Residential Site At Kilcarbery

Infrastructure Design Report

230026-X-94-X-XXX-RP-DBFL-CE-0001

INFRASTRUCTURE

November 2023

DBFL CONSULTING ENGINEERS

Project Title:	**Residential Site At Kilcarbery**		
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1	20/11/23	First Issue	Pierce Lynch	Brendan Manning	Bill Bates

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1 Introduction

1.1 Background

The proposal has been prepared on behalf of South Dublin County Council as a Part 8 application for a residential development, consisting of 88 residential units on undeveloped lands measuring c. 2.03 hectares adjoining the Old Nangor Road, Kilcarbery Grange, Dublin 22.

The proposed development consists of a mix of 88 units consisting of a variety of house and duplex types. The units proposed include 44 no. 3bed 2 storey houses, 8 no. 4 bed 2 storeys houses, 36 no. duplex units (varying from 1 to 3 beds) within 3 storey duplex blocks. The development includes 100 no. surface car park spaces and 110 no. bicycle parking spaces, above ground sustainable urban drainage measures, an ESB kiosk, Irish Water below-ground foul pumping station, proposed new roads, footpath and cycle-paths (including works to provide a cycle-path along a portion of the Old Nangor Road), public open space areas, landscape works, bin/bicycle stores and all associated ancillary site development works.

DBFL were commissioned by South Dublin County Council to undertake an infrastructure design report to accompany a Part 8 Planning Application for the proposed Integrated Social Housing at Kilcarbery in County Dublin within the operational jurisdiction of South Dublin County Council. Refer to *Figure 1.1* and *Figure 1.2* below.

1.2 Objectives

This report addresses the development's main infrastructure elements, including.

- Access and Roads Layout
- Surface Water Drainage
- Foul Drainage
- Water Supply and Distribution

1.3 Location

The site, which is currently greenfield, is approximately 12km southwest of Dublin City Centre, within the operational jurisdiction of South Dublin County Council. Refer to *Figure 1.1* and *Figure 1.2* below.

Figure 1-1 Site Location (Source: Irish Grid Reference Finder)

To the south the site is bounded by a residential development currently in construction referred to "Housing at Kilcarbery". The roads bounding the site to the north, West, South and East are Old Nangor Road, Rowan Green, Rowan Avenue and Grange Avenue respectively.

To the Northeast the St Cuthbert's Road connects to New Nangor road (R134).

It is also noted that the site is located approximately 1.83km northeast of Casement Aerodrome at the closest point.

Figure 1-2 Site Location Plan (Source: Irish Grid Reference Finder)

The subject lands are located within zoning Objective RES-N, to provide for new residential communities in accordance with approved area plans. Please see snip below of the zoning for the area in *Figure 1.3.*

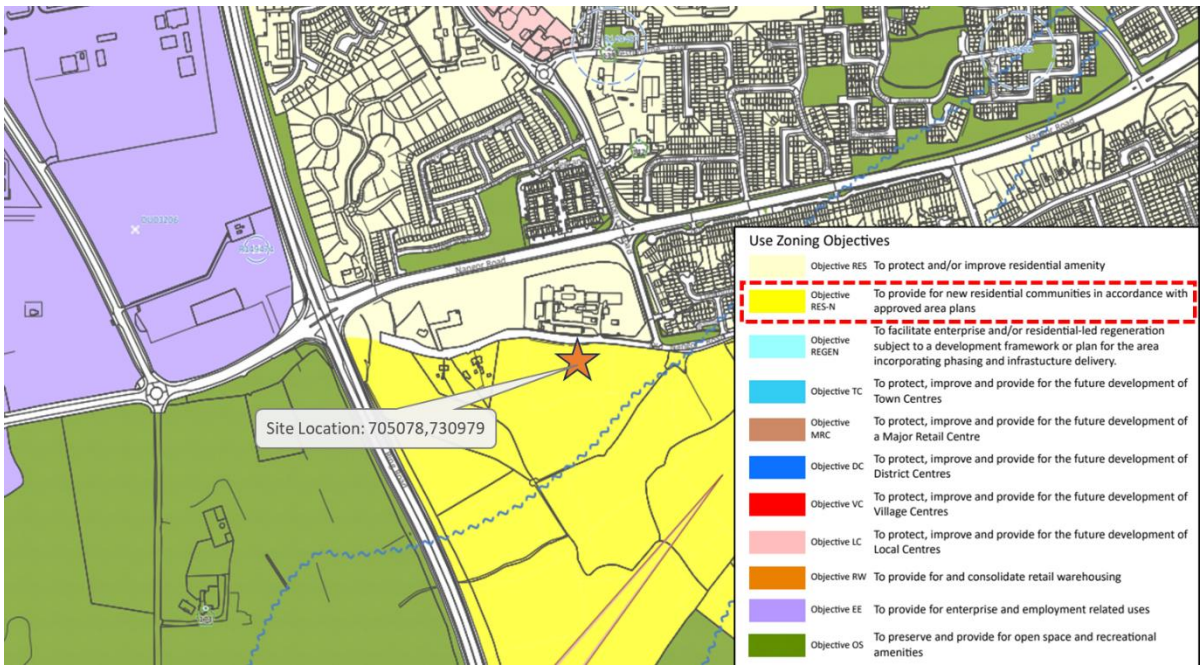


Figure 1-3 Land Use Zoning Map with Site Overlay (Source: South Dublin County Development Plan 2022-2028)

1.4 Topography

The site, which is generally flat, falling from Northwest boundary towards the southeast boundary at an average gradient of 1:96 (refer to Appendix H for Topographic Survey Plans prepared by Land Surveys). The existing topographic survey information is also shown in the background of the Proposed Layout Plans (refer to DBFL Drawings. X-04-DTM-DR-DBFL-CE-1201 Roads Layout).

1.5 Flood Risk

A separate Site-Specific Flood Risk Assessment has been prepared as part of the application. Please refer to report 230026-DBFL-XX-XX-RP-C-0002_SSFRA for further information.

1.6 Ground Investigation

IGSL carried out a preliminary intrusive ground investigation at the site in October 2007 and undertook further detailed investigation at the site in early 2019 (refer to Appendix F for extracts from IGSL's Investigation Report). The original investigation at the site indicated that it is overlaid by a layer of topsoil up to 300mm deep. However, it is noted, from a review of an archaeological report at the site, that depths of up to 700mm were recorded. The recorded subsoil material comprises of sandy gravelly clays over a limestone bedrock. This was later confirmed as part of a detailed intrusive investigation undertaken in 2019.

Further ground investigations were carried out by (GII) ground investigations Ireland in September 2023 (refer to Appendix F for extracts from GII's Investigation Report)

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 3 No. Soakaways to determine a soil infiltration value to BRE digest 365

1.7 Proposed Development

The proposal has been prepared on behalf of South Dublin County Council as a Part 8 application for a residential development, consisting of 88 residential units on undeveloped lands measuring c. 2.03 hectares adjoining the Old Nangor Road, Kilcarbery Grange, Dublin 22.

Figure 1-4 Proposed Road Layout (Source: X-04-DTM-DR-DBFL-CE-1201 Roads Layout)

The following sections are covered in this report for the site:

- Site Access and Street Layout
- Surface Water Drainage
- Wastewater Drainage
- Potable Water supply

Refer to Table 1-1 below for DBFL Drawings.

This report should be read in conjunction with the following drawings, provided for clarity, and submitted with this application. A full drawing register will be provided to accompany the drawing package.

Drawing Numbers	**Title**
X-04-DTM-DR-DBFL-CE-1201	Roads Layout
X-04-DTM-DR-DBFL-CE-1211	Road Hierarchy and Linkages
X-04-DTM-DR-DBFL-CE-5201	Typical Road Construction Details Sheet 1
X-04-DTM-DR-DBFL-CE-5202	Typical Road Construction Details Sheet 2
X-04-DTM-DR-DBFL-CE-5203	Typical Road Construction Details Sheet 3
X-04-DTM-DR-DBFL-CE-5204	Typical Road Construction Details Sheet 4
X-05-DTM-DR-DBFL-CE-1300	Proposed Catchment Areas
X-05-DTM-DR-DBFL-CE-1301	Proposed Site Services
X-05-DTM-DR-DBFL-CE-5301	Typical Drainage Construction Details Sheet 1
X-05-DTM-DR-DBFL-CE-5302	Typical Drainage Construction Details Sheet 2
X-05-DTM-DR-DBFL-CE-5303	Typical Drainage Construction Details Sheet 3
X-05-DTM-DR-DBFL-CE-5304	Typical Drainage Construction Details Sheet 4
X-05-Z00-DTM-DR-DBFL-CE-3301	Longitudinal Sections Through Surface Water
X-05-Z00-DTM-DR-DBFL-CE-3311	Longitudinal Sections Through Foul Sewer Sheet 1
X-05-Z00-DTM-DR-DBFL-CE-3311	Longitudinal Sections Through Foul Sewer Sheet 2
X-93-DTM-DR-DBFL-CE-1301	Proposed Watermain Layout

Table 1-1 Drawing Register

2 Access and Roads

2.1 Overall, Road and Access Layout

Refer to DBFL Report 230026-X-90-X-XXX-RP-DBFL-CE-0002 TTA and drawing no. X-04-DTM-DR-DBFL-CE-1201 Roads Layout for further information and the proposed site access and road layout.

2.1.1 Vehicular Access

The subject development will comprise 4 No. new accesses. Two of these accesses will be to the north of the site onto Old Nangor Road, and two will be to the south onto the emerging Kilcarbery Grange Avenue which is being constructed as part of the permitted development (Planning Ref. SHD3ABP-305267-19) to the south. Access roads to the site will provide thoroughfare in a north-south direction through the site. Additionally, the development traffic will connect to the wider road network via the Old Nangor Road / St Cuthbert's Road junction and the R136 (Outer Ring Road) Left-in Left-out junction.

2.1.2 Pedestrian and Cyclist Access and Facilities

Pedestrians and cyclists will access the site at the same locations as the aforementioned vehicular accesses introduced above. The subject development proposals include for new footpaths along the perimeter of the site that leads to the 4 No. site access locations. Within the site, north-south pedestrian and cyclist movements are facilitated through the site between the two northern and two southern accesses through dedicated pedestrian facilities and traffic calmed streets.

Additionally, there are dedicated cycle facilities proposed as part of the subject scheme on the eastern and northern boundaries of the subject site.

2.1.3 Car Parking

All car parking is located off curtilage (within the site's red line boundary). The subject development proposal includes a total of 100 no. car parking spaces (62 no. spaces for the houses and 38 no. spaces for duplex units). The proposed car parking assignment in relation to the maximum parking requirements is outlined as set out by the South Dublin City Council's Development Plan (2022 – 2028). The parking provided within the subject development does not exceed the maximum allowable parking as indicated in the SDCC Development Plan.

2.1.4 Cycle Parking

A total of 110 no. cycle parking spaces are proposed as part of the subject development, 90 no. of which are for residents (long term cycle parking) and 20 no. of which are for visitors (short stay cycle parking).

2.2 Road Design

The proposed development's internal streets are designed in accordance with the *'Design Manual for Urban Road and Street (DMURS') and a DMURS Compliance Statement* is included with this planning submission.

A *Traffic and Transportation Assessment* (*230026-X-90-X-XXX-RP-DBFL-CE-0002)* has been prepared by DBFL Consulting Engineers and are included as standalone documents.

The proposed development's street layout and hierarchy is shown on drawing (*X-04-DTM-DR-DBFL-CE-1201 Roads Layout, X-04-DTM-DR-DBFL-CE-1211 Road Hierarchy and Linkages*). The standard street details are as follows:

- Primary Local Access – typically 5.5m wide carriageway with 2.0m footpaths.
- Homezones – Typically 4.8 m wide carriageway.

Typical street cross sections also include 2.0m wide footpaths. Maximum road corner radii of 4.5m to 6m are provided at junctions to the distributor road and junction radii of between 1-3m within the site are provided as per DMURS.

2.3 Pavement Design Standards

Local streets within the site are designed in accordance with the Department of the Environment Recommendations for Site Development Works, the Design Manual for Urban Roads and Streets (DMURS) and Local Authority requirements. The link road buildup is accordance with TII. Please refer to DBFL road detail drawing X-04-DTM-DR-DBFL-CE-5201 Typical Road Construction Details Sheet 1-4 for details.

The proposed road construction thicknesses based on an existing ground minimum design CBR (Californian Bearing Ratio) of 3%. Actual CBRs and ground conditions will be confirmed by site investigations prior to construction.

2.4 Vehicle Tracking

The proposed development has been tracked to show that the development circulation layout will accommodate a large refuse vehicle with turning head provided where required. Short cul-de-sacs/home zones are designed to facilitate the turning of smaller delivery vehicles.

3 Surface Water Drainage

3.1 Existing Surface Water Arrangement

The existing site is predominantly greenfield, and the topography of the site generally falls from the from the northwestern boundary towards. There is an existing drainage ditch located outside the southeastern boundary of the subject site.

The proposed discharge point from the site will be directed to an existing 375mm diameter storm sewer within the south bounding road, Rowan Avenue.

This sewer in the south bounding development is directed to an existing 450mm diameter drain within the Old Nangor Road at the junction of Kilcarbery Avenue, which then ultimately discharges to the Camac River downstream.

Refer to figure 3-1 below for details on existing surface water flow paths shown in blue arrows and for the location of the Camac waterbody.

Figure 3-1 Site Plan & River Flow Direction (Source: https://gis.epa.ie/EPAMaps/)

3.2 Proposed Surface Water Drainage

3.2.1 General

The overall surface water drainage strategy has been developed by DBFL Consulting Engineers in consultation with South Dublin County Council (SDCC). The Surface water runoff from the development will be limited to greenfield runoff rates (Qbar) in accordance with the Greater Dublin Strategic Drainage Study (GDSDS). The proposed development site consists of an area of 2.03 Hectares.

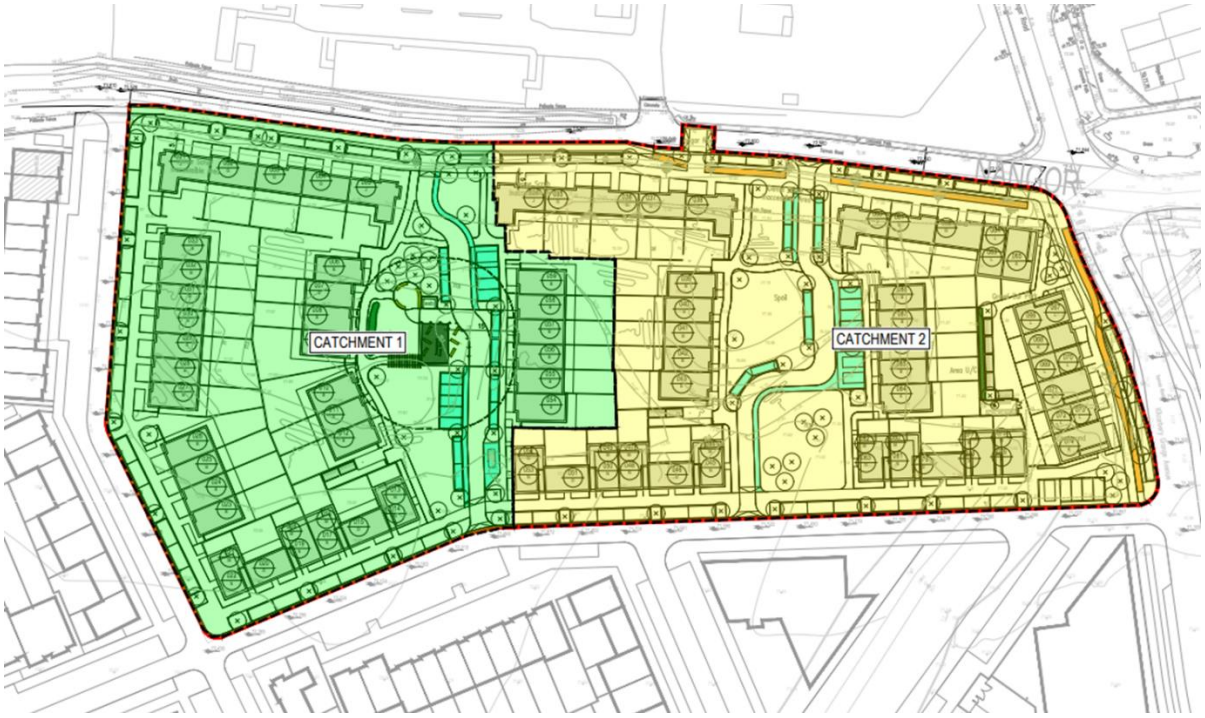


Figure 3-2 Catchment Plan

This strategy is presented on drawing **230026-X-05-DTM-DR-DBFL-CE-1301 Proposed Site Services** & **X-05-DTM-DR-DBFL-CE-1300 Proposed Catchment Areas** which outlines each catchment and its corresponding SuDS and attenuation measures.

Each catchment has various SuDS elements, controls, final treatment and attenuation measures provided on route and in advance of ultimate discharge to the proposed outfall location. Further detail is provided subsequently.

The proposed discharge point from the site will be directed to an existing 375mm diameter storm sewer within the south bounding road, Rowan Avenue.

3.2.2 Compliance with Surface Water Policy

Surface water management for the proposed development is designed to comply with the Greater Dublin Strategic Drainage Study (GDSDS) policies and guidelines and the requirements of South Dublin County Council. The guidelines require the following main 4 main criteria to be provided by the development's surface water design.

- Criterion 1: River Water Quality Protection – satisfied by providing interception storage, treatment of run-off within the SUDS features. This is satisfied using permeable paving, swales, tree pits, rain gardens and petrol interceptors.
- Criterion 2: River Regime Protection – satisfied by attenuating run-off with flow control devices prior to discharge to the outfall.
- Criterion 3: Level of Service (flooding) for the site – satisfied by the Site being outside the 1000 year coastal and fluvial flood levels and extents. Pluvial flood risk addressed by development designed to accommodate surface water runoff from a 100-year period storm (1& AEP) plus climate change (20%) as per the recommendations of the GDSDS. Planned flood routing for storms greater than 100-year return period level considered in design and development run-off contained within site.
- Criterion 4: River flood protection – attenuation provided within the SuDS features permeable paving construction, swales, tree pits, rain gardens and attenuation facilities.

3.2.3 Management of Surface Water Runoff Quality & Routing

In the engineering assessment of surface water quality and routing management, the fall location of the rainwater and its subsequent flow route to the receiving environment play significant roles. Treatment will be determined based on these parameters. Both source and site-wide treatment measures will be strategically positioned along various flow routes.

For the subject site, there exist six primary categories of surface water run-off: green space (Private Gardens), soft landscaping (Public Spaces), roofs, hard landscaping, parking, and roads. These categories are further differentiated based on public and private ownership. The implementation of sustainable urban drainage components depends on the flow trajectory and anticipated ownership and maintenance responsibilities. Each form is discussed, and concepts established.

- Green Space (Private Gardens & Private Communal Spaces).

The primary recipients of the surface water are groundwater and plant uptake. Minimal maintenance is anticipated. To mitigate local flood risks, the design will include overflow gullies. For most storm events up to 1%AEP, there will be no input to the conveyance system, in accordance with the recommendations of the GDSDS.

- Green Space (Public Parks)

The primary recipients for surface water in these areas are groundwater and plant uptake. Landscaping and vegetation strategies will be employed to enhance drainage and promote plant water uptake. Flow paths and SuDS features direct runoff towards public open space. The open areas will be formed to encourage rainfall runoff to be managed as part of the landscape, it is anticipated that areas of greenspace may be subject to temporary ponding particularly after significant rainfall. Day-to-day rainfall runoff is proposed to travel along low flow route.

Storms up to the 100-year critical storm with an additional 20% allowance for climate change will be stored overground in a detention /infiltration basin.

Proposed detention / infiltration basins are proposed in open Green Spaces, to allow easy and safe access for people and maintenance machinery. Access ramps are proposed for both public and maintenance accessibility to the landscaped basins, slopes will not exceed 1 in 4 for access, stepped and shaped embankments are proposed to form the basins sides. Upon being assumed by the Local Authority, maintenance demands are projected to be low.

- Roofs (Housing Units)

Water run-off from the rear sections of roofs is designed to be directed towards rain gardens located at the property's rear. These gardens are engineered to attenuate most significant storm events, adhering to GDSDS guidelines. Water retained within the rain garden's structure will serve as infiltration for the overlying vegetation. In the event of excessive run-off, overflow will be directed first to the rear garden, and subsequently, if necessary, to a gully outlet connected to the primary conveyance drainage system.

Run-off from the front sections of the roofs will be guided towards vegetated zones at the property's front. In extreme events, this will overflow into a designated outfall gully, subsequently joining the main conveyance drainage network.

Anticipated maintenance for this system is minimal and falls under the jurisdiction of either the private property owner or the relevant housing authority.

- Hard Landscaped Areas (footpaths)

Water run-off in these regions will typically be channelled to edge drainage systems or to systematically arranged tree pits, vegetated areas, and green spaces. Hard landscaped (Footpaths) surfaces are designed to slope towards green spaces, facilitating natural drainage to the subsoil or absorption by plants. Adjacent to expansive areas, diffusion storage will be employed to prevent localized ponding. During extreme conditions, when the green space reaches saturation or is inundated, overflow will be directed to the primary conveyance drainage system.

- Roads (Public)

Water run-off in roads areas will typically be channelled to kerb edge/road edge, which are then directed towards inlets (Dropped kerbs or similar) to green spaces, tree pits, or depressions. Road runoff will flow over the edge into these spaces, facilitating natural filtration and absorption by the underlying geology or vegetation.

In locations where it is not possible to sufficient drain contributing hardstanding roads area the use of overflow gullies which are connected to tree pits, vegetated areas, green spaces and conveyancing trenches located at the back of footpaths are used. Gully overflows in extreme events, where the green space is saturated or filled, will pass to the main conveyance drainage network. The conveyancing function for gullies to the network, will generally intercept road run-off removing any contaminated detritus, before being directed to tree pits, vegetated areas, green spaces and conveyancing trenches for controlled conveyance and progressive infiltration, where possible for surface water for the majority of rainfall events.

These SuDs components work in tandem with on-site controls to regulate runoff volumes, in accordance with the requirements of the GDSDS.

- Public Parking Areas (Public)

Water run-off in public parking areas is designed to permeate into proposed permeable paving. This SUDS feature use “open bottom” attenuation facilities will provide the necessary interception volume required by the GDSDS.

There are two types of permeable parking located throughout the site, firstly the permeable paving bounding the site directs flows towards the main attenuation areas. These proposed permeable paving parking bays are “open bottom” with infiltration/conveyance trenches located below. In extreme rainfall events up to 1 in 30-year return period (3%AEP), control manholes will be used to maximise the containment of run-off volumes at source below parking bays allowing for optimal capacity usage of the conveyance trenches for attenuation and infiltration. Spaced between the parking bays also include systematically arranged tree pits and vegetated areas. Water run-off into these drainage systems will infiltrate to the overlying vegetation, and the underlaying infiltration trench. Tree pit high level overflow systems in the event of excess flows will be directed to an overflow inlet into the main drainage network. Excess flows will be directed to overflow in control manholes which will direct runoff to conveyance drainage network for progressive site wide

management in open green areas. Water attenuated within the conveyance trenches will also be taken by tree roots in the tree pits and other planted areas.

The second form of permeable paving located on the proposed site are also “open bottom” however will not have infiltration trenches below. Standard collection drainage pipes work will direct this towards the main drainage network.

3.2.4 Sustainable Drainage Systems (SuDS)

SuDS features will be integrated into the surface water drainage network for the proposed development, with the objective of controlling the quantity of surface water runoff, managing the quality of runoff to prevent pollution, and creating and sustaining local ecosystems. The four main categories of benefits that can be achieved by SuDS are water *quantity*, *quality*, *amenity,* and *biodiversity*. SuDS features can take many forms both above and below ground and can include planting and proprietary / manufactured products.

SuDS features deliver high quality drainage while supporting urban areas to cope better with severe rainfall now and in the future. They also counteract some of the impacts on our water cycle caused by increased urbanisation, such as reduced infiltration, which can result in diminished groundwater supplies. They are used in conjunction with traditional drainage systems, and the use of SuDS features are a requirement of the GDSDS (Greater Dublin Strategic Drainage Study).

The SuDs features proposed for the development include the following:

- Swales
- Permeable paving within public parking.
- Infiltration trenches
- Rain gardens in back Garden (Raised)
- Rain gardens in public open space (Low Lying)
- Bioretention areas
- Tree Pits.
- Detention basins.
- Flow controls device / Control manhole orifices.
- Petrol Interceptors.

The proposed surface water drainage layout for the scheme is detailed in DBFL drawing no X-05-DTM-DR-DBFL-CE-1301 Proposed Site Services.

3.2.5 Surface Water Attenuation

Surface water runoff volumes from the development is attenuated to flow rates equal to the greenfield runoff (Q_{bar}), in accordance with the recommendations of the GDSDS. Surface water run-off from catchment areas will be attenuated using a vortex flow control device (Hydrobrake or equivalent).

Q_{bar} is calculated using the *Institute of Hydrology* equation, as recommended in the Greater Dublin Strategic Drainage Study (GDSDS), as follows:

$$Q_{bar\ [rural]} = 0.00108\ x\ AREA^{0.89} x\ SAAR^{1.17} x\ Soil^{2.17}$$

Where:

- $Q_{bar[rural]}$ is the mean catchment annual flow from a 50-ha rural catchment in m^3/s;
- SAAR is the standard average annual rainfall = 754.75 mm**.**
- SOIL is the soil index, with 5 soil types used and SPR values (standard percentage runoff) applied to each soil type.

  The SPR values for the 5 soil types are as follows:

  Soil 1 = 0.1; Soil 2 = 0.3; Soil 3 = 0.37; Soil 4 = 0.47; Soil 5 = 0.53;

A SPR value of 0.37 (Soil Type 3) is applied for the subject site. Soil type 3 is chosen based on site specific conditions, as confirmed using preliminary site investigations. Refer to Appendix F for extracts from GII's Investigation Report.

Property	**Classes**
Drainage Group	2 - Commonly waterlogged within 60 cm during winter
Depth to "impermeable" layers	> 80 cm
Permeability group	3 - Slow
Slope	1 - 0-2°

Table 3-1 Summary of Site Characteristics

Having decided all four parameters, Table 4.5 was used to reach the index of 'winter rain acceptance'.

Table 4.5 The classification of soils by winter rain acceptance rate from soil survey data.

Drainage class Group	Depth to impermeable layer (cm)	Slope classes								
		0 - 2°			2 - 8°			>8°		
		Permeability rates above impermeable layers								
		Rapid (1)	Medium (2)	Slow (3)	Rapid (1)	Medium (2)	Slow (3)	Rapid (1)	Medium (2)	Slow (3)
1	>80	1			1			1	2	3
	40 - 80					2		3		4
	<40	—	—	—	—	—	—	—	—	—
2	>80	2		3			4	—		
	40 - 80									
	<40	3								
3	>80					5		—		
	40 - 80							—		
	<40									

Winter rain acceptance indices: 1, very high; 2, high; 3, moderate; 4, low; 5, very low. Upland peat and peaty soils are in Class 5. Urban areas are unclassified.

Table 3-2 The classification of soils by winter rain acceptance rate from soil survey data

The calculated allowable outflow rate of 4.1 l/s is applied to the overall surface water catchment, with the storage volume calculated using the Source Control of MicroDrainage and modelled in the Network module of MicroDrainage. A summary of the surface water catchments and their associated Qbar rate and storage requirements are summarised in

Catchment	**Catchment Area (Total)**	**Impermeable Catchment Area (Total)**	**Allowable Outflow (l/s) (Max.)**	**Design Discharge (l/s)**	**Storage Volume Required (100 Yr.)**	**Storage Volume Provided (100 Yr.)**
1	1.02 Ha	0.50 Ha	2.04 l/s	2.5 l/s	295 m3	295m3
2	1.03 Ha	0.52 Ha	2.06 l/s	4.10 l/s	346 m3	371 m3
Cumulative TOTAL:	**2.05 Ha**	**1.02 Ha**	**4.10 l/s**	**4.10 l/s**	**641 m3**	**666 m3**

Table 3-3 below:

In total approximately 641m^3 of storm-water storage is required, a total of 666m^3 of storm-water storage is provided within the attenuation facilities for the subject site.

Refer also to ***Appendix A*** for details of the allowable outflow calculations.

3.2.6 Surface Water Storage

It is proposed to store runoff for a 1% AEP (Annual Exceedance Probability) storm event plus 20% allowance for climate change in detention basins, Bioretention areas, infiltration trenches, swales and Tree pits. The storage requirement has been calculated using the *Source Control* module of *MicroDrainage* and modelled using the *Network Module,* taking into consideration the impermeable area of the surface water catchment, design invert levels, ground levels and depth and type of storage system. A summary of the allowable outflow rates and provided storage volumes for each surface water catchment is included in

Catchment	**Catchment Area (Total)**	**Impermeable Catchment Area (Total)**	**Allowable Outflow (l/s) (Max.)**	**Design Discharge (l/s)**	**Storage Volume Required (100 Yr.)**	**Storage Volume Provided (100 Yr.)**
1	1.02 Ha	0.50 Ha	2.04 l/s	2.5 l/s	295 m3	295m3
2	1.03 Ha	0.52 Ha	2.06 l/s	4.10 l/s	346 m3	371 m3
Cumulative TOTAL:	**2.05 Ha**	**1.02 Ha**	**4.10 l/s**	**4.10 l/s**	**641 m3**	**666 m3**

Table 3-3.

Catchment	**Catchment Area (Total)**	**Impermeable Catchment Area (Total)**	**Allowable Outflow (l/s) (Max.)**	**Design Discharge (l/s)**	**Storage Volume Required (100 Yr.)**	**Storage Volume Provided (100 Yr.)**
1	1.02 Ha	0.50 Ha	2.04 l/s	2.5 l/s	295 m3	295m3
2	1.03 Ha	0.52 Ha	2.06 l/s	4.10 l/s	346 m3	371 m3
Cumulative TOTAL:	**2.05 Ha**	**1.02 Ha**	**4.10 l/s**	**4.10 l/s**	**641 m3**	**666 m3**

Table 3-3 Surface water catchment Summery

Refer to *Appendix B : Attenuation Calculations* & *Appendix C : Surface Water Network calculations* for MicroDrainage surface water Network Model calculations and simulation results.

3.2.7 Interception Storage

To prevent pollutants or sediments discharging into water courses the GDSDS requires *"interception storage"* to be incorporated into the development. The volume of interception required is based on 5mm of rainfall depth from 80% of the runoff from impermeable areas as defined in the GDSDS. Refer to *Table 3-4* below for details of interception required and interception provided.

The interception volume attributable to each SuDs feature consists of the volume of water that can infiltrate to the ground, what will evaporate into the atmosphere and what can transpire through plants and vegetation. Additionally, there will be some loses of water due to absorption and wetting of stone and soil media.

Site Summary	
Impermeable Area (ha)	1.02 ha
Interception Requirements	
Interception Storage Required (m^3) (5mm of 80% Impermeable Area)	40.9 m^3

Table 3-4: Surface Water Interception Storage

3.2.8 Treatment Volume

The GDSDS requires that a "treatment volume" (Vt) be provided to prevent any pollutants or sediments entering river systems. Additionally, a 'treatment train' stormwater runoff management system is required.

The treatment volume is based on treatment 15mm of rainfall depth from 80% of the runoff from impermeable areas as defined in the GDSDS. Treatment volumes are summarised in Table 3-5 below:

Site Summary	
Impermeable Area (ha)	1.02 ha
Treatment Requirements	

Treatment Volume (Vt) (m^3) (15mm of 80% Impermeable Area)	122.6 m^3

Table 3-5: Treatment Volume Requirements

3.3 Surface Water Drainage Design Standards

Surface water drainage for the development is designed using the recommendations of the GDSDS, EN752 and BS8301:1985. The parameters applied to the design of the surface water drainage system are included in *Table 3-6*:

Drainage Design Parameters	
Return period	5 years
Surcharge Check	1%
Separation between TWL Storage System 1% Storm event	500mm
Minimum time of entry	4 minutes
Pipe Friction (Ks)	0.6 mm
Minimum Velocity	1.0 m/s
Standard Average Annual Rainfall	754.75 mm
M5-60	16.90 mm
Ratio r (M5-60/M5-2D)	0.273
Climate Change	20% for rainfall intensities.

Table 3-6: Drainage Design Parameters

Impermeable areas were calculated for each catchment by applying the following runoff coefficients as per *Table 3-7* below:

Type of Surface	Runoff Coefficient
Roofs (Traditional)	0.75
Roofs (Suds)	0.75
Roads (Traditional):	0.95
Roads (SuDs)	0.55
Paths (Traditional)	0.75
Permeable Paving (SuDs)	0.55
Public Open Space	0.15

Table 3-7: Runoff Coefficients

A breakdown of the impermeable areas contributing to the surface water drainage network is summarised within *Table 3-8* . A detailed breakdown for each surface water catchment is included in Error! Reference source not found.

Catchment Area	Gross Area (ha)	Impermeable Area (ha)	Impermeability Factor
1	*1.02 Ha*	*0.50 Ha*	49.5 %
2	*1.03 Ha*	*0.52 Ha*	50.5 %

Table 3-8: Summary of Impermeable Areas

The surface water drainage network including the surface water storage system has been designed and simulated for a range of storm events (including 1 in 2, 1 in 30 and 1 in 100-year storm events) using the *Network* module of *MicroDrainage*. This is based on the Modified Rational Method. The surface water drainage network is designed in accordance with IS EN 752, BS8301:1985 and the recommendations of the 'Greater Dublin Strategic Drainage Study', (GDSDS).

Refer to *Appendix C : Surface Water Network calculations* or surface water sewer network MicroDrainage calculations.

Refer to DBFL drawing number X-05-DTM-DR-DBFL-CE-1301 Proposed Site Services

3.4 Climate Change

Surface water calculations use rainfall values for Kilcarbery, provided by Met Eireann. Rainfall intensities were increased by a factor of 20% to take account of climate change, as required by the GDSDS for surface water drainage design included surface water storage design.

Refer to *Appendix A : Surface Water Allowable outflow* for rainfall data.

3.5 Flood Risk

Refer to the 'Site Specific flood Risk Assessment' (SSFRA) by DBFL Consulting Engineers, which is included as a separate report within the planning application.

The surface water network, attenuation storage and site levels are designed to accommodate a 1% AEP (Annual Exceedance Probability) storm event and includes climate change provision. Floor levels of houses are set above the 1% AEP flood levels by a minimum of 500mm for protection. All footpaths are falling away from houses.

For storms events, exceeding a 1% AEP (Annual Exceedance Probability) storm event, the development has been designed to provide overland flood routes along the various development roads towards green areas, where possible.

4 Foul Drainage

4.1 Existing

Irish Water Record Drawings indicate that there is a 225mm concrete foul sewer to the northeast of the site along St Cuthbert's Road.

This location is chosen to discharge the sites foul network and has been agreed with SDCC and approved as part of the confirmation of feasibility and design vetting stage with Irish Water.

Due to the topography of the site, the site will require pumping in order to connect with the public sewer.

4.2 Foul Sewer Strategy

As there are no connections to the development readily available due to the site's location and topography a pumped solution is necessary for the proposed development. It is therefore proposed to discharge the wastewater from each dwelling to a temporary pump station located within the west bisecting road through the proposed development. The pump station is to cater for 88 units constructed as part of this development and will provide adequate storage for same. This is then to be pumped back to an existing manhole on the St Cuthbert's Road via a rising main. This temporary pump station is to be designed in accordance with Irish Waters Code of Practice for Wastewater Infrastructure and Irish Waters Standard details for Wastewater Infrastructure.

Refer to DBFL drawing X-05-DTM-DR-DBFL-CE-1301 Proposed Site Services for further information.

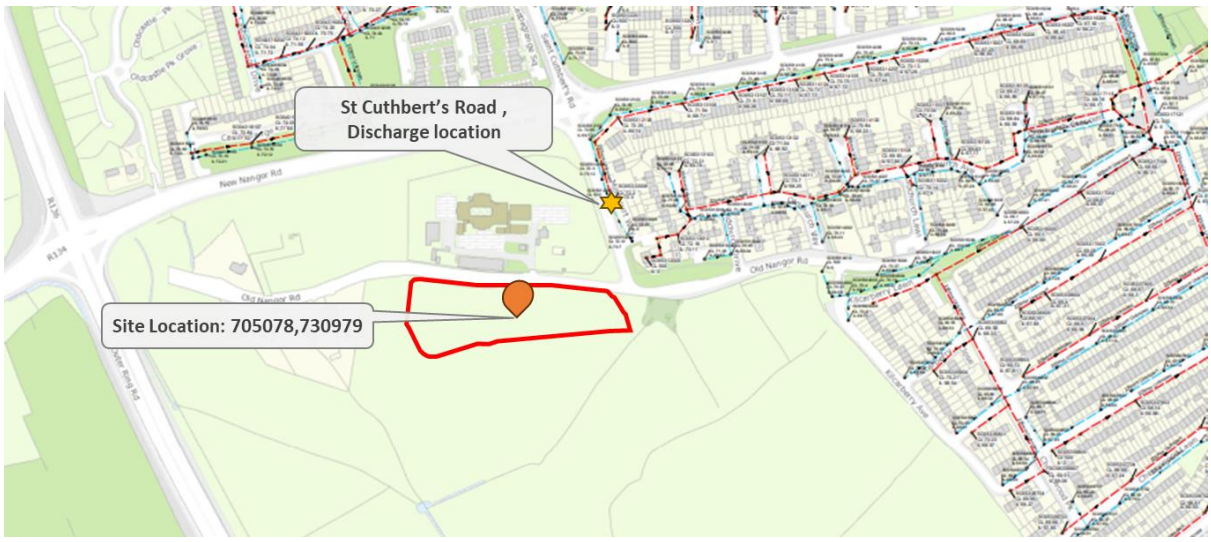


Figure 4-1 Extract from Irish water Network Plan

4.3 Design Calculations

Foul sewers have been designed in accordance with the Building Regulations and specifically in accordance with the principles and methods set out in the DOE "Recommendations for Site Development Works for Housing Areas", IS EN752 (2008), BS8301: 1985, IS EN12056: Part 2 (2000) and the recommendations of the *'Greater Dublin Strategic Drainage Study', (GDSDS)* and the Irish Water Connection and Developer Services, "Irish Water *Code of Practice for Wastewater Infrastructure" &* Irish Water *Standard Details for Wastewater Infrastructure" ,* The following criteria have been applied:

Hydraulic Loading	446l /dwelling/day
Discharge units	14 units per house (BS8301:1985)
Pipe Friction (Ks) (concrete)	1.5mm
Pipe Friction (Ks) (uPVC)	0.15mm
Minimum Diameter	150mm
Minimum Velocity	0.75 m/s (self-cleansing velocity)
Maximum Velocity	3.0 m/s

The foul sewer network has been designed using the *Network* module of *MicroDrainage*, using methods from BS8301:1985, the results of which are included in *Appendix D : Foul Sewer Calculations*. All foul sewers and manholes will be constructed in accordance with the Irish Water Standard Details and the Irish Water Code of Practice for Wastewater.

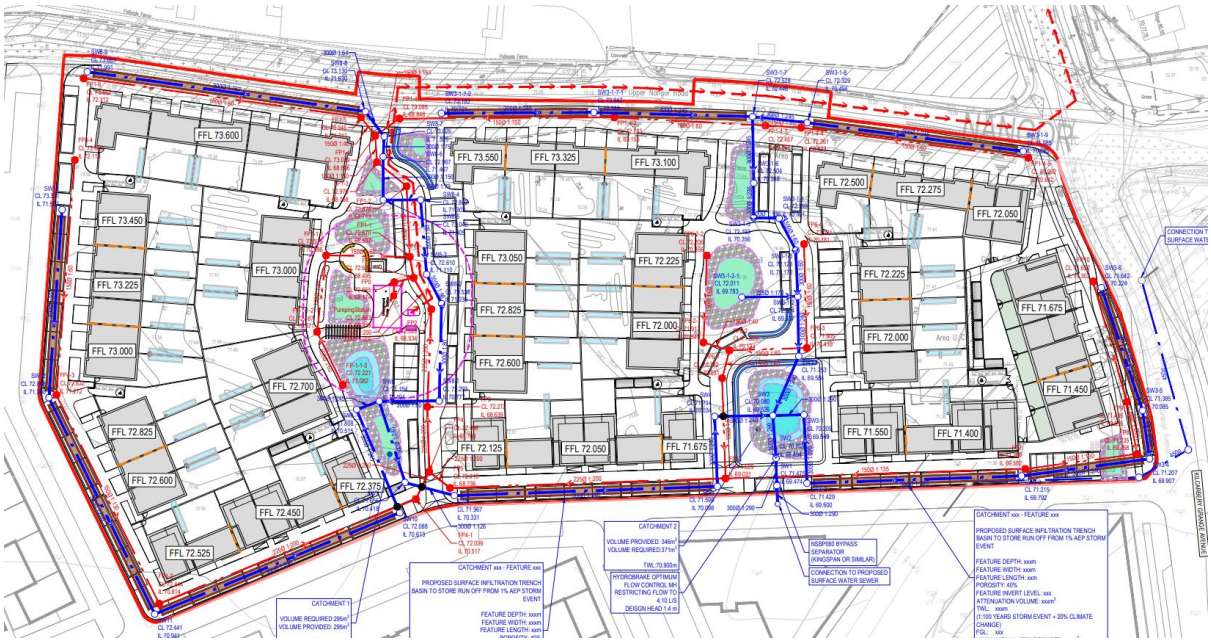


Figure 4-2 Proposed Drainage Network

Foul outfall sewer

The foul outfall sewer is designed to accommodate the following foul loading using Irish Water foul sewer demands are summarised in Table 4-1 below:

Development	No. of Residential Units	No. of Persons @ 2.7 per unit	Discharge per person per day	Peak Discharge (l/s)	Average Discharge (l/s)
Proposed Dwellings	88	238	150	2.58	0.41

Table 4-1: Foul Sewer Hydraulic Loading

4.4 Correspondence with Irish Water

Proposed 150mm/225mm foul sewers are to be in accordance with Irish Water's Code of Practice. Individual houses will connect to the 150/225mm diameter foul sewers via individual 100mm drains. Minimum gradients and pipe diameters for private drains are as per Building Regulations and Irish Water Guidelines. Confirmation of feasibility was confirmed by Irish Water on 03/07/2023, please refer to *Appendix E : Correspondence with Irish Water.*

5 Water Supply and Distribution

5.1 Existing Services

An existing 4" uPVC public watermain runs along the Old Nangor Road (L5254) along the sites northern boundary. There is also an existing 700mm ductile iron public watermain running along the New Nangor Road (R134) approximately 200m beyond the site's northern boundary. There is also an existing 315mm HDPE public watermain running along the St Cuthbert's Road junction to Old Nangor Road and along the proposed sites eastern boundary. It has been confirmed by Irish Water through the pre connection enquiry process that a new connection to the existing network is Feasible without infrastructure upgrade by Irish Water. Refer to Figure 5-1 (below) and *Appendix G : Existing Records* (Irish Water's Record Drawings) which shows the location of these watermains.

Figure 5-1 Extract from Irish Water Network Plan

It is noted that the 315mm HDPE public watermain running along the Old Nangor Road will make a suitable location to connect the watermain network for the proposed development.

5.2 Correspondence with Irish Water

The connection to the public water main will include sluice valves, water meter, scour valve etc. arrangement in accordance with the requirements of Irish Water. Confirmation of feasibility was

confirmed by Irish Water on 03/07/2023, please refer to *Appendix E : Correspondence with Irish Water.*

5.3 Water Demand and Conservation

The development's water-main distribution system is indicated on drawing X-93-DTM-DR-DBFL-CE-1301 Proposed Watermain Layout.

It is noted that the 315mm HDPE public watermain running along the St Cuthbert's Road junction and Old Nangor Road, will make a suitable location to connect the watermain network for the proposed development.

The connection to the public water main will include a bulk meter and sluice valves in accordance with the Irish Water's requirements. The water main layout and details are in accordance with Irish Water Connection and Developer Services, 'Code of Practice for Water Infrastructure' and 'Water Infrastructure Standard Details'.

