lo	oughlir	L		Sheet	o	f	1
EQUIPMENT:	Boring Com	nenced:				L Coordinates			1
Pilcon Wayfarer 1500	Boring Com	pleted:	12.5.8	2		Ground Leve	I		
	-	bed e		£	ess			LES/TESI	'S
DESCRIPTION		Reduced Level	Log	Depth	Thickness	Sample Type T			
Topsoil				. 30	.30		1300		<u> </u>
Stiff brown gravelly silty with cobbles	clay		× ° × ° × ° × ° × ° × ° × ° × ° × ° × °	• 50	2.6	1.50	D	9984	N = 2
				-2 0		2.50	D	9954	
Hard black gravelly silty of with cobbles and boulders (2 hrs. chiselling)	lay		×	-2.9	3.10	3.00			N = 2
			×			4.50			N = 2
			• <u>0</u> ,	_6.0		5.50	D	9955	
				•					
GROUND WATER OBSERVATIONS:	Slight	seepag	e of w	ater	at 2	.50m - se	aled	off.	•
SAMPLE/TEST KEY D Disturbed Sample S.P. B Bulk Sample V W Water Sample C I Piston (P), Tube (U) or R.Q.	T. Standard P Vane Test Core Recov				То	tal chise	lling	2 hrs	•

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<u> </u>							_	64	363
GEOTECHNIC	CAL CC BORE					SERV	ICE	'S LT	TD.
LOCATION: Blackrock	CLIENT: Rooney	Mc. L	oughli	n		Borehole N Sheet		1 1	
EQUIPMENT:	Boring Com					Coordinates	1		
Pilcon Wayfarer 1500	Boring Com		11.5.8	2		Ground Lev	el		
		ced el		ŧ	988		-r	LES/TEST	rs
DESCRIPTION		Reduced Level	Log	Depth	Thickness	Depth	S Type	ampie No.	Test
- Topsoil				30	.30				
Very stiff brown very g silty clay with cobbles	ravelly		, , Ô ,)		2.5	1.00	υ	9916	
			0			1.50			N = 25
			× • • •	-		2.00	D	9915	
			<u>`</u> _`	2.8					
Hard black gravelly silf with cobbles and boulder				4.5	1.7	4.00	D	9918	N = 45
Obstruction 2 hrs. chise	elling								
	Water encount and sealed of		at 4.20	Om B.	G.L.				
SAMPLE/TEST KEY									
D Disturbed Sample B Bulk Sample W Water Sample	S.P.T. Standard P V Vane Test C Core Recov R.Q.D. Rock Qual Designation	very (%) ity		otal	chis	elling 2	hrs.		
								Vanessa)	Press Ltd.

6	L	ৎ	6	8
U	7	2	\mathbf{v}	v.

1. 1.

Report No. 1428	BC	ORING R	ECORD					10	ISL
Contract * BLACKROCK	DEVELOPEMENT				· 1	lorehol Sheet	^{e No.} 1		
Location Rock Rd./Phe	oenix Terrace				nd Diame ble To)Omm		
Client .		•		Ground					
MALONE O'RE	GAN			Date 13-12-89					
Descriptic			uced be			Sample	5	Field f	Records
		Leve		Depth	Ref. No.	Туре	Depth	And T	ests
FILL - Clay , bri	ck,rubble,col	obles,							
boulders.									
				_	6578	D	1.00	1.00	N=18
				2.70					
				_	6579	D	2.00	2.00	N =1 8
	,								
	<u>-</u>			2.70					
Firm grey gravelly	CLAY		•	3.40	6580	D	3.00	3.00	N=22
Stiff to hard bla	ck silty sand	dy		_					
stony CLAY (Bould	er Clay)		* 0		6581	D	4.20	4.00	N=34
Borehole complete	at	•	×	- 4.50					
				_					
				-					
				-					
				-					
	•								
	servations during E			Remarks	<u> </u>	·			
	asing Depth to Depth Water	Rem	arks	Chisel	ling a	at 4.	50 - 1	hour	
	00 3.10		seepage						
	1 2.10	Final]	Level	Sample/T	est kev	_	C-Con	ePenetra	tion Test
$ \begin{tabular}{cccccccccccccccccccccccccccccccccccc$				U-Tube S D-Disturi	ample bed Samp	ole		ws/0.3 m	
				W-Water S-Standar	Sample		V-Van		

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Report No. 1428	BC	RING RECO	RD						ISL		
Contract 4	P DET ET ODEMEN				· .	Borehol Sheet	e No.	2			
	K DEVELOPEMEN	<u> </u>		Туре а	nd Diam						
Rock Rd/Pho	enix Terrace			Cabl							
Client MALONE O	RECAN	•		Ground	Level						
				Date							
Descriptio	n	Reduced Level	Legend	Depth	Ref. No.	Sample: Type	T	Field	Records Tests		
FILL - Clay,bould	ders,brick,gl	ass	\square								
	, ·		\square	1.50	6583	D	1.00				
Stiff grey/black s			0 <u>×</u>	1.50	6584	D	1.50	1.50	N=38		
stony CLAY (Bould	der Clay)		× 0								
			×		658 ⁵	D	3.00	3.00	N=27		
			× 1	_	6586	D	4.50	4.50	N≔46		
Borehole complete	at			5.10							
				-							
				-							
				-				4 9 9			
				-				2			
Water Laval OL	servations during B			Remarks							
	asing Depth to epth Water	oring Remarks			lling	bould	lers in	n Fill	- 2hrs		
14/12/89		No free wa	ter		-				- 2hrs		
				Sample/T U-Tube S D-Disturt W-Water S-Standar	ample bed Sam Sample		N-Blo R-Ref V-Van	ws/0.3 n usal	ation Tes <u>t</u> netres		