Water demand for the proposed development is summarised in *Table 5-1* below:

Area	**No. of Residential Units**	**Average Daily Demand (l/person/day)**	**No. of Persons (2.7 person per unit)**	**Average Daily Demand (m^3/day)**	**Peak Demand (l/s)**
Kilcarbery	88	150	238	0.45	2.72

Table 5-1: Proposed Developments Water Demand

Appendix A : Surface Water Allowable outflow

Met Eireann
Return Period Rainfall Depths for sliding Durations
Irish Grid: Easting: 305127, Northing: 230955,

	Interval		Years											
DURATION	6months,	1year,	2,	3,	4,	5,	10,	20,	30,	50,	75,	100,	150,	200,	250,	500,
5 mins	2.3,	3.5,	4.1,	5.1,	5.7,	6.3,	8.0,	10.1,	11.5,	13.5,	15.4,	16.8,	19.0,	20.8,	22.3,	N/A ,
10 mins	3.2,	4.8,	5.7,	7.1,	8.0,	8.7,	11.2,	14.1,	16.0,	18.9,	21.4,	23.4,	26.5,	29.0,	31.1,	N/A ,
15 mins	3.8,	5.7,	6.7,	8.3,	9.4,	10.3,	13.2,	16.6,	18.9,	22.2,	25.2,	27.5,	31.2,	34.1,	36.6,	N/A ,
30 mins	5.0,	7.4,	8.7,	10.7,	12.1,	13.2,	16.8,	21.0,	23.8,	27.9,	31.6,	34.4,	38.9,	42.4,	45.4,	N/A ,
1 hours	6.6,	9.6,	11.3,	13.8,	15.5,	16.9,	21.4,	26.6,	30.1,	35.1,	39.6,	43.1,	48.5,	52.8,	56.4,	N/A ,
2 hours	8.7,	12.5,	14.6,	17.8,	20.0,	21.7,	27.3,	33.7,	38.0,	44.1,	49.6,	53.9,	60.5,	65.7,	70.0,	N/A ,
3 hours	10.2,	14.6,	17.0,	20.7,	23.2,	25.1,	31.5,	38.8,	43.6,	50.5,	56.6,	61.4,	68.8,	74.6,	79.5,	N/A ,
4 hours	11.5,	16.3,	19.0,	23.0,	25.7,	27.8,	34.8,	42.8,	48.0,	55.5,	62.2,	67.4,	75.5,	81.7,	86.9,	N/A ,
6 hours	13.4,	19.1,	22.1,	26.7,	29.8,	32.2,	40.1,	49.1,	55.1,	63.5,	71.0,	76.8,	85.8,	92.9,	98.7,	N/A ,
9 hours	15.8,	22.3,	25.7,	30.9,	34.5,	37.2,	46.2,	56.4,	63.1,	72.6,	81.0,	87.6,	97.7,	105.5,	112.0,	N/A ,
12 hours	17.7,	24.8,	28.7,	34.4,	38.3,	41.3,	51.1,	62.2,	69.6,	79.9,	89.0,	96.1,	107.0,	115.5,	122.5,	N/A ,
18 hours	20.8,	29.0,	33.4,	39.9,	44.3,	47.8,	58.9,	71.5,	79.7,	91.3,	101.6,	109.6,	121.8,	131.2,	139.1,	N/A ,
24 hours	23.3,	32.3,	37.2,	44.4,	49.2,	53.0,	65.2,	78.9,	87.8,	100.4,	111.6,	120.2,	133.5,	143.7,	152.2,	181.7,
2 days	29.2,	39.5,	44.8,	52.7,	58.0,	62.0,	75.0,	89.3,	98.6,	111.5,	122.8,	131.5,	144.7,	154.8,	163.2,	192.0,
3 days	34.0,	45.2,	51.0,	59.5,	65.1,	69.3,	83.0,	98.0,	107.6,	120.9,	132.4,	141.3,	154.7,	164.9,	173.3,	202.2,
4 days	38.1,	50.2,	56.4,	65.3,	71.2,	75.7,	90.0,	105.5,	115.4,	129.1,	140.9,	149.9,	163.6,	173.9,	182.5,	211.6,
6 days	45.5,	58.9,	65.7,	75.5,	81.9,	86.7,	102.1,	118.5,	129.0,	143.3,	155.7,	165.0,	179.1,	189.8,	198.6,	228.3,
8 days	52.0,	66.6,	73.9,	84.4,	91.2,	96.4,	112.6,	129.9,	140.9,	155.8,	168.6,	178.2,	192.8,	203.8,	212.7,	243.0,
10 days	58.0,	73.5,	81.3,	92.4,	99.6,	105.1,	122.1,	140.1,	151.5,	167.0,	180.2,	190.1,	205.0,	216.3,	225.5,	256.4,
12 days	63.5,	80.0,	88.3,	99.9,	107.5,	113.1,	130.8,	149.6,	161.4,	177.3,	190.9,	201.1,	216.4,	227.9,	237.2,	268.7,
16 days	73.9,	92.0,	101.0,	113.6,	121.8,	127.9,	146.8,	166.8,	179.2,	196.0,	210.2,	220.9,	236.9,	248.8,	258.5,	291.0,
20 days	83.5,	103.1,	112.7,	126.2,	134.8,	141.3,	161.4,	182.4,	195.4,	212.9,	227.8,	238.9,	255.4,	267.7,	277.7,	311.2,
25 days	94.7,	115.9,	126.3,	140.7,	150.0,	156.9,	178.1,	200.3,	214.0,	232.3,	247.8,	259.4,	276.5,	289.3,	299.7,	334.2,

NOTES:
N/A Data not available
These values are derived from a Depth Duration Frequency (DDF) Model
For details refer to:
'Fitzgerald D. L. (2007), Estimates of Point Rainfall Frequencies, Technical Note No. 61, Met Eireann, Dublin',
Available for download at www.met.ie/climate/dataproducts/Estimation-of-Point-Rainfall-Frequencies_TN61.pdf

PROJECT			JOB REF.
Kilcarbery School Site, Co.Dublin			230026
SUBJECT			**Calc. Sheet No.**
Surface Water Calculations - Permissible Site Discharge			1
Drawing ref.	**Calculations by**	**Checked by**	**Date**
230026	PLY	BCM	17-Nov-23

PERMISSIBLE SURFACE WATER DISCHARGE CALCULATIONS

Site Area

What is the overall site area? **2.05** Hectares (ha) Site is Less than 50 Hectares

Pre-Development Catchment Soil Characteristics

Are there different soil types present on the pre-developed site? No

Catchment (This refers to the entire site area)	1	
Area	2.05	Hectares (ha)
Drainage Group	2	Class
Depth to Impermeable Layers	1	Class
Permeability Group above Impermeable Layers	3	Class
Slope (o)	1	Class
SOIL Type	3	
[1]SOIL Index	0.40	

SOIL	SOIL Value	SPR
1	0.15	0.10
2	0.30	0.30
3	0.40	0.37
4	0.45	0.47
5	0.50	0.53

Site SOIL Index Value **0.40**

Site SPR Value **0.37**

Post-Development Catchment Characteristics

Is the development divided into sub-catchments? No

What is the overall site area for catchment? 2.05 Hectares (ha)

Catchment 1	Area (m^2)	Runoff Coeff.	Effective Area (m^2)
Roofs - Type 1 (Draining to gullies)	7766.5	0.75	5824.9
Roofs - Type 2 (Draining to SUDS features)	2491.9	0.75	1868.9
Green Roofs	0.0	0.15	0.0
Roads and Footpaths - Type 1 (Draining to gullies)	0.0	0.95	0.0
Roads and Footpaths - Type 2 (Draining to Suds features)	0.0	0.55	0.0
Paved Areas	0.0	0.75	0.0
Permeable Paving	2542.5	0.55	1398.4
Bioretention Areas	0.0	0.55	0.0
Grassed Areas	7478.3	0.15	1121.7

Effective Catchment Area **10213.9** m^2

Effective Catchment Runoff Coefficient **0.50**

Permissible Site Discharge

What is the Standard Average Annual Rainfall (SAAR)? 754.8 mm From Met Eireann, Co-ordinates N217970, E289843

Is the overall site area less than 50 hectares? Yes

[5]$QBAR_{Rural}$ calculated for 50 ha and linearly interpolated for area of site 7.70 Litres/sec

[7]Site Discharge = **7.70** Litres/sec

Notes and Formulae

1. SOIL index value calculated from Flood Studies Report - The Classification of Soils from Winter Rainfall Acceptance Rate (Table 4.5).

2. SPR value calculated from GDSDS - Table 6.7.

3. Rainfall depth for 100 year return period, 6 hour duration with additional 10% for climate change.

4. Long-term storage Vol_{∞} (m^3) = Rainfall.Area.10.[(PIMP/100)(0.8.α)+(1-PIMP/100)(β.SPR)-SPR]. (GDSDS Section 6.7.3).

   Where long-term storage cannot be provided on-site due to ground conditions, Total Permissible Outflow is to be kept to $QBAR_{(Rural)}$.

5. Total Permissible Outflow - $QBAR_{(Rural)}$ calculated in accordance with GDSDS - Regional Drainage Policies

   (Volume 2 - Chapter 6), i.e. $QBAR(m3/s)=0.00108x(Area)^{0.89}(SAAR)^{1.17}(SOIL)^{2.17}$ - For catchments greater than 50 hectares in area. Flow rates are linearly interpolated for areas samller than 50hectares.

6. Where Total Permissible Outflow is less than 2.0l/s and not achievable, use 2.0 l/s or closest value possible.

7. QBAR multiplied by growth factors of 0.85 for 1 year, 2.1 for 30 year and 2.6 for 100 year return period events, from GDSDS Figure C2.

Appendix B : Attenuation Calculations

Online Controls for SW_1

Orifice Manhole: 11, DS/PN: 3.002, Volume (m³): 2.3

Diameter (m) 0.060 Discharge Coefficient 1.000 Invert Level (m) 71.672

Orifice Manhole: 15, DS/PN: 3.006, Volume (m³): 2.2

Diameter (m) 0.060 Discharge Coefficient 0.600 Invert Level (m) 71.299

Hydro-Brake® Optimum Manhole: 19, DS/PN: 1.006, Volume (m³): 2.7

Unit Reference	MD-SHE-0072-2800-1543-2800
Design Head (m)	1.543
Design Flow (l/s)	2.8
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	72
Invert Level (m)	70.157
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.543	2.8	Kick-Flo®	0.645	1.9
Flush-Flo™	0.316	2.3	Mean Flow over Head Range	-	2.2

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	1.9	1.200	2.5	3.000	3.8	7.000	5.7
0.200	2.3	1.400	2.7	3.500	4.1	7.500	5.9
0.300	2.3	1.600	2.8	4.000	4.4	8.000	6.0
0.400	2.3	1.800	3.0	4.500	4.6	8.500	6.2
0.500	2.2	2.000	3.2	5.000	4.8	9.000	6.4
0.600	2.0	2.200	3.3	5.500	5.1	9.500	6.5
0.800	2.1	2.400	3.4	6.000	5.3		
1.000	2.3	2.600	3.6	6.500	5.5		

Orifice Manhole: 26, DS/PN: 5.001, Volume (m³): 15.7

Diameter (m) 0.060 Discharge Coefficient 0.600 Invert Level (m) 70.460

Orifice Manhole: 30, DS/PN: 4.005, Volume (m³): 2.6

Diameter (m) 0.075 Discharge Coefficient 0.600 Invert Level (m) 70.249

Hydro-Brake® Optimum Manhole: 43, DS/PN: 1.012, Volume (m³): 2.5

Unit Reference	MD-SHE-0090-4100-1387-4100
Design Head (m)	1.387
Design Flow (l/s)	4.1
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	90
Invert Level (m)	69.483
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.387	4.1	Kick-Flo®	0.805	3.2
Flush-Flo™	0.395	4.0	Mean Flow over Head Range	-	3.5

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	2.8	1.200	3.8	3.000	5.9	7.000	8.8
0.200	3.7	1.400	4.1	3.500	6.3	7.500	9.1
0.300	3.9	1.600	4.4	4.000	6.7	8.000	9.3
0.400	4.0	1.800	4.6	4.500	7.1	8.500	9.6
0.500	3.9	2.000	4.9	5.000	7.5	9.000	9.9
0.600	3.8	2.200	5.1	5.500	7.8	9.500	10.1
0.800	3.2	2.400	5.3	6.000	8.1		
1.000	3.5	2.600	5.5	6.500	8.5		

Storage Structures for SW_1

Infiltration Trench Pipe: 1.000

Manning's N	0.075	Trench Width (m)	1.2
Infiltration Coefficient Base (m/hr)	0.00000	Trench Length (m)	42.1
Infiltration Coefficient Side (m/hr)	0.00000	Slope (1:X)	220.0
Safety Factor	2.0	Cap Volume Depth (m)	0.579
Porosity	0.30	Cap Infiltration Depth (m)	0.000
Invert Level (m)	71.502		

Infiltration Trench Pipe: 1.001

Manning's N	0.075	Trench Width (m)	1.2
Infiltration Coefficient Base (m/hr)	0.00000	Trench Length (m)	50.8
Infiltration Coefficient Side (m/hr)	0.00000	Slope (1:X)	220.1
Safety Factor	2.0	Cap Volume Depth (m)	0.539
Porosity	0.30	Cap Infiltration Depth (m)	0.000
Invert Level (m)	71.159		

Infiltration Trench Pipe: 1.002

Manning's N	0.075	Trench Width (m)	1.2
Infiltration Coefficient Base (m/hr)	0.00000	Trench Length (m)	59.7
Infiltration Coefficient Side (m/hr)	0.00000	Slope (1:X)	220.0
Safety Factor	2.0	Cap Volume Depth (m)	0.499
Porosity	0.30	Cap Infiltration Depth (m)	0.000
Invert Level (m)	70.884		

Cellular Storage Manhole: 6, DS/PN: 2.001

Invert Level (m)	70.382	Safety Factor	2.0
Infiltration Coefficient Base (m/hr)	0.00000	Porosity	0.31
Infiltration Coefficient Side (m/hr)	0.00000		

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	173.0	0.0	1.319	0.0	0.0
1.318	173.0	0.0	2.018	0.0	0.0

Infiltration Trench Pipe: 3.000

Manning's N	0.075	Trench Width (m)	1.2
Infiltration Coefficient Base (m/hr)	0.00000	Trench Length (m)	53.4
Infiltration Coefficient Side (m/hr)	0.00000	Slope (1:X)	240.4
Safety Factor	2.0	Cap Volume Depth (m)	0.548
Porosity	0.30	Cap Infiltration Depth (m)	0.000
Invert Level (m)	71.991		

Cellular Storage Manhole: 13, DS/PN: 3.004

Invert Level (m) 71.398 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.31
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	60.0	0.0	1.501	0.0	0.0
1.500	60.0	0.0	1.602	0.0	0.0

Cellular Storage Manhole: 18, DS/PN: 1.005

Invert Level (m) 70.200 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.31
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	190.0	0.0	1.501	0.0	0.0
1.500	190.0	0.0	1.900	0.0	0.0

Infiltration Trench Pipe: 1.007

Manning's N 0.075 Trench Width (m) 1.2
Infiltration Coefficient Base (m/hr) 0.00000 Trench Length (m) 58.7
Infiltration Coefficient Side (m/hr) 0.00000 Slope (1:X) 220.0
Safety Factor 2.0 Cap Volume Depth (m) 0.821
Porosity 0.30 Cap Infiltration Depth (m) 0.000
Invert Level (m) 70.132

Infiltration Trench Pipe: 4.000

Manning's N 0.075 Trench Width (m) 1.2
Infiltration Coefficient Base (m/hr) 0.00000 Trench Length (m) 44.2
Infiltration Coefficient Side (m/hr) 0.00000 Slope (1:X) 240.2
Safety Factor 2.0 Cap Volume Depth (m) 0.670
Porosity 0.30 Cap Infiltration Depth (m) 0.000
Invert Level (m) 70.644

Infiltration Trench Pipe: 5.000

Manning's N 0.075 Trench Width (m) 1.2
Infiltration Coefficient Base (m/hr) 0.00000 Trench Length (m) 62.7
Infiltration Coefficient Side (m/hr) 0.00000 Slope (1:X) 200.0
Safety Factor 2.0 Cap Volume Depth (m) 0.600
Porosity 0.30 Cap Infiltration Depth (m) 0.000
Invert Level (m) 70.774

Cellular Storage Manhole: 28, DS/PN: 4.003

Invert Level (m) 70.344 Infiltration Coefficient Side (m/hr) 0.00000
Infiltration Coefficient Base (m/hr) 0.00000 Safety Factor 2.0

Cellular Storage Manhole: 28, DS/PN: 4.003

Porosity 0.31

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	87.0	0.0	1.729	0.0	0.0
1.728	87.0	0.0	2.193	0.0	0.0

Cellular Storage Manhole: 32, DS/PN: 6.000

Invert Level (m) 69.773 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.31
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	210.0	0.0	1.188	0.0	0.0
1.187	210.0	0.0	2.227	0.0	0.0

Infiltration Trench Pipe: 7.000

Manning's N	0.075	Trench Width (m)	1.2
Infiltration Coefficient Base (m/hr)	0.00000	Trench Length (m)	30.2
Infiltration Coefficient Side (m/hr)	0.00000	Slope (1:X)	239.9
Safety Factor	2.0	Cap Volume Depth (m)	0.618
Porosity	0.30	Cap Infiltration Depth (m)	0.000
Invert Level (m)	70.010		

Infiltration Trench Pipe: 7.002

Manning's N	0.075	Trench Width (m)	1.2
Infiltration Coefficient Base (m/hr)	0.00000	Trench Length (m)	28.7
Infiltration Coefficient Side (m/hr)	0.00000	Slope (1:X)	299.4
Safety Factor	2.0	Cap Volume Depth (m)	0.661
Porosity	0.30	Cap Infiltration Depth (m)	0.000
Invert Level (m)	69.848		

Infiltration Trench Pipe: 7.003

Manning's N	0.075	Trench Width (m)	1.2
Infiltration Coefficient Base (m/hr)	0.00000	Trench Length (m)	46.2
Infiltration Coefficient Side (m/hr)	0.00000	Slope (1:X)	300.0
Safety Factor	2.0	Cap Volume Depth (m)	0.757
Porosity	0.30	Cap Infiltration Depth (m)	0.000
Invert Level (m)	69.752		

Tank or Pond Manhole: 41, DS/PN: 1.010

Invert Level (m) 69.534

Tank or Pond Manhole: 41, DS/PN: 1.010

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	0.0	0.843	142.8	1.430	236.0	1.876	350.9
0.842	0.0	0.880	223.9	1.466	336.3		

Appendix C : Surface Water Network calculations

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for SW_1

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - Scotland and Ireland

Return Period (years)	1	PIMP (%)	100
M5-60 (mm)	16.900	Add Flow / Climate Change (%)	0
Ratio R	0.273	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	2.000
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	300

Designed with Level Soffits

Network Design Table for SW_1

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	n	HYD SECT	DIA (mm)	Section Type	Auto Design
1.000	42.066	0.191	220.0	0.049	5.00	0.0		0.075	→|_|→		Infiltration Trench	
1.001	50.845	0.231	220.1	0.050	0.00	0.0		0.075	→|_|→		Infiltration Trench	
1.002	59.696	0.271	220.0	0.042	0.00	0.0		0.075	→|_|→		Infiltration Trench	
1.003	11.157	0.365	30.6	0.021	0.00	0.0	0.600		o	300	Pipe/Conduit	
2.000	8.310	0.046	180.7	0.028	5.00	0.0	0.600		o	300	Pipe/Conduit	
2.001	8.078	0.040	202.0	0.025	0.00	0.0	0.600		o	300	Pipe/Conduit	
2.002	18.798	0.094	200.0	0.000	0.00	0.0	0.600		o	300	Pipe/Conduit	
1.004	9.635	0.048	200.0	0.000	0.00	0.0	0.600		o	300	Pipe/Conduit	
3.000	53.370	0.222	240.4	0.041	5.00	0.0		0.075	→|_|→		Infiltration Trench	
3.001	9.667	0.097	100.0	0.018	0.00	0.0	0.600		o	300	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.000	30.90	10.17	71.502	0.049	0.0	0.0	0.0	0.14	28.3	4.1
1.001	24.26	16.63	71.159	0.100	0.0	0.0	0.0	0.13	25.5	6.6
1.002	19.71	24.49	70.884	0.142	0.0	0.0	0.0	0.13	22.7	7.6
1.003	19.69	24.55	70.613	0.162	0.0	0.0	0.0	2.85	201.6	8.7
2.000	41.03	5.12	70.428	0.028	0.0	0.0	0.0	1.17	82.5	3.1
2.001	40.68	5.24	70.382	0.053	0.0	0.0	0.0	1.10	77.9	5.9
2.002	39.90	5.52	70.342	0.053	0.0	0.0	0.0	1.11	78.3	5.9
1.004	19.62	24.70	70.248	0.215	0.0	0.0	0.0	1.11	78.3	11.5
3.000	28.54	12.03	71.991	0.041	0.0	0.0	0.0	0.13	25.0	3.2
3.001	28.42	12.13	71.769	0.059	0.0	0.0	0.0	1.57	111.1	4.5

Network Design Table for SW_1

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	n	HYD SECT	DIA (mm)	Section Type	Auto Design
3.002	6.453	0.208	31.0	0.005	0.00	0.0	0.600		o	300	Pipe/Conduit	🔒
3.003	13.107	0.066	200.0	0.055	0.00	0.0	0.600		o	300	Pipe/Conduit	🔒
3.004	13.107	0.066	200.0	0.000	0.00	0.0	0.600		o	300	Pipe/Conduit	🔒
3.005	6.571	0.033	200.0	0.000	0.00	0.0	0.600		o	300	Pipe/Conduit	🔒
3.006	10.770	0.359	30.0	0.019	0.00	0.0	0.600		o	300	Pipe/Conduit	🔒
3.007	22.015	0.699	31.5	0.028	0.00	0.0	0.600		o	300	Pipe/Conduit	🔒
3.008	7.283	0.041	179.0	0.000	0.00	0.0	0.600		o	300	Pipe/Conduit	🔒
1.005	7.802	0.043	180.0	0.032	0.00	0.0	0.600		o	300	Pipe/Conduit	🔒
1.006	4.472	0.025	180.0	0.000	0.00	0.0	0.600		o	300	Pipe/Conduit	🔒
1.007	58.687	0.267	220.0	0.037	0.00	0.0		0.075	→|_|→		Infiltration Trench	🔒
1.008	14.063	0.078	180.0	0.009	0.00	0.0	0.600		o	300	Pipe/Conduit	🔒
1.009	12.484	0.062	200.0	0.003	0.00	0.0	0.600		o	300	Pipe/Conduit	🔒
4.000	44.196	0.184	240.2	0.055	5.00	0.0		0.075	→|_|→		Infiltration Trench	🔒
4.001	14.181	0.079	180.0	0.008	0.00	0.0		0.075	o	300	Pipe/Conduit	🔒
5.000	62.732	0.314	200.0	0.056	5.00	0.0		0.075	→|_|→		Infiltration Trench	🔒
5.001	6.457	0.079	81.7	0.011	0.00	0.0	0.600		o	300	Pipe/Conduit	🔒
4.002	7.410	0.037	200.0	0.000	0.00	0.0		0.075	o	300	Pipe/Conduit	🔒
4.003	7.410	0.037	200.3	0.022	0.00	0.0		0.075	o	300	Pipe/Conduit	🔒

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
3.002	28.38	12.17	71.672	0.064	0.0	0.0	0.0	2.83	200.3	4.9
3.003	28.16	12.37	71.464	0.119	0.0	0.0	0.0	1.11	78.3	9.1
3.004	27.94	12.57	71.398	0.119	0.0	0.0	0.0	1.11	78.3	9.1
3.005	27.84	12.66	71.332	0.119	0.0	0.0	0.0	1.11	78.3	9.1
3.006	27.77	12.73	71.299	0.139	0.0	0.0	0.0	2.88	203.7	10.5
3.007	27.63	12.86	70.940	0.167	0.0	0.0	0.0	2.81	198.7	12.5
3.008	27.52	12.96	70.241	0.167	0.0	0.0	0.0	1.17	82.8	12.5
1.005	19.57	24.81	70.200	0.414	0.0	0.0	0.0	1.17	82.6	22.0
1.006	19.55	24.87	70.157	0.414	0.0	0.0	0.0	1.17	82.6	22.0
1.007	17.60	30.00	70.132	0.451	0.0	0.0	0.0	0.16	46.5	22.0
1.008	17.60	30.00	69.865	0.460	0.0	0.0	0.0	1.17	82.6	22.0
1.009	17.60	30.00	69.787	0.463	0.0	0.0	0.0	1.11	78.3	22.1
4.000	30.68	10.32	70.644	0.055	0.0	0.0	0.0	0.14	33.4	4.6
4.001	28.97	11.66	70.460	0.063	0.0	0.0	0.0	0.18	12.5	5.0
5.000	28.31	12.24	70.774	0.056	0.0	0.0	0.0	0.14	31.2	4.3
5.001	28.24	12.30	70.460	0.067	0.0	0.0	0.0	1.74	123.1	5.1
4.002	27.45	13.03	70.381	0.131	0.0	0.0	0.0	0.17	11.9	9.7
4.003	26.71	13.77	70.344	0.153	0.0	0.0	0.0	0.17	11.8	11.1

Network Design Table for SW_1

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	n	HYD SECT	DIA (mm)	Section Type	Auto Design
4.004	5.791	0.058	100.0	0.000	0.00	0.0	0.600		o	300	Pipe/Conduit	
4.005	7.954	0.199	40.0	0.007	0.00	0.0	0.600		o	300	Pipe/Conduit	
4.006	13.410	0.335	40.0	0.016	0.00	0.0	0.600		o	300	Pipe/Conduit	
6.000	11.639	0.058	200.0	0.044	5.00	0.0	0.600		o	300	Pipe/Conduit	
4.007	10.311	0.047	220.0	0.020	0.00	0.0	0.600		o	300	Pipe/Conduit	
4.008	11.931	0.134	89.0	0.020	0.00	0.0	0.600		o	300	Pipe/Conduit	
7.000	30.227	0.126	239.9	0.036	5.00	0.0		0.075	→|_|→		Infiltration Trench	
7.001	8.752	0.036	240.0	0.016	0.00	0.0	0.600		o	300	Pipe/Conduit	
7.002	28.745	0.096	299.4	0.013	0.00	0.0		0.075	→|_|→		Infiltration Trench	
7.003	46.197	0.154	300.0	0.073	0.00	0.0		0.075	→|_|→		Infiltration Trench	
7.004	14.064	0.047	300.0	0.013	0.00	0.0	0.600		o	300	Pipe/Conduit	
7.005	4.978	0.017	292.8	0.000	0.00	0.0	0.600		o	300	Pipe/Conduit	
1.010	9.195	0.031	296.6	0.023	0.00	0.0	0.600		o	300	Pipe/Conduit	
1.011	5.836	0.020	299.0	0.000	0.00	0.0	0.600		o	300	Pipe/Conduit	
1.012	3.941	0.013	303.2	0.000	0.00	0.0	0.600		o	300	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
4.004	26.65	13.83	70.307	0.153	0.0	0.0	0.0	1.57	111.1	11.1
4.005	26.60	13.89	70.249	0.160	0.0	0.0	0.0	2.49	176.2	11.5
4.006	26.51	13.98	70.050	0.176	0.0	0.0	0.0	2.49	176.2	12.6
6.000	40.86	5.18	69.773	0.044	0.0	0.0	0.0	1.11	78.3	4.9
4.007	26.36	14.14	69.715	0.240	0.0	0.0	0.0	1.06	74.6	17.1
4.008	26.25	14.26	69.668	0.260	0.0	0.0	0.0	1.67	117.9	18.5
7.000	33.04	8.77	70.010	0.036	0.0	0.0	0.0	0.13	29.7	3.3
7.001	32.80	8.91	69.884	0.053	0.0	0.0	0.0	1.01	71.4	4.7
7.002	27.69	12.80	69.848	0.066	0.0	0.0	0.0	0.12	29.3	4.9
7.003	22.81	18.71	69.752	0.139	0.0	0.0	0.0	0.13	35.5	8.6
7.004	22.64	18.97	69.598	0.152	0.0	0.0	0.0	0.90	63.8	9.3
7.005	22.58	19.06	69.551	0.152	0.0	0.0	0.0	0.91	64.6	9.3
1.010	17.60	30.00	69.534	0.898	0.0	0.0	0.0	0.91	64.2	42.8
1.011	17.60	30.00	69.503	0.898	0.0	0.0	0.0	0.90	63.9	42.8
1.012	17.60	30.00	69.483	0.898	0.0	0.0	0.0	0.90	63.5	42.8

Free Flowing Outfall Details for SW_1

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
1.012		71.600	69.470	69.470	300	0

Summary of Critical Results by Maximum Level (Rank 1) for SW_1

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 6 Number of Storage Structures 16 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model		FSR	Ratio R 0.273
Region	Scotland and Ireland	Cv (Summer)	0.750
M5-60 (mm)	16.900	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	ON
DVD Status	ON
Inertia Status	ON

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 240, 360, 480, 600, 720, 960, 1440, 2160
Return Period(s) (years)	1, 30, 100
Climate Change (%)	20, 20, 20

WARNING: Half Drain Time has not been calculated as the structure is too full.

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	1	15 Winter	100	+20%					71.870
1.001	2	960 Winter	100	+20%	100/600 Winter				71.720
1.002	3	960 Winter	100	+20%	30/480 Winter				71.716
1.003	4	960 Winter	100	+20%	30/60 Winter				71.707
2.000	5	960 Winter	100	+20%	1/360 Winter				71.706
2.001	6	960 Winter	100	+20%	1/240 Winter				71.706
2.002	7	960 Winter	100	+20%	1/120 Winter				71.706
1.004	8	960 Winter	100	+20%	1/60 Winter				71.706
3.000	9	15 Winter	100	+20%					72.326
3.001	10	60 Winter	100	+20%	30/30 Winter				72.277
3.002	11	60 Winter	100	+20%	30/30 Summer				72.275
3.003	12	120 Winter	100	+20%	30/30 Summer				72.175
3.004	13	120 Winter	100	+20%	30/15 Winter				72.169
3.005	14	120 Winter	100	+20%	30/15 Summer				72.178
3.006	15	120 Winter	100	+20%	1/60 Winter				72.179
3.007	16	960 Winter	100	+20%	30/240 Winter				71.707
3.008	17	960 Winter	100	+20%	1/60 Summer				71.706

Summary of Critical Results by Maximum Level (Rank 1) for SW_1

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	1	-0.211	0.000	0.53		9	14.9	OK	
1.001	2	0.022	0.000	0.13		268	3.4	SURCHARGED	
1.002	3	0.333	0.000	0.16		608	3.7	SURCHARGED	
1.003	4	0.794	0.000	0.03			4.1	SURCHARGED	
2.000	5	0.978	0.000	0.01			0.9	SURCHARGED	
2.001	6	1.024	0.000	0.02		929	0.9	SURCHARGED	
2.002	7	1.064	0.000	0.01			0.9	SURCHARGED	
1.004	8	1.158	0.000	0.03			1.7	SURCHARGED	
3.000	9	-0.213	0.000	0.39		9	9.8	OK	
3.001	10	0.208	0.000	0.06			5.0	SURCHARGED	
3.002	11	0.303	0.000	0.04			4.9	SURCHARGED	
3.003	12	0.411	0.000	0.18			11.4	SURCHARGED	
3.004	13	0.471	0.000	0.11		75	6.8	SURCHARGED	
3.005	14	0.546	0.000	0.12			6.5	SURCHARGED	
3.006	15	0.580	0.000	0.05			6.8	SURCHARGED	
3.007	16	0.467	0.000	0.03			5.2	SURCHARGED	
3.008	17	1.165	0.000	0.08			5.0	SURCHARGED	

Summary of Critical Results by Maximum Level (Rank 1) for SW_1

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.005	18	960 Winter	100	+20%	1/30 Winter				71.706
1.006	19	960 Winter	100	+20%	1/30 Summer				71.710
1.007	20	1440 Winter	100	+20%					70.883
1.008	21	1440 Winter	100	+20%	1/120 Winter				70.872
1.009	22	1440 Winter	100	+20%	1/120 Summer				70.870
4.000	23	15 Winter	100	+20%					71.054
4.001	24	120 Winter	100	+20%	30/120 Winter				70.896
5.000	25	60 Winter	100	+20%					71.185
5.001	26	60 Winter	100	+20%	30/15 Summer				71.157
4.002	27	960 Winter	100	+20%	30/30 Winter				70.893
4.003	28	1440 Winter	100	+20%	30/30 Winter				70.891
4.004	29	1440 Winter	100	+20%	30/30 Winter				70.890
4.005	30	1440 Winter	100	+20%	30/15 Winter				70.889
4.006	31	1440 Winter	100	+20%	1/600 Winter				70.870
6.000	32	1440 Winter	100	+20%	1/120 Summer				70.869
4.007	33	1440 Winter	100	+20%	1/60 Summer				70.869
4.008	34	1440 Winter	100	+20%	1/30 Winter				70.869
7.000	35	1440 Winter	100	+20%	30/360 Winter				70.873
7.001	36	1440 Winter	100	+20%	1/240 Summer				70.873
7.002	37	1440 Winter	100	+20%	30/240 Summer				70.872
7.003	38	1440 Winter	100	+20%	30/240 Summer				70.871
7.004	39	1440 Winter	100	+20%	1/15 Winter				70.869
7.005	40	1440 Winter	100	+20%	1/15 Summer				70.868
1.010	41	1440 Winter	100	+20%	1/15 Summer				70.868
1.011	42	1440 Winter	100	+20%	1/15 Summer				70.909
1.012	43	1440 Winter	100	+20%	1/15 Summer				70.921

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
1.005	18	1.206	0.000	0.05			3.1	SURCHARGED	
1.006	19	1.253	0.000	0.04			2.3	SURCHARGED	
1.007	20	-0.070	0.000	0.06			2.8	OK	
1.008	21	0.707	0.000	0.04			2.9	SURCHARGED	
1.009	22	0.783	0.000	0.05			2.9	SURCHARGED	
4.000	23	-0.260	0.000	0.48		9	16.1	OK	
4.001	24	0.136	0.000	0.57			7.1	SURCHARGED	
5.000	25	-0.189	0.000	0.12		35	3.9	OK	
5.001	26	0.397	0.000	0.06			4.3	SURCHARGED	
4.002	27	0.212	0.000	0.31			3.6	SURCHARGED	
4.003	28	0.247	0.000	0.27		1104	3.1	SURCHARGED	
4.004	29	0.283	0.000	0.05			3.0	SURCHARGED	
4.005	30	0.340	0.000	0.03			3.1	SURCHARGED	
4.006	31	0.520	0.000	0.02			3.3	SURCHARGED	
6.000	32	0.796	0.000	0.01			0.5	SURCHARGED	
4.007	33	0.854	0.000	0.05			2.8	SURCHARGED	
4.008	34	0.901	0.000	0.04			3.3	SURCHARGED	

Summary of Critical Results by Maximum Level (Rank 1) for SW_1

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
7.000	35	0.245	0.000	0.03			0.8	SURCHARGED	
7.001	36	0.689	0.000	0.02			1.2	SURCHARGED	
7.002	37	0.363	0.000	0.05			1.5	SURCHARGED	
7.003	38	0.362	0.000	0.09			3.2	SURCHARGED	
7.004	39	0.971	0.000	0.07			3.5	SURCHARGED	
7.005	40	1.017	0.000	0.07			3.5	SURCHARGED	
1.010	41	1.034	0.000	0.12			5.7	SURCHARGED	
1.011	42	1.106	0.000	0.11			5.0	SURCHARGED	
1.012	43	1.138	0.000	0.08			4.1	SURCHARGED	

Appendix D : Foul Sewer Calculations

FOUL SEWERAGE DESIGN

Design Criteria for FS_1

Pipe Sizes STANDARD Manhole Sizes STANDARD

Industrial Flow (l/s/ha)	0.00	Add Flow / Climate Change (%)	0
Industrial Peak Flow Factor	0.00	Minimum Backdrop Height (m)	0.600
Calculation Method	BS 8301	Maximum Backdrop Height (m)	1.200
Frequency Factor	0.00	Min Design Depth for Optimisation (m)	1.200
Domestic (l/s/ha)	0.00	Min Vel for Auto Design only (m/s)	0.75
Domestic Peak Flow Factor	6.00	Min Slope for Optimisation (1:X)	300

Designed with Level Soffits

Network Design Table for FS_1

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	Units	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
1.000	26.749	0.446	60.0	0.000	126.0	0.0	1.500	o	150	Pipe/Conduit	
1.001	11.386	0.088	130.0	0.000	0.0	0.0	1.500	o	150	Pipe/Conduit	
1.002	24.198	0.186	130.1	0.000	0.0	0.0	1.500	o	150	Pipe/Conduit	
1.003	64.291	0.476	135.1	0.000	126.0	0.0	1.500	o	150	Pipe/Conduit	
2.000	22.239	0.371	60.0	0.000	70.0	0.0	1.500	o	150	Pipe/Conduit	
2.001	16.572	0.276	60.0	0.000	0.0	0.0	1.500	o	150	Pipe/Conduit	
3.000	18.614	0.310	60.0	0.000	70.0	0.0	1.500	o	150	Pipe/Conduit	
3.001	5.853	0.146	40.0	0.000	0.0	0.0	1.500	o	150	Pipe/Conduit	
2.002	6.193	0.103	60.0	0.000	0.0	0.0	1.500	o	150	Pipe/Conduit	
2.003	21.446	0.357	60.1	0.000	0.0	0.0	1.500	o	150	Pipe/Conduit	

Network Results Table

PN	US/IL (m)	Σ Area (ha)	Σ Base Flow (l/s)	Σ Units	Add Flow (l/s)	P.Dep (mm)	P.Vel (m/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.000	70.302	0.000	0.0	126.0	0.0	46	0.89	1.13	20.0	4.1
1.001	69.856	0.000	0.0	126.0	0.0	57	0.67	0.77	13.6	4.1
1.002	69.768	0.000	0.0	126.0	0.0	57	0.67	0.77	13.6	4.1
1.003	69.582	0.000	0.0	252.0	0.0	64	0.70	0.75	13.3	5.0
2.000	70.781	0.000	0.0	70.0	0.0	43	0.86	1.13	20.0	3.6
2.001	70.410	0.000	0.0	70.0	0.0	43	0.86	1.13	20.0	3.6
3.000	70.856	0.000	0.0	70.0	0.0	43	0.86	1.13	20.0	3.6
3.001	70.546	0.000	0.0	70.0	0.0	39	0.99	1.39	24.5	3.6
2.002	70.134	0.000	0.0	140.0	0.0	47	0.90	1.13	20.0	4.3
2.003	70.031	0.000	0.0	140.0	0.0	47	0.90	1.13	20.0	4.3

Network Design Table for FS_1

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	Units	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
1.004	59.096	0.295	200.0	0.000	140.0	0.0	1.500	o	225	Pipe/Conduit	
1.005	5.678	0.028	200.0	0.000	0.0	0.0	1.500	o	225	Pipe/Conduit	
4.000	50.454	0.841	60.0	0.000	98.0	0.0	1.500	o	150	Pipe/Conduit	
4.001	49.836	0.383	130.1	0.000	56.0	0.0	1.500	o	150	Pipe/Conduit	
4.002	59.420	0.297	200.0	0.000	140.0	0.0	1.500	o	225	Pipe/Conduit	
4.003	6.534	0.033	200.0	0.000	0.0	0.0	1.500	o	225	Pipe/Conduit	
1.006	13.896	0.069	200.0	0.000	0.0	0.0	1.500	o	225	Pipe/Conduit	
1.007	20.928	0.105	200.0	0.000	42.0	0.0	1.500	o	225	Pipe/Conduit	
1.008	7.708	0.039	200.0	0.000	42.0	0.0	1.500	o	225	Pipe/Conduit	
5.000	60.069	1.001	60.0	0.000	70.0	0.0	1.500	o	150	Pipe/Conduit	
5.001	4.979	0.124	40.0	0.000	0.0	0.0	1.500	o	150	Pipe/Conduit	
6.000	49.132	0.819	60.0	0.000	84.0	0.0	1.500	o	150	Pipe/Conduit	
6.001	7.700	0.128	60.0	0.000	0.0	0.0	1.500	o	150	Pipe/Conduit	
6.002	32.410	0.540	60.0	0.000	28.0	0.0	1.500	o	150	Pipe/Conduit	
6.003	46.102	0.307	150.2	0.000	42.0	0.0	1.500	o	150	Pipe/Conduit	
6.004	6.357	0.042	151.4	0.000	0.0	0.0	1.500	o	150	Pipe/Conduit	
5.002	5.635	0.038	150.0	0.000	0.0	0.0	1.500	o	150	Pipe/Conduit	

Network Results Table

PN	US/IL (m)	Σ Area (ha)	Σ Base Flow (l/s)	Σ Units	Add Flow (l/s)	P.Dep (mm)	P.Vel (m/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.004	69.031	0.000	0.0	532.0	0.0	67	0.63	0.81	32.2	6.3
1.005	68.736	0.000	0.0	532.0	0.0	67	0.63	0.81	32.2	6.3
4.000	72.113	0.000	0.0	98.0	0.0	45	0.88	1.13	20.0	3.9
4.001	71.272	0.000	0.0	154.0	0.0	59	0.68	0.77	13.6	4.4
4.002	70.814	0.000	0.0	294.0	0.0	61	0.59	0.81	32.2	5.2
4.003	70.517	0.000	0.0	294.0	0.0	61	0.59	0.81	32.2	5.2
1.006	68.708	0.000	0.0	826.0	0.0	73	0.66	0.81	32.2	7.4
1.007	68.639	0.000	0.0	868.0	0.0	74	0.66	0.81	32.2	7.6
1.008	68.534	0.000	0.0	910.0	0.0	75	0.67	0.81	32.2	7.7
5.000	72.312	0.000	0.0	70.0	0.0	43	0.86	1.13	20.0	3.6
5.001	71.311	0.000	0.0	70.0	0.0	39	0.99	1.39	24.5	3.6
6.000	70.642	0.000	0.0	84.0	0.0	44	0.87	1.13	20.0	3.8
6.001	69.823	0.000	0.0	84.0	0.0	44	0.87	1.13	20.0	3.8
6.002	69.695	0.000	0.0	112.0	0.0	46	0.88	1.13	20.0	4.0
6.003	69.155	0.000	0.0	154.0	0.0	61	0.65	0.71	12.6	4.4
6.004	68.848	0.000	0.0	154.0	0.0	61	0.65	0.71	12.6	4.4
5.002	68.806	0.000	0.0	224.0	0.0	64	0.66	0.71	12.6	4.8

Network Design Table for FS_1

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	Units	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
5.003	8.215	0.055	150.0	0.000	0.0	0.0	1.500	o	150	Pipe/Conduit	
5.004	15.131	0.101	150.0	0.000	0.0	0.0	1.500	o	150	Pipe/Conduit	
7.000	12.646	0.211	59.9	0.000	42.0	0.0	1.500	o	150	Pipe/Conduit	
7.001	16.490	0.275	60.0	0.000	56.0	0.0	1.500	o	150	Pipe/Conduit	
7.002	17.936	0.299	60.0	0.000	0.0	0.0	1.500	o	150	Pipe/Conduit	
5.005	4.564	0.042	108.0	0.000	0.0	0.0	1.500	o	225	Pipe/Conduit	
1.009	4.266	0.021	200.0	0.000	0.0	0.0	1.500	o	225	Pipe/Conduit	
1.010	2.924	0.015	194.9	0.000	0.0	0.0	1.500	o	225	Pipe/Conduit	

Network Results Table

PN	US/IL (m)	Σ Area (ha)	Σ Base Flow (l/s)	Σ Units	Add Flow (l/s)	P.Dep (mm)	P.Vel (m/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
5.003	68.768	0.000	0.0	224.0	0.0	64	0.66	0.71	12.6	4.8
5.004	68.713	0.000	0.0	224.0	0.0	64	0.66	0.71	12.6	4.8
7.000	71.082	0.000	0.0	42.0	0.0	41	0.83	1.13	20.0	3.3
7.001	70.871	0.000	0.0	98.0	0.0	45	0.88	1.13	20.0	3.9
7.002	70.596	0.000	0.0	98.0	0.0	45	0.88	1.13	20.0	3.9
5.005	68.537	0.000	0.0	322.0	0.0	53	0.75	1.10	43.9	5.3
1.009	68.495	0.000	0.0	1232.0	0.0	81	0.69	0.81	32.2	8.8
1.010	68.474	0.000	0.0	1232.0	0.0	80	0.70	0.82	32.6	8.8

Free Flowing Outfall Details for FS_1

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
1.010		72.663	68.459	68.200	0	0

Appendix E : Correspondence with Irish Water

CONFIRMATION OF FEASIBILITY

Uisce Éireann
Bosca OP 448
Oifig Sheachadta na
Cathrach Theas
Cathair Chorcaí

Irish Water
PO Box 448,
South City
Delivery Office,
Cork City.

www.water.ie

Pierce Lynch

Ormond House
Ormond Quay
Dublin
D07W704

3 July 2023

Our Ref: CDS23004873 Pre-Connection Enquiry
Lands at Kilcarbery, Upper Nangor Road, Dublin, Co. Dublin

Dear Applicant/Agent,

We have completed the review of the Pre-Connection Enquiry.

Irish Water has reviewed the pre-connection enquiry in relation to a Water & Wastewater connection for a Housing Development of 88 unit(s) at Lands at Kilcarbery, Upper Nangor Road, Dublin, Co. Dublin, (the **Development)**.

Based upon the details provided we can advise the following regarding connecting to the networks;

- **Water Connection** - Feasible without infrastructure upgrade by Irish Water
- **Wastewater Connection** - Feasible without infrastructure upgrade by Irish Water
  - The proposed wastewater connection is connecting to Irish Water infrastructure through third party infrastructure not owned by Irish Water. Prior to connection the customer is to provide a letter to Irish Water from the third party owner confirming the following:
  - (a) The customer has permission to connect to the third party infrastructure
  - (b) The third party infrastructure has sufficient capacity to cater for the additional load
  - (c) The third party infrastructure is of sufficient integrity to take the connection and the additional load

This letter does not constitute an offer, in whole or in part, to provide a connection to any Irish Water infrastructure. Before the Development can be connected to our network(s) you must submit a connection application and be granted and sign a connection agreement with Irish Water.

As the network capacity changes constantly, this review is only valid at the time of its completion. As soon as planning permission has been granted for the Development, a completed connection application should be submitted. The connection application is available at www.water.ie/connections/get-connected/

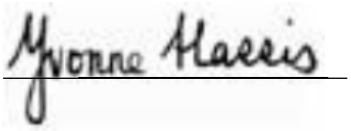
Where can you find more information?

- **Section A -** What is important to know?
- **Section B -** Details of Irish Water's Network(s)

This letter is issued to provide information about the current feasibility of the proposed connection(s) to Irish Water's network(s). This is not a connection offer and capacity in Irish Water's network(s) may only be secured by entering into a connection agreement with Irish Water.

For any further information, visit **www.water.ie/connections**, **email newconnections@water.ie** or contact 1800 278 278**.**

Yours sincerely,



Yvonne Harris
Head of Customer Operations

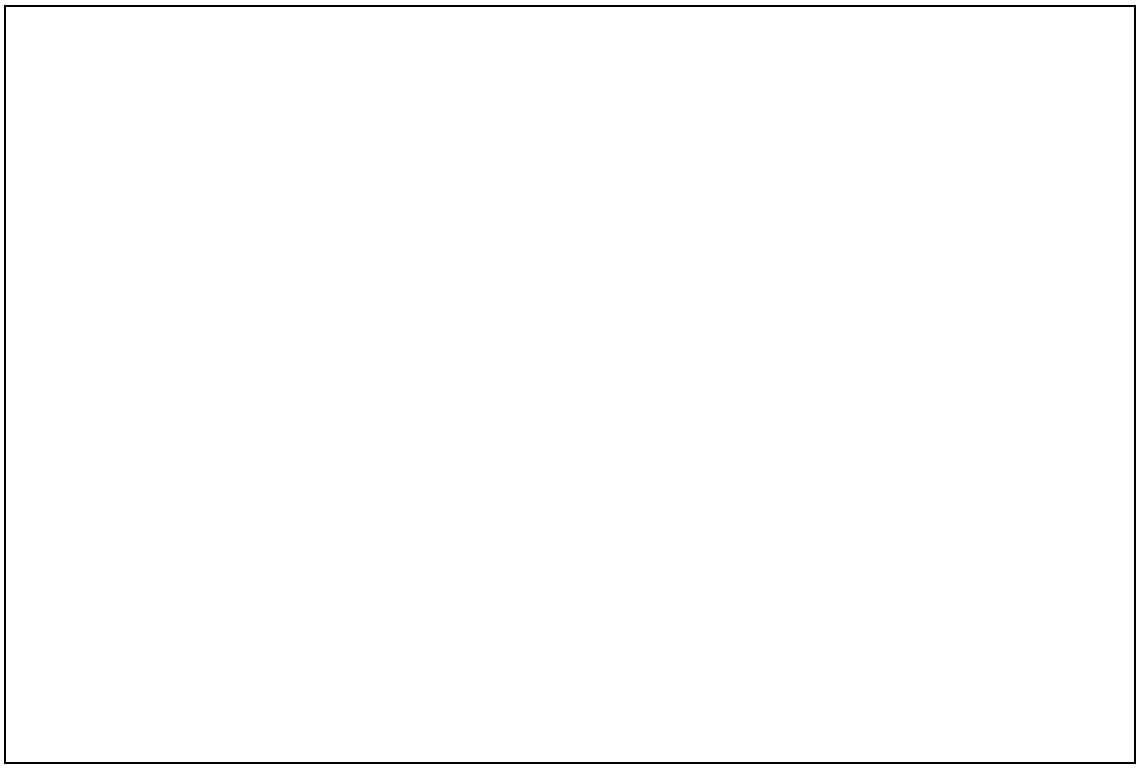
Section A - What is important to know?

What is important to know?	Why is this important?
Do you need a contract to connect?	• Yes, a contract is required to connect. This letter does not constitute a contract or an offer in whole or in part to provide a connection to Irish Water's network(s). • Before the Development can connect to Irish Water's network(s), you must submit a connection application and be granted and sign a connection agreement with Irish Water.
When should I submit a Connection Application?	• A connection application should only be submitted after planning permission has been granted.
Where can I find information on connection charges?	• Irish Water connection charges can be found at: https://www.water.ie/connections/information/charges/
Who will carry out the connection work?	• All works to Irish Water's network(s), including works in the public space, must be carried out by Irish Water*. *Where a Developer has been granted specific permission and has been issued a connection offer for Self-Lay in the Public Road/Area, they may complete the relevant connection works
Fire flow Requirements	• The Confirmation of Feasibility does not extend to fire flow requirements for the Development. Fire flow requirements are a matter for the Developer to determine. • **What to do?** - Contact the relevant Local Fire Authority
Plan for disposal of storm water	• The Confirmation of Feasibility does not extend to the management or disposal of storm water or ground waters. • **What to do?** - Contact the relevant Local Authority to discuss the management or disposal of proposed storm water or ground water discharges.
Where do I find details of Irish Water's network(s)?	• Requests for maps showing Irish Water's network(s) can be submitted to: datarequests@water.ie

What are the design requirements for the connection(s)?	• The design and construction of the Water & Wastewater pipes and related infrastructure to be installed in this Development shall comply with ***the Irish Water Connections and Developer Services Standard Details and Codes of Practice,*** available at www.water.ie/connections
Trade Effluent Licensing	• Any person discharging trade effluent** to a sewer, must have a Trade Effluent Licence issued pursuant to section 16 of the Local Government (Water Pollution) Act, 1977 (as amended). • More information and an application form for a Trade Effluent License can be found at the following link: https://www.water.ie/business/trade-effluent/about/ **trade effluent is defined in the Local Government (Water Pollution) Act, 1977 (as amended)

Section B – Details of Irish Water's Network(s)

The map included below outlines the current Irish Water infrastructure adjacent the Development: To access Irish Water Maps email datarequests@water.ie



Note: The information provided on the included maps as to the position of Irish Water's underground network(s) is provided as a general guide only. The information is based on the best available information provided by each Local Authority in Ireland to Irish Water.

Whilst every care has been taken in respect of the information on Irish Water's network(s), Irish Water assumes no responsibility for and gives no guarantees, undertakings or warranties concerning the accuracy, completeness or up to date nature of the information provided, nor does it accept any liability whatsoever arising from or out of any errors or omissions. This information should not be solely relied upon in the event of excavations or any other works being carried out in the vicinity of Irish Water's underground network(s). The onus is on the parties carrying out excavations or any other works to ensure the exact location of Irish Water's underground network(s) is identified prior to excavations or any other works being carried out. Service connection pipes are not generally shown but their presence should be anticipated.

Appendix F : Ground Investigation

GROUND INVESTIGATIONS IRELAND
Geotechnical & Environmental

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

Tel: 01 601 5175 / 5176
Email: info@gii.ie
Web: www.gii.ie

Ground Investigations Ireland

Proposed Development at Kilcarbery, Clondlakin, County Dublin

South Dublin County Council

Ground Investigation Report

October 2023

GROUND INVESTIGATIONS IRELAND
Geotechnical & Environmental

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

Tel: 01 601 5175 / 5176
Email: info@gii.ie
Web: www.gii.ie

DOCUMENT CONTROL SHEET

Project Title	Proposed Development at Kilcarbery, Clondalkin, County Dublin
Engineer	DBFL Consulting Engineers
Client	South Dublin County Council
Project No	13205-09-23
Document Title	Ground Investigation Report

Rev.	Status	Author(s)	Reviewed By	Approved By	Office of Origin	Issue Date
A	Final	P. Moloney	C. Finnerty	F. McNamara	Dublin	01 November 2023

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

GROUND INVESTIGATIONS IRELAND
Geotechnical & Environmental

Catherinestown House,
Hazelhatch Road,
Newcastle,
Co. Dublin.
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Tel: 01 601 5175 / 5176
Email: info@gii.ie
Web: www.gii.ie

CONTENTS

APPENDICES

1.0 Preamble

On the instructions of DBFL Consulting Engineers, a site investigation was carried out by Ground Investigations Ireland Ltd., in October 2023 at the site of the proposed development in Kilcarbery, Clondalkin, County Dublin.

2.0 Overview

2.1. Background

It is proposed to construct a new development with associated services, access roads and car parking at the proposed site. The proposed construction is envisaged to consist of conventional foundations and pavement make up with some local excavations for services and plant.

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 3 No. Soakaways to determine a soil infiltration value to BRE digest 365
- Report with recommendations

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 in-situ testing was undertaken in the exploratory holes to facilitate the geotechnical descriptions and to enable laboratory testing to be carried out on the soil samples recovered during excavation and drilling.
The procedures used in this site investigation are in accordance with Eurocode 7 Part 2: Ground Investigation and testing (ISEN 1997 – 2:2007) and B.S. 5930:2015.

3.2. Soakaway Testing

The soakaway testing was carried out in selected trial pits at the locations shown in the exploratory hole location plan in Appendix 1. These pits were carefully excavated and filled with water to assess the infiltration characteristics of the proposed site. The pits were allowed to drain and the drop in water level was recorded over time as required by BRE Digest 365. The pits were logged prior to completing the soakaway test and were backfilled with arising's upon completion. The soakaway test results are provided in Appendix 2 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 generally comprised;

- Cohesive Deposits
- Weathered Bedrock

COHESIVE DEPOSITS: Cohesive deposits were encountered beneath the Made Ground and were described typically as *firm brown sandy gravelly CLAY with occasional subangular to subrounded cobbles.*

WEATHERED BEDROCK: In the majority of exploratory holes weathered rock was encountered which was digable with the large excavator to a depth of up to 2.00mBGL below the top of the stratum. The trial pits were terminated upon encountering the more competent bedrock, in which further excavation became more difficult. This material was recovered typically as sandy clayey fine to coarse angular to subangular GRAVEL with occasional angular cobbles.

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.

5.0 Recommendations & Conclusions

5.1. General

The recommendations given and opinions expressed in this report are based on the findings as detailed in the exploratory hole records. Where an opinion is expressed on the material between exploratory hole locations, this is for guidance only and no liability can be accepted for its accuracy. No responsibility can be accepted for conditions which have not been revealed by the exploratory holes. Limited information has been provided at the ground investigation stage and any designs based on the recommendations or conclusions should be completed in accordance with the current design codes, taking into account the variation and the specific details contained within the exploratory hole logs.

5.2. Excavations

Short term temporary excavations in the cohesive deposits will remain stable for a limited time only and will require to be appropriately battered or the sides supported if the excavation is below 1.25mBGL or is required to permit man entry. Excavations in the upper cohesive and weathered rock deposits are expected to be excavatable with conventional excavation equipment, with zones of more intact bedrock below this depth requiring rock breaking techniques. The 8T excavator was generally able to excavate to depths of 1.00m to 2.00m below the top of the weathered rock and became difficult to excavate within the confines of the trial pit on encountering the more competent rock.
Any waste material to be removed off site should be disposed of to a suitably licenced landfill.

5.3. Soakaway Design

An Infiltration rate of f=8.264 x 10^{-6} m/s was calculated for the soakaway location SA-01. At the locations of SA-02 and SA-03 the water level dropped too slowly to allow calculation of ‘f’ the soil infiltration rate. These locations are therefore not recommended as suitable for soakaway design and construction.

The recommendations provided in this report should be verified in the design of the proposed buildings, using the full details of the loading conditions and taking into consideration the allowable tolerable settlements/movements that the building can accommodate. The founding strata should be inspected and verified by a suitably qualified engineer prior to construction of the building foundations.

APPENDIX 1 - Site Location Plan


N
W
E
S
School
NANGOR
ROAD
TP + IT
ITM = X, Y, 705115, 730990
TP-03
SA-03
TP + IT
ITM = X, Y, 704996, 730973
TP-02
SA-02
TP + IT
ITM = X, Y, 705078, 730950
SA-01
TP-01
LEGEND
ORDNANCE SURVEY IRELAND LICENCE
No CYAL50276885
© ORDNANCE SURVEY IRELAND
GOVERNMENT OF IRELAND
P1 - INFORMATION
S - ISSUED
DBFL Consulting Engineers
SCHOOL SITE AT KILCARBERRY
SURVEY REQUIREMENT (GSI)
SOUTH DUBLIN COUNTY COUNCIL
(SDCC)
23025-230025-X-00-DTM-DR-DBFL-CE-9003

APPENDIX 2 – Soakaway Records

Ground Investigations Ireland Ltd
www.gii.ie

Site School Site at Kilcarbery, County Dublin			**Trial Pit Number** SA-01
Machine : JCB 3 CX **Method :** Trial Pit	**Dimensions** 0.50mW x 2.50mL x 2.00mD	**Ground Level (mOD)**	**Client** South Dublin County Council	**Job Number** 13205-09-23
	Location	**Dates** 25/10/2023	**Project Contractor** Ground Investigations Ireland	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(1.10)	Firm brown sandy gravelly CLAY with occasional subangular to subrounded cobbles.		
					1.10			
					(0.90)	Weathered Rock: Recovered as sandy clayey fine to coarse angular to subangular GRAVEL with occasional angular cobbles.		
					2.00	Trial Pit terminated at 2.00mBGL due to obstruction. Weathered Rock.		

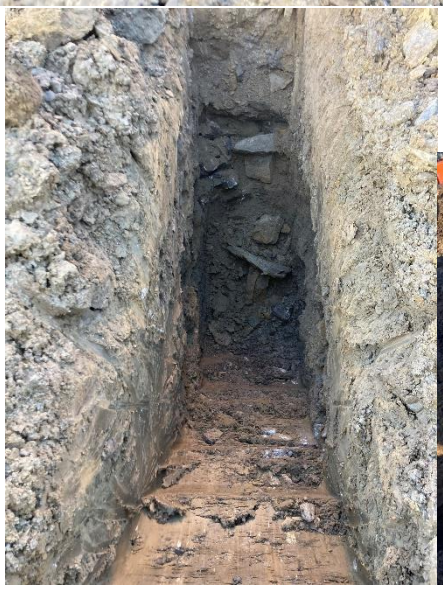
Plan

Remarks

Topsoil stripped off site
No groundwater encountered
Trial Pit stable
Trial pit terminated at 2.00mBGL due to obstruction. Weathered rock.

Scale (approx)	Logged By	Figure No.
1:25	PM	13205-09-23.SA-01

SA-**01**



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SA01

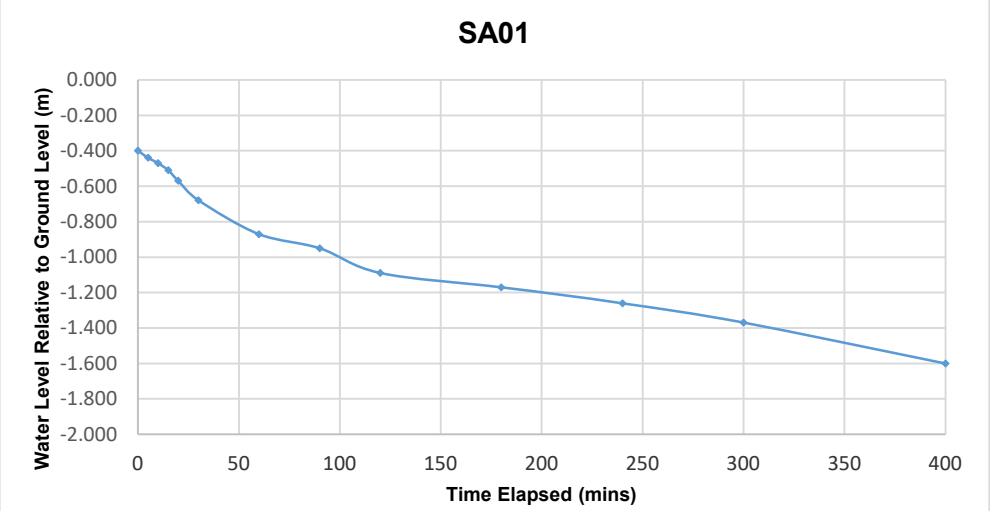
Soakaway Test to BRE Digest 365
Trial Pit Dimensions: 2.50m x 0.50m 2.00m (L x W x D)

Date	Time	Water level (m bgl)
25/10/2023	0	-0.400
25/10/2023	5	-0.440
25/10/2023	10	-0.470
25/10/2023	15	-0.510
25/10/2023	20	-0.570
25/10/2023	30	-0.680
25/10/2023	60	-0.870
25/10/2023	90	-0.950
25/10/2023	120	-1.090
25/10/2023	180	-1.170
25/10/2023	240	-1.260
25/10/2023	300	-1.370
25/10/2023	400	-1.600

Start depth	Depth of Pit		Diff	75% full	25%full
0.40	**2.000**		**1.600**	**0.8**	**1.6**

Length of pit (m)	Width of pit (m)		75-25Ht (m)	Vp75-25 (m3)
2.500	0.500		0.800	1.00
Tp75-25 (from graph) (s)		**20000**	50% Eff Depth	ap50 (m2)
			0.800	6.05

f = 8.264E-06 m/s



Ground Investigations Ireland Ltd
www.gii.ie

Site School Site at Kilcarbery, County Dublin			**Trial Pit Number** SA-02
Machine : JCB 3 CX **Method :** Trial Pit	**Dimensions** 0.50mW x 2.50mL x 2.00mD	**Ground Level (mOD)**	**Client** South Dublin County Council	**Job Number** 13205-09-23
	Location	**Dates** 25/10/2023	**Project Contractor** Ground Investigations Ireland	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(2.00)	Firm brown sandy gravelly CLAY with occasional subangular to subrounded cobbles.		
					2.00	Trial Pit terminated at 2.00mBGL due to obstruction.		

Plan

Remarks

Topsoil stripped off site
No groundwater encountered
Trial Pit stable
Trial pit terminated at 2.00mBGL due to obstruction.

Scale (approx)	Logged By	Figure No.
1:25	PM	13205-09-23.SA-01

SA-**02**

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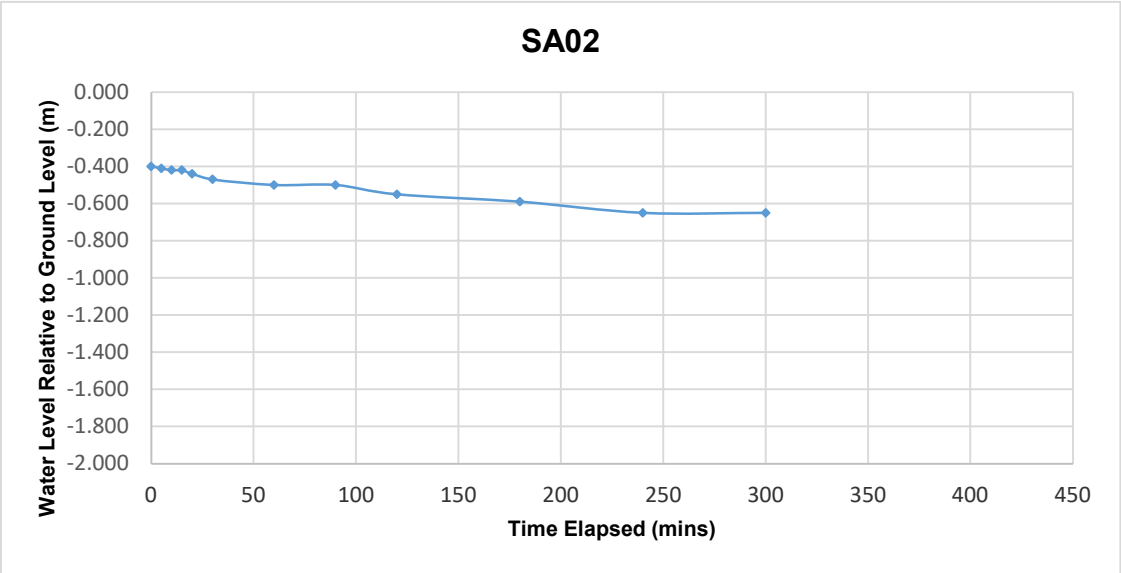
SA02

Soakaway Test to BRE Digest 365
Trial Pit Dimensions: 2.50m x 0.50m 2.00m (L x W x D)

Date	Time	Water level (m bgl)
25/10/2023	0	-0.400
25/10/2023	5	-0.410
25/10/2023	10	-0.420
25/10/2023	15	-0.420
25/10/2023	20	-0.440
25/10/2023	30	-0.470
25/10/2023	60	-0.500
25/10/2023	90	-0.500
25/10/2023	120	-0.550
25/10/2023	180	-0.590
25/10/2023	240	-0.650
25/10/2023	300	-0.650

Start depth	Depth of Pit	Diff	75% full	25%full
0.40	2.000	1.600	0.8	1.6



Ground Investigations Ireland Ltd
www.gii.ie

Site School Site at Kilcarbery, County Dublin			**Trial Pit Number** SA-03
Machine : JCB 3 CX **Method :** Trial Pit	**Dimensions** 0.50mW x 2.50mL x 1.50mD	**Ground Level (mOD)**	**Client** South Dublin County Council	**Job Number** 13205-09-23
	Location	**Dates** 25/10/2023	**Project Contractor** Ground Investigations Ireland	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(1.00)	Firm brown sandy gravelly CLAY with occasional subangular to subrounded cobbles.		
					1.00 (0.50)	Weathered Rock: Recovered as sandy clayey fine to coarse angular to subangular GRAVEL with occasional angular cobbles.		
					1.50	Trial Pit terminated at 1.50mBGL due to obstruction. Weathered Rock.		

Plan

Remarks

Topsoil stripped off site
No groundwater encountered
Trial Pit stable
Trial pit terminated at 1.50mBGL due to obstruction. Weathered Rock

Scale (approx)	Logged By	Figure No.
1:25	PM	13205-09-23.SA-03

SA-**03**

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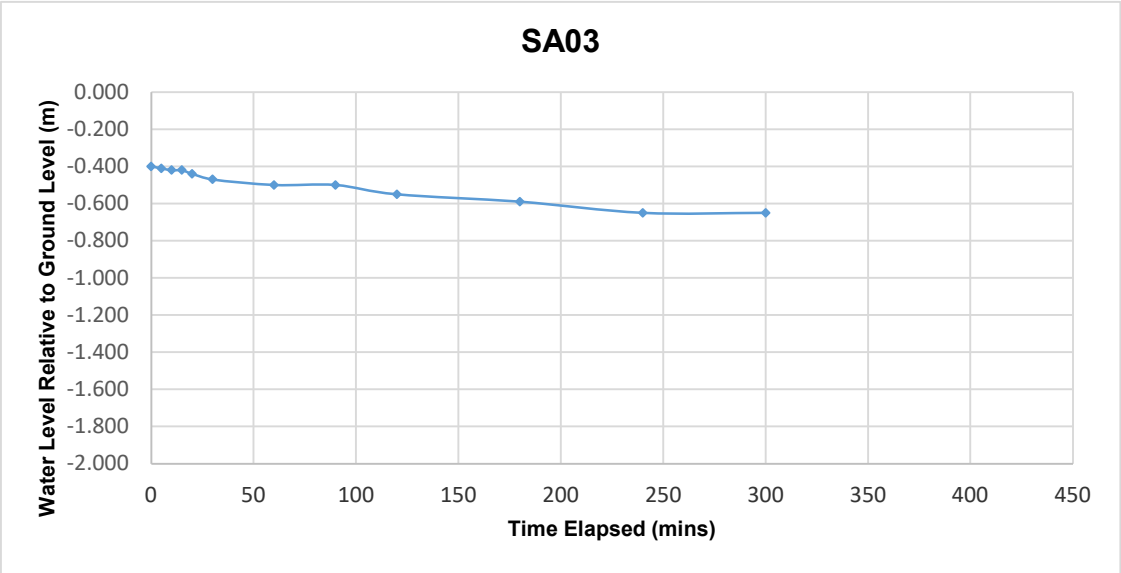
Web: www.gii.ie

SA03

Soakaway Test to BRE Digest 365
Trial Pit Dimensions: 2.50m x 0.50m 1.50m (L x W x D)

Date	Time	Water level (m bgl)
25/10/2023	0	-0.400
25/10/2023	5	-0.430
25/10/2023	10	-0.450
25/10/2023	15	-0.470
25/10/2023	20	-0.510
25/10/2023	30	-0.520
25/10/2023	60	-0.530
25/10/2023	90	-0.530
25/10/2023	120	-0.550
25/10/2023	180	-0.560
25/10/2023	240	-0.640
25/10/2023	300	-0.720

Start depth	Depth of Pit	Diff	75% full	25%full
0.40	1.500	1.100	0.675	1.225



IGSL Limited

DBFL
Consulting Engineers

Kilcarbery Grange
Clondalkin
Dublin 22

Ground Investigation Report

Report No. 21452

September 2019

Report

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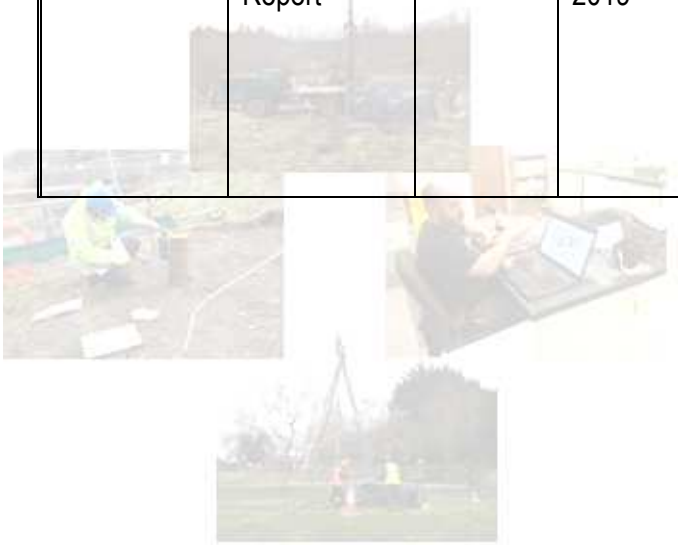

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Appendices

FOREWORD

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

Standards

The ground investigation works for this project (Kilcarbery, Clondalkin) have been carried out by IGSL in accordance with Eurocode 7 - Part 2: Ground Investigation & Testing (EN 1997-2:2007). This has been used together with complementary documents such as BS 5930 (1999), BS 1377 (Parts 1 to 9) and Engineers Ireland Specification & Related Documents for Ground Investigation in Ireland (2006). A new National Annex for use in the Republic of Ireland is currently in circulation for comment and will be adopted in the near future. In the mean time, the following Irish (IS) and European Standards or Norms are referenced:

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

Reporting

Recommendations made and opinions expressed in this report are based on the strata observed in the exploratory holes, together with the results of in-situ and laboratory tests. No responsibility can be held by IGSL Ltd for ground conditions between exploratory hole locations.

The engineering logs provide ground profiles and configuration of strata relevant to the investigation depths achieved and caution should be taken when extrapolating between exploratory points. No liability is accepted for ground conditions extraneous to the investigation points.

This report has been prepared for DBFL Consulting Engineers and the information should not be used without prior written permission. The recommendations developed in this report specifically relate to the proposed development. IGSL Ltd accepts no responsibility or liability for this document being used other than for the purposes for which it was intended.

Boring Procedures

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

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

Rotary Drilling Procedures
Rotary drilling methods have been used to recover bedrock samples in line with Section 3.5 of IS EN 1997-2:2007 and IS EN ISO 22475-1. Where cable percussive boreholes terminated prematurely on an obstruction within overburden, open hole drilling methods (odex or symmetrix) were utilized to advance the drillholes through the superficial deposits with coring in bedrock. The key objectives of the rock sampling were to obtain high core recovery (TCR), minimize sample disturbance and facilitate accurate identification of strength, weathering and discontinuity characteristics.

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

Groundwater
The depth of entry of any influx of groundwater is recorded during the course of boring operations. However, the normal rate of boring does not usually permit the recording of an equilibrium level for any one water strike. Where possible drilling is suspended for a period of twenty minutes to monitor the subsequent rise in water level. Groundwater conditions observed in the borings or pits are those appertaining to the period of investigation. It should be noted however, that groundwater levels are subject to diurnal, seasonal and climatic variations and can also be affected by drainage conditions, tidal variations etc.

Engineering Logging
Soil and rock identification has been based on the examination of the samples recovered and conforms with IS EN ISO 14688-1:2002 and IS EN ISO 14689-1:2004. Rock weathering classification conforms to IS EN ISO 14689-1:2003 while discontinuities (bedding planes, joints, cleavages, faults etc) are classified in accordance with 4.3.3 of IS EN ISO 14689-1:2003. Rock mechanical indices (TCR, SCR, RQD) are defined in accordance with IS EN ISO 22475-1:2006.

Retention of Samples
Samples shall be retained for a period of 60 days following approval of the final factual report, as detailed in the Scope of Works.

1.0 Introduction and Objectives

It is proposed to construct a residential development at Kilcarbery, Clondalkin in Dublin 22.

The site location is as shown on Figure 1 with the approximate site outline shown in red.

Figure 1 – Site Location

IGSL Limited were appointed by DBFL Consulting Engineers to conduct a ground investigation at the site. The objectives of the investigation were to ascertain the ground and groundwater conditions, including the depth and composition of the underlying bedrock.

Phased geotechnical works were carried out during the period December 2018 to May 2019.

2.0 Scope of Works

The programme of exploratory works included the following:

- 16 no. cable percussive boreholes
- 10 no. rotary coreholes
- 68 no. mechanically excavated trial pits
- 20 no. Window samples
- 70 no. DPH dynamic probes
- 22 no. infiltration tests
- 25 no. plate bearing tests
- A programme of geotechnical and chemical / environmental laboratory testing

The exploratory hole locations are shown on the as-surveyed site plan in Appendix 10.

2.1 Cable Percussive Boreholes

Boreholes were constructed in 16 locations (BH02 to BH17), using a Dando 2000 rig equipped with 200 mm casing. Borehole BH01 was inaccessible to the cable percussive rig and was instead drilled using a smaller window sample rig (WS BH01).

A hand dug inspection pit was excavated at each location prior to commencing drilling works and the locations were scanned for services using a CAT detection tool.

During the course of boring, in-situ Standard Penetration Tests (SPT) were undertaken at regular intervals. Samples were also recovered to assist in the visual description of recovered soils and to provide specimens for laboratory testing.

Instances of groundwater ingress were recorded and monitored for a further 20 minutes to permit the water to rise.

The borehole records are presented in Appendix 1 of this report.

2.2 Rotary Coreholes

Rotary coreholes RC01 to RC10 were drilled to investigate for the presence of bedrock.

A tracked Comacchio 205 coring rig was used. Symmetrix open hole techniques were used to advance through the overburden deposits, reverting to rotary coring on encountering bedrock.

Rotary coring of rock was carried out using an air/mist flush to maximise recovery. Cores of 78 mm diameter were recovered and placed securely in wooden storage boxes.

The recovered core was inspected by a qualified engineering geologist and logged in detail at IGSL's laboratory. Records detailing the Total Core Recovery (TCR), Solid Core Recovery (SCR) and Rock Quality Designation (RQD) were produced.

All cores were labelled and photographed for inclusion in the report. Photographs are presented digitally for ease of browsing and to permit close examination at high resolution. Corehole records and photographs are included in Appendix 2 of this report.

2.3 Trial Pits

Trial pitting was performed at 68 locations (TP01 to TP70 excluding TP66 and TP67) using a wheeled JCB excavator. The trial pits were logged and sampled by an IGSL geotechnical engineer in accordance with BS 5930 (1999+A2:2010). Pits TP66 and TP67 were omitted form the investigation due to their location within an active services yard.

Pit sidewalls were assessed in terms of their short term stability and any instances of groundwater ingress were recorded. Bulk soil samples were also recovered to provide specimens for laboratory testing. The samples were placed in heavy duty polyethene bags and sealed before being transported to Naas for laboratory testing. For this project, environmental samples were obtained and placed in appropriate containers.

The trial pits were backfilled with the as-dug arisings and reinstated to the satisfaction of IGSL's site geotechnical engineer. The trial pit logs in Appendix 3 include descriptions of the soils encountered, groundwater conditions and stability of the pit sidewalls.

2.4 Window Samples

Window sampling was undertaken using a tracked Terrier percussive rig.

Window samples are advanced by driving a steel sampling tube under constant percussive effort. The soils enter the tube within a protective plastic liner, which is withdrawn after every metre of progress. The liners are then placed in wooden channel boxes and transported to the IGSL offices where they are logged and sub-sampled as required.

For this project, sub-sampling also included the recovery of environmental samples, which were placed in appropriate containers (amber glass jars and vials).

The window sample records are presented in Appendix 4 of this report and show the soil recovery per metre run. Also shown are the depths of the discrete samples extracted for environmental analysis.

2.5 Dynamic Probing

Dynamic probing (DP01 to DP70) was undertaken adjacent to each trial pit and labelled according to the relevant trial pit (i.e. DP01 was undertaken at TP01). Probes provide an indication of the in-situ strength / density of the soils encountered in the trial pits.

The dynamic probe utilised by IGSL Ltd complies with the requirements of ISO 22476-2: 2005+A1: 2011 – Geotechnical Investigation and testing – Field testing - Part 2: Dynamic probing. DPH probing comprises a 50 kg drop weight, 500mm drop height and a 43.7mm diameter (90°) cone.

In accordance with the standards, the number of blows required to drive the probe through each 100mm increment of penetration is recorded. Probing is generally terminated when blow counts,

N_{100} values, exceed 25, in order to avoid damage to equipment. Detailed probe records are provided in Appendix 5 on which the blow counts are recorded both numerically and graphically.

2.6 Infiltration Tests

Infiltration tests were performed in 22 locations (IT01 to IT23, excluding IT14) to ascertain the suitability of the sub-soils for soakaway purposes. Testing was performed in accordance with BRE Digest 365 'Soakaway Design'.

To obtain a measure of the infiltration rate of the sub-soils, water was poured into each test pit to ensure total saturation of the sub-soils. This procedure was repeated twice more, and records were taken of the fall in water level against time. The results for the final stages of testing, following the saturation periods, are enclosed in Appendix 6.

The infiltration rate is the volume of water dispersed per unit exposed area per unit of time, and is generally expressed as metres/minute or metres/second.

2.7 Plate Bearing Tests

Plate bearing tests were performed in 25 locations (PT01 to PT26, excluding PT8) to obtain a measure of the moduli of subgrade reaction (ks) and equivalent CBR values. A 450 mm diameter plate was used, and tests were generally performed at a depth of 0.5 metres below existing ground level. Tests were performed in accordance with BS 1377 Part 9: 1990. "In-situ Tests". The incremental loading test (4.1.6.4.2) was used.

The maximum applied load was estimated on the basis of obtaining an accumulative displacement of at least 1.25 mm. The load was then applied in five approximately equal increments to the design load. To measure recovery the load was removed in three increments. A second phase of loading and unloading was performed to assess the benefits of further compaction.

The settlement under each increment was measured against time until movement had effectively ceased and the results are presented as graphs of applied pressure against settlement. Calculation of Modulus of Sub-grade Reaction (k) and CBR values are in accordance with NRA HD25-26/10 Volume7: Pavement Design and Maintenance.

The plate bearing test records are included in Appendix 7 of this report.

2.8 As-Built Survey

On completion of fieldworks, the location (x,y) and elevation (z) of each exploratory location was determined by detailed survey using GPS Realtime Kinetic survey instrument.

The National Grid survey co-ordinates and ground levels related to Malin Head Datum are presented on the exploratory hole records and these were used to plot the as-built locations on the Aerial Site Plan in Appendix 10 of this report.

3.0 Laboratory Testing

Laboratory testing was performed on selected samples to assist in soil classification. Laboratory test results are segregated and presented as follows:

- Appendix 7 – Geotechnical Laboratory Testing
- Appendix 8 – Chemical and Environmental Test Reports (Chemtest Laboratory)

Geotechnical Tests were undertaken in the IGSL laboratory and comprised:

- Moisture Content
- Atterberg Limits (Plasticity Index)
- Particle Size Distribution (PSD)
- Moisture Condition Value (MCV)
- California Bearing Ratio (CBR)
- Dry Density / Moisture Content Relationship (Compaction Test)
- Point Load Index (on rock core samples)

Chemical and environmental tests included:

- Sulphate and pH Analysis of soils (Chemtest Laboratory)
- RILTA Suite (Chemtest Laboratory)

4.0 Ground Conditions

4.1 Boreholes

Boreholes were constructed in 16 locations as shown on the site plan and reached a maximum depth of 3.2 metres below existing ground level (m BGL).

Topsoil was present in all locations, typically 0.1 to 0.3 m in thickness.

Made Ground was identified below the Topsoil in two locations. Borehole WS BH01 met with an obstruction in Made Ground at a depth of 0.2 m BGL, while BH02 penetrated Made Ground to a depth of 1.1 m BGL. The Made Ground comprised clay with some extraneous (non-natural) materials including fragments of red brick and plastic.

In some locations, the thin layer of subsoil directly beneath the Topsoil had the appearance of possible Made Ground (reworked clay), although the absence of extraneous matter made this difficult to confirm.

In all boreholes, the underlying indigenous soils comprised sandy gravelly clay. The condition of the upper clay was variable, with some boreholes encountering high strength (very stiff) deposits from shallow depth. In other locations, the upper clay deposits were weathered and of low to medium strength (soft to firm).

The variations in the condition of the upper soils were reflected by marked differences in the results of Standard Penetration Tests (SPTs) undertaken at a depth of 1 m BGL. Where soft to firm upper soils were present, these were characterised by “N” values mostly in the range 7 to 10. These deposits were mostly present within the central and east-central portion of the site (boreholes BH05, 09, 10, 11, 13, 14, 15 and 16) and were confined to the upper 1 to 2 m BGL.

The remaining boreholes were located within the west and south-west (BH02, 03, 04, 06, 07 and 08), north-east (BH12) and south-east (BH17). In these locations, no soft or firm soils were present and high strength (stiff or very stiff) gravelly clay soils were encountered within the upper metre.

All boreholes encountered basal deposits of brown or black sandy very gravelly clay (glacial till) with cobbles. SPT “N” values greater than 25 within the upper till confirmed the stiff to very stiff consistency, while tests at greater depth generally produced higher “N” values. The boreholes reached the base of the very stiff gravelly clay soils at depths in the range 0.9 to 2.9 m BGL.

All boreholes terminated within very dense and coarse angular gravel and cobbles, which had the appearance of possible highly weathered upper bedrock.

As previously mentioned, the results of Standard Penetration Tests (SPTs) were used to assess the in-situ soil strengths. Figure 2 shows a plot of SPT “N” values versus depth.

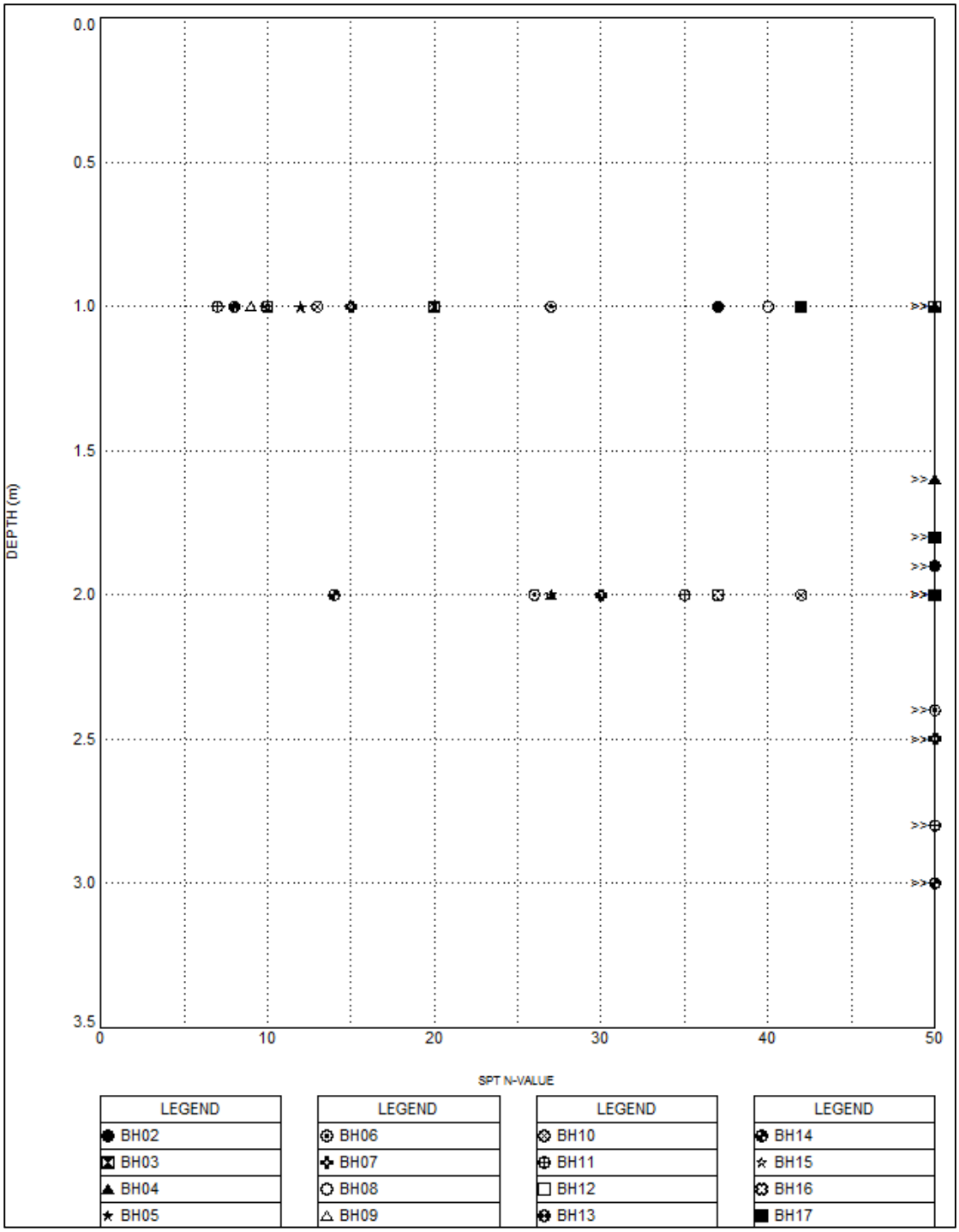

Figure 2 – SPT "N" values versus depth (m BGL)

It can be seen from Figure 2 that there was high variability in consistency within the upper soils (i.e. 1 m BGL), indicating the presence of both low and high strength soils at this depth. The SPT "N" values at 2 m BGL, with one exception (BH14) are in excess of 25, showing that the transition to high strength soils occurs within the 1 to 2 m depth range.

Below 2 metres m BGL, "N" values in excess of 50 (i.e. "Refusal") are mainly reflective of the very dense coarse angular gravel and cobbles that were present at the base of each borehole.

4.2 Rotary Coreholes

Coreholes RC01 to RC10 were drilled in selected locations as specified by the client.

In all locations, Symmetrix "open hole" techniques were used to advance through the overburden soils. While the corehole records contain soil descriptions, it is noted that these are based on highly pulverised drill returns.

The drill returns were assessed by the driller as grey/black sandy gravelly clay to depths in the range 2 to 3 m BGL, at which depths the returns had the appearance of highly weathered upper bedrock. Coring of bedrock was then attempted.

The bedrock was described as slightly weathered medium strong to very strong grey/black argillaceous limestone with localised moderately to highly weathered mudstone / shale zones. There was evidence of localised pyrite within the shale units. Typical core recovery is shown in Photo 1.

Total Core Recovery (TCR) was excellent (100% for all core runs). Rock Quality Designation (RQD) was generally in the range 25 to 60%, and dependent on the degree of weathering, reducing to zero in upper highly weathered (non-intact) zones.