Report No. 1428	BORIN	IGSL								
Contract	OCK DEVELOPEMENT					3				
	Phoenix Terrace				Type and Diameter Cable Tool 200mm					
Client . MALONE (O'REGAN			Ground Date	Ground Level					
		<u></u>								
Descriptio	n	Reduced Level	Legend	Depth	Ref. No.	Type	-	Field Records And Tests		
FILL - Brick,ash,o	clay									
				2.00	6587	D	1.50	1.50 N=15		
FILL - Yellow/brow with fragme stone	wn silty CLAY ents of brick &			-	6588	D	3.00	3.00 №=11		
Firm brown silty s	sandy CLA¥		. ~	-	6589	D	4.00			
Stiff brown silty CLAY	very gravelly		2 <u>2</u> 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	- 4 . 50	6590 D 5.0	5.00	4.50 №=23			
Hard black silty s	stony CLAY	<u>+</u> -	x 3 x 0 x 0 x 0	-5.60 -5.80	6591	D	5.70			
Refusal at 5.80 pr	esumed boulders			-						
Water Loval Oh	servations during Boring	L		Remarks	<u> </u>					
Date Hole C Depth D 15/12/89 4.10	asing Depth to Water 4.10 4.10 Se	Remarks epage o nal lev	of wat rel	Chis er ^{Chis}	sellin			3 - 2hrs		
				Sample/1 U-Tube S D-Disturt W-Water S-Standar	Sample bed Sam Sample		N-Blov R-Refi V-Van			

Client: LEE McCULLOUGH & PARTNERS Dia Dates: 25.9.96 - 26 9.96 Ground Level m O D Description Red Level Depth m Ref No Type Depth MADE GROUND soil and roots 0 30 0 30 0 30 0 40 0 40 Medium dense brown gravelly sity CLAY with fine roots								6120	
Methods Dates: 25.9.95 - 26 9.95 Description Let end begin motion MADE GROUND eoil and roots 0 30 Medium dense brown gravelly sity CLAY with fine roots 0 30 0 96 0 60 9 0 0 60 2 0 0 2 0 0 2 0 0 3 0 0 4 0 0 5 0 0	Contract EMBASSY OF THE NET No. 3653						Sheet	No	1.G.S 1 1 of
Description Red end Depth MADE GROUND soil and roots 0 30 0 60 96 D 0 60 Medium dense brown gravelly sity CLAY with fine roots	Client: LEE McCULLOUGH & P/	ARTNERS					Dia		Cable To 200mm
MADE GROUND soil and roots 0 30 Medium dense brown gravelly sity CLAY with line roots 0 60 Dense CLAY or sitbound sandy GRAVEL 0 Stiff brown sity sandy gravelly CLAY 0 Stiff gray-black very sitty gravelly CLAY 0 3 99 D 3 50	Descri	ption		end	Depth				Field Te
Medium dense brown gravelly sitty CLAY with fine roots 0 60 96 0 60 96 0 60 Dense CLAY or sittbound sandy GRAVEL 3 3 97 D 2 00 2 Stiff brown silty sandy gravelly CLAY 3 2 80 98 D 2 60 Very stiff grey-black very silty gravelly CLAY 3 50 99 D 3 40	MADE GROUND soil and roots	<u> </u>	Level			No	+		-
Dense CLAY or siltbound sandy GRAVEL 97 D 2 00 2 Stiff brown silty sandy gravelly CLAY 2 80 2 80 2 80 2 60 Very stiff grey-black very silty gravelly CLAY 3 50 99 D 3 40	Medium dense brown gravelly sitty CLA	Y with fine roots				3.0		0.60	
Stiff brown silty sandy gravelly CLAY 3 Very stiff grey-black very silty gravelly CLAY 3 50 99 0 3 50 99 0 3 40 1 1 1 1 1 1 1 1 1	1 Dense CLAY or siltbound sandy GRAVE	L			0.00			0.60	1 0 N=3
Stiff brown silty sandy gravelly CLAY 280 Very stiff grey-black very silty gravelly CLAY 350 99 0 350 350	2			1 1 1 0	0.40	97	D	2 00	2 00 N=
				1 1		98	D	2 60	
	Sivery still grey-black very slity gravelly	CLAY		1411414	3 50	99	D	3 40	300 N=
							Borehole No Sheet No Method Dia Ground Level m (samples Type Dep D 0 61 D 2 00 D 2 00 D 2 60 D 3 40		
		50		D	ate	Hole	Cased	Water	Remarks
				2					No free w

		R1465							
TRIAL PIT RECORD							I.G.S.L.		
Contract:EMBASSY OF THE NETHERLANDSNo.3653LocationMERRION ROADClientLEE McCULLOUGHDate25.9.96					Excav				
Description	Red. Level	-	Depth	Ref No	samples Type		Remarks		
MADE GROUND : Sand, topsoil and a little gravel	Lever								
Hard grey-brown gravelly CLAY/clayey gravel		0 400	0.50 1.00	101	D	0.70			
* Root growth noted to about 0.75 metres. Roots of 12/15mm diameter from 0 - 0.50 metres, root diameter reducing to fine thread fibres at 1.00m				rater C Dry	- -	S			