Photo 1 – Core recovery at RC05 (3.0 – 5.4 m BGL) showing highly fractured upper bedrock from3.0-3.5m

Point load tests undertaken on rock core samples yielded Is_{50} values typically in the range 2 to 5 MPa, indicating equivalent UCS values of the order of 40 to 100 MPa. The results therefore indicate that the limestone bedrock is predominately medium strong to strong in accordance with BS EN ISO 14689-1.

4.3 Trial Pits

The trial pits generally reflected the findings of the boreholes.

Made Ground was identified in 9 of the 68 trial pits and these were located towards the western site boundary. The relevant trial pits were TP01, 08, 09, 13, 14, 16, 17, 18 and 19 where the Made Ground comprised sandy gravelly clay with some extraneous constituents including fragments of metal, plastic and timber. The Made Ground was generally confined to the upper metre, deepening to 1.6 m at TP08 and TP19.

The indigenous soils were described as brown sandy gravelly clay. In most locations, the clay deposits were stiff or very stiff from shallow depth (< 1.0 m BGL). However, similar to the boreholes, low strength (soft / firm) upper soils were encountered in some places.

The soft or soft/firm upper soils were most extensive at trial pits TP03 and TP04, which were undertaken near the north-western site boundary. In these pits, deposits of soft and soft/firm silt were encountered to depths of 2.4 and 3.5 m BGL respectively.

At TP63 (north-eastern corner of the site), firm sandy gravelly clay persisted to a depth of 1.7 m BGL.

The remaining trial pits advanced through high strength (stiff or very stiff) glacial till soils to the excavated depths (max 2.5 m BGL). In all cases, the trial pits terminated on an obstruction, which in places, had the appearance of possible weathered bedrock.

Trial pits excavated within high strength glacial till soils remained stable during the period of excavation (typically 45 minutes). However, where granular lenses were encountered within the glacial till (e.g. TP55), some instability was noted. Significant instability of sidewalls was also observed within the low strength upper silts at TP03.

4.4 Window Samples

Window samples were recovered with the prime purpose of obtaining specimens for environmental testing. The window samples reached depths of up to 3.2 m BGL and reported deposits of stiff and very stiff gravelly clay throughout. Detailed examination of the undisturbed recovery permitted the identification of thin granular lenses within the glacial till.

4.5 Dynamic Probes

Dynamic probing was undertaken adjacent to the trial pits in order to obtain a profile of soil resistance that could be correlated with the trial pit observations.

The dynamic probes generally reflected the strength assessments made in the trial pits. Soil resistance was generally variable within the upper 0.5 to 1.0 m BGL. Below this depth, resistance generally increased steadily, indicating the transition to high strength glacial till soils.

The most notable exceptions to the above occurred at probes DP03 and DP04, where low N_{100} blow counts were recorded to depths of 2.0 and 3.0 m BGL respectively. These correlated with the corresponding trial pits, which encountered soft and soft/firm silt deposits to these depths. Both probes terminated in high resistance soils, indicating that the low strength soils are underlain by glacial till.

At probe DP63, low to moderate resistance persisted to a depth of 2.0 m BGL, confirming the firm condition of the clay deposits to this depth.

All probes terminated within high resistance soils, reaching a maximum depth of 3.0 m BGL.

4.6 Infiltration Tests

Infiltration tests were performed in 22 locations across the site to ascertain the suitability of the sub-soils for soakaway purposes.

All test pits were excavated through sandy gravelly clay (glacial till), which is characterised by its very low permeability. As expected, the monitored stages showed no fall in water level during the test period of 60 minutes, resulting in an infiltration rate of 0 m/s for all tests.

4.7 Plate Bearing Tests

The plate tests results (equivalent CBR values) are summarised on Table 1.

Location	Subgrade	Depth (m BGL)	Cycle 1 CBR (%)	Cycle 2 CBR (%)
PBT1	Brown sandy gravelly CLAY	0.50	1.8	4.5
PBT2	Brown sandy gravelly CLAY	0.50	4.1	9.9
PBT3	Brown sandy gravelly CLAY	0.50	0.8	1.3
PBT4	Brown sandy gravelly CLAY	0.50	1.5	1.8
PBT5	Brown sandy gravelly CLAY	0.50	0.6	1.1
PBT6	Brown sandy gravelly CLAY	0.50	0.8	0.9
PBT7	Brown sandy gravelly CLAY	0.50	1.0	1.4
PBT9	Brown sandy gravelly CLAY	0.50	1.5	2.4
PBT10	Brown sandy gravelly CLAY	0.50	0.5	0.5
PBT11	Brown sandy gravelly CLAY	0.50	4.3	10.0
PBT12	Brown sandy gravelly CLAY	0.50	1.5	1.8
PBT13	Brown sandy gravelly CLAY	0.50	1.1	2.6
PBT14	Brown sandy gravelly CLAY	0.50	0.9	3.1
PBT15	Brown sandy gravelly CLAY	0.50	1.3	1.3
PBT16	Brown sandy gravelly CLAY	0.50	1.8	2.6
PBT17	Brown sandy gravelly CLAY	0.50	0.4	0.6
PBT18	Brown sandy gravelly CLAY	0.50	0.4	0.4
PBT19	Brown sandy gravelly CLAY	0.50	0.6	2.2
PBT20	Brown sandy gravelly CLAY	0.50	4.0	4.0
PBT21	Brown sandy gravelly CLAY	0.50	2.5	4.1
PBT22	Brown sandy gravelly CLAY	0.50	0.6	0.7
PBT23	Brown sandy gravelly CLAY	0.50	4.2	9.0
PBT24	Brown sandy gravelly CLAY	0.50	0.4	0.5
PBT25	Brown sandy gravelly CLAY	0.50	0.4	1.0
PBT26	Brown sandy gravelly CLAY	0.50	1.8	2.2

Table 1 – Summary of Plate Bearing Test Results

It is noted that the plate tests were undertaken within the upper 0.5 metres, which have been shown to be of variable strength.

4.8 Groundwater

Groundwater was observed in almost all boreholes, mostly in the form of slow ingress. The water strike depths mostly ranged between 1.6 and 2.4 m BGL in association with the basal coarse angular deposits. Where strikes occurred within the clay soils, a secondary strike was generally observed at the terminal depth.

In all instances, the water levels rose during the subsequent 20 minute observation period. At the end of drilling, water levels were mostly at depths of between 1.0 and 1.5 m BGL.

Groundwater was also encountered in the majority of trial pits, mostly within the depth range 1.0 to 2.0 m BGL. It is noted that groundwater ingress occurred most often at the base of the trial pits, particularly where coarse granular deposits (possible highly weathered bedrock) were present at the pit base.

Water strikes were also recorded during rotary drilling. However, it is noted that the water flush medium used during rotary drilling can mask or obscure groundwater strikes. Water strikes occurred at depths of between 2.5 and 3.0 m BGL. Water levels were recorded at the end of drilling and were mostly in the range 1 to 2 m BGL.

Since the short period of drilling rarely permits the true groundwater levels to establish, standpipes were installed in coreholes RC08 and RC09 in order to facilitate long term groundwater monitoring.

5.0 Laboratory Test Results

Laboratory testing was undertaken on selected samples in order to assist in the classification of the subsoils. The results of geotechnical testing are included in Appendix 8, while the environmental test results are presented in Appendix 9.

5.1 Soil Classification

Atterberg Limits tests classified the gravelly clay soils as low to intermediate plasticity CLAY (CL to CI). Where soft upper soils were encountered at TP03, these classified as high plasticity SILT (MH).

Moisture contents within the upper soils were variable, and generally high, with some exceeding 40% moisture. Moisture contents for the underlying glacial till soils were generally lower, mostly ranging between 13 and 20%.

Particle Size Distribution (PSD) tests showed the indigenous sandy gravelly clay soils to be generally well graded, with most showing typical "straight line" grading curves. The fines (silt/clay) contents were relatively high, ranging between 33 and 81%, with the majority of samples containing more than 45% fines. This would be considered unusual high for glacial till soils, which are typically coarser in composition.

5.2 Moisture Condition Value (MCV)

MCV tests provide a rapid indication of the potential for soil reusability at the current moisture content. For the purposes of preliminary assessment, an MCV of 8 or greater is a typical requirement of earthworks specifications for soils to be reused as engineering fill. A total of 18 samples were tested. The results are summarised on Table 2.

Location	Depth (m BGL)	Moisture Content (%)	Soil Type	MCV
TP01	0.8	13	Sandy gravelly CLAY	11.6
TP03	1.0	22	Sandy gravelly SILT	2.6
TP07	0.6	13	Sandy gravelly CLAY	7.8
TP14	1.0	18	Sandy gravelly CLAY	9.2
TP20	1.4	30	Sandy gravelly CLAY	8.5
TP23	0.6	23	Sandy gravelly CLAY	0.6
TP27	0.8	16	Sandy gravelly CLAY	8.9
TP30	0.6	22	Sandy gravelly CLAY	7.8
TP33	0.5	15	Sandy gravelly CLAY	7.3
TP40	0.6	17	Sandy gravelly CLAY	7.2
TP44	0.5	23	Sandy gravelly CLAY	9.4
TP48	0.6	15	Sandy gravelly CLAY	6.9
TP51	1.2	18	Sandy gravelly CLAY	7.8
TP53	1.5	15	Sandy gravelly CLAY	6.8
TP57	0.5	24	Sandy gravelly CLAY	9.2
TP62	0.6	15	Sandy gravelly CLAY	8.5
TP65	1.2	18	Sandy gravelly CLAY	6.6
TP70	0.5	28	Sandy gravelly CLAY	8.9

Table 2 – Summary of MCV results

Table 2 shows that 8 of the 18 samples exceeded an MCV of 8. Of the remaining 10 tests, 6 were in the range 6 to 8, while only two samples were in a soft condition. Notably, the sample of silt from TP03 has already been shown by dynamic probing to be in a soft condition in-situ.

5.3 California Bearing Ratio (CBR)

CBR testing was performed on 9 samples in accordance with test No.7 of BS 1377: Part 4: 1990. To minimise disturbance, specimens were prepared in accordance with clause 7.2.3.3 Method 2. This entails compressing the soil into the test mould in three equal layers using static compaction. In accordance with the specification the test specimens had a maximum particle size of 20 mm.

The CBR results are summarised in Table 3.

Location	Depth (m BGL)	Moisture Content (%)	Description	CBR (%) average
TP01	0.8	13	Sandy gravelly CLAY	5.4
TP03	1.0	21	Sandy gravelly SILT	0.6
TP20	0.8	29	Sandy gravelly CLAY	2.0
TP30	0.6	21	Sandy gravelly CLAY	3.7
TP33	0.5	15	Sandy gravelly CLAY	3.9
TP44	0.5	23	Sandy gravelly CLAY	4.3
TP51	0.5	17	Sandy gravelly CLAY	2.8
TP53	0.6	15	Sandy gravelly CLAY	1.7
TP65	0.6	16	Sandy gravelly CLAY	13.0

Table 3 – Summary of CBR Test Results

Table 3 shows that seven of the nine samples tested yielded CBR values greater than 2%. The sample from TP03 yielded a particularly low CBR value (0.6%), although this silty material was shown to be in a soft condition in-situ.

5.4 Compaction Test (Dry Density / Moisture Content Relationship)

Compaction testing was undertaken to determine the dry density of soil when it is compacted in a specific manner over a range of moisture content values. The results are plotted as a graph of moisture content against dry density to determine the optimum moisture content (OMC) i.e. the moisture content at which the maximum dry density is achieved.

Testing was performed in accordance with method 3.3 of BS 1377: Part 4: 1990. In this test, soil passing the 20 mm sieve is compacted into a one litre compaction mould, in three layers, with a vibrating hammer.

The results are summarised in Table 4, which also shows the dry density and moisture content values for the sample in its “as-received” condition. The dry density of the as-received sample is expressed as a percentage of the optimum.

Location	Depth (m BGL)	As Sampled Moisture Content (%)	Soil Type	Dry Density at Natural Moisture Content (Mg/m^3)	Maximum Dry Density (Mg/m^3)	NDD/ MDD (%)	Optimum Moisture Content (%)
TP01	0.8	13	Sandy gravelly CLAY	1.97	1.99	99	11
TP03	1.0	21	Sandy gravelly SILT	1.70	1.83	93	13
TP20	0.8	29	Sandy gravelly CLAY	1.55	1.70	91	13
TP30	0.6	21	Sandy gravelly CLAY	1.61	1.78	90	14
TP33	0.5	15	Sandy gravelly CLAY	1.76	1.88	94	10
TP44	0.5	23	Sandy gravelly CLAY	1.61	1.71	94	15
TP51	0.5	17	Sandy gravelly CLAY	1.79	1.84	97	12
TP53	0.6	15	Sandy gravelly CLAY	1.87	2.00	93	9
TP65	0.6	16	Sandy gravelly CLAY	1.76	1.85	95	10

Table 4 – Summary of Compaction Test Results

Table 4 shows that the Optimum Moisture Content (OMC) was in the range 9 to 15% for all samples tested. The as-received moisture contents were significantly higher than the OMC, with the samples generally between 5 and 8% "wet of optimum".

5.5 Sulphate and pH Analysis

The results of chemical testing showed very low concentrations of soluble sulphates for 7 of the 8 samples tested. In addition, the pH values indicated near neutral conditions.

A sample retrieved from BH02 (1.5 m BGL) exhibited a comparatively high Sulphate level of 0.53 g/l.

5.6 Point Load Test (Rock Core Samples)

The Point Load Index Test provides a rapid strength assessment from rock fragments or cores. The test specimen is compressed between two cones loaded from a hydraulic hand pump. The core fails due to the tensile forces over the diametral area between the points. The strength at failure is expressed as the point load index Is.

For purposes of comparison the Is values are corrected to give the equivalent strength for a 50 mm diameter specimen. The compressive strength of the rock (q_c) can be established using a correlation suggested by Goodman where UCS ≈ 18 to 24 x Is_{50}.

The results showed Is_{50} values in the range 2 to 5 MPa, correlating to equivalent UCS values in the range 40 to 100 MPa. In accordance with Table 5 of EN ISO 14869-1, these strengths would confirm the rock to be predominately Medium Strong to Strong.

5.7 Environmental Laboratory Testing

Environmental testing was performed on 42 no. samples recovered from the window samples in order to assess their suitability for disposal to landfill.

The samples were tested in accordance with the RILTA Suite, which is used to determine the suitability of soils for disposal to a landfill. The RILTA suite includes Heavy Metals, Polycyclic Aromatic Hydrocarbons (PAH), TPH-CWG, BTEX, PCB and Total Organic Carbon (TOC) carried out on dry soil samples. Also included are leachate analyses, whereby leachate is generated in accordance with CEN 10:1 specification and this is tested for the presence of recognised contaminants including Heavy Metals, Dissolved Organic Carbon (DOC) and Total Dissolved Solids (TDS). An Asbestos Screen is also included in the RILTA Suite.

The results of WAC analyses were assessed with respect to the criteria for inert waste as stipulated in the European Landfill Directive.

The results showed that 41 of the 42 samples tested satisfied the inert landfill limits.

The notable exception to this occurred at window sample WS02, where a specimen from 1.0 m BGL exhibited a Mineral Oil level of 1100 mg/kg, thus exceeding the inert landfill limit of 500 mg/kg significantly. It is noted that a sample from a similar depth at nearby trial pit TP19 also contained Mineral Oil, but at 200 mg/kg, this was not sufficiently elevated to exceed the inert limits.

6.0 Ground Assessment and Recommendations

The general ground conditions have been shown to comprise sandy gravelly clay from shallow depth.

Made Ground comprising sandy gravelly clay with some fragments of Construction and Demolition (C&D) waste mantled the natural clay soils in some locations, but this was confined to the western portion of the site and was mostly limited to the upper metre.

The strength of the upper c. 1m of gravelly clay is highly variable, ranging between soft / firm and stiff / very stiff in consistency. In particular, localised deposits of soft silt were uncovered near the western boundary of the site, and these extended to depths of up to 3.0 m BGL. The silt deposits were observed to be laminated and are therefore likely to be related to historical water (fluvial or alluvial) deposition.

The site is underlain in all locations by stiff and very stiff deposits of sandy gravelly clay. These brown and black gravelly clays represent glacial till, which is often referred to as the "Dublin Boulder Clay" and typically mantles the limestone bedrock from which it is derived. The difference in coloration and consistency between the upper brown and lower grey/black deposits are usually attributed to weathering of the upper till.

Localised pockets of coarse material (cobbles / boulders) were occasionally present within the glacial till, and these are possibly the result of glacial meltwater channels.

Rotary drilling confirmed the presence of limestone bedrock at depths of between 2 and 3 m BGL and bedrock was proven (cored) to a maximum depth of 8 m BGL. The limestone was assessed by laboratory strength testing to be Medium Strong to Strong.

Groundwater was observed in the boreholes and trial pits at depths of between 1 and 2 m BGL, most often in conjunction with the weathered bedrock horizon. Water levels in the coreholes were recorded at 1 to 2 m BGL at the end of drilling. Future monitoring of constructed standpipes will confirm the true groundwater levels.

The stability of temporary excavations (trial pits) within the glacial till soils was generally good. However, pits dug within the soft silt deposits were unstable, as were localised granular lenses within the glacial till.

6.1 Structural Foundations

The exploratory holes have shown marked variations in the consistency of the upper metre of soil, with soft or loose zones often present to depths of between 0.5 and 1.0 m BGL. However, with the exception of the soft silt deposits at the western boundary, stiff gravelly clay soils can be expected from approximately a metre depth.

It is recommended that the foundations for the proposed residential development are constructed on the stiff or very stiff gravelly clay soils that were encountered in all exploratory holes and identified by high resistance in all dynamic probes. An allowable bearing pressure of the order of 150 kPa could be assumed for the upper stiff deposits. An increased bearing pressure of the order of 250 to 300 kPa could be imposed on the the deeper, very stiff gravelly clay soils. The

transition to the very stiff deposits varies, but would be expected at depths of between 1 and 2 metres across the site.

The transition to the very stiff soils should be readily identifiable by a noticeable increase in the resistance to excavation. In view of the variations in strength of the upper deposits, it will be important to reinforce foundation concrete to minimise the effects of differential movements.

If higher bearing pressures are required, consideration could be given to utilising the underlying limestone bedrock as a founding medium. Based on the strengths measured in Point Load tests, and on documented geotechnical data, a bearing pressure of the order of 600 kPa could be assumed for the upper highly fractured bedrock horizon, increasing to c. 1500 kPa within the intact limestone bedrock. Based on the results of the coreholes, it is anticipated that excavations of the order of 2.5 to 3.0 metres would be required to reach the upper bedrock.

A key consideration if adopting trench / fill techniques for foundations will be the stability of open trenches. As noted previously, instability was noted within sift/firm upper soils and within localised granular pockets in a number of trial pits. Provision should therefore be made for nominal trench control measures to maintain the stability of shallow foundation excavations.

6.2 Groundwater

Groundwater was encountered at depths of between 1 and 2 m BGL in the exploratory holes.

Groundwater ingress would therefore be expected within excavations below 1.0 m BGL. The rate of water flow through the gravelly clay (glacial till) would be expected to be low, most likely in the form of seepage. However, where granular (gravel) lenses are present, the rate of inflow will be higher. High inflow rates could also be expected where the upper highly fractured limestone bedrock is exposed at the base of foundation trenches.

Standpipes were installed in all coreholes to permit long term monitoring. It is strongly recommended that the standpipes are regularly monitored until construction commences. Readings should also be taken after periods of heavy rainfall to determine the effect of prolonged precipitation on the groundwater table.

6.3 Potential for Pyritic Heave

As discussed in Section 4.2, the bedrock comprises grey/black argillaceous limestone with localised highly weathered mudstone / shale zones. There was evidence of localised pyrite within the shale units, which is not uncommon amongst the Dublin limestones.

While pyrite chemical analysis does not form part of this report, the risk of pyritic expansion within the limestone bedrock should be considered and addressed.

With regard to the potential for pyritic heave of foundations, there should be no concerns regarding foundation construction on suitably prepared limestone formations. When constructing foundations on the limestone bedrock, suitable preparation of the exposed limestone will be critical in advance of blinding with lean mix concrete. Any loose / unconsolidated material (mudstone / shale) should be removed and the bedrock formation blinded without delay. The purpose of this is to reduce the timeframe for oxidation. Foundations can then be constructed directly on the lean mix concrete with no residual concerns regarding pyritic heave.

6.4 Pavements and Hard Standings

The results of the in-situ plate bearing tests indicated generally low CBR values, with the majority of values below 2%. The second load cycles showed minimal improvement. However, it is noted that the tests were performed within the upper 0.5 metres, which has been shown to be highly variable in consistency, and often of low strength.

To facilitate a conventional pavement design, a minimum design CBR of 2.5% is generally required (Ref: NRA HD 25-26/10:2010). Where a CBR of 2.5% cannot be achieved at the required formation level by proof rolling, this is classed as a "soft subgrade". Capping thicknesses should then be designed in accordance with NRA HD 25-26/10 with reference to Section 3.23 ("Soft Subgrades").

In accordance with the aforementioned design manual, soft subgrades can either be improved (e.g. using lime) or removed and replaced with a more suitable material. The thickness removed will typically be between 0.5 and 1.0 m. Although the new material may be of good quality, the new subgrade should be assumed to be equivalent to one of a CBR of 2.5%.

It is noted that the soft soils were generally confined to the upper 0.5 to 1.0 metres. Consideration could therefore be given to the removal of the upper soft material (or Made Ground where present) and the assessment of the underlying stiffer soils as a potential subgrade. Allowance should be made for additional plate bearing tests on the deeper subgrade to verify the design CBR value.

A geotextile separator at subgrade level and geogrid reinforcement within the capping layer would be recommended to accommodate any variabilities within the subgrade.

Laboratory testing (Atterberg Limits) has classified the near-surface soils as low to intermediate plasticity clays. Groundwater has been shown to be present within 1 metre of current ground level in places. Shallow groundwater, if present at or near subgrade level, can have a catastrophic softening effect on exposed subgrade, particularly in low plasticity and non-plastic silt/clay soils. It will be imperative to maintain a dry subgrade before construction of the capping layer.

Adequate drainage measures should be implemented before construction so that the groundwater table is kept below (ideally 0.5 metres below) subgrade level. Stripped subgrade should also be protected from surface water ingress or disturbance from unnecessary pedestrian or vehicular traffic. The time between stripping to formation level and placement of the capping layer should be minimised.

Low plasticity and non-plastic soils are particularly susceptible to dilation and rapid weakening as a result of dynamic compaction. In view of the shallow groundwater table, any proof rolling of the subgrade soils should be performed statically using a smooth roller in order to avoid vibratory disturbance. Initial placement of the capping layer should also be carried out using a static roller for the same reason.

Any residual zones of soft subgrade should be removed and replaced with 6F capping or starter layer material (Class 6A / 6B). Plate bearing tests should be considered during construction to verify or validate the stiffness / density of the formation soils.

If there are particular concerns regarding the condition of the formation soils, additional plate bearing tests could be conducted directly on the exposed subgrade in order to confirm the design CBR value prior to placement of the capping layer.

It is important that argillaceous sedimentary rocks (i.e. muddy limestone, calcareous mudstone, shale, etc.) are not used in sub-base, capping or as a starter layer. These have high potential to give rise to degradation (i.e. poor durability and soundness) and slaking and therefore would not be suitable. All granular fills (particularly Series 600 and 800 material) should be thoroughly examined, tested and approved in advance of being used in the pavement construction.

6.5 Reusability of Excavated Soils

California Bearing Ratio (CBR), Moisture Condition Value (MCV) and Compaction (Dry Density / Moisture Content) tests were undertaken on selected samples in order to assess their reusability characteristics.

The laboratory tests yielded CBR values mostly in excess of 2%, while the MCV values, with two notable exceptions, were mostly in the range 7 to 9.

When cross-referenced with the particle size analysis results, the indigenous soils are thought to have the potential to be re-used as Class 2C fill (stony cohesive fill in accordance with Series 600 of the Specification for Earthworks: 2013). The gradings show variations in the fines (silt/clay) content, classifying most samples as 2C1 (High Fines Content) and some as 2C2 (Low Fines Content).

Compaction testing generally showed Maximum Dry Densities (MDD) in the range 1.7 to 2.0 Mg/m^3 with Optimum Moisture Contents (OMC) of 10 to 15%. The as-received moisture contents were shown to be 5 to 8% wet of OMC in most cases, achieving 90 to 99% of MDD.

These soils should not be placed and compacted in wet weather as they will degrade and soften. In all instances, the formation soils (either excavated or re-compacted as fill) should be protected immediately with capping and not trafficked by dump trucks or earthwork plant.

Monitoring and control of soil moisture contents will be of critical importance when placing and compacting the indigenous cohesive tills. Ideally, the moisture contents should be lowered to within 1 to 2% of the OMC before placing and compacting.

Depending on the project's earthworks specification, the performance predicted by the laboratory testing may not be acceptable. For example, a minimum CBR value of 5% could be required. In this case, consideration could be given to re-engineering the site-won materials using lime or cement stabilisation. This is a hydration process which lowers the moisture content of the soil via an exothermic reaction, leading to a much stiffer soil matrix.

It is recommended that compaction trials be carried out in the field so that that the performance of placed soils can be verified. This would be particularly important when considering the reuse of the finer clay soils (>50% passing the 63 µm sieve). Trials generally take the form of 0.5 to 1.0 metres of placed fill, which is then subjected to in-situ testing to measure the achieved level of compaction and performance. Samples from the trial are also tested in the laboratory to monitor the moisture content.

6.6 Soakaway Systems

Infiltration testing was performed to ascertain the suitability of the sub-soils for soakaway purposes. Testing was performed in accordance with BRE Digest 365 'Soakaway Design'.

The soils exhibited no infiltration during the test period. Since conventional soakaway systems will not function in these ground conditions, run-off water should be discharged to an existing surface water system, using attenuation techniques to regulate the flow.

6.7 Chemical Attack on Buried Concrete

The results of Sulphate and pH testing showed very low Sulphate and near-neutral pH levels in almost all samples.

Since the soluble sulphate concentrations for these samples were significantly below 0.5 g/l, and pH values were above 2.5, a Design Sulphate Class of DS-1 may be assumed in accordance with Table C1 of BRE Special Digest 1 Concrete in Aggressive Ground: 2005.

A sample retrieved from BH02 (1.5 m BGL) exhibited a Sulphate level of 0.53 g/l, which was marginally higher than the limit of 0.5 g/l for Class DS-1. Instead, Class DS-2 would be appropriate.

Assuming a static groundwater table, an ACEC (Aggressive Chemical Environment for Concrete) Classification of AC-1s is applicable for all samples.

In terms of concrete to I.S. EN 206-1:2013, the chemical testing demonstrates that concrete could be manufactured to Class XA1.

6.8 Landfill Disposal of Excavated Soils

The results of the RILTA Suites showed that 41 of the 42 samples tested fully complied with the inert landfill limits as listed in the EU Council Decision 2003/33/EC.

One sample from WS02 exhibited elevated Mineral Oil levels, which would prevent this sample from being accepted at an inert landfill. A sample from a nearby trial pit (TP19) also contained Mineral Oil, but at a lesser concentration.

The results therefore suggest that there may be a localised "hot spot" in the vicinity of WS02. The presence of hydrocarbons suggests contamination in the form of diesel or oil. The extent of the hydrocarbon contamination should be further investigated since it will be necessary to segregate contaminated soils when disposing to landfill.

If required, the results of the RILTA Suite can also be used to carry out a full Waste Characterisation Assessment (WCA). This assessment is undertaken by an environmental specialist and determines whether the soils are hazardous or non-hazardous in advance of being dispatched to landfill. A WCA would be particularly useful where hydrocarbon contaminations are present, since sufficiently elevated levels of hydrocarbons can cause a sample's waste classification to be downgraded from non-hazardous to hazardous.

Monitoring of excavation operations will be important in order to identify any contamination “hot spots” that may have remained undetected prior to construction. Where hydrocarbon-rich soils are encountered, these should be identifiable by their strong odour. Hydrocarbons can also be identified in groundwater by their rainbow sheen.

7.0 References

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2. Manual of Contract Documents for Highway Works, Volume 5, Section 3, Ground Investigation, Part 4: Specification
3. BRE Special Digest 1: 2005 – Concrete in aggressive ground
4. EN 1997-3; Eurocode 7: Geotechnical Design – Part 3: Design assisted by field testing; 1997
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7. Manual of Contract Documents for Road Works, Volume 1: Specification for Road Works (March 2007)
8. Manual of Soil Laboratory Testing, Volume 3; K.H. Head
9. ISRM – Suggested Methods for Determining Point Load Strength
10. ISRM – Suggested Methods for Determining the Uniaxial Compressive Strength and Deformability of Rock Materials
11. TRL Report 447- Sulphate specification for structural backfills

Appendix 1

Cable Percussive Boreholes

GEOTECHNICAL BORING RECORD

REPORT NUMBER 21452

CONTRACT Kilcarbery Grange

BOREHOLE NO. BH05
SHEET Sheet 1 of 1

CO-ORDINATES 705,033.43 E
730,879.80 N
GROUND LEVEL (mOD) 72.06

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

DATE COMMENCED 18/01/2019
DATE COMPLETED 18/01/2019

CLIENT
ENGINEER DBFL

SPT HAMMER REF. NO.
ENERGY RATIO (%)

BORED BY E.Leahy
PROCESSED BY F.C

Depth (m)	Description	Legend	Elevation	Depth (m)	Samples: Ref. Number	Samples: Sample Type	Samples: Depth (m)	Samples: Recovery	Field Test Results	Standpipe Details
0	TOPSOIL		71.76	0.30						
	Brown sandy SILT/CLAY with some gravel (Possible Made Ground)		71.46	0.60						
1	Firm brown very sandy gravelly CLAY		70.56	1.50	AA97130	B	1.00		N = 12 (2, 3, 3, 2, 3, 4)	
2	Stiff to very stiff grey/black gravelly CLAY with angular cobbles		69.76	2.30	AA97131 AA97132	B B	2.00 2.10-2.40		N = 27 (2, 3, 3, 5, 9, 10)	
	Dense angular GRAVEL and COBBLES		69.56	2.50						
	Obstruction End of Borehole at 2.50 m									
3										
4										
5										
6										
7										
8										
9										

HARD STRATA BORING/CHISELLING

From (m)	To (m)	Time (h)	Comments
2.30	2.50	2	

WATER STRIKE DETAILS

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

GROUNDWATER PROGRESS

Date	Hole Depth	Casing Depth	Depth to Water	Comments

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type

REMARKS Hand dug inspection pit carried out .

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

IGSL BH LOG 21452.GPJ IGSL.GDT 18/9/19

GEOTECHNICAL BORING RECORD

REPORT NUMBER 21452

CONTRACT Kilcarbery Grange

BOREHOLE NO. BH11
SHEET Sheet 1 of 1

CO-ORDINATES 705,123.02 E
730,926.98 N
GROUND LEVEL (mOD) 70.70

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

DATE COMMENCED 17/01/2019
DATE COMPLETED 17/01/2019

CLIENT
ENGINEER DBFL

SPT HAMMER REF. NO.
ENERGY RATIO (%)

BORED BY E.Leahy
PROCESSED BY F.C

Depth (m)	Description	Legend	Elevation	Depth (m)	Samples: Ref. Number	Samples: Sample Type	Samples: Depth (m)	Samples: Recovery	Field Test Results	Standpipe Details
0	TOPSOIL		70.50	0.20						
	Brown sandy SILT/CLAY		70.10	0.60						
	Soft brown/grey SILT/CLAY with some gravel				AA97125	B	1.00		N = 7 (0, 1, 1, 1, 2, 3)	
1			69.30	1.40						
	Very stiff brown gravelly CLAY with angular cobbles				AA97126	B	2.00		N = 35 (2, 5, 7, 8, 10, 10)	
2			68.00	2.70						
	Dense angular GRAVEL and COBBLES		67.90	2.80	AA97127	B	2.70-2.80		N = 50/75 mm (25, 50)	
3	Obstruction End of Borehole at 2.80 m									
4										
5										
6										
7										
8										
9										

HARD STRATA BORING/CHISELLING

From (m)	To (m)	Time (h)	Comments
2.60	2.80	2	

WATER STRIKE DETAILS

Water Strike	Casing Depth	Sealed At	Rise To	Time (min)	Comments
1.80	1.80	No	Yes	20	Slow

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type

GROUNDWATER PROGRESS

Date	Hole Depth	Casing Depth	Depth to Water	Comments
17-01-19	2.80	Nil	1.00	End of BH

REMARKS Hand dug inspection pit carried out .

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

IGSL BH LOG 21452.GPJ IGSL.GDT 18/9/19

Appendix 2

Rotary Coreholes

GEOTECHNICAL CORE LOG RECORD

REPORT NUMBER 21452

CONTRACT Kilcarbery Grange

DRILLHOLE NO RC01
SHEET Sheet 1 of 1

CO-ORDINATES
GROUND LEVEL (mOD)

RIG TYPE GEO205
FLUSH Air/Mist
INCLINATION (deg) -90
CORE DIAMETER (mm) 78

DATE DRILLED 27/05/2019
DATE LOGGED 27/05/2019

CLIENT
ENGINEER DBFL

DRILLED BY IGSL
LOGGED BY D.O'Shea

Downhole Depth (m)	Core Run Depth (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Fracture Spacing Log (mm) 0 250 500	Non-intact Zone	Legend	Description	Depth (m)	Elevation	Standpipe Details	SPT (N Value)
0								SYMMETRIX DRILLING: No recovery, observed by driller as returns of TOPSOIL	0.30			
								SYMMETRIX DRILLING: No recovery, observed by driller as returns of grey brown sandy gravelly CLAY	1.10			
1								SYMMETRIX DRILLING: No recovery, observed by driller as returns of grey black gravelly CLAY	2.10			
2								SYMMETRIX DRILLING: No recovery, observed by driller as returns of possible rock	2.60			
	2.60	100	76	23				Very strong to medium strong where intact, medium to thinly bedded (to thinly laminated where fissile mudstone/shale), grey/dark grey/black, fine-grained, LIMESTONE (argillaceous limestone grading regularly (every approx 0.10-0.80m) into calci-siltite limestone with subordinate MUDSTONE, local stylolites, pyrite present), slightly weathered to highly weathered at fissile mudstone/shale zones at (5.42-5.45m). Many incipient fractures throughout.				
3	3.80	100	94	63		569.999999999999		Discontinuities are widely to closely spaced, smooth to locally rough, planar to locally curviplanar. Apertures are tight to locally open, locally clay-smeared, locally calcite-veined (1-15mm thick). Dips are 10°, 40° & very locally 70° & sub-vertical.				
4												
5	5.30	100	81	44								
6	6.80								6.80			
7								End of Borehole at 6.80 m				
8												
9												

REMARKS

Hole cased 0.00-2.60m.

WATER STRIKE DETAILS

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

INSTALLATION DETAILS

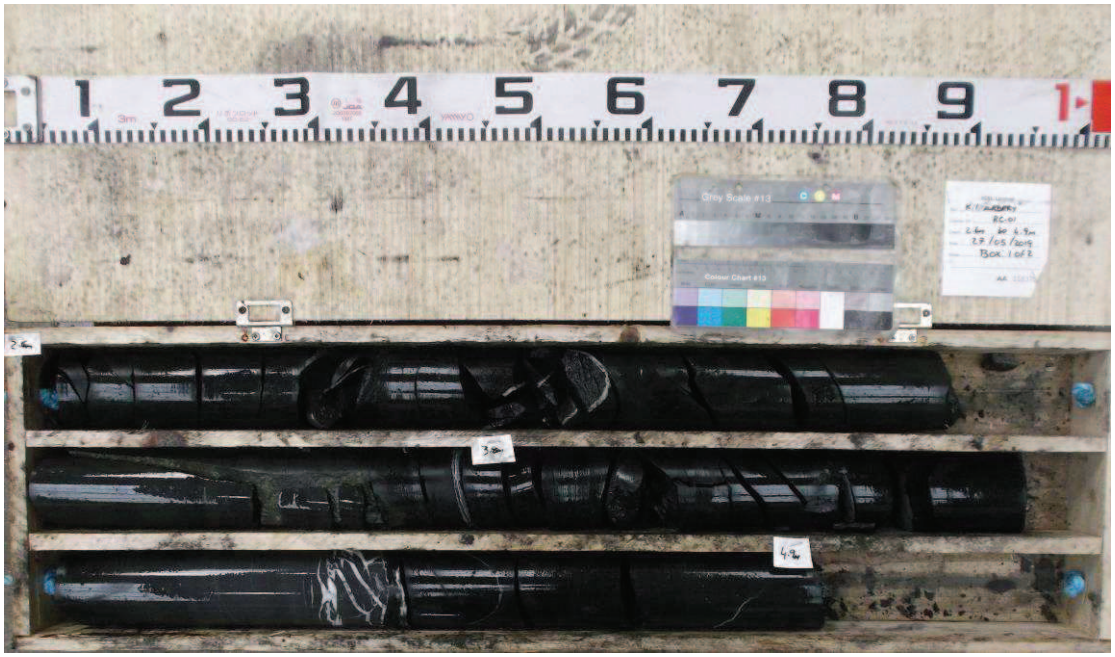
Date	Tip Depth	RZ Top	RZ Base	Type

GROUNDWATER DETAILS

Date	Hole Depth	Casing Depth	Depth to Water	Comments
27-05-19	6.80	2.60	1.80	Water level recorded 5 mins after end of drilling.

IGSL RC FI 10M 21452.GPJ IGSL.GDT 19/6/19

RC01 Box 1 of 2 – 2.60-4.90m



RC01 Box 2 of 2 – 4.90-6.80m

Appendix 3

Trial Pit Records

TRIAL PIT RECORD

REPORT NUMBER 21452

CONTRACT	Kilcarbery Grange	**TRIAL PIT NO.**	**TP21**
		SHEET	Sheet 1 of 1
LOGGED BY	JC	**CO-ORDINATES**	704,937.90 E 731,020.54 N
		DATE STARTED	17/12/2018
		DATE COMPLETED	17/12/2018
CLIENT		**GROUND LEVEL (m)**	72.78
ENGINEER	DBFL	**EXCAVATION METHOD**	JCB 3CX

Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples: Sample Ref	Samples: Type	Samples: Depth	Vane Test (KPa)	Hand Penetrometer (KPa)
0.0 Topsoil		0.20	72.58						
Stiff grey sandy gravelly CLAY with numerous angular cobbles					AA110122	B	0.80		
1.0 Obstruction End of Trial Pit at 1.20m		1.20	71.58						
2.0									
3.0									
4.0									

Groundwater Conditions
No Groundwater encountered

Stability
Trial pit remained stable

General Remarks
CAT scanned location.

TRIAL PIT RECORD

REPORT NUMBER 21452

CONTRACT	Kilcarbery Grange	**TRIAL PIT NO.**	**TP22**
		SHEET	Sheet 1 of 1
LOGGED BY	JC	**CO-ORDINATES**	704,925.35 E 730,972.48 N
		DATE STARTED	17/12/2018
		DATE COMPLETED	17/12/2018
CLIENT		**GROUND LEVEL (m)**	72.85
ENGINEER	DBFL	**EXCAVATION METHOD**	JCB 3CX

Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples: Sample Ref	Samples: Type	Samples: Depth	Vane Test (KPa)	Hand Penetrometer (KPa)
0.0 Topsoil		0.30	72.55						
Stiff grey brown sandy gravelly CLAY with occasional angular cobbles					AA110119	B	0.80		
1.0									
Dense black angular GRAVEL. (Possible weathered rock).		1.30	71.55						
Obstruction End of Trial Pit at 1.50m		1.50	71.35	1 (Moderate)					
2.0									
3.0									
4.0									

Groundwater Conditions
Groundwater encountered at 1.50m

Stability
Trial pit remained stable

General Remarks
CAT scanned location.

TRIAL PIT RECORD

REPORT NUMBER 21452

CONTRACT	Kilcarbery Grange	**TRIAL PIT NO.**	**TP23**
		SHEET	Sheet 1 of 1
LOGGED BY	JC	**CO-ORDINATES**	704,945.30 E 730,964.67 N
		DATE STARTED	17/12/2018
		DATE COMPLETED	17/12/2018
CLIENT		**GROUND LEVEL (m)**	72.80
ENGINEER	DBFL	**EXCAVATION METHOD**	JCB 3CX

Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples: Sample Ref	Samples: Type	Samples: Depth	Vane Test (KPa)	Hand Penetrometer (KPa)
0.0 Topsoil		0.20	72.60						
Stiff grey brown sandy gravelly CLAY					AA110120	B	0.60		
1.0 Very stiff grey sandy gravelly CLAY with angular cobbles		1.20	71.60						
				1 (Moderate)	AA110121	B	1.60		
Obstruction 2.0 End of Trial Pit at 1.90m		1.90	70.90						
3.0									
4.0									

Groundwater Conditions
Groundwater encountered at 1.80m

Stability
Trial pit remained stable

General Remarks
CAT scanned location.

TRIAL PIT RECORD

REPORT NUMBER 21452

CONTRACT	Kilcarbery Grange	**TRIAL PIT NO.**	**TP24**
		SHEET	Sheet 1 of 1
LOGGED BY	JC	**CO-ORDINATES**	704,966.88 E 730,898.05 N
		DATE STARTED	17/12/2018
		DATE COMPLETED	17/12/2018
CLIENT		**GROUND LEVEL (m)**	72.20
ENGINEER	DBFL	**EXCAVATION METHOD**	JCB 3CX

Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples: Sample Ref	Samples: Type	Samples: Depth	Vane Test (KPa)	Hand Penetrometer (KPa)
0.0 Topsoil		0.20	72.00						
Stiff brown sandy gravelly CLAY.					AA110117	B	0.80		
1.0									
Fine to medium to coarse grey black sandy angular GRAVEL. (Possible weathered rock).		1.50	70.70	(Moderate)					
Obstruction End of Trial Pit at 1.90m		1.90	70.30		AA110118	B	1.80		
2.0									
3.0									
4.0									

Groundwater Conditions
Groundwater encountered at 1.60m

Stability
Trial pit remained stable

General Remarks
CAT scanned location.

TRIAL PIT RECORD

REPORT NUMBER 21452

CONTRACT	Kilcarbery Grange	**TRIAL PIT NO.**	**TP39**
		SHEET	Sheet 1 of 1
LOGGED BY	JC	**CO-ORDINATES**	705,084.17 E 730,861.00 N
		DATE STARTED	17/12/2018
		DATE COMPLETED	17/12/2018
CLIENT		**GROUND LEVEL (m)**	71.90
ENGINEER	DBFL	**EXCAVATION METHOD**	JCB 3CX

Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples: Sample Ref	Samples: Type	Samples: Depth	Vane Test (KPa)	Hand Penetrometer (KPa)
0.0 Topsoil		0.20	71.70						
Firm brown sandy gravelly CLAY		0.40	71.50						
Stiff mottled grey brown sandy gravelly CLAY					AA110129	B	1.00		
Moderate to highly weathered sandy angular GRAVEL		1.60	70.30	1 (Moderate)	AA110130	B	1.80		
2.0 Obstruction End of Trial Pit at 2.10m		2.10	69.80						
3.0									
4.0									

Groundwater Conditions
Groundwater encountered at 1.80m

Stability
Trial pit remained stable

General Remarks
CAT scanned location.

TRIAL PIT RECORD

REPORT NUMBER 21452

CONTRACT	Kilcarbery Grange	**TRIAL PIT NO.**	**TP40**
		SHEET	Sheet 1 of 1
LOGGED BY	JC	**CO-ORDINATES**	705,061.03 E 730,896.06 N
		DATE STARTED	17/12/2018
		DATE COMPLETED	17/12/2018
CLIENT		**GROUND LEVEL (m)**	71.91
ENGINEER	DBFL	**EXCAVATION METHOD**	JCB 3CX

Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples: Sample Ref	Samples: Type	Samples: Depth	Vane Test (KPa)	Hand Penetrometer (KPa)
0.0 Topsoil		0.20	71.71						
Stiff grey brown sandy gravelly CLAY					AA110127	B	0.60		
1.0				1 (Moderate)					
Moderate to highly weathered sandy angular GRAVEL		1.20	70.71		AA110128	B	1.30		
Obstruction End of Trial Pit at 1.40m		1.40	70.51						
2.0									
3.0									
4.0									

Groundwater Conditions
Groundwater encountered at 1.20

Stability
Trial pit remained stable

General Remarks
CAT scanned location.