REP	ORT NO.	GEOTECH	NIC	NICAL BORING RECORD							
CON	TRACT: Thomas Pr	or House Development					BOREHOLE SHEET:	.G.S.L.			
CLIE	NT: Michael Pu	nch & Partners					DATE STAF	1 of 2 16.12	.97		
LOC	ATION: Ballsbridge	BOF	REHOLE REHOLE D SING DEP	EPTH	m) 200 11.60 11.60	DATE COMI BORED BY: LOGGED BY		17.12.97 I.G.S.L. I.G.S.L.			
E)							SAMPLES				
DOWNHOLE DEPTH (m)		DESCRIPTION	SYMBOLIC LOG	ELEVATION (mOD)	ОЕРТН (m)	REFERENCE NUMBER	SAMPLE TYPE	DEPTH RECOVERED	FIELD TEST RESULTS		
θ -	Tarmacadam			0.10				Depth	n N		
•	MADE GROUND (Col	mprised of imported stone)			0.30						
- -1 -	Firm brown silty grave (Possible Made Groun				1.10	3551	D	1.00	1.00	19	
- - -2 -	Medium dense to dens with cobbles and boul	e fine to coarse sandy GRAVEL ders				3552	D	2.00	2.00	25	
- - 3 -						3553	D	3.00	3.00	31	
- 4 						3554	D	4.00	4.00	24	
- -5 - -						3555	D	5.00	5.00	33	
- - -6 -						3556	D	6.50	6.00	43	
		·			6.80						
- -7 -	Very stiff brown silty				7.00				7.00	38	
- - -8 - -	very stiff to hard blac with cobbles and bou	k slightly silty gravelly CLAY Iders				3557	D	7.50	8.00	60	
- 9						3558	D	9.00	9.00	52	
	narks.	·	1	DATE	Water leve	l observatio	ns during bo	pring			
Сы	selling					HOLE DEPTH	CASING DEPTH	DEPTH TO WATER	HEMA		
	From 0 - (From 3.50	0.40 for 0.75hrs - 3.80 for 1hr - 9.00 for 1.25hrs			17.12	5.30 5.30	5.30 5.30	5.30 4.40	Stril 20 m		
	FIE	LD TEST KEY: U-U100, Db-Disturbe	d Sa	mple, S-S	I. PT, W-W	later Sampli	l e, R-Refusal.				

REPORTING	le l	GEOTEC	CHNIC	AL BC	DRING	RECO	RD	I	.G.S.L.		
ONTRACT	Thomas Prior	House Development					BOREHOLE	NO.:	D.: 2		
CLIENT:	Michael Punc	1 Datham					SHEET:	TT-D.	2 of 2		
Peiely (†	MICHAEL PUNC	ก ณ เรลานเชาร์	BOP		HAM (mn	n) 200					
OCATION	Ballsbridge, D	ublin 4						Lots I toto	2 of 2 16.12.97 17.12.97 I.G.S.L. 9 10.00 58 10.00 58 11.00 25 for75mm then Ref		
2						11.80	124	4			
Ê							SAMPLES				
DOWNHOLE DEPTH (m)				6		£		e	LTS		
			6	ĕ		E			มีอ		
щ į	Df	ESCRIPTION	ŭ		_	ž	ц Ц Ц	5			
힏			9	Õ	Ē	NG		l W	ES		
ξ.			<u>e</u>	NA.	HOLE DIAM.(mm) 200 DATE COMPLETED: 17.12.97 HOLE DEPTH 11.60 BORED BY: I.G.S.L. IG DEPTH (m) 11.80 LOGGED BY: I.G.S.L. IG DEPTH (m) II.80 III.80 III.80 IG DEPTH (m) III.80 III.80 III.80 III.80 III.80 III.80 III.80						
8			SYMBOLIC LOG	ELE	E	ž	SAV	E E			
9											
		lightly silty gravelly CLAY							[
with c	bbies and bouldes	5				3558	D	9.50			
10									10.00 56		
							_				
						3559	D	10.50			
11									11.00 25		
							-				
					11.00	3560	D	11.50	then Ref		
		······································			11.00						
12 Refus	I										
13											
14											
15											
16											
17											
	11 (M										
18						141-1 *	L above state		<u> </u>		
nemarks	Installed 50m	m groundwater and gas monit	orina et	andninee	Date	Water leve Hole	observation Casing	s during bo Depth to	ring Remarks		
	with gravel p	ack & bentonite seals.	enni ar		Date	Depth	Depth	Water	Cherneliks		
Chiselling	•										
	From 11.40	11.60 for 2hrs			17,12	11.40	11.40	11.40	Seepage		
						11.60	NIE	7.50	Bh End		
		D TEST KEY: U-U100, Db-Distu					<u> </u>	L	1		

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(II)

	EPORT NO. GEO1 DNTRACT: Thomas Prior House Development JENT: Michael Punch & Partners DCATION: Ballsbridge, Dublin 4 DESCRIPTION DESCRIPTION Topsoil Firm brown silty gravelly sandy CLAY (Possible Made Ground) Medium dense to dense fine to coarse sandy GRA with cobbles and boulders										
REP	ORT NO.		GEOTECH	INIC	AL BO	DRING	RECO	RD	1.	G.S.L	
CON	ITRACT:	Thomas Pr	ior House Development					BOREHOLE		3	-
	INT:	Michae! Pu	nch & Partners					SHEET: DATE STAP		1 of 2 17.12.	<u>9</u> :
					REHOLE I			DATE COMP		18.12.	
LOC	ATION:	Ballsbridge	, Dublin 4		REHOLE D		12.10	BORED BY:		I.G.S.L.	
~				CAS	SING DEP	<u>TH (m)</u>	12.10	LOGGED BY	<u>/:</u>	I.G.S.L.	
5								SAMPLES		S	
Ъ									ũ	5	
Ш				Ø	E		S	1 10		ES I	
Щ			DESCRIPTION	12	z	2	, m	λbi	8 I		
P				12	E E	<u>ь</u>	L L L L L L L L L L L L L L L L L L L		Ŭ	ES	
MN				N N	N N	÷	Ē	JPL	Ę	<u> </u>	
õ				SYMBOLIC LOG	ELEVATION (mOD)	DEPTH (m)	REFERENCE NUMBER	SAMPLE TYPE	DEPTH RECOVERED	FIELD TEST RESULTS	
Ð				—							
•	Topsoil					0.20				Depth	
	Firm brow	vn siltv orave	liv sandy CLAY								
-1							3561	D	1.00	1.00	1
-											
				1		1.60					
						1.00					
2							3562	D	2.00	2.00	1
•											
		Hes and boul	ders								
3										3.00	3
										5.00	
•							3563	D	3.50		
-											
- - 4											
								ļ ;		4.50	2
•				1				}			
- - 5							0504		5.00		
- 3							3564	D	5.00		
						5.40					
-											
- -6		to hard blac bles and bou	k slightly slity gravelly CLAY				3565	D	6.00	6.00	
-0			Iders				3000	U	0.00	6.00	4
•											
•								U100	7.00	Faile	-
- - 7	1							0100	7.00	Faller	0
-											
-							3566	D	7.50		2
•										for 75	
- - 8	1 :				1					then r	e
-											
•	1										
- 9							3567	D	9.00	9.00	(
-	narks.			<u> </u>				l observation			
						DATÉ	HOLE	CASING	DEPTH TO		iK
Chi	ealling						DEPTH	DEPTH	WATER		_
oni	iselling	From 6.50	- 6.90 for 1 hr			18.12	5.00	5.00	5.00	Strik	ρ
						1.0.12	5.00	5.00	4.30	20 mi	
								5.00			
							-		4	4	
			LD TEST KEY: U-U100, Db-Disturbe				· · · · ·		i		

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	DRT NO.			OTECHN		AL BO	DRING	RECO		REHOLE NO.: :		
CON	TRACT	Thomas Pric	or House Development						BOREHOLE SHEET:	NO.:	3	
CLIË	NT:	Michael Pun	ch & Partners						DATE STAF	TED:	2 of 2 17.12.97	
100	101-	Dellet 14	Dublic 4								18.12.97	
LOCI	ATION:	Ballsbridge,	Dudlin 4						1			
Ê				ľ	1			12.10	SAMPLES		1.9.0.L.	
DOWNHOLE DEPTH (m)						â		E		e	TI ST	
Ē				9	g	ŌĔ		N N			L SU	
Ë		0	DESCRIPTION		3	NC	Ê			l g		
¥				5	۲ ۲	ATIC	5 1	ŭ		#	TES	
8			BOREHOLE DIAM.(mm) 200 DATE COMPLETED: 18.12. Idge, Dublin 4 BOREHOLE DEPTH 12.10 BORED BY: I.G.S.L. DESCRIPTION Image: Discrimination of the second secon									
-9									<u>ă</u>	Ē		
Very stiff to hard black slightly sitty gravelly CLAY with cobbles and boulders												
	with cobb	les and bould	ers									
								-				
10								3568	D	10.00	10.00 Re	
11												
								3569	D	11.50	11.50 5	
											for150mr then Ref	
12												
					-		12.10					
. 1	Refusal											
13												
·												
								1				
-14												
.												
15												
16												
17												
		1.12										
18												
Rem	arks	Installed 60.	nm groundwater and ga	e monitorin-	p.t.c	ndeleas	Date	Water level	observation			
		with gravel p	pack & bentonite seals.	is monitoring	stā	nichibes		Hole Depth	Casing Depth	Depth to Water	Remarks	
Chis	elling.		- 12.10 for 2hrs									
		FIOT 11.60	· 12.10 for Zhrs				18,12	12.10	Nil	6.20	Bh End	
							. 1				4	

		K3	940	55				1070	73	3	
REP	ORT NO.	GEOTECH	NIC	AL BO	ORING	RECO	RD		I.G.S.L.		
CON	TRACT: Thomas I	Prior House Development					BOREHOLE	4 1 of 2			
CLIE	NT: Michael F	Punch & Partners					DATE STAF		19.12.97		
LOC	ATION: Ballsbridg	e, Dublin 4	BOR	REHOLE I	EPTH	n) 200 10.60	DATE COMP BORED BY:		20.12 I.G.S.L		
Ê			CAS	ING DEP	TH (m)	10.60	LOGGED BY SAMPLES	(:	I.G.S.L	-	
DOWNHOLE DEPTH (m)		DESCRIPTION	SYMBOLIC LOG	ELEVATION (mOD)	DEPTH (m)	REFERENCE NUMBER	SAMPLE TYPE	DEPTH RECOVERED	FIELD TEST RESULTS		
θ -	Topsoll				0.20				Depth	n N	
- - - 1 -	MADE GROUND (C brown silty clay mat	omprised of red bric, mortar in a rix)				3570	D	1.00	1.00	7	
- - -2	, , , , , , , , , , , , , , , , , , ,				1.80	3571	D	2.00	2.00	24	
- - -3 -	Medium dense to de with cobbles and bo	nse fine to coarse sandy GRAVEL oulders				3572	D	3.50	3.00	23	
- -4 - - - - - 5						3573	D	5.00	4.50	32	
- - - 6 -	Very stiff to hard bl	ack slightly silty gravelly CLAY			5.70	3574	D	6.00	6.00	44	
- -7 - - - -8	with cobbles and bo	bulders				3575	D	7.50	7.50	61	
- - - 9						3576	D	9.00	9.00	Ref	
	marks.				DATE		observatio		oring		
Chi		- 1.8for 0.50hrs			19.12	DEPTH 5.50	DEPTH 5.50	WATER 5.50	Strl	ke	
		30 - 5.00 for 2hrs IELD TEST KEY: U-U100, Db-Disturbe	ed Sa	mple, S-S	SPT, W-V	5.50 Vater Samp	5.50	4.80	20 n		