IGSL TP LOG 21452.GPJ IGSL.GDT 18/9/19

TRIAL PIT RECORD

REPORT NUMBER 21452

CONTRACT	Kilcarbery Grange	**TRIAL PIT NO.**	**TP41**
		SHEET	Sheet 1 of 1
LOGGED BY	JC	**CO-ORDINATES**	705,052.32 E 730,937.93 N
		DATE STARTED	17/12/2018
		DATE COMPLETED	17/12/2018
CLIENT		**GROUND LEVEL (m)**	72.28
ENGINEER	DBFL	**EXCAVATION METHOD**	JCB 3CX

Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples: Sample Ref	Samples: Type	Samples: Depth	Vane Test (KPa)	Hand Penetrometer (KPa)
TOPSOIL		0.20	72.08						
Soft brown sandy gravelly CLAY		0.40	71.88						
Firm grey brown sandy gravelly CLAY					AA110125	B	0.70		
Broken black angular limestone BOULDER with clay infilling. (Possible weathered rock).		1.30	70.98		AA110126	B	1.40		
Broken black angular coarse limestone GRAVEL and cobbles with clay infilling. (Possible weathered rock).		1.70	70.58						
End of Trial Pit at 1.90m		1.90	70.38						

Groundwater Conditions
Locally Moist

Stability
Minor collapsing between 0.40 - 1.30m

General Remarks
CAT scanned location.

IGSL TP LOG 21452.GPJ IGSL.GDT 18/9/19

TRIAL PIT RECORD

REPORT NUMBER 21452

CONTRACT	Kilcarbery Grange	**TRIAL PIT NO.**	**TP42**
		SHEET	Sheet 1 of 1
LOGGED BY	JC	**CO-ORDINATES**	705,027.90 E 730,987.03 N
		DATE STARTED	17/12/2018
		DATE COMPLETED	17/12/2018
CLIENT		**GROUND LEVEL (m)**	72.58
ENGINEER	DBFL	**EXCAVATION METHOD**	JCB 3CX

Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples: Sample Ref	Samples: Type	Samples: Depth	Vane Test (KPa)	Hand Penetrometer (KPa)
0.0 Topsoil		0.25	72.33						
Stiff brown sandy gravelly CLAY		0.50	72.08						
Dense angular limestone GRAVEL with infilling of soft grey sandy clay (Possible weathered rock).					AA110123	B	0.50		
				1 (Moderate)	AA110124	B	1.50		
Obstruction End of Trial Pit at 1.70m		1.70	70.88						

1.0
2.0
3.0
4.0

Groundwater Conditions
Groundwater encountereded at 1.70m

Stability
Trial pit remained stable

General Remarks
CAT scanned location.

TRIAL PIT RECORD

REPORT NUMBER 21452

CONTRACT	Kilcarbery Grange	**TRIAL PIT NO.**	**TP43**
		SHEET	Sheet 1 of 1
LOGGED BY	JC	**CO-ORDINATES**	705,104.79 E 730,959.99 N
		DATE STARTED	17/12/2018
		DATE COMPLETED	17/12/2018
CLIENT		**GROUND LEVEL (m)**	71.79
ENGINEER	DBFL	**EXCAVATION METHOD**	JCB 3CX

Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Samples: Sample Ref	Samples: Type	Samples: Depth	Vane Test (KPa)	Hand Penetrometer (KPa)
0.0 Topsoil		0.15	71.64						
Firm brown sandy gravelly CLAY		0.30	71.49						
Very stiff mottled grey brown sandy gravelly CLAY					AA110131	B	0.70		
1.0 Moderate to highly weathered sandy angular GRAVEL		1.40	70.39		AA110132	B	1.50		
Obstruction 2.0 End of Trial Pit at 1.90m		1.90	69.89						
3.0									
4.0									

Groundwater Conditions
No Groundwater encountered

Stability
Trial pit remained stable

General Remarks
CAT scanned location.

IGSL TP LOG 21452.GPJ IGSL.GDT 18/9/19

TP20

TP21

TP22

TP23

TP24

TP25

TP39

TP40

TP41

TP42

TP43

TP45

Appendix 4

Window Sample Records

IGSL Limited

WINDOW SAMPLE RECORD

REPORT NUMBER 21452

CONTRACT Killcarberry, Grange Castle

BH NO. **WS15**

SHEET Sheet 1 of 1

CO-ORDINATES(_) 704,976 E
730,850 N

GROUND LEVEL (mOD) 72.05

DATE DRILLED

DATE LOGGED

CLIENT DBFL

ENGINEER

DRILLED BY

LOGGED BY K. Kinsella

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Depth of Sample Run (m)	Recovery (%)	Blowcount	Samples: Ref. Number	Samples: Sample Type	Samples: Depth (m)
0.0	Grey TOPSOIL with grass rootlets		0.05	72.00		0.00-1.00	100				
	Brownish grey/greyish brown slightly sandy CLAY with occasional gravel										
			0.40	71.65						ENV	0.50
	Grey sandy gravelly CLAY, gravel is angular to subrounded										
			0.90	71.15							
1.0	Grey/dark grey sandy very gravelly CLAY, gravel is angular to subangular					1.00-1.15	100				
			1.15	70.90							
	Final Depth 1.15m										
2.0											
3.0											

General Remarks

Installations

IGSL Limited

WINDOW SAMPLE RECORD

REPORT NUMBER 21452

CONTRACT Killcarberry, Grange Castle

BH NO. **WS16**

SHEET Sheet 1 of 1

CO-ORDINATES(_) 704,936 E
730,928 N

GROUND LEVEL (mOD) 72.47

DATE DRILLED

DATE LOGGED

CLIENT DBFL

ENGINEER

DRILLED BY

LOGGED BY K. Kinsella

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Depth of Sample Run (m)	Recovery (%)	Blowcount	Samples Ref. Number	Samples Sample Type	Samples Depth (m)
0.0	Grey TOPSOIL with grass rootlets		0.03	72.44		0.00-1.00	100				
	Greyish brown/brownish grey sandy slightly gravelly CLAY with roots										
			0.35	72.12							
	Grey sandy gravelly CLAY, gravel is subangular to subrounded									ENV	0.50
1.0						1.00-2.00	95				
	Grey to dark grey sandy very gravelly CLAY, geravel is angular to subrounded		1.10	71.37							
			1.90	70.57							
2.0	Dark grey very clayey sandy angular to subangular GRAVEL					2.00-2.15	100				
			2.15	70.32							
	Final Depth 2.15m										
3.0											

General Remarks

Installations

WS WITH DISCRETE SAMPLES 21452.GPJ IGSL.GDT 9/5/19

IGSL Limited

WINDOW SAMPLE RECORD

REPORT NUMBER 21452

CONTRACT Killcarberry, Grange Castle

BH NO. **WS17**

SHEET Sheet 1 of 1

CO-ORDINATES(_) 705,129 E
730,900 N

GROUND LEVEL (mOD) 71.75

DATE DRILLED

DATE LOGGED

CLIENT DBFL

ENGINEER

DRILLED BY

LOGGED BY K. Kinsella

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation	Water Strike	Depth of Sample Run (m)	Recovery (%)	Blowcount	Samples Ref. Number	Samples Sample Type	Samples Depth (m)
0.0	Grey/dark grey TOPSOIL with grass rootlets		0.05	71.70		0.00-1.00	100				
	Grey/brownish grey sandy CLAY with roots		0.18	71.57							
	Light brown slightly sandy SILT with rootlets										
	Light brown slightly sandy CLAY with rare subangular to subrounded gravel		0.40	71.35						ENV	0.50
	Grey/brownish grey slightly sandy CLAY with rare subangular to subrounded gravel		0.70	71.05							
1.0						1.00-2.00	100				
	Grey very clayey sandy GRAVEL, gravel is angular to subangular		1.20	70.55							
	Grey to dark grey slightly sandy gravelly CLAY, very gravelly from 2.00-2.15m and 2.45-2.60m		1.50	70.25							
2.0						2.00-2.60	100				
	Final Depth 2.60m		2.60	69.15							
3.0											

General Remarks

Installations

WS WITH DISCRETE SAMPLES 21452.GPJ IGSL.GDT 9/5/19

Appendix 5

Dynamic Probe Records

DYNAMIC PROBE RECORD

REPORT NUMBER 21452

CONTRACT Killcarberry, Grange Castle

PROBE NO. DP21
SHEET Sheet 1 of 1

CO-ORDINATES 704,937.90 E
731,020.54 N
GROUND LEVEL (mOD) 72.78

HAMMER MASS (kg) 50
INCREMENT SIZE (mm) 100
FALL HEIGHT (mm) 500

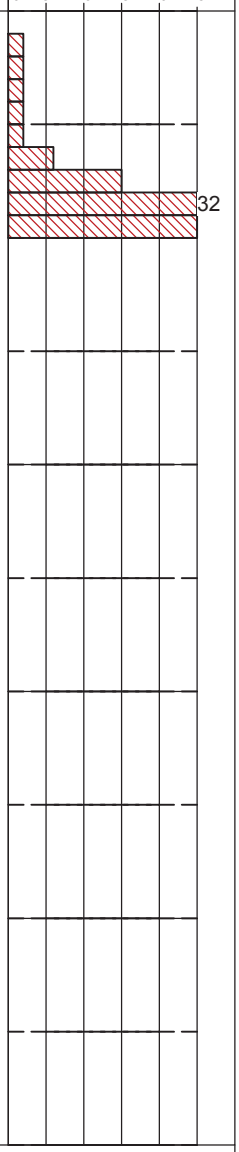
DATE DRILLED 09/01/2019
DATE LOGGED 09/01/2019

CLIENT DBFL
ENGINEER

PROBE TYPE DPH

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water	Depth (m)	Probe Readings (Blows/Increment)
0.0	.					0.00	0
						0.10	2
						0.20	2
						0.30	2
						0.40	2
						0.50	2
						0.60	6
						0.70	15
						0.80	32
						0.90	25
1.0	End of Probe at 1.00 m			71.78			
2.0							
3.0							
4.0							

Graphic Probe Record



GROUNDWATER OBSERVATIONS

REMARKS
CAT scanned location.

DYNAMIC PROBE RECORD

REPORT NUMBER 21452

CONTRACT Killcarberry, Grange Castle

PROBE NO. DP22
SHEET Sheet 1 of 1

CO-ORDINATES 704,925.35 E
730,972.48 N
GROUND LEVEL (mOD) 72.85

HAMMER MASS (kg) 50
INCREMENT SIZE (mm) 100
FALL HEIGHT (mm) 500

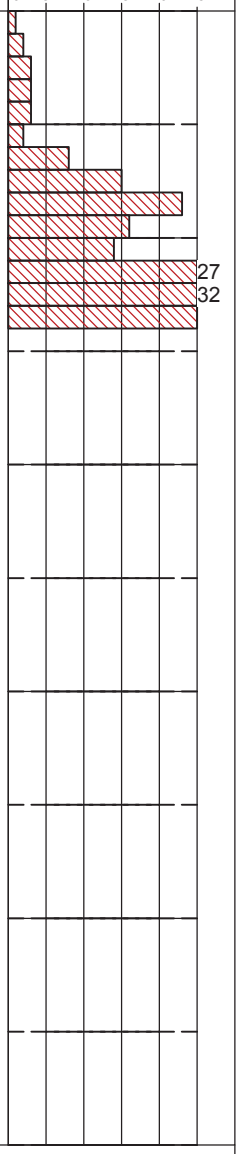
DATE DRILLED 09/01/2019
DATE LOGGED 09/01/2019

CLIENT DBFL
ENGINEER

PROBE TYPE DPH

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water	Depth (m)	Probe Readings (Blows/Increment)
0.0	.					0.00	1
						0.10	2
						0.20	3
						0.30	3
						0.40	3
						0.50	2
						0.60	8
						0.70	15
						0.80	23
						0.90	16
1.0						1.00	14
						1.10	27
						1.20	32
						1.30	25
	End of Probe at 1.40 m			71.45			
2.0							
3.0							
4.0							

Graphic Probe Record



GROUNDWATER OBSERVATIONS

REMARKS
CAT scanned location.

DYNAMIC PROBE RECORD

REPORT NUMBER 21452

CONTRACT Killcarberry, Grange Castle

PROBE NO. DP23
SHEET Sheet 1 of 1

CO-ORDINATES 704,945.30 E
730,964.67 N
GROUND LEVEL (mOD) 72.80

HAMMER MASS (kg) 50
INCREMENT SIZE (mm) 100
FALL HEIGHT (mm) 500

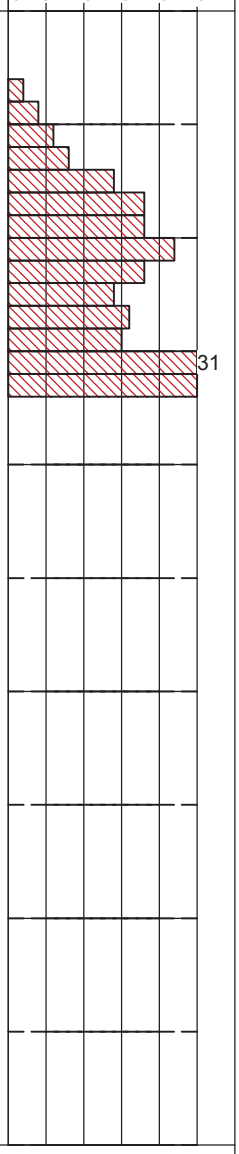
DATE DRILLED 09/01/2019
DATE LOGGED 09/01/2019

CLIENT DBFL
ENGINEER

PROBE TYPE DPH

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water	Depth (m)	Probe Readings (Blows/Increment)
0.0	.					0.00	0
						0.10	0
						0.20	0
						0.30	2
						0.40	4
						0.50	6
						0.60	8
						0.70	14
						0.80	18
						0.90	18
1.0						1.00	22
						1.10	18
						1.20	14
						1.30	16
						1.40	15
						1.50	31
						1.60	25
	End of Probe at 1.70 m			71.10			
2.0							
3.0							
4.0							

Graphic Probe Record



GROUNDWATER OBSERVATIONS

REMARKS
CAT scanned location.

DYNAMIC PROBE RECORD

REPORT NUMBER 21452

CONTRACT Killcarberry, Grange Castle

PROBE NO. DP24
SHEET Sheet 1 of 1

CO-ORDINATES 704,966.88 E
730,898.05 N
GROUND LEVEL (mOD) 72.20

HAMMER MASS (kg) 50
INCREMENT SIZE (mm) 100
FALL HEIGHT (mm) 500

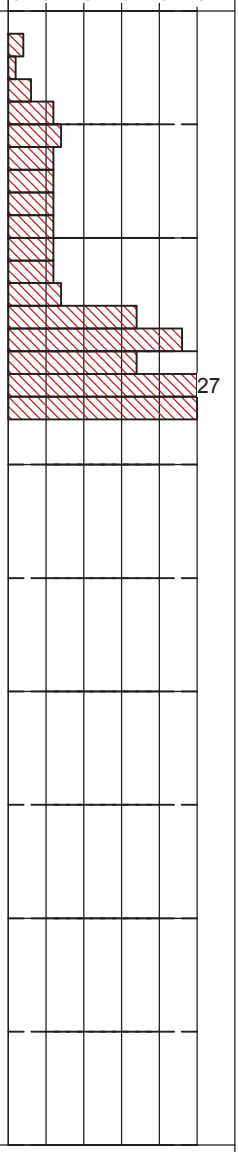
DATE DRILLED 09/01/2019
DATE LOGGED 09/01/2019

CLIENT DBFL
ENGINEER

PROBE TYPE DPH

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water	Depth (m)	Probe Readings (Blows/Increment)
0.0	.					0.00	0
						0.10	2
						0.20	1
						0.30	3
						0.40	6
						0.50	7
						0.60	6
						0.70	6
						0.80	6
						0.90	6
1.0						1.00	6
						1.10	6
						1.20	7
						1.30	17
						1.40	23
						1.50	17
						1.60	27
						1.70	25
	End of Probe at 1.80 m			70.40			
2.0							
3.0							
4.0							

Graphic Probe Record



GROUNDWATER OBSERVATIONS

REMARKS
CAT scanned location.

DYNAMIC PROBE RECORD

REPORT NUMBER 21452

CONTRACT Killcarberry, Grange Castle

PROBE NO. **DP40**
SHEET Sheet 1 of 1

CO-ORDINATES 705,061.03 E
730,896.06 N
GROUND LEVEL (mOD) 71.91

HAMMER MASS (kg) 50
INCREMENT SIZE (mm) 100
FALL HEIGHT (mm) 500

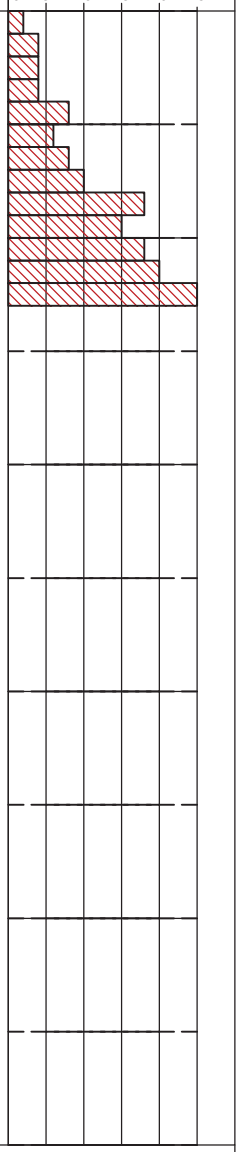
DATE DRILLED 10/01/2019
DATE LOGGED 10/01/2019

CLIENT DBFL
ENGINEER

PROBE TYPE DPH

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water	Depth (m)	Probe Readings (Blows/Increment)
0.0	.					0.00	2
						0.10	4
						0.20	4
						0.30	4
						0.40	8
						0.50	6
						0.60	8
						0.70	10
						0.80	18
						0.90	15
1.0						1.00	18
						1.10	20
						1.20	25
	End of Probe at 1.30 m			70.61			
2.0							
3.0							
4.0							

Graphic Probe Record



GROUNDWATER OBSERVATIONS

REMARKS
CAT scanned location.

DYNAMIC PROBE RECORD

REPORT NUMBER 21452

CONTRACT Killcarberry, Grange Castle

PROBE NO. **DP41**
SHEET Sheet 1 of 1

CO-ORDINATES 705,052.32 E
730,937.93 N
GROUND LEVEL (mOD) 72.28

HAMMER MASS (kg) 50
INCREMENT SIZE (mm) 100
FALL HEIGHT (mm) 500

DATE DRILLED 09/01/2019
DATE LOGGED 09/01/2019

CLIENT DBFL
ENGINEER

PROBE TYPE DPH

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water	Depth (m)	Probe Readings (Blows/Increment)
0.0	.					0.00	0
						0.10	0
						0.20	0
						0.30	0
						0.40	0
						0.50	0
						0.60	0
						0.70	2
						0.80	4
						0.90	2
1.0						1.00	4
						1.10	2
						1.20	12
						1.30	25
						1.40	21
						1.50	17
						1.60	17
						1.70	9
						1.80	11
						1.90	8
2.0	End of Probe at 2.00 m			70.28			
3.0							
4.0							

Graphic Probe Record: 0 5 10 15 20 25

GROUNDWATER OBSERVATIONS

REMARKS
CAT scanned location.

IGSL DP LOG 100MM INCREMENTS 21452.GPJ IGSL.GDT 10/5/19

DYNAMIC PROBE RECORD

REPORT NUMBER 21452

CONTRACT Killcarberry, Grange Castle

PROBE NO. **DP42**
SHEET Sheet 1 of 1

CO-ORDINATES 705,027.90 E
730,987.03 N
GROUND LEVEL (mOD) 72.58

HAMMER MASS (kg) 50
INCREMENT SIZE (mm) 100
FALL HEIGHT (mm) 500

DATE DRILLED 09/01/2019
DATE LOGGED 09/01/2019

CLIENT DBFL
ENGINEER

PROBE TYPE DPH

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water	Depth (m)	Probe Readings (Blows/Increment)
0.0	.					0.00	0
						0.10	0
						0.20	0
						0.30	6
						0.40	4
						0.50	6
						0.60	8
						0.70	16
						0.80	15
						0.90	10
1.0						1.00	8
						1.10	12
						1.20	13
						1.30	15
						1.40	19
						1.50	19
						1.60	17
						1.70	25
	End of Probe at 1.80 m			70.78			
2.0							
3.0							
4.0							

Graphic Probe Record: 0 5 10 15 20 25

GROUNDWATER OBSERVATIONS

REMARKS
CAT scanned location.

IGSL DP LOG 100MM INCREMENTS 21452.GPJ IGSL.GDT 10/5/19

DYNAMIC PROBE RECORD

REPORT NUMBER 21452

CONTRACT Killcarberry, Grange Castle

PROBE NO. DP43
SHEET Sheet 1 of 1

CO-ORDINATES 705,104.79 E
730,959.99 N
GROUND LEVEL (mOD) 71.79

HAMMER MASS (kg) 50
INCREMENT SIZE (mm) 100
FALL HEIGHT (mm) 500

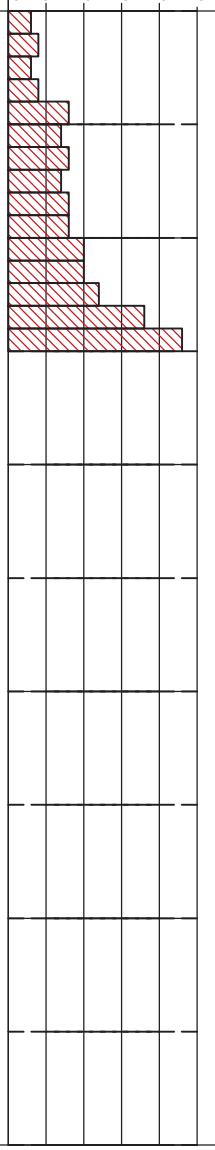
DATE DRILLED 10/01/2019
DATE LOGGED 10/01/2019

CLIENT DBFL
ENGINEER

PROBE TYPE DPH

Depth (m)	Geotechnical Description	Legend	Depth (m)	Elevation (mOD)	Water	Depth (m)	Probe Readings (Blows/Increment)
0.0	.					0.00	3
						0.10	4
						0.20	3
						0.30	4
						0.40	8
						0.50	7
						0.60	8
						0.70	7
						0.80	8
						0.90	8
1.0						1.00	10
						1.10	10
						1.20	12
						1.30	18
						1.40	23
	End of Probe at 1.50 m			70.29			
2.0							
3.0							
4.0							

Graphic Probe Record



GROUNDWATER OBSERVATIONS

REMARKS
CAT scanned location.

Appendix 6

Infiltration Test Records

Soakaway Design f -value from field tests (F2C) IGSL

Contract: Kilcarberry Grange Contract No. 21452
Test No. IT11
Client DBFL
Date: 18/01/2019

Summary of ground conditions

from	to	Description	Ground water
0.00	0.20	TOPSOIL	Not Encountered
0.20	1.50	Brown sandy gravelly CLAY	

Notes:

Field Data

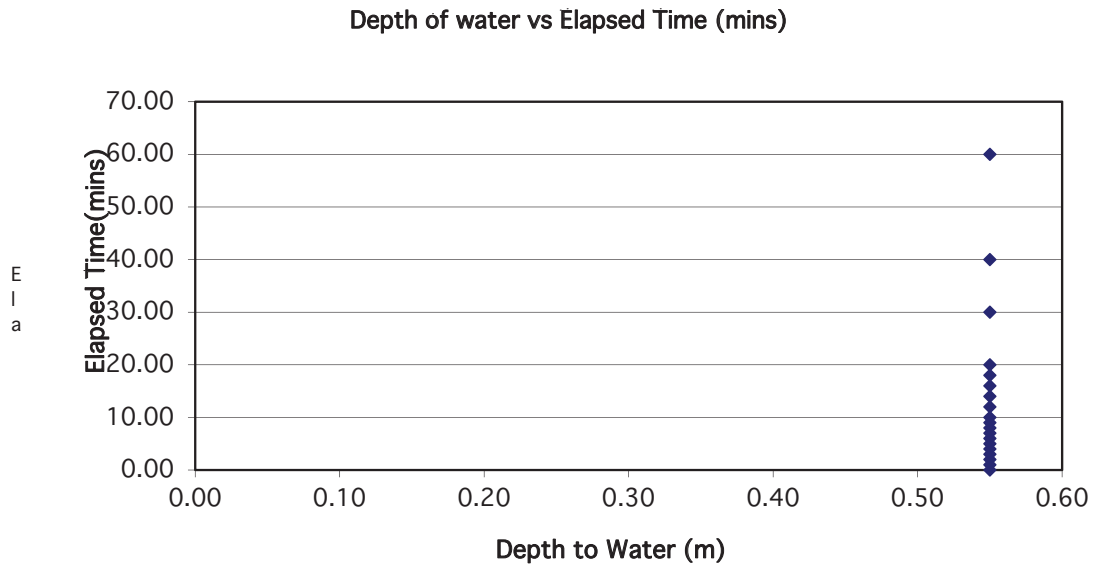
Depth to Water (m)	Elapsed Time (min)
0.55	0.00
0.55	1.00
0.55	2.00
0.55	3.00
0.55	4.00
0.55	5.00
0.55	6.00
0.55	7.00
0.55	8.00
0.55	9.00
0.55	10.00
0.55	12.00
0.55	14.00
0.55	16.00
0.55	18.00
0.55	20.00
0.55	30.00
0.55	40.00
0.55	60.00

Field Test

Depth of Pit (D)	1.50	m
Width of Pit (B)	0.80	m
Length of Pit (L)	1.30	m
Initial depth to Water =	0.55	m
Final depth to water =	0.55	m
Elapsed time (mins)=	60.00	
Top of permeable soil	-	m
Base of permeable soil	-	m
Base area=	1.04	m2
*Av. side area of permeable stratum over test perio	3.99	m2
Total Exposed area =	5.03	m2

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

f= 0 m/min or 0 m/sec



Soakaway Design f -value from field tests (F2C) IGSL

Contract: Kilcarberry Grange Contract No. 21452
Test No. IT12
Client DBFL
Date: 23/01/2019

Summary of ground conditions

from	to	Description	Ground water
0.00	0.20	TOPSOIL	Not Encountered
0.20	1.50	Brown sandy gravelly CLAY	

Notes:

Field Data

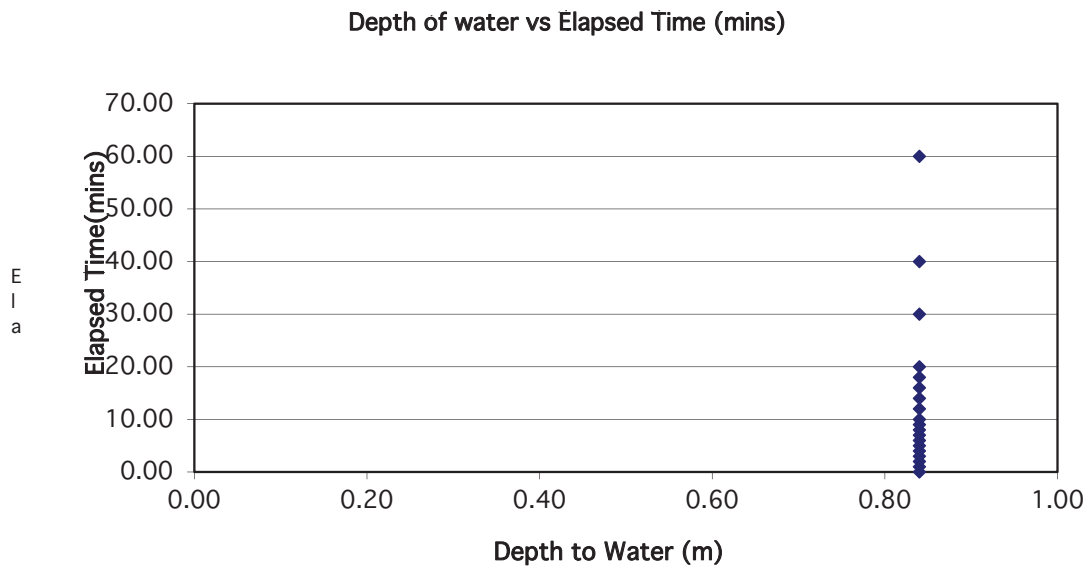
Depth to Water (m)	Elapsed Time (min)
0.84	0.00
0.84	1.00
0.84	2.00
0.84	3.00
0.84	4.00
0.84	5.00
0.84	6.00
0.84	7.00
0.84	8.00
0.84	9.00
0.84	10.00
0.84	12.00
0.84	14.00
0.84	16.00
0.84	18.00
0.84	20.00
0.84	30.00
0.84	40.00
0.84	60.00

Field Test

Depth of Pit (D)	1.50	m
Width of Pit (B)	0.80	m
Length of Pit (L)	1.40	m
Initial depth to Water =	0.84	m
Final depth to water =	0.84	m
Elapsed time (mins)=	60.00	
Top of permeable soil	-	m
Base of permeable soil	-	m
Base area=	1.12	m2
*Av. side area of permeable stratum over test perio	2.904	m2
Total Exposed area =	4.024	m2

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

f= 0 m/min or 0 m/sec



Soakaway Design f -value from field tests (F2C) IGSL

Contract: Kilcarberry Grange Contract No. 21452
Test No. IT13
Client DBFL
Date: 18/01/2019

Summary of ground conditions

from	to	Description	Ground water
0.00	0.20	TOPSOIL	Not Encountered
0.20	1.50	Brown sandy gravelly CLAY	

Notes:

Field Data

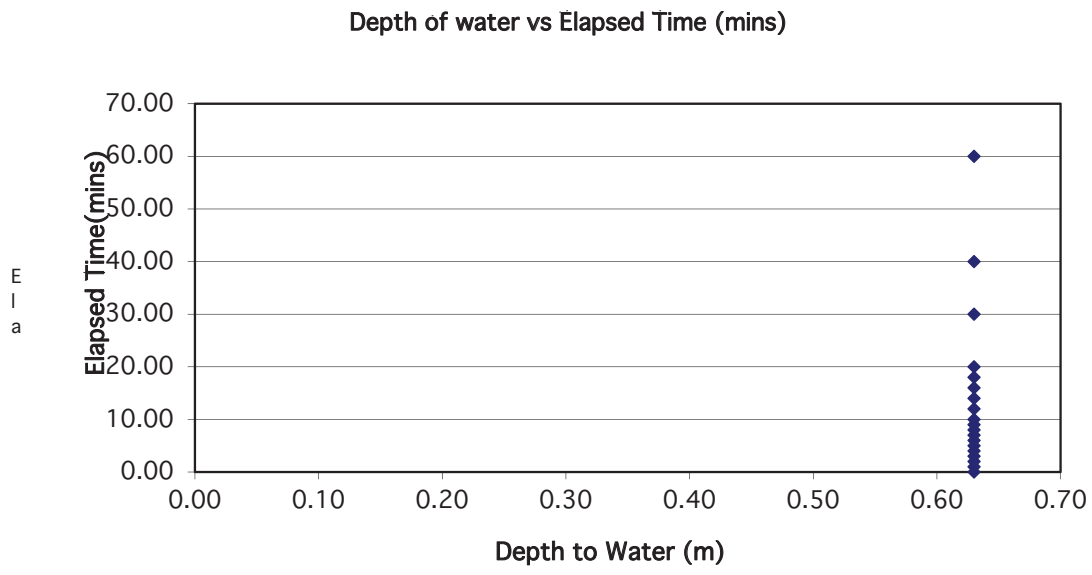
Depth to Water (m)	Elapsed Time (min)
0.63	0.00
0.63	1.00
0.63	2.00
0.63	3.00
0.63	4.00
0.63	5.00
0.63	6.00
0.63	7.00
0.63	8.00
0.63	9.00
0.63	10.00
0.63	12.00
0.63	14.00
0.63	16.00
0.63	18.00
0.63	20.00
0.63	30.00
0.63	40.00
0.63	60.00

Field Test

Depth of Pit (D)	1.50	m
Width of Pit (B)	0.90	m
Length of Pit (L)	1.30	m
Initial depth to Water =	0.63	m
Final depth to water =	0.63	m
Elapsed time (mins)=	60.00	
Top of permeable soil	-	m
Base of permeable soil	-	m
Base area=	1.17	m2
*Av. side area of permeable stratum over test perio	3.828	m2
Total Exposed area =	4.998	m2

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

f= 0 m/min or 0 m/sec



IT11

IT12

IT13

IT15

Appendix 7

Plate Bearing Test Records

PLATE TEST REPORT SHEET (F3.1)

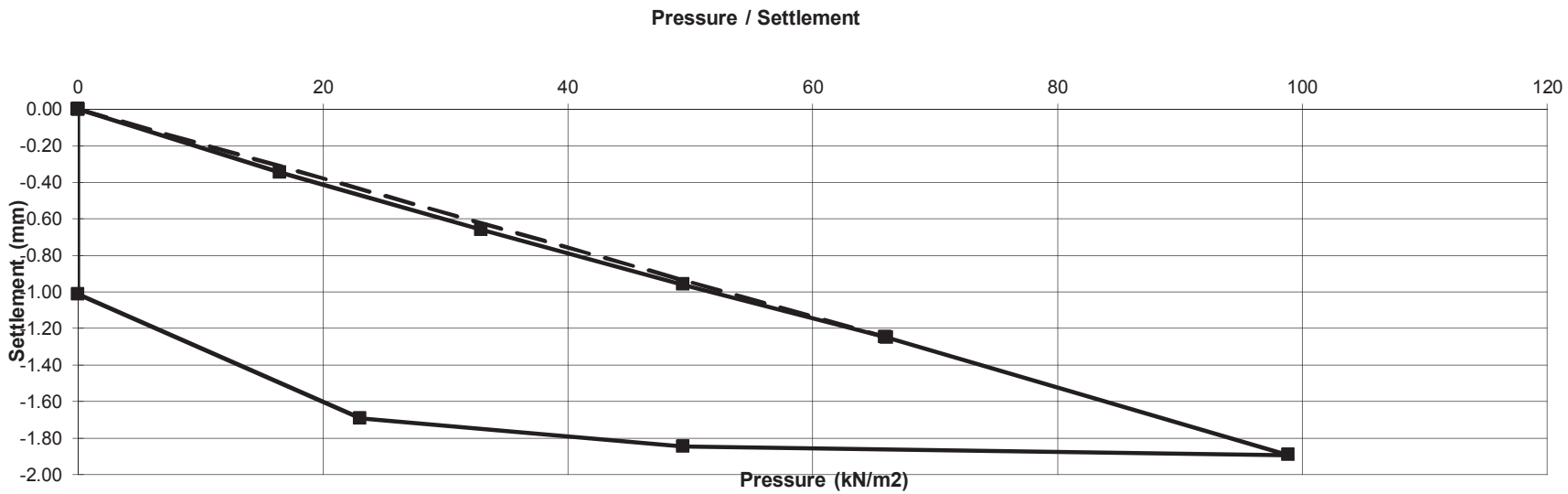
Applied Pressure/Settlement Curve

Reference No.	R97021
Contract	Kilcarberry Grange
Test No.	PT 11 Load
Location	704965.896 E 731007.694 N
Depth	72.668m
Client	DBFL
Plate Diameter:	450 mm
Test Method	BS 1377: Part 9: 1990 Test4 - Incremental Loading Test
Technician	K.Maher
Authorised by	
Date	19/12/2018

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

Brown sandy gravelly CLAY

Sample Ref No. N/A



Gradient at 1.25 mm settlement intersection = 53
Modulus of subgrade reaction = 34 MPa/m
Correction factor applied = 0.64 as per HD 25-26/10

Equivalent CBR value in accordance with NRA HD25-26/10 4.3 %

PLATE TEST REPORT SHEET (F3.1)

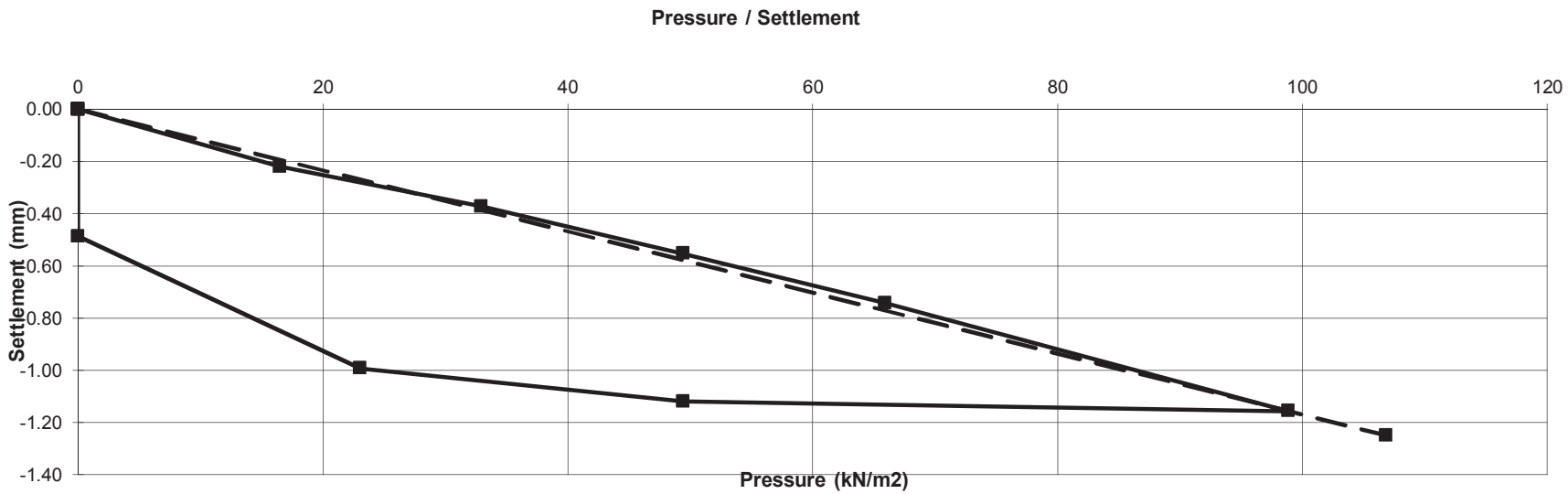
Applied Pressure/Settlement Curve

Reference No.	R97021
Contract	Kilcarberry Grange
Test No.	PT 11 ReLoad
Location	704965.896 E 731007.694 N
Depth	72.668m
Client	DBFL
Plate Diameter:	450 mm
Test Method	BS 1377: Part 9: 1990 Test4 - Incremental Loading Test
Technician	K.Maher
Authorised by	
Date	19/12/2018

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

Brown sandy gravelly CLAY

Sample Ref No. N/A



Gradient at 1.25 mm settlement intersection = 85
Modulus of subgrade reaction = 55 MPa/m
Correction factor applied = 0.64 as per HD 25-26/10

Equivalent CBR value in accordance with NRA HD25-26/10 10.0 %

PLATE TEST REPORT SHEET (F3.1)

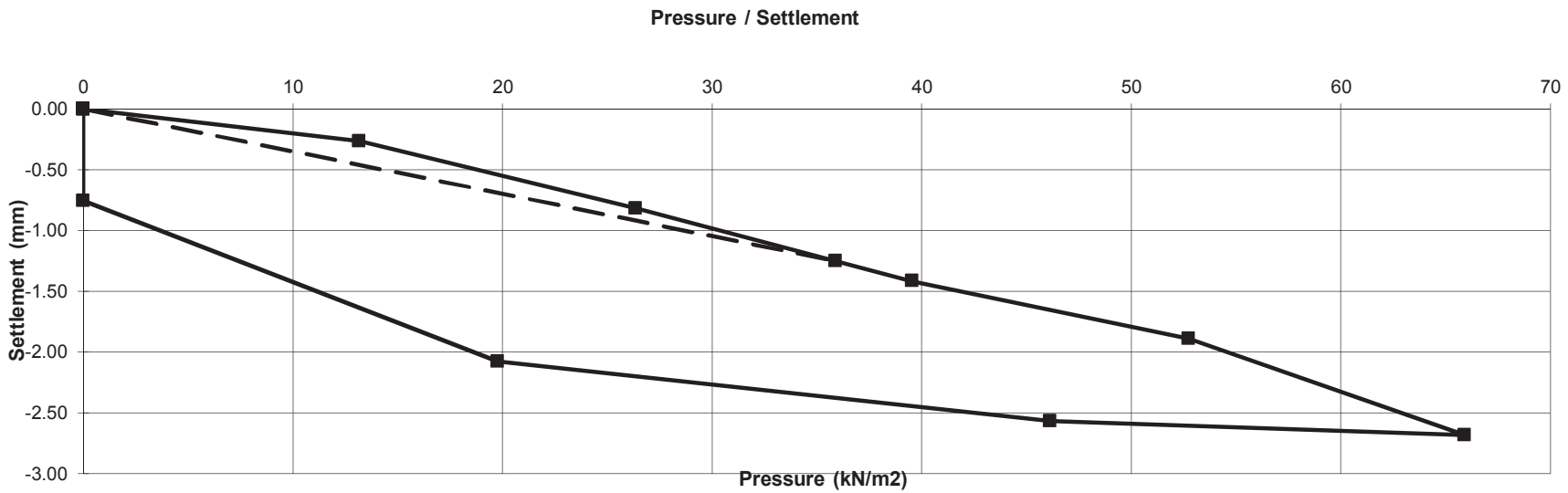
Applied Pressure/Settlement Curve

Reference No.	R98150
Contract	Kilcarberry Grange
Test No.	PT 12 Load
Location	705099.335 E 730905.932 N
Depth	71.576m
Client	DBFL
Plate Diameter:	450 mm
Test Method	BS 1377: Part 9: 1990 Test4 - Incremental Loading Test
Technician	Shaun Hughes
Authorised by	
Date	17/01/2019

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

Brown sandy gravelly CLAY

Sample Ref No. N/A



Gradient at 1.25 mm settlement intersection = 29
Modulus of subgrade reaction = 18 MPa/m
Correction factor applied = 0.64 as per HD 25-26/10

Equivalent CBR value in accordance with NRA HD25-26/10 1.5 %

PLATE TEST REPORT SHEET (F3.1)

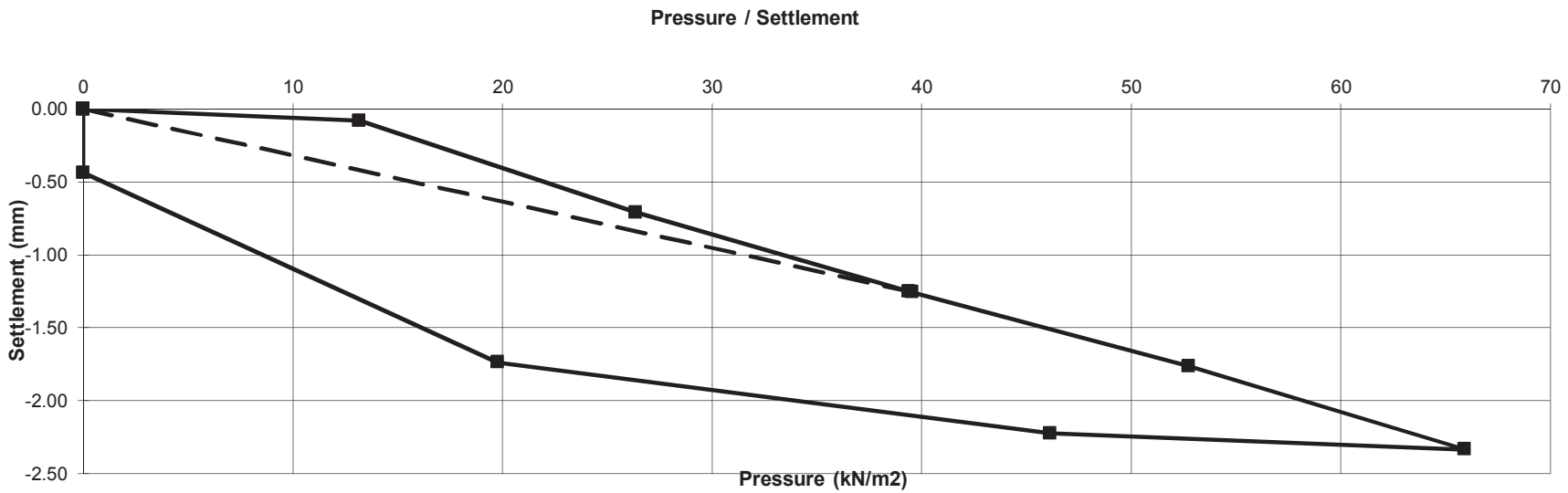
Applied Pressure/Settlement Curve

Reference No.	R98150
Contract	Kilcarberry Grange
Test No.	PT 12 ReLoad
Location	705099.335 E 730905.932 N
Depth	71.576m
Client	DBFL
Plate Diameter:	450 mm
Test Method	BS 1377: Part 9: 1990 Test4 - Incremental Loading Test
Technician	Shaun Hughes
Authorised by	
Date	17/01/2019

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

Brown sandy gravelly CLAY

Sample Ref No. N/A



Gradient at 1.25 mm settlement intersection = 32
Modulus of subgrade reaction = 20 MPa/m
Correction factor applied = 0.64 as per HD 25-26/10

Equivalent CBR value in accordance with NRA HD25-26/10 1.8 %

PLATE TEST REPORT SHEET (F3.1)

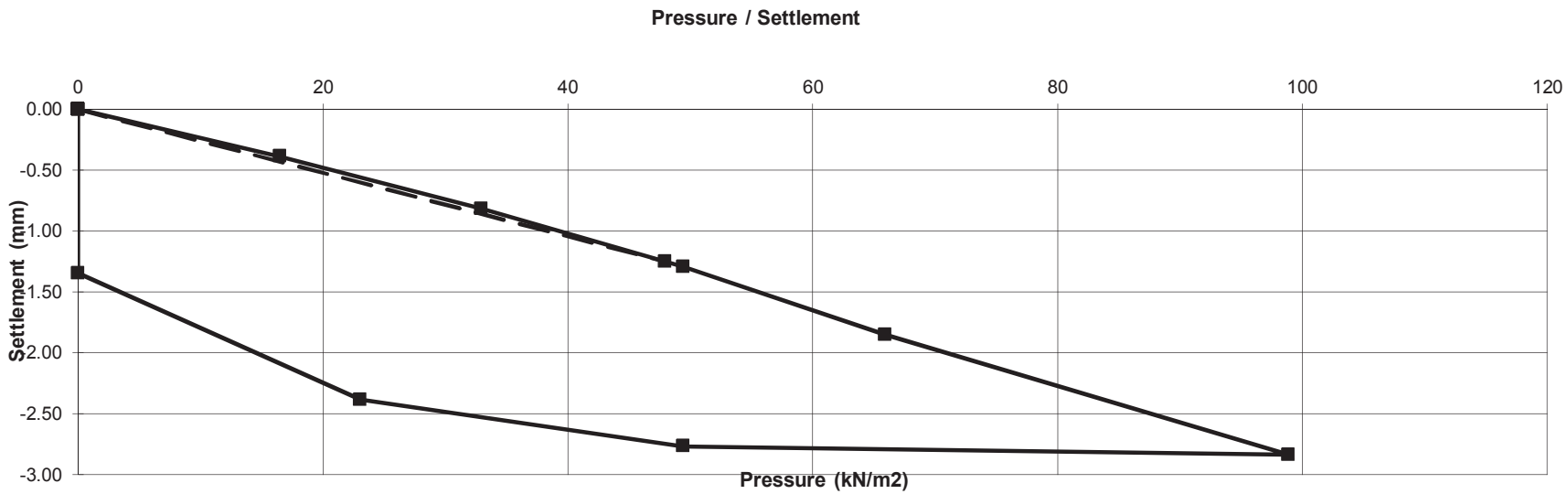
Applied Pressure/Settlement Curve

Reference No.	R97024
Contract	Kilcarberry Grange
Test No.	PT 21 Load
Location	705155.953 E 731000.118 N
Depth	71.08m
Client	DBFL
Plate Diameter:	450 mm
Test Method	BS 1377: Part 9: 1990 Test4 - Incremental Loading Test
Technician	K.Maher
Authorised by	
Date	19/12/2018

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

Brown sandy gravelly CLAY

Sample Ref No. N/A



Gradient at 1.25 mm settlement intersection = 38
Modulus of subgrade reaction = 25 MPa/m
Correction factor applied = 0.64 as per HD 25-26/10

Equivalent CBR value in accordance with NRA HD25-26/10 2.5 %

PLATE TEST REPORT SHEET (F3.1)

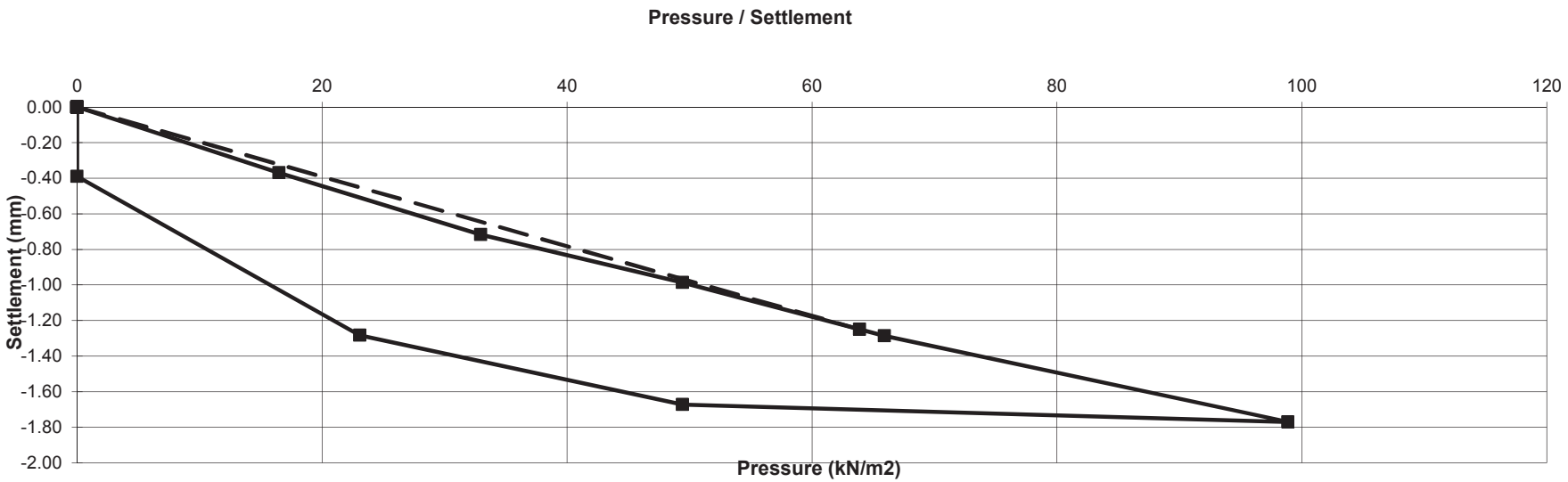
Applied Pressure/Settlement Curve

Reference No.	R97024
Contract	Kilcarberry Grange
Test No.	PT 21 ReLoad
Location	705155.953 E 731000.118 N
Depth	71.08m
Client	DBFL
Plate Diameter:	450 mm
Test Method	BS 1377: Part 9: 1990 Test4 - Incremental Loading Test
Technician	K.Maher
Authorised by	
Date	19/12/2018

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

Brown sandy gravelly CLAY

Sample Ref No. N/A



Gradient at 1.25 mm settlement intersection = 51
Modulus of subgrade reaction = 33 MPa/m
Correction factor applied = 0.64 as per HD 25-26/10

Equivalent CBR value in accordance with NRA HD25-26/10 4.1 %

PLATE TEST REPORT SHEET (F3.1)

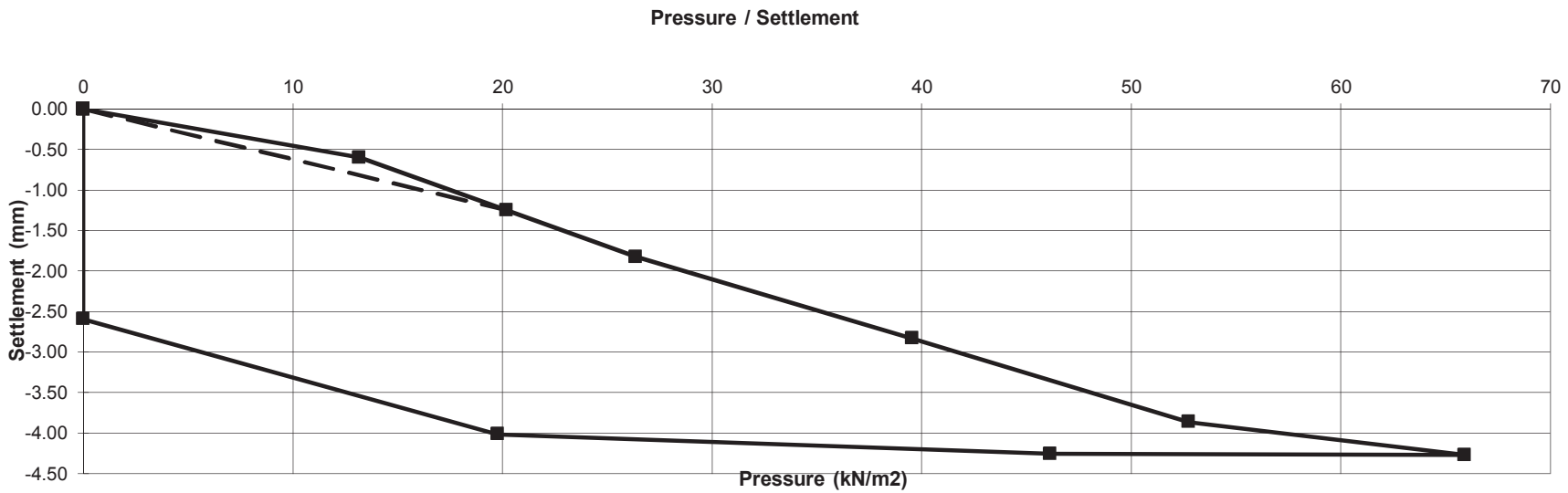
Applied Pressure/Settlement Curve

Reference No.	R98157
Contract	Kilcarberry Grange
Test No.	PT 22 Load
Location	705184.805 E 730991.353 N
Depth	71.008m
Client	DBFL
Plate Diameter:	450 mm
Test Method	BS 1377: Part 9: 1990 Test4 - Incremental Loading Test
Technician	Shaun Hughes
Authorised by	
Date	17/01/2019

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

Brown sandy gravelly CLAY

Sample Ref No. N/A



Gradient at 1.25 mm settlement intersection = 16
Modulus of subgrade reaction = 10 MPa/m
Correction factor applied = 0.64 as per HD 25-26/10

Equivalent CBR value in accordance with NRA HD25-26/10 0.6 %

PLATE TEST REPORT SHEET (F3.1)

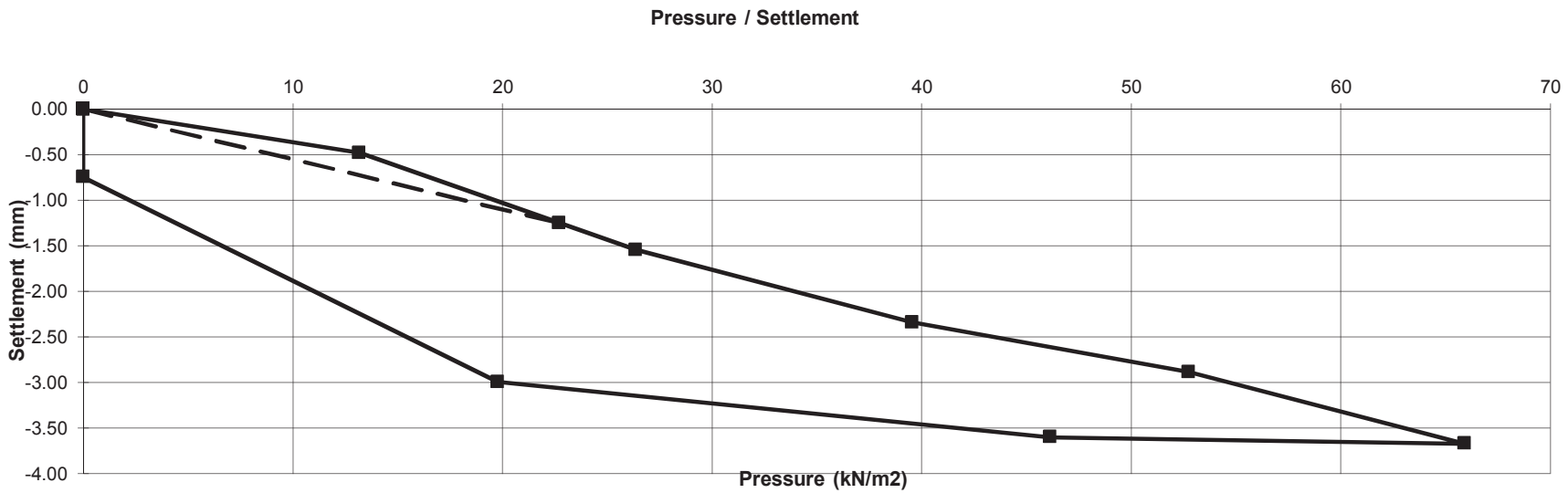
Applied Pressure/Settlement Curve

Reference No.	R98157
Contract	Kilcarberry Grange
Test No.	PT 22 ReLoad
Location	705184.805 E 730991.353 N
Depth	71.008m
Client	DBFL
Plate Diameter:	450 mm
Test Method	BS 1377: Part 9: 1990 Test4 - Incremental Loading Test
Technician	Shaun Hughes
Authorised by	
Date	17/01/2019

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

Brown sandy gravelly CLAY

Sample Ref No. N/A



Gradient at 1.25 mm settlement intersection = 18
Modulus of subgrade reaction = 12 MPa/m
Correction factor applied = 0.64 as per HD 25-26/10

Equivalent CBR value in accordance with NRA HD25-26/10 0.7 %

Appendix 8

Geotechnical Laboratory Testing

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

Test Report

Determination of Moisture Content, Liquid & Plastic Limits

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

ISO 17025 IVNAB ACCREDITED TESTING DETAILED IN SCOPE REG NO.133T

Report No. **R98469** Contract No. 21452 Contract Name: Kilcarbery Housing Scheme , Grange Castle , Dublin

Customer DBFL / Adwood JV

Samples Received: 07/02/19 Date Tested: 07/02/19

BH/TP	Sample No.	Depth (m)	Lab. Ref	Sample Type	Moisture Content %	Liquid Limit %	Plastic Limit %	Plasticity Index	% <425µm	Preparation	Liquid Limit Clause	Classification (BS5930)	Description
TP02	AA3248	0.8	A19/0340	B	33	52	34	18	77	WS	4.4	M H	Black sandy, gravelly, SILT
TP02	AA3250	2.5	A19/0341	B	11	38	20	18	75	WS	4.4	C I	Black slightly sandy, gravelly, CLAY
TP03	AA110103	2.0	A19/0342	B	22	24	NP	NP	100	WS	4.4		ark brown/black SILT
TP03	AA110104	2.6	A19/0343	B	12	28	15	13	58	WS	4.4	C L	Black slightly sandy, gravelly, CLAY
TP04	AA110103	1.0	A19/0344	B	52	35	20	15	98	WS	4.4	C L	Grey slightly gravelly, slightly sandy, CLAY
TP04	AA110107	2.8	A19/0345	B	22	28	NP	NP	99	WS	4.4		Grey slightly sandy, SILT
TP07	AA110136	1.6	A19/0346	B	11	39	20	19	36	WS	4.4	C I	Black clayey, sandy, GRAVEL with some cobbles
TP10	AA110149	1.5	A19/0347	B	21	37	21	16	59	WS	4.4	C I	Grey/black sandy gravelly CLAY
TP13	AA110138	1.6	A19/0348	B	14	35	20	15	87	WS	4.4	C L	Grey/black sandy gravelly CLAY
TP19	AA3242	3.0	A19/0350	B	13	33	18	15	47	WS	4.4	C L	Black slightly sandy, slightly gravelly, CLAY
TP22	AA110119	0.8	A19/0351	B	16	34	20	14	70	WS	4.4	C L	Brown sandy gravelly CLAY
TP27	AA110172	1.0	A19/0352	B	18	35	21	14	46	WS	4.4	C L	Grey sandy gravelly CLAY
TP36	AA110180	1.0	A19/0353	B	21	38	22	16	86	WS	4.4	C I	Brown slightly sandy, slightly gravelly, CLAY
TP39	AA110129	1.0	A19/0354	B	16.6	39	20	19	68	WS	4.4	C I	Brown slightly sandy, slightly gravelly, CLAY
TP55	AA115177	0.6	A19/0355	B	15	35	21	14	61	WS	4.4	C L	Grey sandy gravelly CLAY

Notes:
Preparation: WS - Wet sieved; AR - As received; NP - Non plastic
Liquid Limit Clause: 4.3 Cone Penetrometer definitive method; 4.4 Cone Penetrometer one point method
Sample Type: B - Bulk Disturbed; U - Undisturbed

Remarks:

NOTE: *Clause 3.2 of BS1377 is a "withdrawn" standard due to publication of ISO17892-1:2014
Opinions and interpretations are outside the scope of accreditation.
The results relate to the specimens tested. Any remaining material will be retained for one month.

IGSL Ltd Materials Laboratory

Persons authorized to approve reports

H Byrne (Laboratory Manager)

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H Byrne	19/3/19	1 of 1

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

Test Report

Determination of Moisture Content, Liquid & Plastic Limits

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

ISO 17025 IVNAB ACCREDITED TESTING DETAILED IN SCOPE REG NO.133T

Report No. **R98470** Contract No. 21452 Contract Name: Kilcarbery Housing Scheme , Grange Castle , Dublin

Customer DBFL / Adwood JV

Samples Received: 07/02/19 Date Tested: 07/02/19

BH/TP	Sample No.	Depth (m)	Lab. Ref	Sample Type	Moisture Content %	Liquid Limit %	Plastic Limit %	Plasticity Index	% <425µm	Preparation	Liquid Limit Clause	Classification (BS5930)	Description
TP57	AA115183	1.2	A19/0356	B	17	34	17	17	59	WS	4.4	C L	Brown slightly sandy, slightly gravelly, CLAY
TP57	AA115184	2.2	A19/0357	B	20	38	21	17	46	WS	4.4	C I	Brown sandy gravelly CLAY
TP61	AA110197	1.0	A19/0358	B	16	34	21	13	59	WS	4.4	C L	Grey/brown sandy gravelly CLAY
TP63	AA115187	0.6	A19/0359	B	17	49	NP	NP	74	WS	4.4		Mottled grey/brown slightly sandy slightly gravelly SILT
BH02	AA97129	1.5	A19/0361	B	14	32	17	15	38	WS	4.4	C L	Brown sandy gravelly CLAY
BH04	AA98100	1.0	A19/0362	B	22	33	23	10	87	WS	4.4	C L	Brown slightly sandy, slightly gravelly, CLAY with some cobbles
BH06	AA97102	2.0	A19/0363	B	15	36	20	16	55	WS	4.4	C I	Brown slightly sandy, slightly gravelly, CLAY with some cobbles
BH07	AA101053	2.0	A19/0364	B	30	38	23	15	86	WS	4.4	C I	Brown slightly sandy, slightly gravelly, CLAY
BH10	AA97123	2.0	A19/0365	B	20	34	18	16	46	WS	4.4	C L	Brown slightly sandy, slightly gravelly, CLAY
BH11	AA97126	2.0	A19/0366	B	14	34	NP	NP	59	WS	4.4		Brown slightly silty, slightly sandy, GRAVEL
BH13	AA97108	2.0	A19/0367	B	14	38	20	18	65	WS	4.4	C I	Brown sandy, slightly gravelly, CLAY
BH14	AA97105	2.0	A19/0368	B	15	37	18	19	47	WS	4.4	C I	Brown sandy gravelly CLAY
BH15	AA97111	1.0	A19/0369	B	18	40	20	20	75	WS	4.4	C I	Grey slightly sandy gravelly CLAY
BH16	AA97117	2.0	A19/0370	B	17	35	20	15	46	WS	4.4	C L	Brown slightly sandy, slightly gravelly, CLAY

Notes:
Preparation: WS - Wet sieved; AR - As received; NP - Non plastic
Liquid Limit Clause: 4.3 Cone Penetrometer definitive method; 4.4 Cone Penetrometer one point method
Sample Type: B - Bulk Disturbed; U - Undisturbed

Remarks:

NOTE: *Clause 3.2 of BS1377 is a "withdrawn" standard due to publication of ISO17892-1:2014
Opinions and interpretations are outside the scope of accreditation.
The results relate to the specimens tested. Any remaining material will be retained for one month.

IGSL Ltd Materials Laboratory

Persons authorized to approve reports

H Byrne (Laboratory Manager)

Approved by: H Byrne

Date: 19/3/19

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

Test Report

Determination of Moisture Content, Liquid & Plastic Limits

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

ISO 17025 INAB ACCREDITED TESTING DETAILED IN SCOPE REG NO. 133T

Report No. **R98471** Contract No. 21452 Contract Name: Kilcarbery Housing Scheme , Grange Castle , Dublin

Customer DBFL / Adwood JV

Samples Received: 07/02/19 Date Tested: 07/02/19

BH/TP	Sample No.	Depth (m)	Lab. Ref	Sample Type	Moisture Content %	Liquid Limit %	Plastic Limit %	Plasticity Index	% <425µm	Preparation	Liquid Limit Clause	Classification (BS5930)	Description
TP01	AA3246	0.8	A19/0371	B	13	34	18	16	67	WS	4.4	C L	Grey/brown sandy gravelly CLAY
TP03	AA110102	1.0	A19/0372	B	26	30	18	12	78	WS	4.4	C L	Brown/black sandy gravelly CLAY
TP20	32483/44	0.8	A19/0375	B	31	54	25	29	83	WS	4.4	C H	Brown slightly sandy, slightly gravelly, CLAY
TP30	AA110166/56	0.6	A19/0378	B	16	41	24	17	92	WS	4.4	C I	Mottled brown slightly sandy, slightly gravelly, CLAY with some cobbles
TP44	AA110192/3	1.0	A19/0381	B	24	45	26	19	73	WS	4.4	C I	Brown slightly sandy, slightly gravelly, CLAY
TP51	AA115169/70	0.5	A19/0383	B	17	34	22	12	64	WS	4.4	C L	Brown slightly sandy, slightly gravelly, CLAY
TP53	AA115172/3	0.6	A19/0384	B	13	31	19	12	37	WS	4.4	C L	Brown slightly sandy, gravelly, CLAY
TP65	AA115189/90	0.6	A19/0387	B	15	35	20	15	65	WS	4.4	C L	Mottled grey/brown slightly sandy, slightly gravelly, CLAY

Notes:
Preparation: WS - Wet sieved; AR - As received; NP - Non plastic
Liquid Limit Clause: 4.3 Cone Penetrometer definitive method; 4.4 Cone Penetrometer one point method
Sample Type: B - Bulk Disturbed; U - Undisturbed

Remarks:

NOTE: *Clause 3.2 of BS1377 is a "withdrawn" standard due to publication of ISO17892-1:2014
Opinions and interpretations are outside the scope of accreditation.
The results relate to the specimens tested. Any remaining material will be retained for one month.

IGSL Ltd Materials Laboratory

Persons authorized to approve reports

H Byrne (Laboratory Manager)

Approved by	Date	Page
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TEST REPORT
Determination of Particle Size Distribution

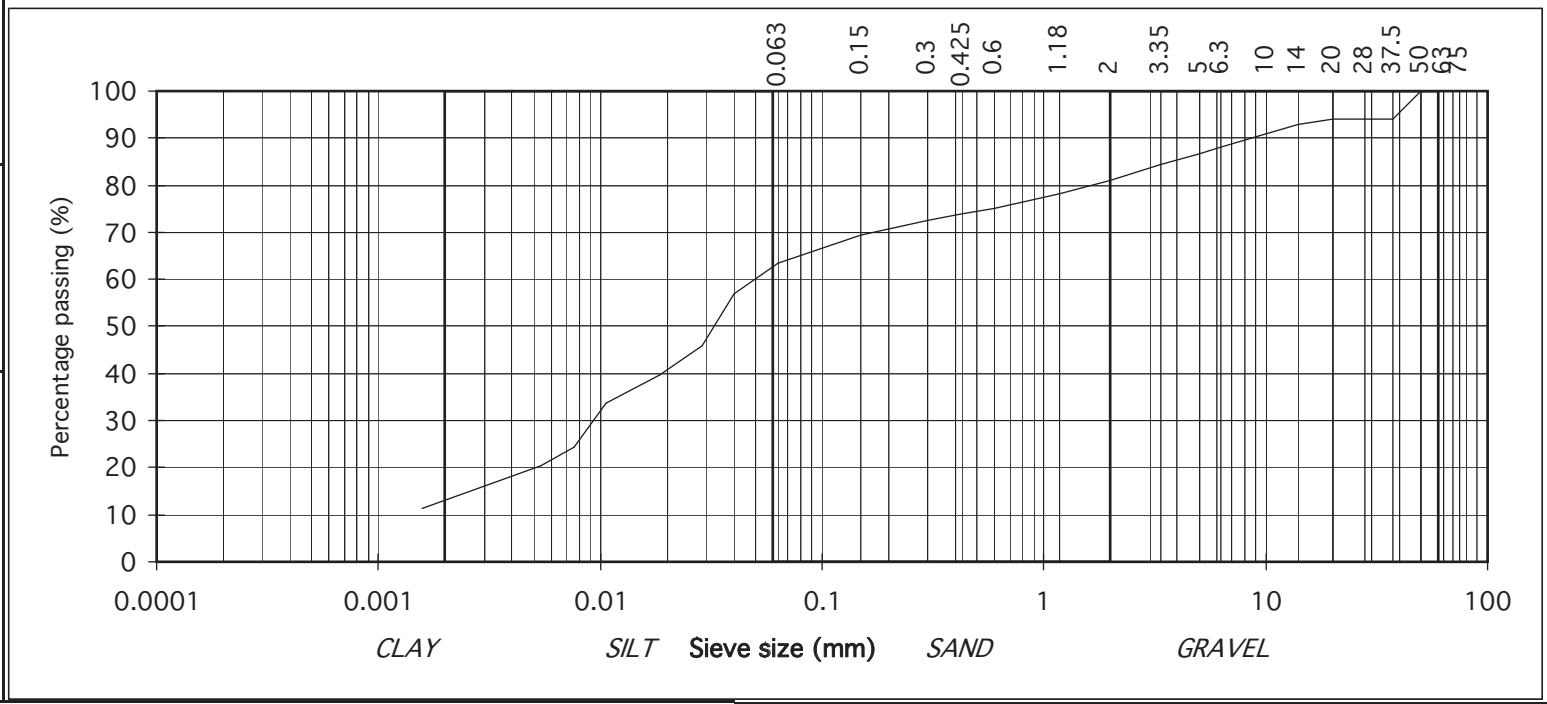
Tested in accordance with: BS1377:Part2:1990 , clause 9.2 & 9.5
(note: Sedimentation stage not accredited)

ISO 17025 IVNAB ACCREDITED TESTING DETAILED IN SCOPE REG NO. 1337

particle size	% passing	
75	100	COBBLES
63	100	
50	100	GRAVEL
37.5	94	
28	94	
20	94	
14	93	
10	91	
6.3	88	
5	87	
3.35	84	
2	81	
1.18	78	SAND
0.6	75	
0.425	74	
0.3	73	
0.15	69	
0.063	63	SILT/CLAY
0.040	57	
0.029	46	
0.018	40	
0.011	34	
0.008	24	
0.005	20	
0.002	11	

Contract No: 21452 Report No. R98567
Contract: Kilcarberry Housing Scheme,Grange Castle , Dublin
BH/TP : TP44
Sample No. AA110192/9 Lab. Sample No. A19/0381
Sample Type: B
Depth (m) 0.50 Customer: DBFL / Adwood JV
Date Received 07/02/2019 Date Testing started 07/02/2019
Description: Brown slightly sandy, slightly gravelly, CLAY

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



IGSL Ltd Materials Laboratory

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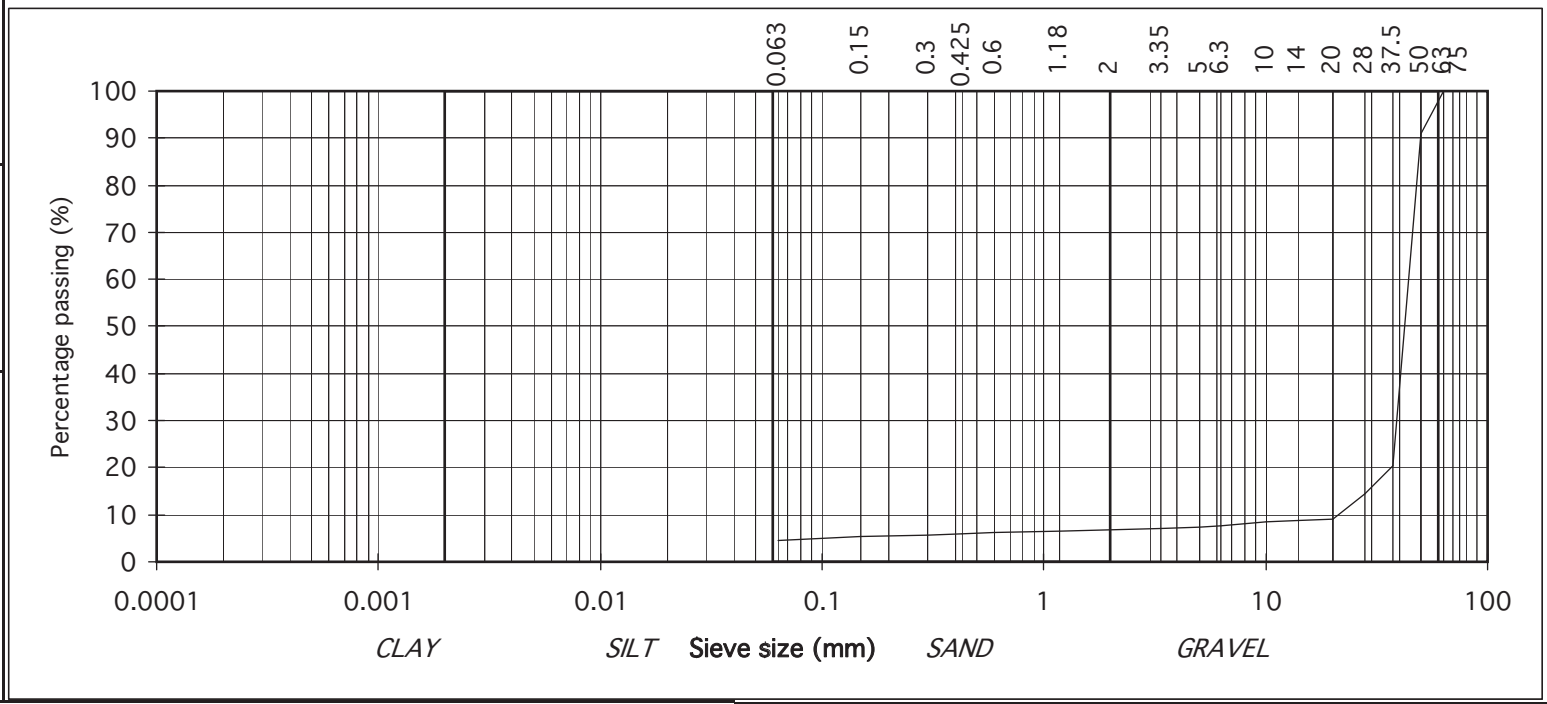
Persons authorised to approve report: J Barrett (Quality Manager) H Byrne (Laboratory Manager)

TEST REPORT
Determination of Particle Size Distribution
Tested in accordance with: BS1377:Part2:1990 , clause 9.2 & 9.5
(note: Sedimentation stage not accredited)

particle size	% passing	
75	100	COBBLES
63	100	
50	91	GRAVEL
37.5	20	
28	14	
20	9	
14	9	
10	8	
6.3	8	
5	7	
3.35	7	
2	7	
1.18	6	SAND
0.6	6	
0.425	6	
0.3	6	
0.15	5	
0.063	4	SILT/CLAY

Contract No: 21452 Report No. R99035
Contract: Kilcarberry Housing Scheme,Grange Castle , Dublin
BH/TP : BH11
Sample No. AA97126 Lab. Sample No. A19/0366
Sample Type: B
Depth (m) 2.00 Customer: DBFL / Adwood JV
Date Received 07/02/2019 Date Testing started 22/02/2019
Description: Brown slightly silty, slightly sandy, GRAVEL

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



IGSL Ltd Materials Laboratory

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

IGSL Ltd
Materials Laboratory
Unit J5,M7 Business Park
Naas
Co. Kildare
045 899324

Test Report

Determination of Moisture Condition Value at Natural Moisture Content

Tested in accordance with BS1377:Part 4:1990, clause 5.4

ISO 17025 IVNAB ACCREDITED TESTING DETAILED IN SCOPE REG NO. 133T

Report No.	**R98473**
Contract No.	21452
Contract Name:	Kilcarbery Housing Scheme , Grange Castle , Dublin
Customer:	DBFL/Adwood JV
BH/TP	TP23
Sample No.	AA110120
Depth (m)	0.60
Sample Type:	B
Lab Sample No.	A19/0376
Source (if applicable)	unknown
Material Type (if applicable):	B
Sample Received:	07/02/19
Date Tested:	07/02/19
Sample Cert:	N/A
Moisture Content (%):	23
% Particles > 20mm (By dry mass):	6.5
MCV:	0.6
Interpretation of Plot:	Steepest Straight Line
Description of Soil:	Brown sandy gravelly SILT/CLAY

The result relates to the specimen tested.
Any remaining material will be retained for one month.
Sampling and opinions and interpretations are outside the scope of accreditation.

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

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IGSL Ltd
Materials Laboratory
Unit J5,M7 Business Park
Naas
Co. Kildare
045 899324

Test Report

Determination of Moisture Condition Value at Natural Moisture Content

Tested in accordance with BS1377:Part 4:1990, clause 5.4

ISO 17025 INAB ACCREDITED TESTING DETAILED IN SCOPE REG NO. 133T

Report No.	**R98474**
Contract No.	21452
Contract Name:	Kilcarbery Housing Scheme , Grange Castle , Dublin
Customer:	DBFL/Adwood JV
BH/TP	TP40
Sample No.	AA110192/3
Depth (m)	0.60
Sample Type:	B
Lab Sample No.	A19/0380
Source (if applicable)	unknown
Material Type (if applicable):	B
Sample Received:	07/02/19
Date Tested:	07/02/19
Sample Cert:	N/A
Moisture Content (%):	17
% Particles > 20mm (By dry mass):	13
MCV:	7.2
Interpretation of Plot:	Steepest Straight Line
Description of Soil:	Brown slightly sandy gravelly SILT/CLAY

The result relates to the specimen tested.
Any remaining material will be retained for one month.
Sampling and opinions and interpretations are outside the scope of accreditation.

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

IGSL Ltd Materials Laboratory	Approved by	Date	Page
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IGSL Ltd
Materials Laboratory
Unit J5,M7 Business Park
Naas
Co. Kildare
045 899324

Test Report

Determination of Moisture Condition Value at Natural Moisture Content

Tested in accordance with BS1377:Part 4:1990, clause 5.4

ISO 17025 INAB ACCREDITED TESTING DETAILED IN SCOPE REG NO. 133T

Report No.	**R98632**
Contract No.	21452
Contract Name:	Kilcarbery Housing Scheme , Grange Castle , Dublin
Customer:	DBFL/Adwood JV
BH/TP	TP44
Sample No.	AA110192/93
Depth (m)	0.50
Sample Type:	B
Lab Sample No.	A19/0381
Source (if applicable)	unknown
Material Type (if applicable):	B
Sample Received:	07/02/19
Date Tested:	13/02/19
Sample Cert:	N/A
Moisture Content (%):	23
% Particles > 20mm (By dry mass):	5
MCV:	9.4
Interpretation of Plot:	Steepest Straight Line
Description of Soil:	Brown slightly sandy, slightly gravelly, CLAY

The result relates to the specimen tested.
Any remaining material will be retained for one month.
Sampling and opinions and interpretations are outside the scope of accreditation.

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

IGSL Ltd Materials Laboratory	Approved by	Date	Page
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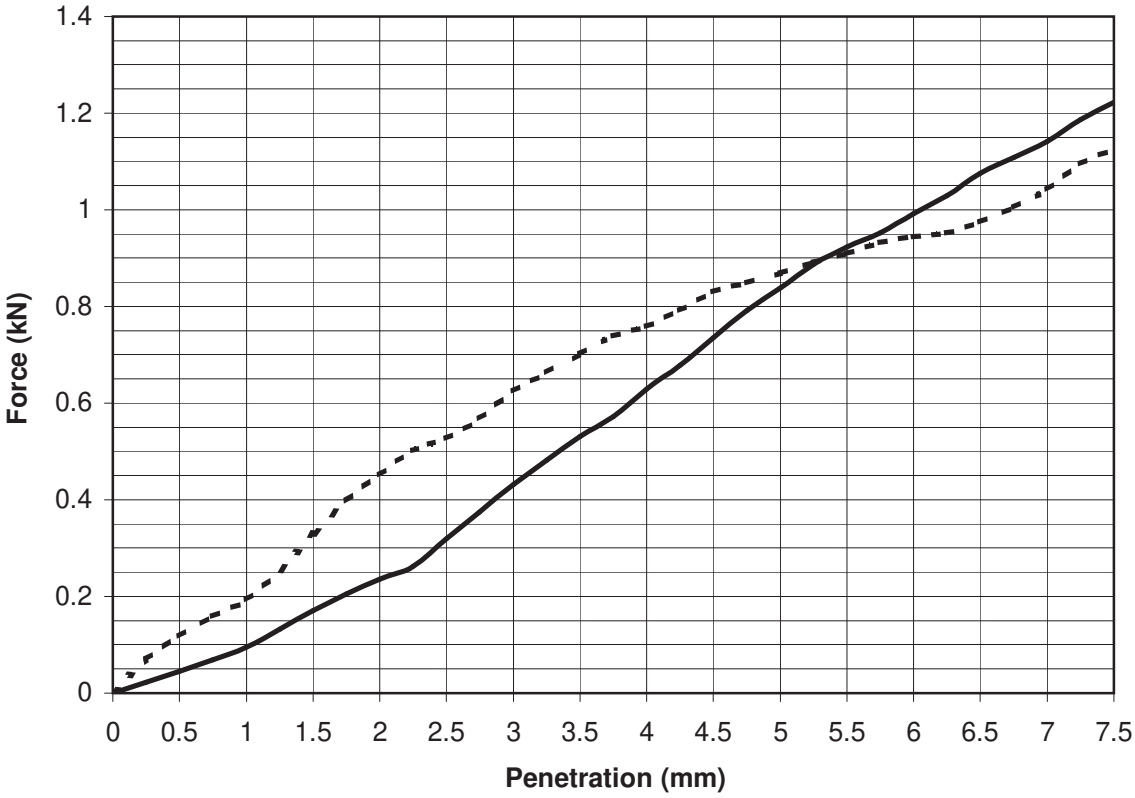
IGSL Ltd
Materials Laboratory
Unit J5,M7 Business Park
Naas Co.Kildare
045 899324

TEST REPORT
Determination of California Bearing Ratio (CBR)

Tested in accordance with BS1377:Part 4:1990, clause 7

ISO 17025 INAB ACCREDITED TESTING DETAILED IN SCOPE REG NO.133T

Report No.	R98660	Contract	Kilcarberry Housing Scheme,Grange Castle,Dublin
Contract No.	21452	Customer	DBFL/Adwood JV
Date received	07/02/19	Date Tested	14/02/19
BH/TP No.	TP44	Sample No.	AA110192/93 Type: B
Depth (m)	0.50	Lab sample No.	A19/0381



Key: ———— Top ---------- Base

Description:	Brown slightly sandy, slightly gravelly, CLAY		
Initial Condition:	Unsoaked		
Moisture Content (%):	23	Bulk Density (Mg/m^3):	1.99
Surcharge (kg):	4	Dry Density (Mg/m^3):	1.61
% Material >20mm:	4		
Method of compaction:	Static Compaction Method 2		

Test Result	Top	Base
CBR %	**4.2**	**4.4**
Moisture Content %	23	23

Persons authorized to approve reports

J Barrett (Quality Manager)
H Byrne (Laboratory Manager)

IGSL Ltd Materials Laboratory

Approved by	Date	Page No.
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IGSL Ltd
Materials Laboratory
M7 Business Park
Naas
Co. Kildare

Test Report

Dry Density/Moisture Content Relationship

Tested in accordance with BS1377:Part 4:1990

ISO 17025 INAB ACCREDITED TESTING DETAILED IN SCOPE REG NO. 133T

Report No. R98774 Contract No. 21452

Contract Name: Kilcarberry Housing Scheme , Grange Castle , Dublin

Lab Contract No. 21452 Location: TP44

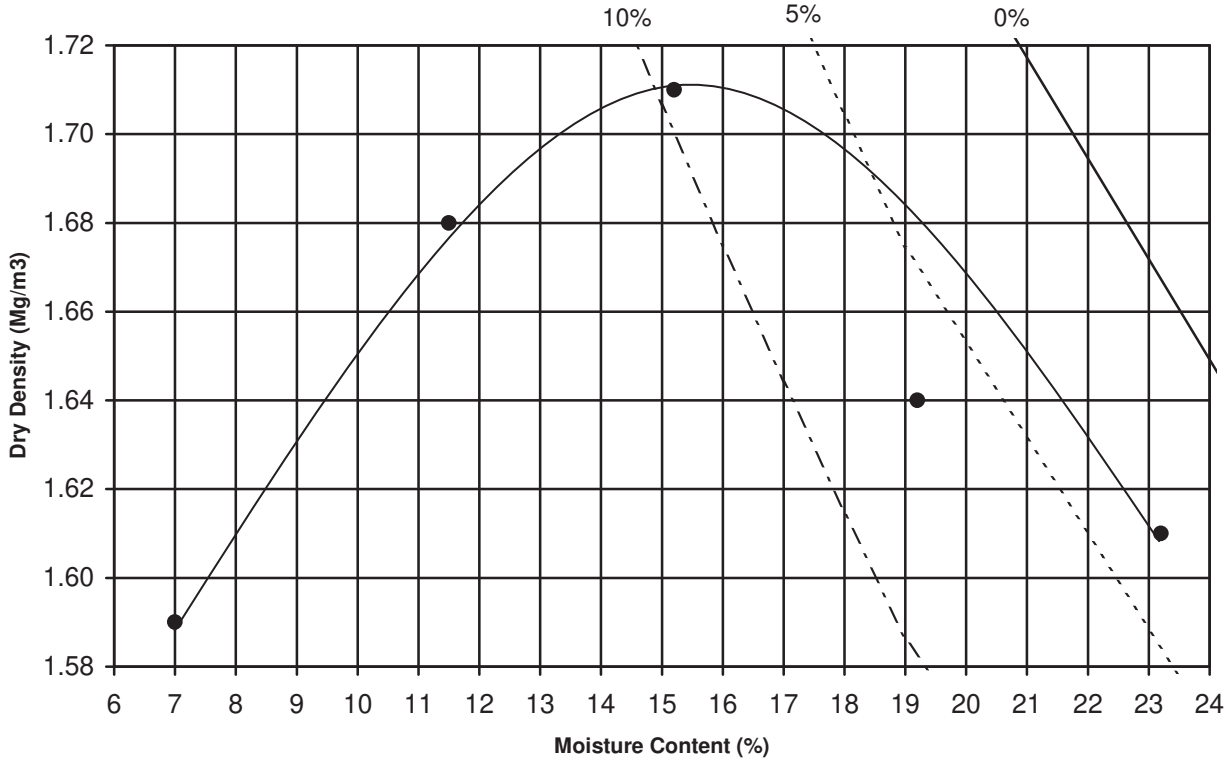
Sample No. AA110192/93 Depth (m) 0.5 Material Type B

Lab sample no. A19/0381 Customer: DBFL/Adwood JV

Date Received: 07/02/2019 Test Method: 2.5 KG Rammer

Date Tested: 14/02/2019 BS1377:Part 4:1990 3.3

Dry Density (Mg/m^3)	1.61	1.64	1.71	1.68	1.59	0.00	
Moisture Content (%)	23	19	15	12	7.0	0	



Maximum Dry Density (Mg/m^3): 1.71 Optimum Moisture Content (%): 15

Description: Brown slightly sandy, slightly gravelly, CLAY

Sample Preparation: Material passing 20mm ~~Single~~ / Separate samples used

Particle Density (Mg/m^3): 2.65 Particle Density: Assumed

% retained on 20/37.5mm sieve: 4

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

The result relates to the specimen tested.
Opinions and interpretations are outside the scope of accreditation

IGSL Materials Laboratory	Approved by	Date	Page
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(Diametrial) POINT LOAD STRENGTH INDEX TEST DATA