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REPORTINO.		GEOTEC	HNIC	AL BO	DRING	RECO	RD	I	.G.S.L.
ONTRACT:	Thomas Prior House Dev	velopment					BOREHOLE	NO.:	4
LIENT:	Michael Punch & Partner	S					SHEET: DATE STAR		2 of 2 19.12.97
			BOF	REHOLE [DIAM.(mn	n) 200	DATE COM		20.12.97
OCATION:	Ballsbridge, Dublin 4			EHOLE DI		10.60	BORED BY:		I.G.S.L.
2					11H (m)	10.80	LOGGED BY SAMPLES	·	I.G.S.L.
DOWNHOLE DEPTH (m)							OMMPLES		Ś
				ELEVATION (mOD)		REFERENCE NUMBER	1	DEPTH RECOVERED	FIELD TEST RESULTS
	DESCRIPTION		S	Ē		DN.	щ	8	ЦЩ.
2			<u>5</u>	NO	Ē	N N N N N N N N N N N N N N N N N N N	Σ	Ŭ	ST
N. N			X	VAT	∓		1 2	비造	
§			SYMBOLIC LOG	Ē	DEPTH (m)	쁥	SAMPLE TYPE	<u> </u>	
9				<u>نی</u>					<u> </u>
	to hard black slightly sitty	gravelly CLAY					_		
with cobb	les and boulders					2576	D	9,50	
10									
						3577	D	10.50	10.50 Ref
					10.60	33//		10.50	10.50 Ker
									1
11 Refusal									
12									
13								1	
14									
15									
16									
17									
	3 A								
	0.25								
18									
Remarks							observation		
	Installed 50mm groundw with gravel pack & bent	ater and gas monit	oring st	andpipes	Date	Hole	Casing	Depth to	Remarks
Chiselling.	wini graver pack & DOU	unite sealis.				Depth	Depth	Water	
	From 10.00 - 10.60 for	2hrs			19.12	10,60	Nil	7.10	Bh End
		Y: U-U100, Db-Distu				atan Damat	D D of the state		L

														107	942
RE	PORT	NO						GE	OTECHNIC	AL C	:OF	RE LOO	G REC	ORD	I.G.S.L.
CON	ITRACT:	Thor	nas F	rior H	ouse	Site	Inves	stigation						DRILLHOLE NO .:	RC2
CLIE									CORE DIAMET	EB (mm	1):	NQ (54)		SHEET: DATE STARTED:	1 of 2 Jan-98
	INEER: ATION:						S		GROUND LEVE					DATE COMPLETED:	Jan-98
	ATION:	Balla	onag		IIN 4.				INCLINATION: FLUSH:			Vertical Water		DRILLED BY: LOGGED BY:	IGSL
Ē	-					ractu cing (Pa					
DOWNHOLE DEPTH (m)	CORE RUN DEPTH (m)	T.C.R.%	S.C.R.%	R.Q.D.%	o	0920 0920	200	DISCONTI	NUTTES	POINT LOAD Is(50) MPa	SYMBOLIC LOG	ELEVATION (mOD)	DEPTH (m)	GEOTECHNICAL	DESCRIPTION
0 - - - -	0.00												0.00	OVERBURDEN Returns of grave!	
- - -2 - - -	3,00	4	•												
- 4 - 4		10	-	-											
-6	5.60														8
- 7 - 7 - 8 -		4		-											
-9	9.00	5	-	•									10,00		
-10 REM	ARKS:		Core whici	logge is ta Point	ken a	is tha	t del	e with BS 5930 exc lined by Norbury et	ept for definition al 1986	of sol	id co			KEY TO SYMBOLIC	CLOG

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RE	PORT	NO.						GEOTI	REC	ORD	I.G.S.L.				
CON	ITRACT:	Тһоп	nas P	rior H	ouse	use Site Investigation								DRILLHOLE NO.: SHEET:	RC2
						CORE DIAMETER (mm): NQ (5) Partners GROUND LEVEL (mOD): 4. INCLINATION: Vertica FLUSH: Water								DATE STARTED: DATE COMPLETED: DRILLED BY: LOGGED BY:	2 of 2 Jan-98 Jan-98 IGSL IGSL
DOWNHOLE DEPTH (m)	CORE RUN DEPTH (m)	T.C.R.%	S.C.R.%	R.O.D.%		ractur Sing (092 092				POINT LOAD Is(50) MPa	SYMBOLIC LOG	ELEVATION (mOD)	OEPTH (m)	GEOTECHNICAL	
-10 - - - -11	11.20	5	-	•									10.00	OVERBURDEN Returns of gravel	
-12 - -	11,20	11	-	-											
-13 - -	13.00														
- -14 - -	14.60	8	•	•											
- -15 - -		14	-	-											y.
- -16 -	16.00							Rough planar occasiona smeared fractures	illy clay					Grey fine grained si weathered calcisitite	ghtly LIMESTONE
- -17 - -	17.50	100	69	37	<u>ک</u>									strong	
- -18 - -	18.80	92	63	53]							18.80		
- -19 - - - - -20			·					End of Corehole							
	ARKS:		which	logge i is ta Point	ken a	is tha	t del	e with BS 5930 except (lined by Norbury et al 1 iple	ior definition 986	of sol	id co			KEY TO SYMBOLI	LOG