Contract: Kilcarbery Grange
Contract no. 21452
Date of test: 19/6/19

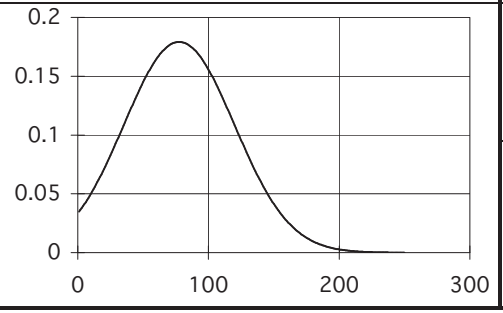
Sample Type: Core

RC No.	Depth m	D (Diameter) mm	P (failure load) kN	F	Is (index strength) Mpa	Is(50) (index strength) Mpa	*UCS MPa	Type	Orienation
RC01	3.4	78	22.0	1.222	3.62	4.42	88	d	//
	4.8	78	21.0	1.222	3.45	4.22	84	d	//
	4.9	78	32.0	1.222	5.26	6.42	128	d	//
	5.1	78	36.0	1.222	5.92	7.23	145	d	//
RC02	4.1	78	11.0	1.222	1.81	2.21	44	d	//
	5.2	78	26.0	1.222	4.27	5.22	104	d	//
	6.6	78	16.0	1.222	2.63	3.21	64	d	//
	6.8	78	4.0	1.222	0.66	0.80	16	d	//
RC03	3.4	78	28.0	1.222	4.60	5.62	112	d	//
	4.2	78	9.0	1.222	1.48	1.81	36	d	//
	4.3	78	34.0	1.222	5.59	6.83	137	d	//
	5.7	78	8.0	1.222	1.31	1.61	32	d	//
RC04	3.8	78	8.0	1.222	1.31	1.61	32	d	//
	5.2	78	29.0	1.222	4.77	5.82	116	d	//
	6.6	78	31.0	1.222	5.10	6.22	124	d	//
	7.4	78	4.0	1.222	0.66	0.80	16	d	//
RC05	4.5	78	18.0	1.222	2.96	3.61	72	d	//
	5.9	78	11.0	1.222	1.81	2.21	44	d	//
	6.5	78	19.0	1.222	3.12	3.81	76	d	//

Statistical Summary Data	Is(50)	UCS*
Number of Samples Tested	19	19
Minimum	0.80	16
Average	3.88	78
Maximum	7.23	145
Standard Dev.	2.12	42
Upper 95% Confidence Limit	8.02	160.49
Lower 95% Confidence Limit	-0.27	-5.36

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

*UCS Normal Distribution Curve



Abbreviations	
i	irregular
a	axial
b	block
d	diametral

approx. orientation to planes of weakness/bedding

U	unknown
P	perpendicular
//	parallel

(Diametrial) POINT LOAD STRENGTH INDEX TEST DATA

Contract: Kilcarbery Grange
Contract no. 21452
Date of test: 19/6/19

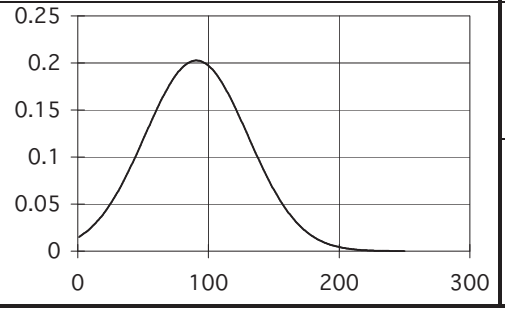
Sample Type: Core

RC No.	Depth m	D (Diameter) mm	P (failure load) kN	F	Is (index strength) Mpa	Is(50) (index strength) Mpa	*UCS MPa	Type	Orienation
RC06	4.3	78	11.0	1.222	1.81	2.21	44	d	//
	4.6	78	28.0	1.222	4.60	5.62	112	d	//
	6.2	78	35.0	1.222	5.75	7.03	141	d	//
	6.6	78	31.0	1.222	5.10	6.22	124	d	//
RC07	4.3	78	23.0	1.222	3.78	4.62	92	d	//
	5.0	78	24.0	1.222	3.94	4.82	96	d	//
	6.7	78	2.0	1.222	0.33	0.40	8	d	//
	7.5	78	15.0	1.222	2.47	3.01	60	d	//
RC08	3.0	78	32.0	1.222	5.26	6.42	128	d	//
	4.9	78	21.0	1.222	3.45	4.22	84	d	//
	5.0	78	26.0	1.222	4.27	5.22	104	d	//
	5.9	78	22.0	1.222	3.62	4.42	88	d	//
RC09	3.3	78	21.0	1.222	3.45	4.22	84	d	//
	4.4	78	31.0	1.222	5.10	6.22	124	d	//
	5.1	78	29.0	1.222	4.77	5.82	116	d	//
	5.3	78	30.0	1.222	4.93	6.02	120	d	//
RC10	4.1	78	10.0	1.222	1.64	2.01	40	d	//
	4.6	78	31.0	1.222	5.10	6.22	124	d	//
	4.7	78	28.0	1.222	4.60	5.62	112	d	//
	6.3	78	2.0	1.222	0.33	0.40	8	d	//

Statistical Summary Data	Is(50)	UCS*
Number of Samples Tested	20	20
Minimum	0.40	8
Average	4.54	91
Maximum	7.03	141
Standard Dev.	1.97	39
Upper 95% Confidence Limit	8.40	167.93
Lower 95% Confidence Limit	0.68	13.58

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

*UCS Normal Distribution Curve



Abbreviations	
i	irregular
a	axial
b	block
d	diametral

approx. orientation to planes of weakness/bedding

U	unknown
P	perpendicular
//	parallel

Appendix 9

Chemical & Environmental Laboratory Testing

Chemtest
The right chemistry to deliver results
Chemtest Ltd.
Depot Road
Newmarket
CB8 0AL
Tel: 01638 606070
Email: info@chemtest.com

UKAS TESTING
2183

Final Report

Report No.:	19-03749-1
Initial Date of Issue:	18-Feb-2019
Client	IGSL
Client Address:	M7 Business Park Naas County Kildare Ireland
Contact(s):	Darren Keogh
Project	Kilcaberry

Quotation No.:		**Date Received:**	01-Feb-2019
Order No.:		**Date Instructed:**	04-Feb-2019
No. of Samples:	18		
Turnaround (Wkdays):	7	**Results Due:**	12-Feb-2019
Date Approved:	18-Feb-2019		

Approved By:

Details: Glynn Harvey, Laboratory Manager

Chemtest
The right chemistry to deliver results

Results - Leachate

Project: Kilcaberry

Client: IGSL					**Chemtest Job No.:**	19-03749	19-03749	19-03749	19-03749	19-03749	19-03749	19-03749	19-03749	19-03749	19-03749	19-03749	19-03749	19-03749
Quotation No.:					**Chemtest Sample ID.:**	765799	765800	765801	765802	765803	765804	765805	765806	765807	765808	765809	765810	765811
					Sample Location:	WS2	WS3	WS4	WS5	WS6	WS7	WS8	WS9	WS10	WS11	WS12	WS13	WS14
					Sample Type:	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
					Top Depth (m):	1.00	1.00	1.00	1.00	0.50	1.00	1.00	1.00	1.00	1.00	1.00	0.50	0.50
					Bottom Depth (m):					1.00							1.00	1.00
Determinand	**Accred.**	**SOP**	**Units**	**LOD**														
Ammonium	U	1220	mg/l	0.050		0.55	0.075	0.068	< 0.050	0.079	0.078	0.080	0.40	0.23	0.25	0.23	0.14	0.12
Ammonium	N	1220	mg/kg	0.10		5.5	0.75	0.68	0.45	0.79	0.78	0.80	4.0	2.3	2.5	2.3	1.4	1.2
Boron (Dissolved)	U	1450	µg/l	20		< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20
Boron (Dissolved)	U	1450	mg/kg	0.20		< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20

Chemtest
The right chemistry to deliver results

Results - Leachate

Project: Kilcaberry

Client: IGSL					**Chemtest Job No.:**	19-03749	19-03749	19-03749	19-03749	19-03749
Quotation No.:					**Chemtest Sample ID.:**	765812	765813	765814	765815	765816
					Sample Location:	WS15	WS16	WS17	WS18	WS19
					Sample Type:	SOIL	SOIL	SOIL	SOIL	SOIL
					Top Depth (m):	1.00	1.00	1.00	1.00	0.50
					Bottom Depth (m):					1.00
Determinand	**Accred.**	**SOP**	**Units**	**LOD**						
Ammonium	U	1220	mg/l	0.050		0.071	0.059	< 0.050	0.062	0.15
Ammonium	N	1220	mg/kg	0.10		0.71	0.59	0.36	0.62	1.5
Boron (Dissolved)	U	1450	µg/l	20		< 20	< 20	< 20	< 20	< 20
Boron (Dissolved)	U	1450	mg/kg	0.20		< 0.20	< 0.20	< 0.20	< 0.20	< 0.20

Chemtest
The right chemistry to deliver results

Results - Soil

Project: Kilcaberry

Client: IGSL					**Chemtest Job No.:**	19-03749	19-03749	19-03749	19-03749	19-03749	19-03749	19-03749	19-03749	19-03749
Quotation No.:					**Chemtest Sample ID.:**	765808	765809	765810	765811	765812	765813	765814	765815	765816
					Sample Location:	WS11	WS12	WS13	WS14	WS15	WS16	WS17	WS18	WS19
					Sample Type:	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
					Top Depth (m):	1.00	1.00	0.50	0.50	1.00	1.00	1.00	1.00	0.50
					Bottom Depth (m):			1.00	1.00					1.00
					Asbestos Lab:	COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY
Determinand	**Accred.**	**SOP**	**Units**	**LOD**										
ACM Type	U	2192		N/A		-	-	-	-	-	-	-	-	-
Asbestos Identification	U	2192	%	0.001		No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected
ACM Detection Stage	U	2192		N/A		-	-	-	-	-	-	-	-	-
Moisture	N	2030	%	0.020		15	15	14	10	13	12	18	21	13
Boron (Hot Water Soluble)	U	2120	mg/kg	0.40		< 0.40	< 0.40	< 0.40	< 0.40	< 0.40	< 0.40	< 0.40	< 0.40	0.88
Sulphur (Elemental)	U	2180	mg/kg	1.0		[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0
Cyanide (Total)	U	2300	mg/kg	0.50		[A] < 0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50	[A] < 0.50
Sulphide (Easily Liberatable)	N	2325	mg/kg	0.50		[A] 11	[A] 10	[A] 15	[A] 22	[A] 13	[A] 19	[A] 23	[A] 20	[A] 12
Sulphate (Acid Soluble)	U	2430	%	0.010		[A] < 0.010	[A] < 0.010	[A] < 0.010	[A] < 0.010	[A] < 0.010	[A] < 0.010	[A] < 0.010	[A] 0.019	[A] < 0.010
Arsenic	U	2450	mg/kg	1.0		33	23	21	24	24	24	22	19	23
Barium	U	2450	mg/kg	10		25	22	20	25	28	26	21	30	46
Cadmium	U	2450	mg/kg	0.10		2.2	4.0	6.1	2.7	4.2	2.8	4.5	1.7	2.3
Chromium	U	2450	mg/kg	1.0		13	10	11	9.9	21	13	10	16	12
Molybdenum	U	2450	mg/kg	2.0		5.9	12	9.4	6.2	7.4	5.1	9.3	6.9	5.1
Antimony	N	2450	mg/kg	2.0		6.0	4.5	3.9	2.4	4.3	2.4	8.7	6.8	4.6
Copper	U	2450	mg/kg	0.50		28	27	23	22	33	24	21	35	29
Mercury	U	2450	mg/kg	0.10		< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Nickel	U	2450	mg/kg	0.50		68	58	46	44	77	53	46	80	55
Lead	U	2450	mg/kg	0.50		34	15	14	15	17	14	14	22	14
Selenium	U	2450	mg/kg	0.20		0.23	< 0.20	0.32	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
Zinc	U	2450	mg/kg	0.50		75	120	130	71	92	67	96	120	72
Chromium (Trivalent)	N	2490	mg/kg	1.0		13	10	11	9.9	21	13	10	16	12
Chromium (Hexavalent)	N	2490	mg/kg	0.50		< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Total Organic Carbon	U	2625	%	0.20		[A] 0.55	[A] 0.41	[A] 0.36	[A] 0.31	[A] 0.50	[A] 0.46	[A] 0.41	[A] 0.57	[A] 1.3
Mineral Oil	N	2670	mg/kg	10		< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10
Aliphatic TPH >C5-C6	N	2680	mg/kg	1.0		[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0
Aliphatic TPH >C6-C8	N	2680	mg/kg	1.0		[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0
Aliphatic TPH >C8-C10	U	2680	mg/kg	1.0		[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0
Aliphatic TPH >C10-C12	U	2680	mg/kg	1.0		[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0
Aliphatic TPH >C12-C16	U	2680	mg/kg	1.0		[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0
Aliphatic TPH >C16-C21	U	2680	mg/kg	1.0		[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0
Aliphatic TPH >C21-C35	U	2680	mg/kg	1.0		[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0
Aliphatic TPH >C35-C44	N	2680	mg/kg	1.0		[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0
Total Aliphatic Hydrocarbons	N	2680	mg/kg	5.0		[A] < 5.0	[A] < 5.0	[A] < 5.0	[A] < 5.0	[A] < 5.0	[A] < 5.0	[A] < 5.0	[A] < 5.0	[A] < 5.0
Aromatic TPH >C5-C7	N	2680	mg/kg	1.0		[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0
Aromatic TPH >C7-C8	N	2680	mg/kg	1.0		[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0
Aromatic TPH >C8-C10	U	2680	mg/kg	1.0		[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0
Aromatic TPH >C10-C12	U	2680	mg/kg	1.0		[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0

Chemtest
The right chemistry to deliver results

Results - Soil

Project: Kilcaberry

Client: IGSL					Chemtest Job No.:	19-03749	19-03749	19-03749	19-03749	19-03749	19-03749	19-03749	19-03749	19-03749
Quotation No.:					Chemtest Sample ID.:	765808	765809	765810	765811	765812	765813	765814	765815	765816
					Sample Location:	WS11	WS12	WS13	WS14	WS15	WS16	WS17	WS18	WS19
					Sample Type:	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
					Top Depth (m):	1.00	1.00	0.50	0.50	1.00	1.00	1.00	1.00	0.50
					Bottom Depth (m):			1.00	1.00					1.00
					Asbestos Lab:	COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY
Determinand	**Accred.**	**SOP**	**Units**	**LOD**										
Aromatic TPH >C12-C16	U	2680	mg/kg	1.0		[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0
Aromatic TPH >C16-C21	U	2680	mg/kg	1.0		[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0
Aromatic TPH >C21-C35	U	2680	mg/kg	1.0		[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0
Aromatic TPH >C35-C44	N	2680	mg/kg	1.0		[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0
Total Aromatic Hydrocarbons	N	2680	mg/kg	5.0		[A] < 5.0	[A] < 5.0	[A] < 5.0	[A] < 5.0	[A] < 5.0	[A] < 5.0	[A] < 5.0	[A] < 5.0	[A] < 5.0
Total Petroleum Hydrocarbons	N	2680	mg/kg	10.0		[A] < 10	[A] < 10	[A] < 10	[A] < 10	[A] < 10	[A] < 10	[A] < 10	[A] < 10	[A] < 10
Benzene	U	2760	µg/kg	1.0		[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0
Toluene	U	2760	µg/kg	1.0		[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0
Ethylbenzene	U	2760	µg/kg	1.0		[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0
m & p-Xylene	U	2760	µg/kg	1.0		[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0
o-Xylene	U	2760	µg/kg	1.0		[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0
Methyl Tert-Butyl Ether	U	2760	µg/kg	1.0		[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0	[A] < 1.0
Naphthalene	U	2800	mg/kg	0.10		< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Acenaphthylene	N	2800	mg/kg	0.10		< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Acenaphthene	U	2800	mg/kg	0.10		< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Fluorene	U	2800	mg/kg	0.10		< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Phenanthrene	U	2800	mg/kg	0.10		< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Anthracene	U	2800	mg/kg	0.10		< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Fluoranthene	U	2800	mg/kg	0.10		< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Pyrene	U	2800	mg/kg	0.10		< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[a]anthracene	U	2800	mg/kg	0.10		< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Chrysene	U	2800	mg/kg	0.10		< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[b]fluoranthene	U	2800	mg/kg	0.10		< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[k]fluoranthene	U	2800	mg/kg	0.10		< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[a]pyrene	U	2800	mg/kg	0.10		< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Indeno(1,2,3-c,d)Pyrene	U	2800	mg/kg	0.10		< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Dibenz(a,h)Anthracene	N	2800	mg/kg	0.10		< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[g,h,i]perylene	U	2800	mg/kg	0.10		< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Coronene	N	2800	mg/kg	0.10		< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Total Of 17 PAH's	N	2800	mg/kg	2.0		< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
PCB 28	U	2815	mg/kg	0.010		[A] < 0.010	[A] < 0.010	[A] < 0.010	[A] < 0.010	[A] < 0.010	[A] < 0.010	[A] < 0.010	[A] < 0.010	[A] < 0.010
PCB 52	U	2815	mg/kg	0.010		[A] < 0.010	[A] < 0.010	[A] < 0.010	[A] < 0.010	[A] < 0.010	[A] < 0.010	[A] < 0.010	[A] < 0.010	[A] < 0.010
PCB 90+101	U	2815	mg/kg	0.010		[A] < 0.010	[A] < 0.010	[A] < 0.010	[A] < 0.010	[A] < 0.010	[A] < 0.010	[A] < 0.010	[A] < 0.010	[A] < 0.010
PCB 118	U	2815	mg/kg	0.010		[A] < 0.010	[A] < 0.010	[A] < 0.010	[A] < 0.010	[A] < 0.010	[A] < 0.010	[A] < 0.010	[A] < 0.010	[A] < 0.010
PCB 153	U	2815	mg/kg	0.010		[A] < 0.010	[A] < 0.010	[A] < 0.010	[A] < 0.010	[A] < 0.010	[A] < 0.010	[A] < 0.010	[A] < 0.010	[A] < 0.010
PCB 138	U	2815	mg/kg	0.010		[A] < 0.010	[A] < 0.010	[A] < 0.010	[A] < 0.010	[A] < 0.010	[A] < 0.010	[A] < 0.010	[A] < 0.010	[A] < 0.010
PCB 180	U	2815	mg/kg	0.010		[A] < 0.010	[A] < 0.010	[A] < 0.010	[A] < 0.010	[A] < 0.010	[A] < 0.010	[A] < 0.010	[A] < 0.010	[A] < 0.010
Total PCBs (7 Congeners)	N	2815	mg/kg	0.10		[A] < 0.10	[A] < 0.10	[A] < 0.10	[A] < 0.10	[A] < 0.10	[A] < 0.10	[A] < 0.10	[A] < 0.10	[A] < 0.10
Total Phenols	U	2920	mg/kg	0.30		< 0.30	< 0.30	< 0.30	< 0.30	< 0.30	< 0.30	< 0.30	< 0.30	< 0.30

Results - Single Stage WAC

Project: Kilcaberry

					Landfill Waste Acceptance Criteria Limits		
Chemtest Job No:	19-03749						
Chemtest Sample ID:	765812						
Sample Ref:							
Sample ID:							
Sample Location:	WS15						
Top Depth(m):	1.00						
Bottom Depth(m):							
Sampling Date:							
Determinand	**SOP**	**Accred.**	**Units**		**Inert Waste Landfill**	**Stable, Non-reactive hazardous waste in non-hazardous Landfill**	**Hazardous Waste Landfill**
Total Organic Carbon	2625	U	%	[A] 0.50	3	5	6
Loss On Ignition	2610	U	%	2.7	--	--	10
Total BTEX	2760	U	mg/kg	[A] < 0.010	6	--	--
Total PCBs (7 Congeners)	2815	U	mg/kg	< 0.10	1	--	--
TPH Total WAC (Mineral Oil)	2670	U	mg/kg	[A] < 10	500	--	--
Total (Of 17) PAH's	2800	N	mg/kg	< 2.0	100	--	--
pH	2010	U		8.5	--	>6	--
Acid Neutralisation Capacity	2015	N	mol/kg	0.19	--	To evaluate	To evaluate
Eluate Analysis			**10:1 Eluate mg/l**	**10:1 Eluate mg/kg**	**Limit values for compliance leaching test using BS EN 12457 at L/S 10 l/kg**		
Arsenic	1450	U	< 0.0010	< 0.050	0.5	2	25
Barium	1450	U	< 0.0010	< 0.50	20	100	300
Cadmium	1450	U	< 0.00010	< 0.010	0.04	1	5
Chromium	1450	U	< 0.0010	< 0.050	0.5	10	70
Copper	1450	U	< 0.0010	< 0.050	2	50	100
Mercury	1450	U	< 0.00050	< 0.0050	0.01	0.2	2
Molybdenum	1450	U	< 0.0010	< 0.050	0.5	10	30
Nickel	1450	U	< 0.0010	< 0.050	0.4	10	40
Lead	1450	U	< 0.0010	< 0.010	0.5	10	50
Antimony	1450	U	< 0.0010	< 0.010	0.06	0.7	5
Selenium	1450	U	< 0.0010	< 0.010	0.1	0.5	7
Zinc	1450	U	< 0.0010	< 0.50	4	50	200
Chloride	1220	U	< 1.0	< 10	800	15000	25000
Fluoride	1220	U	0.064	< 1.0	10	150	500
Sulphate	1220	U	< 1.0	< 10	1000	20000	50000
Total Dissolved Solids	1020	N	25	250	4000	60000	100000
Phenol Index	1920	U	< 0.030	< 0.30	1	-	-
Dissolved Organic Carbon	1610	U	5.2	52	500	800	1000

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

Waste Acceptance Criteria

Landfill WAC analysis (specifically leaching test results) must not be used for hazardous waste classification purposes. This analysis is only applicable for hazardous waste landfill acceptance and does not give any indication as to whether a waste may be hazardous or non-hazardous.

Results - Single Stage WAC

Project: Kilcaberry

					Landfill Waste Acceptance Criteria Limits		
Chemtest Job No:	19-03749						
Chemtest Sample ID:	765813						
Sample Ref:							
Sample ID:							
Sample Location:	WS16						
Top Depth(m):	1.00						
Bottom Depth(m):							
Sampling Date:							
Determinand	**SOP**	**Accred.**	**Units**		**Inert Waste Landfill**	**Stable, Non-reactive hazardous waste in non-hazardous Landfill**	**Hazardous Waste Landfill**
Total Organic Carbon	2625	U	%	[A] 0.46	3	5	6
Loss On Ignition	2610	U	%	2.1	--	--	10
Total BTEX	2760	U	mg/kg	[A] < 0.010	6	--	--
Total PCBs (7 Congeners)	2815	U	mg/kg	< 0.10	1	--	--
TPH Total WAC (Mineral Oil)	2670	U	mg/kg	[A] < 10	500	--	--
Total (Of 17) PAH's	2800	N	mg/kg	< 2.0	100	--	--
pH	2010	U		8.5	--	>6	--
Acid Neutralisation Capacity	2015	N	mol/kg	0.56	--	To evaluate	To evaluate
Eluate Analysis			**10:1 Eluate mg/l**	**10:1 Eluate mg/kg**	**Limit values for compliance leaching test using BS EN 12457 at L/S 10 l/kg**		
Arsenic	1450	U	< 0.0010	< 0.050	0.5	2	25
Barium	1450	U	< 0.0010	< 0.50	20	100	300
Cadmium	1450	U	< 0.00010	< 0.010	0.04	1	5
Chromium	1450	U	< 0.0010	< 0.050	0.5	10	70
Copper	1450	U	< 0.0010	< 0.050	2	50	100
Mercury	1450	U	< 0.00050	< 0.0050	0.01	0.2	2
Molybdenum	1450	U	< 0.0010	< 0.050	0.5	10	30
Nickel	1450	U	< 0.0010	< 0.050	0.4	10	40
Lead	1450	U	< 0.0010	< 0.010	0.5	10	50
Antimony	1450	U	< 0.0010	< 0.010	0.06	0.7	5
Selenium	1450	U	< 0.0010	< 0.010	0.1	0.5	7
Zinc	1450	U	< 0.0010	< 0.50	4	50	200
Chloride	1220	U	< 1.0	< 10	800	15000	25000
Fluoride	1220	U	0.082	< 1.0	10	150	500
Sulphate	1220	U	< 1.0	< 10	1000	20000	50000
Total Dissolved Solids	1020	N	33	320	4000	60000	100000
Phenol Index	1920	U	< 0.030	< 0.30	1	-	-
Dissolved Organic Carbon	1610	U	3.5	< 50	500	800	1000

Solid Information	
Dry mass of test portion/kg	0.090
Moisture (%)	12

Waste Acceptance Criteria

Landfill WAC analysis (specifically leaching test results) must not be used for hazardous waste classification purposes. This analysis is only applicable for hazardous waste landfill acceptance and does not give any indication as to whether a waste may be hazardous or non-hazardous.

Results - Single Stage WAC

Project: Kilcaberry

					Landfill Waste Acceptance Criteria Limits		
Chemtest Job No:	19-03749						
Chemtest Sample ID:	765814						
Sample Ref:							
Sample ID:							
Sample Location:	WS17						
Top Depth(m):	1.00						
Bottom Depth(m):							
Sampling Date:							
Determinand	**SOP**	**Accred.**	**Units**		**Inert Waste Landfill**	**Stable, Non-reactive hazardous waste in non-hazardous Landfill**	**Hazardous Waste Landfill**
Total Organic Carbon	2625	U	%	[A] 0.41	3	5	6
Loss On Ignition	2610	U	%	2.6	--	--	10
Total BTEX	2760	U	mg/kg	[A] < 0.010	6	--	--
Total PCBs (7 Congeners)	2815	U	mg/kg	< 0.10	1	--	--
TPH Total WAC (Mineral Oil)	2670	U	mg/kg	[A] < 10	500	--	--
Total (Of 17) PAH's	2800	N	mg/kg	< 2.0	100	--	--
pH	2010	U		8.6	--	>6	--
Acid Neutralisation Capacity	2015	N	mol/kg	0.92	--	To evaluate	To evaluate
Eluate Analysis			**10:1 Eluate mg/l**	**10:1 Eluate mg/kg**	**Limit values for compliance leaching test using BS EN 12457 at L/S 10 l/kg**		
Arsenic	1450	U	< 0.0010	< 0.050	0.5	2	25
Barium	1450	U	< 0.0010	< 0.50	20	100	300
Cadmium	1450	U	< 0.00010	< 0.010	0.04	1	5
Chromium	1450	U	< 0.0010	< 0.050	0.5	10	70
Copper	1450	U	< 0.0010	< 0.050	2	50	100
Mercury	1450	U	< 0.00050	< 0.0050	0.01	0.2	2
Molybdenum	1450	U	0.0011	< 0.050	0.5	10	30
Nickel	1450	U	< 0.0010	< 0.050	0.4	10	40
Lead	1450	U	< 0.0010	< 0.010	0.5	10	50
Antimony	1450	U	< 0.0010	< 0.010	0.06	0.7	5
Selenium	1450	U	< 0.0010	< 0.010	0.1	0.5	7
Zinc	1450	U	< 0.0010	< 0.50	4	50	200
Chloride	1220	U	< 1.0	< 10	800	15000	25000
Fluoride	1220	U	0.078	< 1.0	10	150	500
Sulphate	1220	U	< 1.0	< 10	1000	20000	50000
Total Dissolved Solids	1020	N	29	290	4000	60000	100000
Phenol Index	1920	U	< 0.030	< 0.30	1	-	-
Dissolved Organic Carbon	1610	U	4.8	< 50	500	800	1000

Solid Information	
Dry mass of test portion/kg	0.090
Moisture (%)	18

Waste Acceptance Criteria

Landfill WAC analysis (specifically leaching test results) must not be used for hazardous waste classification purposes. This analysis is only applicable for hazardous waste landfill acceptance and does not give any indication as to whether a waste may be hazardous or non-hazardous.

Deviations

In accordance with UKAS Policy on Deviating Samples TPS 63. Chemtest have a procedure to ensure 'upon receipt of each sample a competent laboratory shall assess whether the sample is suitable with regard to the requested test(s)'. This policy and the respective holding times applied, can be supplied upon request.The reason a sample is declared as deviating is detailed below. Where applicable the analysis remains UKAS/MCERTs accredited but the results may be compromised.

Sample:	Sample Ref:	Sample ID:	Sample Location:	Sampled Date:	Deviation Code(s):	Containers Received:
765810			WS13		A	Amber Glass 250ml
765810			WS13		A	Amber Glass 60ml
765811			WS14		A	Amber Glass 250ml
765811			WS14		A	Amber Glass 60ml
765812			WS15		A	Amber Glass 250ml
765812			WS15		A	Amber Glass 60ml
765813			WS16		A	Amber Glass 250ml
765813			WS16		A	Amber Glass 60ml
765814			WS17		A	Amber Glass 250ml
765814			WS17		A	Amber Glass 60ml
765815			WS18		A	Amber Glass 250ml
765815			WS18		A	Amber Glass 60ml
765816			WS19		A	Amber Glass 250ml
765816			WS19		A	Amber Glass 60ml

Test Methods

SOP	Title	Parameters included	Method summary
1020	Electrical Conductivity and Total Dissolved Solids (TDS) in Waters	Electrical Conductivity and Total Dissolved Solids (TDS) in Waters	Conductivity Meter
1220	Anions, Alkalinity & Ammonium in Waters	Fluoride; Chloride; Nitrite; Nitrate; Total; Oxidisable Nitrogen (TON); Sulfate; Phosphate; Alkalinity; Ammonium	Automated colorimetric analysis using 'Aquakem 600' Discrete Analyser.
1450	Metals in Waters by ICP-MS	Metals, including: Antimony; Arsenic; Barium; Beryllium; Boron; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Tin; Vanadium; Zinc	Filtration of samples followed by direct determination by inductively coupled plasma mass spectrometry (ICP-MS).
1610	Total/Dissolved Organic Carbon in Waters	Organic Carbon	TOC Analyser using Catalytic Oxidation
1920	Phenols in Waters by HPLC	Phenolic compounds including: Phenol, Cresols, Xylenols, Trimethylphenols Note: Chlorophenols are excluded.	Determination by High Performance Liquid Chromatography (HPLC) using electrochemical detection.
2010	pH Value of Soils	pH	pH Meter
2015	Acid Neutralisation Capacity	Acid Reserve	Titration
2030	Moisture and Stone Content of Soils(Requirement of MCERTS)	Moisture content	Determination of moisture content of soil as a percentage of its as received mass obtained at <37°C.
2120	Water Soluble Boron, Sulphate, Magnesium & Chromium	Boron; Sulphate; Magnesium; Chromium	Aqueous extraction / ICP-OES
2180	Sulphur (Elemental) in Soils by HPLC	Sulphur	Dichloromethane extraction / HPLC with UV detection
2192	Asbestos	Asbestos	Polarised light microscopy / Gravimetry
2300	Cyanides & Thiocyanate in Soils	Free (or easy liberatable) Cyanide; total Cyanide; complex Cyanide; Thiocyanate	Allkaline extraction followed by colorimetric determination using Automated Flow Injection Analyser.
2325	Sulphide in Soils	Sulphide	Steam distillation with sulphuric acid / analysis by 'Aquakem 600' Discrete Analyser, using N,N–dimethyl-p-phenylenediamine.
2430	Total Sulphate in soils	Total Sulphate	Acid digestion followed by determination of sulphate in extract by ICP-OES.
2450	Acid Soluble Metals in Soils	Metals, including: Arsenic; Barium; Beryllium; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Vanadium; Zinc	Acid digestion followed by determination of metals in extract by ICP-MS.
2490	Hexavalent Chromium in Soils	Chromium [VI]	Soil extracts are prepared by extracting dried and ground soil samples into boiling water. Chromium [VI] is determined by 'Aquakem 600' Discrete Analyser using 1,5-diphenylcarbazide.
2610	Loss on Ignition	loss on ignition (LOI)	Determination of the proportion by mass that is lost from a soil by ignition at 550°C.
2625	Total Organic Carbon in Soils	Total organic Carbon (TOC)	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.
2670	Total Petroleum Hydrocarbons (TPH) in Soils by GC-FID	TPH (C6–C40); optional carbon banding, e.g. 3-band – GRO, DRO & LRO*TPH C8–C40	Dichloromethane extraction / GC-FID
2680	TPH A/A Split	Aliphatics: >C5–C6, >C6–C8,>C8–C10, >C10–C12, >C12–C16, >C16–C21, >C21–C35, >C35– C44Aromatics: >C5–C7, >C7–C8, >C8– C10, >C10–C12, >C12–C16, >C16– C21, >C21– C35, >C35– C44	Dichloromethane extraction / GCxGC FID detection

Test Methods

SOP	Title	Parameters included	Method summary
2760	Volatile Organic Compounds (VOCs) in Soils by Headspace GC-MS	Volatile organic compounds, including BTEX and halogenated Aliphatic/Aromatics.(cf. USEPA Method 8260)*please refer to UKAS schedule	Automated headspace gas chromatographic (GC) analysis of a soil sample, as received, with mass spectrometric (MS) detection of volatile organic compounds.
2800	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Soil by GC-MS	Acenaphthene*; Acenaphthylene; Anthracene*; Benzo[a]Anthracene*; Benzo[a]Pyrene*; Benzo[b]Fluoranthene*; Benzo[ghi]Perylene*; Benzo[k]Fluoranthene; Chrysene*; Dibenz[ah]Anthracene; Fluoranthene*; Fluorene*; Indeno[123cd]Pyrene*; Naphthalene*; Phenanthrene*; Pyrene*	Dichloromethane extraction / GC-MS
2815	Polychlorinated Biphenyls (PCB) ICES7Congeners in Soils by GC-MS	ICES7 PCB congeners	Acetone/Hexane extraction / GC-MS
2920	Phenols in Soils by HPLC	Phenolic compounds including Resorcinol, Phenol, Methylphenols, Dimethylphenols, 1-Naphthol and TrimethylphenolsNote: chlorophenols are excluded.	60:40 methanol/water mixture extraction, followed by HPLC determination using electrochemical detection.
640	Characterisation of Waste (Leaching)	Waste material including soil, sludges and granular waste	ComplianceTest for Leaching of Granular Waste Material and Sludge

Report Information

Key

U	UKAS accredited
M	MCERTS and UKAS accredited
N	Unaccredited
S	This analysis has been subcontracted to a UKAS accredited laboratory that is accredited for this analysis
SN	This analysis has been subcontracted to a UKAS accredited laboratory that is not accredited for this analysis
T	This analysis has been subcontracted to an unaccredited laboratory
I/S	Insufficient Sample
U/S	Unsuitable Sample
N/E	not evaluated
<	"less than"
>	"greater than"

Comments or interpretations are beyond the scope of UKAS accreditation
The results relate only to the items tested
Uncertainty of measurement for the determinands tested are available upon request
None of the results in this report have been recovery corrected
All results are expressed on a dry weight basis
The following tests were analysed on samples as received and the results subsequently corrected to a dry weight basis TPH, BTEX, VOCs, SVOCs, PCBs, Phenols
For all other tests the samples were dried at < 37°C prior to analysis
All Asbestos testing is performed at the indicated laboratory
Issue numbers are sequential starting with 1 all subsequent reports are incremented by 1

Sample Deviation Codes

A - Date of sampling not supplied
B - Sample age exceeds stability time (sampling to extraction)
C - Sample not received in appropriate containers
D - Broken Container
E - Insufficient Sample (Applies to LOI in Trommel Fines Only)

Sample Retention and Disposal

All soil samples will be retained for a period of 45 days from the date of receipt
All water samples will be retained for 14 days from the date of receipt
Charges may apply to extended sample storage

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

Chemtest
The right chemistry to deliver results
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UKAS TESTING
2183

Final Report

Report No.:	19-05352-1
Initial Date of Issue:	28-Feb-2019
Client	IGSL
Client Address:	M7 Business Park Naas County Kildare Ireland
Contact(s):	Darren Keogh
Project	Kilcarbury

Quotation No.:		**Date Received:**	14-Feb-2019
Order No.:		**Date Instructed:**	14-Feb-2019
No. of Samples:	23		
Turnaround (Wkdays):	7	**Results Due:**	22-Feb-2019
Date Approved:	28-Feb-2019		

Approved By:

Details: Robert Monk, Technical Manager

Chemtest
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Results - Leachate

Project: Kilcarbury

Client: IGSL				**Chemtest Job No.:**	19-05352	19-05352	19-05352	19-05352	19-05352	19-05352	19-05352	19-05352	19-05352	19-05352
Quotation No.:				**Chemtest Sample ID.:**	773958	773959	773960	773961	773962	773963	773964	773965	773966	773968
				Sample Location:	BH2	BH6	BH9	BH11	BH14	BH17	TP8	TP9	TP10	TP13
				Sample Type:	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
				Top Depth (m):	1.00	1.00	1.00	1.00	1.00	1.00	0.80	0.50	1.50	0.60
				Date Sampled:	08-Feb-2019	08-Feb-2019	08-Feb-2019	08-Feb-2019	08-Feb-2019	08-Feb-2019	08-Feb-2019	08-Feb-2019	08-Feb-2019	08-Feb-2019
Determinand	**Accred.**	**SOP**	**Units**	**LOD**										
Ammonium	U	1220	mg/l	0.050	0.074	0.10	0.13	0.11	0.076	0.11	0.22	0.11	0.069	0.070
Ammonium	N	1220	mg/kg	0.10	0.74	1.0	1.3	1.1	0.76	1.1	2.2	1.1	0.69	0.70
Boron (Dissolved)	U	1450	µg/l	20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20
Boron (Dissolved)	U	1450	mg/kg	0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20

Chemtest
The right chemistry to deliver results

Results - Leachate

Project: Kilcarbury

Client: IGSL				**Chemtest Job No.:**	19-05352	19-05352	19-05352	19-05352	19-05352	19-05352	19-05352	19-05352	19-05352	19-05352
Quotation No.:				**Chemtest Sample ID.:**	773969	773970	773971	773972	773973	773974	773975	773976	773977	773978
				Sample Location:	TP13	TP16	TP16	TP17	TP18	TP18	TP19	TP19	TP25	TP33
				Sample Type:	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
				Top Depth (m):	1.60	0.50	1.50	0.50	0.50	1.50	1.00	2.00	0.50	0.50
				Date Sampled:	08-Feb-2019	08-Feb-2019	08-Feb-2019	08-Feb-2019	08-Feb-2019	08-Feb-2019	08-Feb-2019	08-Feb-2019	08-Feb-2019	08-Feb-2019
Determinand	**Accred.**	**SOP**	**Units**	**LOD**										
Ammonium	U	1220	mg/l	0.050	0.11	0.093	0.12	0.13	0.14	0.12	0.18	0.16	0.14	0.087
Ammonium	N	1220	mg/kg	0.10	1.1	0.93	1.2	1.3	1.4	1.2	1.8	1.6	1.4	0.87
Boron (Dissolved)	U	1450	µg/l	20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20
Boron (Dissolved)	U	1450	mg/kg	0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20

Chemtest
The right chemistry to deliver results

Results - Leachate

Project: Kilcarbury

Client: IGSL			**Chemtest Job No.:**		19-05352	19-05352	19-05352
Quotation No.:			**Chemtest Sample ID.:**		773979	773980	773981
			Sample Location:		TP46	TP61	TP69
			Sample Type:		SOIL	SOIL	SOIL
			Top Depth (m):		0.50	1.00	1.00
			Date Sampled:		08-Feb-2019	08-Feb-2019	08-Feb-2019
Determinand	**Accred.**	**SOP**	**Units**	**LOD**			
Ammonium	U	1220	mg/l	0.050	0.11	0.070	0.071
Ammonium	N	1220	mg/kg	0.10	1.1	0.70	0.71
Boron (Dissolved)	U	1450	µg/l	20	< 20	< 20	< 20
Boron (Dissolved)	U	1450	mg/kg	0.20	< 0.20	< 0.20	< 0.20

Chemtest
The right chemistry to deliver results

Results - Soil

Project: Kilcarbury

Client: IGSL				**Chemtest Job No.:**	19-05352	19-05352	19-05352	19-05352	19-05352	19-05352	19-05352	19-05352	19-05352
Quotation No.:				**Chemtest Sample ID.:**	773958	773959	773960	773961	773962	773963	773964	773965	773966
				Sample Location:	BH2	BH6	BH9	BH11	BH14	BH17	TP8	TP9	TP10
				Sample Type:	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
				Top Depth (m):	1.00	1.00	1.00	1.00	1.00	1.00	0.80	0.50	1.50
				Date Sampled:	08-Feb-2019	08-Feb-2019	08-Feb-2019	08-Feb-2019	08-Feb-2019	08-Feb-2019	08-Feb-2019	08-Feb-2019	08-Feb-2019
				Asbestos Lab:	COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY
Determinand	**Accred.**	**SOP**	**Units**	**LOD**									
ACM Type	U	2192		N/A	-	-	-	-	-	-	-	-	-
Asbestos Identification	U	2192	%	0.001	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected
ACM Detection Stage	U	2192		N/A	-	-	-	-	-	-	-	-	-
Moisture	N	2030	%	0.020	12	12	13	14	19	14	16	14	13
pH	U	2010		N/A									
Boron (Hot Water Soluble)	U	2120	mg/kg	0.40	< 0.40	< 0.40	< 0.40	< 0.40	< 0.40	< 0.40	< 0.40	< 0.40	< 0.40
Sulphate (2:1 Water Soluble) as SO4	U	2120	g/l	0.010									
Sulphur (Elemental)	U	2180	mg/kg	1.0	4.6	< 1.0	< 1.0	< 1.0	< 1.0	1.6	< 1.0	< 1.0	< 1.0
Cyanide (Total)	U	2300	mg/kg	0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Sulphide (Easily Liberatable)	N	2325	mg/kg	0.50	11	15	16	12	2.5	7.6	15	7.5	14
Sulphate (Acid Soluble)	U	2430	%	0.010	0.061	0.042	0.021	0.017	0.023	0.11	0.048	0.051	< 0.010
Arsenic	U	2450	mg/kg	1.0	21	22	27	24	20	25	23	23	29
Barium	U	2450	mg/kg	10	65	43	58	39	55	87	68	59	21
Cadmium	U	2450	mg/kg	0.10	1.4	2.0	5.0	3.7	2.6	2.1	2.2	2.2	6.4
Chromium	U	2450	mg/kg	1.0	20	14	13	14	22	22	24	18	12
Molybdenum	U	2450	mg/kg	2.0	3.5	3.7	11	9.4	4.8	3.9	5.2	5.7	23
Antimony	N	2450	mg/kg	2.0	5.6	4.3	6.2	5.2	3.5	2.7	2.7	2.5	9.7
Copper	U	2450	mg/kg	0.50	29	26	34	31	30	32	35	34	40
Mercury	U	2450	mg/kg	0.10	1.6	1.1	1.1	0.77	0.46	1.1	0.64	0.60	0.44
Nickel	U	2450	mg/kg	0.50	46	52	71	88	66	52	69	60	89
Lead	U	2450	mg/kg	0.50	49	18	17	19	21	42	29	31	33
Selenium	U	2450	mg/kg	0.20	8.3	4.6	5.0	3.6	2.3	6.6	4.1	4.1	6.2
Zinc	U	2450	mg/kg	0.50	81	66	130	110	96	96	110	95	170
Chromium (Trivalent)	N	2490	mg/kg	1.0	20	14	13	14	22	22	24	18	12
Chromium (Hexavalent)	N	2490	mg/kg	0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Total Organic Carbon	U	2625	%	0.20	1.2	0.29	0.33	0.32	0.41	1.1	0.66	0.57	0.40
Mineral Oil	N	2670	mg/kg	10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10
Aliphatic TPH >C5-C6	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C6-C8	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C8-C10	U	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C10-C12	U	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C12-C16	U	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C16-C21	U	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C21-C35	U	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C35-C44	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Total Aliphatic Hydrocarbons	N	2680	mg/kg	5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Aromatic TPH >C5-C7	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C7-C8	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0

Chemtest
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Results - Soil

Project: Kilcarbury

Client: IGSL			**Chemtest Job No.:**		19-05352	19-05352	19-05352	19-05352	19-05352	19-05352	19-05352	19-05352	19-05352
Quotation No.:			**Chemtest Sample ID.:**		773958	773959	773960	773961	773962	773963	773964	773965	773966
			Sample Location:		BH2	BH6	BH9	BH11	BH14	BH17	TP8	TP9	TP10
			Sample Type:		SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
			Top Depth (m):		1.00	1.00	1.00	1.00	1.00	1.00	0.80	0.50	1.50
			Date Sampled:		08-Feb-2019	08-Feb-2019	08-Feb-2019	08-Feb-2019	08-Feb-2019	08-Feb-2019	08-Feb-2019	08-Feb-2019	08-Feb-2019
			Asbestos Lab:		COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY
Determinand	**Accred.**	**SOP**	**Units**	**LOD**									
Aromatic TPH >C8-C10	U	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C10-C12	U	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C12-C16	U	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C16-C21	U	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C21-C35	U	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C35-C44	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Total Aromatic Hydrocarbons	N	2680	mg/kg	5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Total Petroleum Hydrocarbons	N	2680	mg/kg	10.0	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10
Benzene	U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Toluene	U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Ethylbenzene	U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
m & p-Xylene	U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
o-Xylene	U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Methyl Tert-Butyl Ether	U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Naphthalene	U	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Acenaphthylene	N	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Acenaphthene	U	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Fluorene	U	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Phenanthrene	U	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Anthracene	U	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Fluoranthene	U	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Pyrene	U	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[a]anthracene	U	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Chrysene	U	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[b]fluoranthene	U	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[k]fluoranthene	U	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[a]pyrene	U	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Indeno(1,2,3-c,d)Pyrene	U	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Dibenz(a,h)Anthracene	N	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[g,h,i]perylene	U	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Coronene	N	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Total Of 17 PAH's	N	2800	mg/kg	2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
PCB 28	U	2815	mg/kg	0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
PCB 52	U	2815	mg/kg	0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
PCB 90+101	U	2815	mg/kg	0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
PCB 118	U	2815	mg/kg	0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
PCB 153	U	2815	mg/kg	0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
PCB 138	U	2815	mg/kg	0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
PCB 180	U	2815	mg/kg	0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010