R3720

New Residential/hospice Development

LAYERS FOR BOREHOLE 115957 (Company Name: 1)

LAYER	TOP	BASE	STRENGTH	COLOUR	MINORLITH	MAJORLITH	INTERPRETATION
1159570	0	1				Fill - Made Ground	Fill - Made Ground
1							
1159570	1	3.4	Very Stiff	Brown	Silty Gravelly	Clay	Clay
2							
1159570	3.4	7	Very Stiff to	Black	Silty Gravelly	Clay	Clay
3			Hard				

R3720

New Residential/hospice Development

LAYERS FOR BOREHOLE 115958 (Company Name: 2)

LAYER	TOP	BASE	STRENGTH	COLOUR	MINORLITH	MAJORLITH	INTERPRETATION
1159580	0	.2				Top Soil	Top Soil
1							
1159580	.2	.9				Fill - Made Ground	Fill - Made Ground
2							
1159580	.9	3.4	Very Stiff	Brown	Silty Gravelly	Clay	Clay
3							
1159580	3.4	6.1	Very Stiff to	Black	Silty Gravelly	Clay	Clay
4			Hard				

R3964

Horseshow House Bar

LAYERS FOR BOREHOLE 118439 (Company Name: 1)

LAYER	TOP	BASE	STRENGTH	COLOUR	MINORLITH	MAJORLITH	INTERPRETATION
1184390 1	0	.05				Fill - Made Ground	Fill - Made Ground
1184390 2	.05	.35				Fill - Made Ground	Fill - Made Ground
1184390 3	.35	1.4				Fill - Made Ground	Fill - Made Ground
1184390 4	1.4	1.8	Soft	Brown	Sandy	Clay	Clay
1184390 5	1.8	2.8	Firm to Stiff	Brown	Silty Gravelly	Clay	Clay
1184390 6	2.8	6	Stiff to very Stiff	Brown	Silty Sandy Very Gravelly	Clay	Clay
1184390 7	6	9.7	Very Stiff to Hard		Slightly Silty Gravelly	Clay	Clay



Commercial and Residential Development

LAYERS FOR BOREHOLE 121797 (Company Name: 2)

LAYER	TOP	BASE	STRENGTH	COLOUR	MINORLITH	MAJORLITH	INTERPRETATION
1217970	0	.15				Fill - Made Ground	Fill - Made Ground
1							
1217970	.15	.5				Fill - Made Ground	Fill - Made Ground
2							
1217970	.5	1.9				Fill - Made Ground	Fill - Made Ground
3							
1217970	1.9	2.1	Stiff	Brown	Gravelly	Clay	Clay
4							
1217970	2.1	5.7	Very Stiff to	Black	Slightly Silty	Clay	Clay
5			Hard		Gravelly	-	

Commercial and Residential Development

LAYERS FOR BOREHOLE 121798 (Company Name: 3)

LAYER	TOP	BASE	STRENGTH	COLOUR	MINORLITH	MAJORLITH	INTERPRETATION
1217980	0	.5				Fill - Made Ground	Fill - Made Ground
1							
1217980	.5	1.7				Fill - Made Ground	Fill - Made Ground
2							
1217980	1.7	4.3	Stiff to very	Brown	Gravelly	Clay	Clay
3			Stiff				
1217980	4.3	4.6	Very Stiff	Dark Grey	Slightly Silty	Clay	Clay
4					Gravelly		

R5002

Residential/commercial development

LAYERS FOR BOREHOLE 129941 (Company Name: BH1)

LAYER	TOP	BASE	STRENGTH	COLOUR	MINORLITH	MAJORLITH	INTERPRETATION
1299410	0	.6				Fill - Made Ground	Fill - Made Ground
1							
1299410	.6	1.6				Fill - Made Ground	Fill - Made Ground
2							
1299410	1.6	3.5				Fill - Made Ground	Fill - Made Ground
3							
1299410	3.5	3.7		Grey	Fine	Sand	Sand
4							
1299410	3.7	4.5	Very Stiff to	Black	Gravelly	Clay	Clay
5			Hard				

R5002

Residential/commercial development

LAYERS FOR BOREHOLE 129942 (Company Name: BH2)

LAYER	TOP	BASE	STRENGTH	COLOUR	MINORLITH	MAJORLITH	INTERPRETATION
1299420	0	.3				Fill - Made Ground	Fill - Made Ground
1							
1299420	.3	3.4				Fill - Made Ground	Fill - Made Ground
2							
1299420	3.4	4.2	Medium	Grey		Sand	Sand
3			Dense				
1299420	4.2	4.4	Hard	Black	Gravelly	Clay	Clay
4					-		-

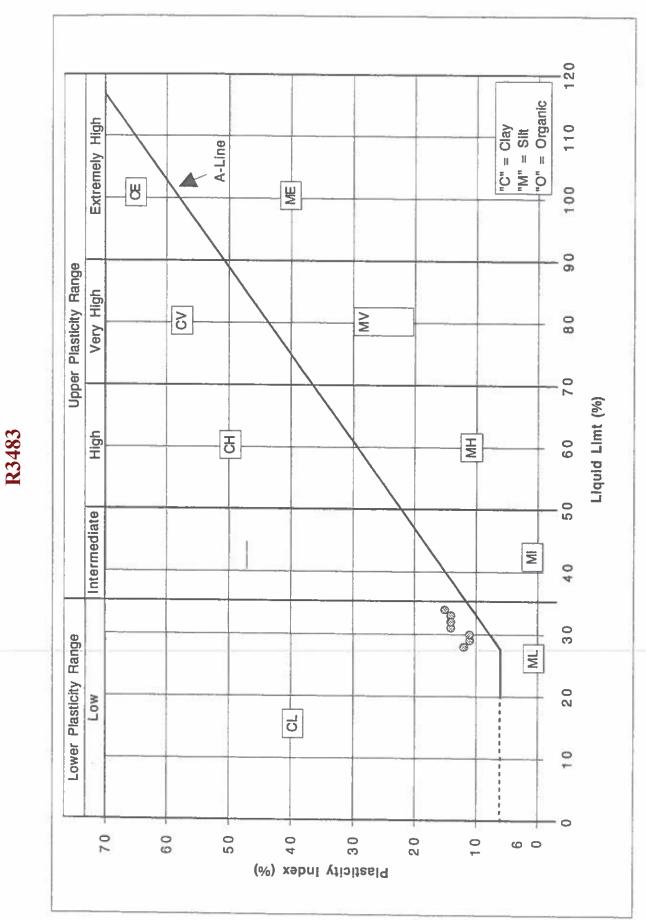
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.G.S.L 100 GRAVEL 10 SAND Thomas Prior House Development 0.1 **PARTICLE SIZE ANALYSIS** SILT 0.01 Thos. Prior Bh1/3543/3m **TEST METHOD: Wet Sleve** 0.001 **R3483** 3543 3.00 CLAY -BOREHOLE No. 0.0001 CONTRACT: SAMPLE No. 0.0 100.0 90.06 80.0 70.0 60.0 50.0 40.0 30.0 20.0 10.0 DEPTH: COBBLES SILT/CLAY GRAVEL SAND %passing 100.0 100.0 82.2 71.9 63.5 57.2 48.0 36.5 24.2 17.4 12.1 5.9 5.0 4.1 1.8 3.4 2.7 2.2 particle size Report No. 75 63 50 37.5 28 28 28 14 14 14 16 3.35 6.3 6.3 5 3.35 2 1.18 0.6 0.425 0.3 0.063 0.04 0.03 0.02 0.013 0.009 0.002 0.005

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.G.S.L 100 GRAVEL 10 SAND Thomas Prior House Development 0.1 **PARTICLE SIZE ANALYSIS** SILT 0.01 **FEST METHOD: Wet Sieve** 0.001 **R3483** 3545 6.00 CLAY BOREHOLE No. 0.0001 CONTRACT: SAMPLE No. 100.0 90.0 80.0 70.0 60.0 50.0 40.0 10.0 0.0 30.0 20.0 DEPTH: COBBLES SILT/CLAY GRAVEL SAND %passing 100.0 89.9 81.7 100.0 100.0 75.6 66.7 55.4 43.4 33.5 24.8 9.4 5.2 3.1 2.8 1.4 0.9 2.1 particle size Report No. 75 63 50 50 28 28 28 14 14 14 14 14 10 6.3 6.3 5 3.35 5 0.425 0.63 0.05 0.05 0.03 0.013 0.009 0.005 0.002

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Thos. Prior Bh1/3545/6m

I.G.S.L 100 GRAVEL 10 SAND Thomas Prior House Development 0.1 **PARTICLE SIZE ANALYSIS** SILT 0.01 Thos. Prior Bh2/3555/5m **FEST METHOD: Wet Sieve** 0.001 **R3483** 3555 5.00 CLAY N BOREHOLE No. 0.0001 CONTRACT: SAMPLE No. 100.0 90.06 0.0 **DEPTH:** 80.0 70.0 60.0 50.0 40.0 30.0 20.0 10.0 COBBLES SILT/CLAY GRAVEL SAND %passing 100.0 100.0 0.00 85.4 60.8 44.6 33.2 25.8 19.7 15.3 10.5 7.8 5.8 3.9 2.5 3.1 1.4 0.4 particle size 14 10 6.3 5 3.35 7 1.18 0.6 0.425 0.425 0.425 0.15 0.03 0.03 0.03 Report No. 0.013 0.009 0.005 0.002 75 63 50 37.5 28 20

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.G.S.L 100 GRAVEL 10 SAND Thomas Prior House Development 0.1 **PARTICLE SIZE ANALYSIS** SILT 0.01 **FEST METHOD: Wet Sieve** 0.001 **R3483** 3563 3.50 CLAY თ BOREHOLE No. 0.0001 CONTRACT: SAMPLE No. 100.0 90.06 0.0 DEPTH: 80.0 70.0 50.0 40.0 60.0 30.0 20.0 10.0 COBBLES SILT/CLAY GRAVEL SAND %passing 100.0 100.0 88.6 78.6 70.5 62.4 51.5 40.4 28.5 20.0 9.7 7.2 6.2 5.2 3.3 2.5 1.5 1.7 particle size Report No. 14 10 6.3 5 3.35 7 1.18 0.6 0.425 0.425 0.425 0.425 0.03 0.03 0.03 0.03 0.013 0.009 0.005 75 63 50 37.5 28 20

Thos. Prior Bh3/3563/3.5m

.G.S.L 100 GRAVEL 10 SAND Thomas Prior House Development 0.1 **PARTICLE SIZE ANALYSIS** 0.01 SILT TEST METHOD: Wet Sieve 0.001 **R3483** 3573 5.00 CLAY 4 BOREHOLE No. 0.0001 SAMPLE No. CONTRACT: DEPTH: 100.0 0.0 90.0 80.0 70.0 60.0 50.0 40.0 30.0 20.0 10.0 SILT/CLAY COBBLES GRAVEL SAND %passing 100.0 100.0 100.0 83.3 61.5 45.0 33.4 25.8 19.6 17.4 14.5 14.5 10.0 6.8 4.3 3.5 2.9 1.7 0.8 particle size Report No. 75 63 50 37.5 28 28 28 14 14 14 14 16 3.35 5 3.35 5 3.35 0.06 0.15 0.03 0.03 0.013 0.009 0.005 0.002 0.02

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Thos. Prior Bh4/3573/5m

.G.S.L 100 GRAVE **0** CINNS Thomas Prior House Develoment 0.1 **PARTICLE SIZE ANALYSIS** SILT 0.01 Thos. Prior Bh5/3580/4m **FEST METHOD: Wet Sieve** 0.001 **R3483** 3580 4.00 CLAY ເດ BOREHOLE No. 0.0001 SAMPLE No. CONTRACT: 0.0 100.0 90.0 50.0 10.0 80.0 70.0 60.0 40.0 30.0 20.0 DEPTH: SILT/CLAY COBBLES ١., GRAVEL SAND %passing 100.0 100.0 86.9 78.2 59.9 39.3 25.5 18.5 13.2 11.7 9,9 7.8 6.4 5.5 4.7 3.7 5.1 4.1 particle size 14 10 6.3 5 3.35 7 1.18 0.6 0.425 0.425 0.425 0.063 0.03 0.03 0.03 0.03 0.002 Report No. 0.013 0.005 0.009 75 63 50 37.5 28 20

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SANPLE	LORE NO.	DEPTH	APP. COHESION CU.P.S.I.	Angle of Shearing Resistance. Qu.	B.D. P.C.F.	174	LaLe \$	P.L. \$	Description.
22716	1	7*6* to 9*0*	19.0	10 ⁰	142.5	12.3	36	23	Very stiff black boulder clay.
22722	2	510# to 616"	18.5	40	143.7	13-3	36	18	Firs brown boulder clay.
22729	3	5'0" to 6'6"	7.5	16 ⁰	1/1.5	14.8	.7	19	Firm brown stony clay.
22739	5	5*0# . to 6*6#	16.5	8°	143.5	13.1	38	20	Firm brown boulder slay.
22743	6	5*0" to 6*6"	14.0	4°	134	18.8	41	19.	Firm brown stony clay.
		i		18 -					
		19		740	· · · · ·	122		6 5	

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R1108/B64363

CLASSIFICATION TEST RESULTS

Report No.

CONTRACT BLACKROCK

Borehole No.	Sample No.	Depth (metres)	Description	Percentage Passing 425 µm sieve	Liquid Limit (LL)	Plastic Limit (PL)	Plasticity Index (Pl)	Water Content %
l	9916	1.00	Brown gravelly silt clay	у	24	12	12	
5	9980	3.00	Black gravelly silt clay	-Y	28	10	18	
•								
				•	•		•	
-								

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Appendix F

Geotechnical Risk Register

ARUP

JOB TITLE	Belfield / Blackrock to City Centre Core Bus Corridor Scheme
JOB NUMBER	268401-00
MADE BY	Ozgur Alper
CHECKED BY	Geoff Petelka
DATE	06/08/2021
Description of spreadsheet	Geotechnical Risk Register
Member/Location	
Filonomo	Contachnical Rick Pagistar

Filename

Geotechnical Risk Register

CONTENTS OF SPREADSHEET

	Description
Cover	
Notes	
Geotechnical Risk Register	
Hide	Hidden

AUTHORISATION OF LATEST VERSION

Type and method of check		
Signatures & dates:	Made by	
	Checked	

REVISION	S	Curre	nt Revision	
		Cur	rent Status	
Rev.	Date	Made by	Checked	Description
1	06/08/21	OA	GP	

(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 subseugent aspect of the risk has been identified even after the prescribed mitigation control.

(3) Risk Analysis Matrix

Risk Table		Severity			
Likelihood	н	м	L		
Н	н	н	М		
М	н	м	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				
01/01/00	06/08/21	GP				

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.
- 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.
- 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 Rev.

Particular Definitions

JOB TITLE: Belfield / Blackrock to City Centre Core Bus Corridor Scheme JOB NO: 268401-00

Hazard: 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.

D .(Sub	Created	Created By Phase of W			Hazard		Risk				Pre-Mitigatio Risk Analysis		Risk Control Mitigation Measures			Post-Mitigation Risk Analysis		1	
Ref.	Ref.	Date	Initials	and/or Source	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	Status
1	(i)	30/07/2021	OA	Preliminary Design	Contamination	Encountering unexpected contaminated ground during construction.		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	Active
2	(i)	30/07/2021	OA	Preliminary Design	Contamination	Encountering unexpected contaminated ground during construction.		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	Active
3	(ii)	30/07/2021	OA	Preliminary Design	Unforeseen ground conditions	Less favourable ground material properties.	Geology	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	Active
4	(iii)	30/07/2021	OA	Preliminary Design	Unforeseen ground conditions	Presence of alluvium or estuarine silt/clay below the made ground.	Geology	Material present may cause settlement.	Design	R	н	н	н	Further GI to be scheduled at detailed design	Detailed Design	Client	L	L	L	Active
6	(ii)	30/07/2021	OA	Preliminary Design	Unforeseen ground conditions	Low undrained shear strength and effective parameters of Made Ground	Geology	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	Active
7	(iv)	30/07/2021	OA	06/08/2021	Chemically reactive ground	Aggressive ground conditions	Geology	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	Active
8	(i)	30/07/2021	OA	Preliminary Design	Unforeseen ground conditions	Re-useability of the material		Material excavated during the works may not be suitable for reuse on site and require export from site 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	Active
9	(iii)	30/07/2021	OA	Preliminary Design	Settlement	Insufficient characterisation of the ground materials.	Geology	Unexpected or poor ground materials could lead to excessive deformation of the retaining wall 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	Active