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Results - Soil

Project: Kilcarbury

Client: IGSL			**Chemtest Job No.:**		19-05352	19-05352	19-05352	19-05352	19-05352	19-05352	19-05352	19-05352	19-05352
Quotation No.:			**Chemtest Sample ID.:**		773958	773959	773960	773961	773962	773963	773964	773965	773966
			Sample Location:		BH2	BH6	BH9	BH11	BH14	BH17	TP8	TP9	TP10
			Sample Type:		SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
			Top Depth (m):		1.00	1.00	1.00	1.00	1.00	1.00	0.80	0.50	1.50
			Date Sampled:		08-Feb-2019	08-Feb-2019	08-Feb-2019	08-Feb-2019	08-Feb-2019	08-Feb-2019	08-Feb-2019	08-Feb-2019	08-Feb-2019
			Asbestos Lab:		COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY
Determinand	**Accred.**	**SOP**	**Units**	**LOD**									
Total PCBs (7 Congeners)	N	2815	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Total Phenols	U	2920	mg/kg	0.30	< 0.30	< 0.30	< 0.30	< 0.30	< 0.30	< 0.30	< 0.30	< 0.30	< 0.30

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Results - Soil

Project: Kilcarbury

Client: IGSL					**Chemtest Job No.:**	19-05352	19-05352	19-05352	19-05352	19-05352	19-05352	19-05352	19-05352	19-05352
Quotation No.:					**Chemtest Sample ID.:**	773968	773969	773970	773971	773972	773973	773974	773975	773976
					Sample Location:	TP13	TP13	TP16	TP16	TP17	TP18	TP18	TP19	TP19
					Sample Type:	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
					Top Depth (m):	0.60	1.60	0.50	1.50	0.50	0.50	1.50	1.00	2.00
					Date Sampled:	08-Feb-2019	08-Feb-2019	08-Feb-2019	08-Feb-2019	08-Feb-2019	08-Feb-2019	08-Feb-2019	08-Feb-2019	08-Feb-2019
					Asbestos Lab:	COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY
Determinand	**Accred.**	**SOP**	**Units**	**LOD**										
ACM Type	U	2192		N/A		-	-	-	-	-	-	-	-	-
Asbestos Identification	U	2192	%	0.001		No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected
ACM Detection Stage	U	2192		N/A		-	-	-	-	-	-	-	-	-
Moisture	N	2030	%	0.020		20	13	14	22	14	15	11	15	15
pH	U	2010		N/A			8.1							
Boron (Hot Water Soluble)	U	2120	mg/kg	0.40		0.74	< 0.40	< 0.40	< 0.40	0.51	< 0.40	< 0.40	0.48	< 0.40
Sulphate (2:1 Water Soluble) as SO4	U	2120	g/l	0.010			< 0.010							
Sulphur (Elemental)	U	2180	mg/kg	1.0		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	1.1	< 1.0	2.9	< 1.0
Cyanide (Total)	U	2300	mg/kg	0.50		< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Sulphide (Easily Liberatable)	N	2325	mg/kg	0.50		8.0	10	13	3.5	9.5	6.4	10	6.4	9.5
Sulphate (Acid Soluble)	U	2430	%	0.010		0.11	0.049	0.059	0.022	0.082	0.091	0.018	0.081	< 0.010
Arsenic	U	2450	mg/kg	1.0		22	23	32	20	24	28	21	9.9	23
Barium	U	2450	mg/kg	10		100	51	70	67	68	96	92	37	63
Cadmium	U	2450	mg/kg	0.10		2.2	2.3	2.2	0.86	2.5	2.0	2.2	0.90	1.7
Chromium	U	2450	mg/kg	1.0		26	16	21	25	20	23	15	8.8	17
Molybdenum	U	2450	mg/kg	2.0		4.6	4.3	4.7	6.3	4.1	3.5	5.1	< 2.0	5.3
Antimony	N	2450	mg/kg	2.0		11	2.8	2.5	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
Copper	U	2450	mg/kg	0.50		63	28	32	13	32	34	30	18	30
Mercury	U	2450	mg/kg	0.10		0.57	0.41	0.62	0.52	0.36	0.33	0.53	0.18	0.36
Nickel	U	2450	mg/kg	0.50		54	53	53	42	48	50	62	23	51
Lead	U	2450	mg/kg	0.50		340	39	53	22	41	52	21	34	19
Selenium	U	2450	mg/kg	0.20		6.3	2.1	3.9	3.0	13	2.8	4.0	1.5	2.0
Zinc	U	2450	mg/kg	0.50		270	78	150	83	97	98	85	51	76
Chromium (Trivalent)	N	2490	mg/kg	1.0		26	16	21	25	20	23	15	8.8	17
Chromium (Hexavalent)	N	2490	mg/kg	0.50		< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Total Organic Carbon	U	2625	%	0.20		2.3	0.27	1.2	0.46	1.1	1.3	0.53	1.8	0.68
Mineral Oil	N	2670	mg/kg	10		< 10	< 10	< 10	< 10	< 10	< 10	< 10	58	< 10
Aliphatic TPH >C5-C6	N	2680	mg/kg	1.0		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C6-C8	N	2680	mg/kg	1.0		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C8-C10	U	2680	mg/kg	1.0		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C10-C12	U	2680	mg/kg	1.0		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C12-C16	U	2680	mg/kg	1.0		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	9.8	< 1.0
Aliphatic TPH >C16-C21	U	2680	mg/kg	1.0		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	12	< 1.0
Aliphatic TPH >C21-C35	U	2680	mg/kg	1.0		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C35-C44	N	2680	mg/kg	1.0		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	47	< 1.0
Total Aliphatic Hydrocarbons	N	2680	mg/kg	5.0		< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	69	< 5.0
Aromatic TPH >C5-C7	N	2680	mg/kg	1.0		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C7-C8	N	2680	mg/kg	1.0		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0

Chemtest
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Results - Soil

Project: Kilcarbury

Client: IGSL					**Chemtest Job No.:**	19-05352	19-05352	19-05352	19-05352	19-05352	19-05352	19-05352	19-05352	19-05352
Quotation No.:					**Chemtest Sample ID.:**	773968	773969	773970	773971	773972	773973	773974	773975	773976
					Sample Location:	TP13	TP13	TP16	TP16	TP17	TP18	TP18	TP19	TP19
					Sample Type:	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
					Top Depth (m):	0.60	1.60	0.50	1.50	0.50	0.50	1.50	1.00	2.00
					Date Sampled:	08-Feb-2019	08-Feb-2019	08-Feb-2019	08-Feb-2019	08-Feb-2019	08-Feb-2019	08-Feb-2019	08-Feb-2019	08-Feb-2019
					Asbestos Lab:	COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY
Determinand	**Accred.**	**SOP**	**Units**	**LOD**										
Aromatic TPH >C8-C10	U	2680	mg/kg	1.0		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C10-C12	U	2680	mg/kg	1.0		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C12-C16	U	2680	mg/kg	1.0		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C16-C21	U	2680	mg/kg	1.0		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	14	< 1.0
Aromatic TPH >C21-C35	U	2680	mg/kg	1.0		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	110	< 1.0
Aromatic TPH >C35-C44	N	2680	mg/kg	1.0		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Total Aromatic Hydrocarbons	N	2680	mg/kg	5.0		< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	130	< 5.0
Total Petroleum Hydrocarbons	N	2680	mg/kg	10.0		< 10	< 10	< 10	< 10	< 10	< 10	< 10	190	< 10
Benzene	U	2760	µg/kg	1.0		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Toluene	U	2760	µg/kg	1.0		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Ethylbenzene	U	2760	µg/kg	1.0		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
m & p-Xylene	U	2760	µg/kg	1.0		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
o-Xylene	U	2760	µg/kg	1.0		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Methyl Tert-Butyl Ether	U	2760	µg/kg	1.0		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Naphthalene	U	2800	mg/kg	0.10		< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	1.3	< 0.10
Acenaphthylene	N	2800	mg/kg	0.10		< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	0.23	< 0.10
Acenaphthene	U	2800	mg/kg	0.10		< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	0.44	< 0.10
Fluorene	U	2800	mg/kg	0.10		< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	0.49	< 0.10
Phenanthrene	U	2800	mg/kg	0.10		< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	0.88	< 0.10	3.7	< 0.10
Anthracene	U	2800	mg/kg	0.10		< 0.10	< 0.10	0.15	< 0.10	< 0.10	0.15	< 0.10	1.5	< 0.10
Fluoranthene	U	2800	mg/kg	0.10		< 0.10	< 0.10	0.13	< 0.10	0.58	0.79	< 0.10	6.3	< 0.10
Pyrene	U	2800	mg/kg	0.10		< 0.10	< 0.10	0.10	< 0.10	0.52	0.71	< 0.10	5.1	< 0.10
Benzo[a]anthracene	U	2800	mg/kg	0.10		< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	1.9	< 0.10
Chrysene	U	2800	mg/kg	0.10		< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	2.2	< 0.10
Benzo[b]fluoranthene	U	2800	mg/kg	0.10		< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	2.1	< 0.10
Benzo[k]fluoranthene	U	2800	mg/kg	0.10		< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	0.91	< 0.10
Benzo[a]pyrene	U	2800	mg/kg	0.10		< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	1.2	< 0.10
Indeno(1,2,3-c,d)Pyrene	U	2800	mg/kg	0.10		< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	0.40	< 0.10
Dibenz(a,h)Anthracene	N	2800	mg/kg	0.10		< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[g,h,i]perylene	U	2800	mg/kg	0.10		< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	0.50	< 0.10
Coronene	N	2800	mg/kg	0.10		< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Total Of 17 PAH's	N	2800	mg/kg	2.0		< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	2.5	< 2.0	28	< 2.0
PCB 28	U	2815	mg/kg	0.010		< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
PCB 52	U	2815	mg/kg	0.010		< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
PCB 90+101	U	2815	mg/kg	0.010		< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
PCB 118	U	2815	mg/kg	0.010		< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
PCB 153	U	2815	mg/kg	0.010		< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
PCB 138	U	2815	mg/kg	0.010		< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
PCB 180	U	2815	mg/kg	0.010		< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010

Chemtest
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Results - Soil

Project: Kilcarbury

Client: IGSL			**Chemtest Job No.:**		19-05352	19-05352	19-05352	19-05352	19-05352	19-05352	19-05352	19-05352	19-05352
Quotation No.:			**Chemtest Sample ID.:**		773968	773969	773970	773971	773972	773973	773974	773975	773976
			Sample Location:		TP13	TP13	TP16	TP16	TP17	TP18	TP18	TP19	TP19
			Sample Type:		SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
			Top Depth (m):		0.60	1.60	0.50	1.50	0.50	0.50	1.50	1.00	2.00
			Date Sampled:		08-Feb-2019	08-Feb-2019	08-Feb-2019	08-Feb-2019	08-Feb-2019	08-Feb-2019	08-Feb-2019	08-Feb-2019	08-Feb-2019
			Asbestos Lab:		COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY
Determinand	**Accred.**	**SOP**	**Units**	**LOD**									
Total PCBs (7 Congeners)	N	2815	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Total Phenols	U	2920	mg/kg	0.30	< 0.30	< 0.30	< 0.30	< 0.30	< 0.30	< 0.30	< 0.30	3.5	2.0

Chemtest
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Results - Soil

Project: Kilcarbury

Client: IGSL				**Chemtest Job No.:**	19-05352	19-05352	19-05352	19-05352	19-05352
Quotation No.:				**Chemtest Sample ID.:**	773977	773978	773979	773980	773981
				Sample Location:	TP25	TP33	TP46	TP61	TP69
				Sample Type:	SOIL	SOIL	SOIL	SOIL	SOIL
				Top Depth (m):	0.50	0.50	0.50	1.00	1.00
				Date Sampled:	08-Feb-2019	08-Feb-2019	08-Feb-2019	08-Feb-2019	08-Feb-2019
				Asbestos Lab:	COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY
Determinand	**Accred.**	**SOP**	**Units**	**LOD**					
ACM Type	U	2192		N/A	-	-	-	-	-
Asbestos Identification	U	2192	%	0.001	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected
ACM Detection Stage	U	2192		N/A	-	-	-	-	-
Moisture	N	2030	%	0.020	14	17	15	14	11
pH	U	2010		N/A					
Boron (Hot Water Soluble)	U	2120	mg/kg	0.40	0.47	< 0.40	< 0.40	< 0.40	< 0.40
Sulphate (2:1 Water Soluble) as SO4	U	2120	g/l	0.010					
Sulphur (Elemental)	U	2180	mg/kg	1.0	1.4	1.0	< 1.0	< 1.0	< 1.0
Cyanide (Total)	U	2300	mg/kg	0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Sulphide (Easily Liberatable)	N	2325	mg/kg	0.50	9.5	11	18	11	13
Sulphate (Acid Soluble)	U	2430	%	0.010	0.097	0.10	0.047	0.014	< 0.010
Arsenic	U	2450	mg/kg	1.0	23	25	22	24	23
Barium	U	2450	mg/kg	10	76	84	57	29	16
Cadmium	U	2450	mg/kg	0.10	1.8	2.1	2.1	2.2	8.4
Chromium	U	2450	mg/kg	1.0	19	21	17	11	12
Molybdenum	U	2450	mg/kg	2.0	3.8	4.4	4.6	6.3	15
Antimony	N	2450	mg/kg	2.0	< 2.0	< 2.0	< 2.0	2.0	6.3
Copper	U	2450	mg/kg	0.50	29	37	34	24	29
Mercury	U	2450	mg/kg	0.10	0.62	0.29	0.24	0.25	0.18
Nickel	U	2450	mg/kg	0.50	44	50	57	68	80
Lead	U	2450	mg/kg	0.50	36	56	39	23	25
Selenium	U	2450	mg/kg	0.20	4.7	4.7	2.4	2.0	3.2
Zinc	U	2450	mg/kg	0.50	87	110	97	79	250
Chromium (Trivalent)	N	2490	mg/kg	1.0	19	21	17	11	12
Chromium (Hexavalent)	N	2490	mg/kg	0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Total Organic Carbon	U	2625	%	0.20	1.3	1.6	0.91	0.32	0.34
Mineral Oil	N	2670	mg/kg	10	< 10	< 10	< 10	< 10	< 10
Aliphatic TPH >C5-C6	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C6-C8	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C8-C10	U	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C10-C12	U	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C12-C16	U	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C16-C21	U	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C21-C35	U	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C35-C44	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Total Aliphatic Hydrocarbons	N	2680	mg/kg	5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Aromatic TPH >C5-C7	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C7-C8	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0

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Results - Soil

Project: Kilcarbury

Client: IGSL			**Chemtest Job No.:**		19-05352	19-05352	19-05352	19-05352	19-05352
Quotation No.:			**Chemtest Sample ID.:**		773977	773978	773979	773980	773981
			Sample Location:		TP25	TP33	TP46	TP61	TP69
			Sample Type:		SOIL	SOIL	SOIL	SOIL	SOIL
			Top Depth (m):		0.50	0.50	0.50	1.00	1.00
			Date Sampled:		08-Feb-2019	08-Feb-2019	08-Feb-2019	08-Feb-2019	08-Feb-2019
			Asbestos Lab:		COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY
Determinand	**Accred.**	**SOP**	**Units**	**LOD**					
Aromatic TPH >C8-C10	U	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C10-C12	U	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C12-C16	U	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C16-C21	U	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C21-C35	U	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C35-C44	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Total Aromatic Hydrocarbons	N	2680	mg/kg	5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Total Petroleum Hydrocarbons	N	2680	mg/kg	10.0	< 10	< 10	< 10	< 10	< 10
Benzene	U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Toluene	U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Ethylbenzene	U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
m & p-Xylene	U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
o-Xylene	U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Methyl Tert-Butyl Ether	U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Naphthalene	U	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Acenaphthylene	N	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Acenaphthene	U	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Fluorene	U	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Phenanthrene	U	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Anthracene	U	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Fluoranthene	U	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Pyrene	U	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[a]anthracene	U	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Chrysene	U	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[b]fluoranthene	U	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[k]fluoranthene	U	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[a]pyrene	U	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Indeno(1,2,3-c,d)Pyrene	U	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Dibenz(a,h)Anthracene	N	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[g,h,i]perylene	U	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Coronene	N	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Total Of 17 PAH's	N	2800	mg/kg	2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
PCB 28	U	2815	mg/kg	0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
PCB 52	U	2815	mg/kg	0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
PCB 90+101	U	2815	mg/kg	0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
PCB 118	U	2815	mg/kg	0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
PCB 153	U	2815	mg/kg	0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
PCB 138	U	2815	mg/kg	0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
PCB 180	U	2815	mg/kg	0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010

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Results - Soil

Project: Kilcarbury

Client: IGSL				**Chemtest Job No.:**	19-05352	19-05352	19-05352	19-05352	19-05352
Quotation No.:				**Chemtest Sample ID.:**	773977	773978	773979	773980	773981
				Sample Location:	TP25	TP33	TP46	TP61	TP69
				Sample Type:	SOIL	SOIL	SOIL	SOIL	SOIL
				Top Depth (m):	0.50	0.50	0.50	1.00	1.00
				Date Sampled:	08-Feb-2019	08-Feb-2019	08-Feb-2019	08-Feb-2019	08-Feb-2019
				Asbestos Lab:	COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY
Determinand	**Accred.**	**SOP**	**Units**	**LOD**					
Total PCBs (7 Congeners)	N	2815	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Total Phenols	U	2920	mg/kg	0.30	0.50	< 0.30	< 0.30	< 0.30	< 0.30

Results - Single Stage WAC

Project: Kilcarbury

					Landfill Waste Acceptance Criteria Limits		
Chemtest Job No:	19-05352						
Chemtest Sample ID:	773961						
Sample Ref:							
Sample ID:							
Sample Location:	BH11						
Top Depth(m):	1.00						
Bottom Depth(m):							
Sampling Date:	08-Feb-2019						
Determinand	**SOP**	**Accred.**	**Units**		**Inert Waste Landfill**	**Stable, Non-reactive hazardous waste in non-hazardous Landfill**	**Hazardous Waste Landfill**
Total Organic Carbon	2625	U	%	0.32	3	5	6
Loss On Ignition	2610	U	%	1.8	--	--	10
Total BTEX	2760	U	mg/kg	< 0.010	6	--	--
Total PCBs (7 Congeners)	2815	U	mg/kg	< 0.10	1	--	--
TPH Total WAC (Mineral Oil)	2670	U	mg/kg	< 10	500	--	--
Total (Of 17) PAH's	2800	N	mg/kg	< 2.0	100	--	--
pH	2010	U		8.5	--	>6	--
Acid Neutralisation Capacity	2015	N	mol/kg	0.082	--	To evaluate	To evaluate
Eluate Analysis			**10:1 Eluate mg/l**	**10:1 Eluate mg/kg**	**Limit values for compliance leaching test using BS EN 12457 at L/S 10 l/kg**		
Arsenic	1450	U	< 0.0010	< 0.050	0.5	2	25
Barium	1450	U	< 0.0010	< 0.50	20	100	300
Cadmium	1450	U	< 0.00010	< 0.010	0.04	1	5
Chromium	1450	U	< 0.0010	< 0.050	0.5	10	70
Copper	1450	U	< 0.0010	< 0.050	2	50	100
Mercury	1450	U	< 0.00050	< 0.0050	0.01	0.2	2
Molybdenum	1450	U	0.0034	< 0.050	0.5	10	30
Nickel	1450	U	< 0.0010	< 0.050	0.4	10	40
Lead	1450	U	< 0.0010	< 0.010	0.5	10	50
Antimony	1450	U	< 0.0010	< 0.010	0.06	0.7	5
Selenium	1450	U	< 0.0010	< 0.010	0.1	0.5	7
Zinc	1450	U	< 0.0010	< 0.50	4	50	200
Chloride	1220	U	< 1.0	< 10	800	15000	25000
Fluoride	1220	U	0.15	1.5	10	150	500
Sulphate	1220	U	1.3	13	1000	20000	50000
Total Dissolved Solids	1020	N	45	450	4000	60000	100000
Phenol Index	1920	U	< 0.030	< 0.30	1	-	-
Dissolved Organic Carbon	1610	U	5.2	52	500	800	1000

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

Waste Acceptance Criteria

Landfill WAC analysis (specifically leaching test results) must not be used for hazardous waste classification purposes. This analysis is only applicable for hazardous waste landfill acceptance and does not give any indication as to whether a waste may be hazardous or non-hazardous.

Test Methods

SOP	Title	Parameters included	Method summary
1020	Electrical Conductivity and Total Dissolved Solids (TDS) in Waters	Electrical Conductivity and Total Dissolved Solids (TDS) in Waters	Conductivity Meter
1220	Anions, Alkalinity & Ammonium in Waters	Fluoride; Chloride; Nitrite; Nitrate; Total; Oxidisable Nitrogen (TON); Sulfate; Phosphate; Alkalinity; Ammonium	Automated colorimetric analysis using 'Aquakem 600' Discrete Analyser.
1450	Metals in Waters by ICP-MS	Metals, including: Antimony; Arsenic; Barium; Beryllium; Boron; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Tin; Vanadium; Zinc	Filtration of samples followed by direct determination by inductively coupled plasma mass spectrometry (ICP-MS).
1610	Total/Dissolved Organic Carbon in Waters	Organic Carbon	TOC Analyser using Catalytic Oxidation
1920	Phenols in Waters by HPLC	Phenolic compounds including: Phenol, Cresols, Xylenols, Trimethylphenols Note: Chlorophenols are excluded.	Determination by High Performance Liquid Chromatography (HPLC) using electrochemical detection.
2010	pH Value of Soils	pH	pH Meter
2015	Acid Neutralisation Capacity	Acid Reserve	Titration
2030	Moisture and Stone Content of Soils(Requirement of MCERTS)	Moisture content	Determination of moisture content of soil as a percentage of its as received mass obtained at <37°C.
2120	Water Soluble Boron, Sulphate, Magnesium & Chromium	Boron; Sulphate; Magnesium; Chromium	Aqueous extraction / ICP-OES
2180	Sulphur (Elemental) in Soils by HPLC	Sulphur	Dichloromethane extraction / HPLC with UV detection
2192	Asbestos	Asbestos	Polarised light microscopy / Gravimetry
2300	Cyanides & Thiocyanate in Soils	Free (or easy liberatable) Cyanide; total Cyanide; complex Cyanide; Thiocyanate	Allkaline extraction followed by colorimetric determination using Automated Flow Injection Analyser.
2325	Sulphide in Soils	Sulphide	Steam distillation with sulphuric acid / analysis by 'Aquakem 600' Discrete Analyser, using N,N–dimethyl-p-phenylenediamine.
2430	Total Sulphate in soils	Total Sulphate	Acid digestion followed by determination of sulphate in extract by ICP-OES.
2450	Acid Soluble Metals in Soils	Metals, including: Arsenic; Barium; Beryllium; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Vanadium; Zinc	Acid digestion followed by determination of metals in extract by ICP-MS.
2490	Hexavalent Chromium in Soils	Chromium [VI]	Soil extracts are prepared by extracting dried and ground soil samples into boiling water. Chromium [VI] is determined by 'Aquakem 600' Discrete Analyser using 1,5-diphenylcarbazide.
2610	Loss on Ignition	loss on ignition (LOI)	Determination of the proportion by mass that is lost from a soil by ignition at 550°C.
2625	Total Organic Carbon in Soils	Total organic Carbon (TOC)	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.
2670	Total Petroleum Hydrocarbons (TPH) in Soils by GC-FID	TPH (C6–C40); optional carbon banding, e.g. 3-band – GRO, DRO & LRO*TPH C8–C40	Dichloromethane extraction / GC-FID
2680	TPH A/A Split	Aliphatics: >C5–C6, >C6–C8,>C8–C10, >C10–C12, >C12–C16, >C16–C21, >C21–C35, >C35– C44Aromatics: >C5–C7, >C7–C8, >C8– C10, >C10–C12, >C12–C16, >C16– C21, >C21– C35, >C35– C44	Dichloromethane extraction / GCxGC FID detection

Test Methods

SOP	Title	Parameters included	Method summary
2760	Volatile Organic Compounds (VOCs) in Soils by Headspace GC-MS	Volatile organic compounds, including BTEX and halogenated Aliphatic/Aromatics.(cf. USEPA Method 8260)*please refer to UKAS schedule	Automated headspace gas chromatographic (GC) analysis of a soil sample, as received, with mass spectrometric (MS) detection of volatile organic compounds.
2800	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Soil by GC-MS	Acenaphthene*; Acenaphthylene; Anthracene*; Benzo[a]Anthracene*; Benzo[a]Pyrene*; Benzo[b]Fluoranthene*; Benzo[ghi]Perylene*; Benzo[k]Fluoranthene; Chrysene*; Dibenz[ah]Anthracene; Fluoranthene*; Fluorene*; Indeno[123cd]Pyrene*; Naphthalene*; Phenanthrene*; Pyrene*	Dichloromethane extraction / GC-MS
2815	Polychlorinated Biphenyls (PCB) ICES7Congeners in Soils by GC-MS	ICES7 PCB congeners	Acetone/Hexane extraction / GC-MS
2920	Phenols in Soils by HPLC	Phenolic compounds including Resorcinol, Phenol, Methylphenols, Dimethylphenols, 1-Naphthol and TrimethylphenolsNote: chlorophenols are excluded.	60:40 methanol/water mixture extraction, followed by HPLC determination using electrochemical detection.
640	Characterisation of Waste (Leaching)	Waste material including soil, sludges and granular waste	ComplianceTest for Leaching of Granular Waste Material and Sludge

Report Information

Key

U	UKAS accredited
M	MCERTS and UKAS accredited
N	Unaccredited
S	This analysis has been subcontracted to a UKAS accredited laboratory that is accredited for this analysis
SN	This analysis has been subcontracted to a UKAS accredited laboratory that is not accredited for this analysis
T	This analysis has been subcontracted to an unaccredited laboratory
I/S	Insufficient Sample
U/S	Unsuitable Sample
N/E	not evaluated
<	"less than"
>	"greater than"

Comments or interpretations are beyond the scope of UKAS accreditation
The results relate only to the items tested
Uncertainty of measurement for the determinands tested are available upon request
None of the results in this report have been recovery corrected
All results are expressed on a dry weight basis
The following tests were analysed on samples as received and the results subsequently corrected to a dry weight basis TPH, BTEX, VOCs, SVOCs, PCBs, Phenols
For all other tests the samples were dried at < 37°C prior to analysis
All Asbestos testing is performed at the indicated laboratory
Issue numbers are sequential starting with 1 all subsequent reports are incremented by 1

Sample Deviation Codes

A - Date of sampling not supplied
B - Sample age exceeds stability time (sampling to extraction)
C - Sample not received in appropriate containers
D - Broken Container
E - Insufficient Sample (Applies to LOI in Trommel Fines Only)

Sample Retention and Disposal

All soil samples will be retained for a period of 45 days from the date of receipt
All water samples will be retained for 14 days from the date of receipt
Charges may apply to extended sample storage

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

Chemtest
The right chemistry to deliver results
Chemtest Ltd.
Depot Road
Newmarket
CB8 0AL
Tel: 01638 606070
Email: info@chemtest.com

UKAS TESTING
2183

Final Report

Report No.:	19-06556-1
Initial Date of Issue:	11-Mar-2019
Client	IGSL
Client Address:	M7 Business Park Naas County Kildare Ireland
Contact(s):	Darren Keogh
Project	Kilearberry

Quotation No.:		**Date Received:**	21-Feb-2019
Order No.:		**Date Instructed:**	21-Feb-2019
No. of Samples:	1		
Turnaround (Wkdays):	7	**Results Due:**	01-Mar-2019
Date Approved:	11-Mar-2019		

Approved By:

Details: Robert Monk, Technical Manager

Chemtest
The right chemistry to deliver results

Results - Leachate

Project: Kilearberry

Client: IGSL			**Chemtest Job No.:**		19-06556
Quotation No.:			**Chemtest Sample ID.:**		780176
			Sample Location:		BH12
			Sample Type:		SOIL
			Top Depth (m):		1.00
Determinand	**Accred.**	**SOP**	**Units**	**LOD**	
Ammonium	U	1220	mg/l	0.050	0.15
Ammonium	N	1220	mg/kg	0.10	1.5
Boron (Dissolved)	U	1450	µg/l	20	< 20
Boron (Dissolved)	U	1450	mg/kg	0.20	< 0.20

Chemtest
The right chemistry to deliver results

Results - Soil

Project: Kilearberry

Client: IGSL			**Chemtest Job No.:**		19-06556
Quotation No.:			**Chemtest Sample ID.:**		780176
			Sample Location:		BH12
			Sample Type:		SOIL
			Top Depth (m):		1.00
			Asbestos Lab:		DURHAM
Determinand	**Accred.**	**SOP**	**Units**	**LOD**	
ACM Type	U	2192		N/A	-
Asbestos Identification	U	2192	%	0.001	No Asbestos Detected
ACM Detection Stage	U	2192		N/A	-
Moisture	N	2030	%	0.020	2.5
Boron (Hot Water Soluble)	U	2120	mg/kg	0.40	< 0.40
Sulphur (Elemental)	U	2180	mg/kg	1.0	[A] 14
Cyanide (Total)	U	2300	mg/kg	0.50	[A] < 0.50
Sulphide (Easily Liberatable)	N	2325	mg/kg	0.50	[A] 11
Sulphate (Acid Soluble)	U	2430	%	0.010	[A] 0.65
Arsenic	U	2450	mg/kg	1.0	17
Barium	U	2450	mg/kg	10	13
Cadmium	U	2450	mg/kg	0.10	1.8
Chromium	U	2450	mg/kg	1.0	14
Molybdenum	U	2450	mg/kg	2.0	4.0
Antimony	N	2450	mg/kg	2.0	< 2.0
Copper	U	2450	mg/kg	0.50	23
Mercury	U	2450	mg/kg	0.10	< 0.10
Nickel	U	2450	mg/kg	0.50	30
Lead	U	2450	mg/kg	0.50	22
Selenium	U	2450	mg/kg	0.20	1.9
Zinc	U	2450	mg/kg	0.50	57
Chromium (Trivalent)	N	2490	mg/kg	1.0	14
Chromium (Hexavalent)	N	2490	mg/kg	0.50	< 0.50
Total Organic Carbon	U	2625	%	0.20	[A] 0.55
Mineral Oil	N	2670	mg/kg	10	< 10
Aliphatic TPH >C5-C6	N	2680	mg/kg	1.0	[AC] < 1.0
Aliphatic TPH >C6-C8	N	2680	mg/kg	1.0	[AC] < 1.0
Aliphatic TPH >C8-C10	U	2680	mg/kg	1.0	[AC] < 1.0
Aliphatic TPH >C10-C12	U	2680	mg/kg	1.0	[AC] < 1.0
Aliphatic TPH >C12-C16	U	2680	mg/kg	1.0	[AC] < 1.0
Aliphatic TPH >C16-C21	U	2680	mg/kg	1.0	[AC] < 1.0
Aliphatic TPH >C21-C35	U	2680	mg/kg	1.0	[AC] < 1.0
Aliphatic TPH >C35-C44	N	2680	mg/kg	1.0	[AC] < 1.0
Total Aliphatic Hydrocarbons	N	2680	mg/kg	5.0	[AC] < 5.0
Aromatic TPH >C5-C7	N	2680	mg/kg	1.0	[AC] < 1.0
Aromatic TPH >C7-C8	N	2680	mg/kg	1.0	[AC] < 1.0
Aromatic TPH >C8-C10	U	2680	mg/kg	1.0	[AC] < 1.0
Aromatic TPH >C10-C12	U	2680	mg/kg	1.0	[AC] < 1.0
Aromatic TPH >C12-C16	U	2680	mg/kg	1.0	[AC] < 1.0

Chemtest
The right chemistry to deliver results

Results - Soil

Project: Kilearberry

Client: IGSL			**Chemtest Job No.:**		19-06556
Quotation No.:			**Chemtest Sample ID.:**		780176
			Sample Location:		BH12
			Sample Type:		SOIL
			Top Depth (m):		1.00
			Asbestos Lab:		DURHAM
Determinand	**Accred.**	**SOP**	**Units**	**LOD**	
Aromatic TPH >C16-C21	U	2680	mg/kg	1.0	[AC] < 1.0
Aromatic TPH >C21-C35	U	2680	mg/kg	1.0	[AC] < 1.0
Aromatic TPH >C35-C44	N	2680	mg/kg	1.0	[AC] < 1.0
Total Aromatic Hydrocarbons	N	2680	mg/kg	5.0	[AC] < 5.0
Total Petroleum Hydrocarbons	N	2680	mg/kg	10.0	[AC] < 10
Benzene	U	2760	µg/kg	1.0	[AC] < 1.0
Toluene	U	2760	µg/kg	1.0	[AC] < 1.0
Ethylbenzene	U	2760	µg/kg	1.0	[AC] < 1.0
m & p-Xylene	U	2760	µg/kg	1.0	[AC] < 1.0
o-Xylene	U	2760	µg/kg	1.0	[AC] < 1.0
Methyl Tert-Butyl Ether	U	2760	µg/kg	1.0	[AC] < 1.0
Naphthalene	U	2800	mg/kg	0.10	< 0.10
Acenaphthylene	N	2800	mg/kg	0.10	< 0.10
Acenaphthene	U	2800	mg/kg	0.10	< 0.10
Fluorene	U	2800	mg/kg	0.10	< 0.10
Phenanthrene	U	2800	mg/kg	0.10	< 0.10
Anthracene	U	2800	mg/kg	0.10	< 0.10
Fluoranthene	U	2800	mg/kg	0.10	< 0.10
Pyrene	U	2800	mg/kg	0.10	< 0.10
Benzo[a]anthracene	U	2800	mg/kg	0.10	< 0.10
Chrysene	U	2800	mg/kg	0.10	< 0.10
Benzo[b]fluoranthene	U	2800	mg/kg	0.10	< 0.10
Benzo[k]fluoranthene	U	2800	mg/kg	0.10	< 0.10
Benzo[a]pyrene	U	2800	mg/kg	0.10	< 0.10
Indeno(1,2,3-c,d)Pyrene	U	2800	mg/kg	0.10	< 0.10
Dibenz(a,h)Anthracene	N	2800	mg/kg	0.10	< 0.10
Benzo[g,h,i]perylene	U	2800	mg/kg	0.10	< 0.10
Coronene	N	2800	mg/kg	0.10	< 0.10
Total Of 17 PAH's	N	2800	mg/kg	2.0	< 2.0
PCB 28	U	2815	mg/kg	0.010	[AC] < 0.010
PCB 52	U	2815	mg/kg	0.010	[AC] < 0.010
PCB 90+101	U	2815	mg/kg	0.010	[AC] < 0.010
PCB 118	U	2815	mg/kg	0.010	[AC] < 0.010
PCB 153	U	2815	mg/kg	0.010	[AC] < 0.010
PCB 138	U	2815	mg/kg	0.010	[AC] < 0.010
PCB 180	U	2815	mg/kg	0.010	[AC] < 0.010
Total PCBs (7 Congeners)	N	2815	mg/kg	0.10	[AC] < 0.10
Total Phenols	U	2920	mg/kg	0.30	< 0.30

Results - Single Stage WAC

Project: Kilearberry

					Landfill Waste Acceptance Criteria Limits		
Chemtest Job No:	19-06556						
Chemtest Sample ID:	780176						
Sample Ref:							
Sample ID:							
Sample Location:	BH12						
Top Depth(m):	1.00						
Bottom Depth(m):							
Sampling Date:							
Determinand	**SOP**	**Accred.**	**Units**		**Inert Waste Landfill**	**Stable, Non-reactive hazardous waste in non-hazardous Landfill**	**Hazardous Waste Landfill**
Total Organic Carbon	2625	U	%	[A] 0.55	3	5	6
Loss On Ignition	2610	U	%	0.99	--	--	10
Total BTEX	2760	U	mg/kg	[AC] < 0.010	6	--	--
Total PCBs (7 Congeners)	2815	U	mg/kg	< 0.10	1	--	--
TPH Total WAC (Mineral Oil)	2670	U	mg/kg	[AC] < 10	500	--	--
Total (Of 17) PAH's	2800	N	mg/kg	< 2.0	100	--	--
pH	2010	U		8.1	--	>6	--
Acid Neutralisation Capacity	2015	N	mol/kg	< 0.0020	--	To evaluate	To evaluate
Eluate Analysis			**10:1 Eluate mg/l**	**10:1 Eluate mg/kg**	**Limit values for compliance leaching test using BS EN 12457 at L/S 10 l/kg**		
Arsenic	1450	U	< 0.0010	< 0.050	0.5	2	25
Barium	1450	U	0.0012	< 0.50	20	100	300
Cadmium	1450	U	< 0.00010	< 0.010	0.04	1	5
Chromium	1450	U	< 0.0010	< 0.050	0.5	10	70
Copper	1450	U	< 0.0010	< 0.050	2	50	100
Mercury	1450	U	< 0.00050	< 0.0050	0.01	0.2	2
Molybdenum	1450	U	< 0.0010	< 0.050	0.5	10	30
Nickel	1450	U	< 0.0010	< 0.050	0.4	10	40
Lead	1450	U	< 0.0010	< 0.010	0.5	10	50
Antimony	1450	U	< 0.0010	< 0.010	0.06	0.7	5
Selenium	1450	U	< 0.0010	< 0.010	0.1	0.5	7
Zinc	1450	U	< 0.0010	< 0.50	4	50	200
Chloride	1220	U	< 1.0	< 10	800	15000	25000
Fluoride	1220	U	0.092	< 1.0	10	150	500
Sulphate	1220	U	1.6	16	1000	20000	50000
Total Dissolved Solids	1020	N	22	220	4000	60000	100000
Phenol Index	1920	U	0.16	1.6	1	-	-
Dissolved Organic Carbon	1610	U	7.2	72	500	800	1000

Solid Information	
Dry mass of test portion/kg	0.090
Moisture (%)	2.5

Waste Acceptance Criteria

Landfill WAC analysis (specifically leaching test results) must not be used for hazardous waste classification purposes. This analysis is only applicable for hazardous waste landfill acceptance and does not give any indication as to whether a waste may be hazardous or non-hazardous.

Deviations

In accordance with UKAS Policy on Deviating Samples TPS 63. Chemtest have a procedure to ensure 'upon receipt of each sample a competent laboratory shall assess whether the sample is suitable with regard to the requested test(s)'. This policy and the respective holding times applied, can be supplied upon request.The reason a sample is declared as deviating is detailed below. Where applicable the analysis remains UKAS/MCERTs accredited but the results may be compromised.

Sample:	Sample Ref:	Sample ID:	Sample Location:	Sampled Date:	Deviation Code(s):	Containers Received:
780176			BH12		AC	Plastic Tub 500g

Test Methods

SOP	Title	Parameters included	Method summary
1020	Electrical Conductivity and Total Dissolved Solids (TDS) in Waters	Electrical Conductivity and Total Dissolved Solids (TDS) in Waters	Conductivity Meter
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1450	Metals in Waters by ICP-MS	Metals, including: Antimony; Arsenic; Barium; Beryllium; Boron; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Tin; Vanadium; Zinc	Filtration of samples followed by direct determination by inductively coupled plasma mass spectrometry (ICP-MS).
1610	Total/Dissolved Organic Carbon in Waters	Organic Carbon	TOC Analyser using Catalytic Oxidation
1920	Phenols in Waters by HPLC	Phenolic compounds including: Phenol, Cresols, Xylenols, Trimethylphenols Note: Chlorophenols are excluded.	Determination by High Performance Liquid Chromatography (HPLC) using electrochemical detection.
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2030	Moisture and Stone Content of Soils(Requirement of MCERTS)	Moisture content	Determination of moisture content of soil as a percentage of its as received mass obtained at <37°C.
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2180	Sulphur (Elemental) in Soils by HPLC	Sulphur	Dichloromethane extraction / HPLC with UV detection
2192	Asbestos	Asbestos	Polarised light microscopy / Gravimetry
2300	Cyanides & Thiocyanate in Soils	Free (or easy liberatable) Cyanide; total Cyanide; complex Cyanide; Thiocyanate	Allkaline extraction followed by colorimetric determination using Automated Flow Injection Analyser.
2325	Sulphide in Soils	Sulphide	Steam distillation with sulphuric acid / analysis by 'Aquakem 600' Discrete Analyser, using N,N–dimethyl-p-phenylenediamine.
2430	Total Sulphate in soils	Total Sulphate	Acid digestion followed by determination of sulphate in extract by ICP-OES.
2450	Acid Soluble Metals in Soils	Metals, including: Arsenic; Barium; Beryllium; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Vanadium; Zinc	Acid digestion followed by determination of metals in extract by ICP-MS.
2490	Hexavalent Chromium in Soils	Chromium [VI]	Soil extracts are prepared by extracting dried and ground soil samples into boiling water. Chromium [VI] is determined by 'Aquakem 600' Discrete Analyser using 1,5-diphenylcarbazide.
2610	Loss on Ignition	loss on ignition (LOI)	Determination of the proportion by mass that is lost from a soil by ignition at 550°C.
2625	Total Organic Carbon in Soils	Total organic Carbon (TOC)	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.
2670	Total Petroleum Hydrocarbons (TPH) in Soils by GC-FID	TPH (C6–C40); optional carbon banding, e.g. 3-band – GRO, DRO & LRO*TPH C8–C40	Dichloromethane extraction / GC-FID
2680	TPH A/A Split	Aliphatics: >C5–C6, >C6–C8,>C8–C10, >C10–C12, >C12–C16, >C16–C21, >C21–C35, >C35– C44Aromatics: >C5–C7, >C7–C8, >C8– C10, >C10–C12, >C12–C16, >C16– C21, >C21– C35, >C35– C44	Dichloromethane extraction / GCxGC FID detection

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Test Methods

SOP	Title	Parameters included	Method summary
2760	Volatile Organic Compounds (VOCs) in Soils by Headspace GC-MS	Volatile organic compounds, including BTEX and halogenated Aliphatic/Aromatics.(cf. USEPA Method 8260)*please refer to UKAS schedule	Automated headspace gas chromatographic (GC) analysis of a soil sample, as received, with mass spectrometric (MS) detection of volatile organic compounds.
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2815	Polychlorinated Biphenyls (PCB) ICES7Congeners in Soils by GC-MS	ICES7 PCB congeners	Acetone/Hexane extraction / GC-MS
2920	Phenols in Soils by HPLC	Phenolic compounds including Resorcinol, Phenol, Methylphenols, Dimethylphenols, 1-Naphthol and TrimethylphenolsNote: chlorophenols are excluded.	60:40 methanol/water mixture extraction, followed by HPLC determination using electrochemical detection.
640	Characterisation of Waste (Leaching)	Waste material including soil, sludges and granular waste	ComplianceTest for Leaching of Granular Waste Material and Sludge

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N	Unaccredited
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T	This analysis has been subcontracted to an unaccredited laboratory
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U/S	Unsuitable Sample
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>	"greater than"

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Uncertainty of measurement for the determinands tested are available upon request
None of the results in this report have been recovery corrected
All results are expressed on a dry weight basis
The following tests were analysed on samples as received and the results subsequently corrected to a dry weight basis TPH, BTEX, VOCs, SVOCs, PCBs, Phenols
For all other tests the samples were dried at < 37°C prior to analysis
All Asbestos testing is performed at the indicated laboratory
Issue numbers are sequential starting with 1 all subsequent reports are incremented by 1

Sample Deviation Codes

A - Date of sampling not supplied
B - Sample age exceeds stability time (sampling to extraction)
C - Sample not received in appropriate containers
D - Broken Container
E - Insufficient Sample (Applies to LOI in Trommel Fines Only)

Sample Retention and Disposal

All soil samples will be retained for a period of 45 days from the date of receipt
All water samples will be retained for 14 days from the date of receipt
Charges may apply to extended sample storage

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

Appendix 10

As-Surveyed Site Plans

ExpertGPS

21452 Kilcarbery - Boreholes, Coreholes, Trial Pits and Dynamic Probes

50 0 50 100 150 200 250 300 350 400 450 500 550 600 650 700 750 800 850 900 950 1000 m

Scale: 1 : 4000.

MN

2°47'

ExpertGPS

21452 Kilcarbery - Plate Bearing Tests, Infiltration Tests and Window Samples

50 0 50 100 150 200 250 300 350 400 450 500 550 600 650 700 750 800 850 900 950 1000 m

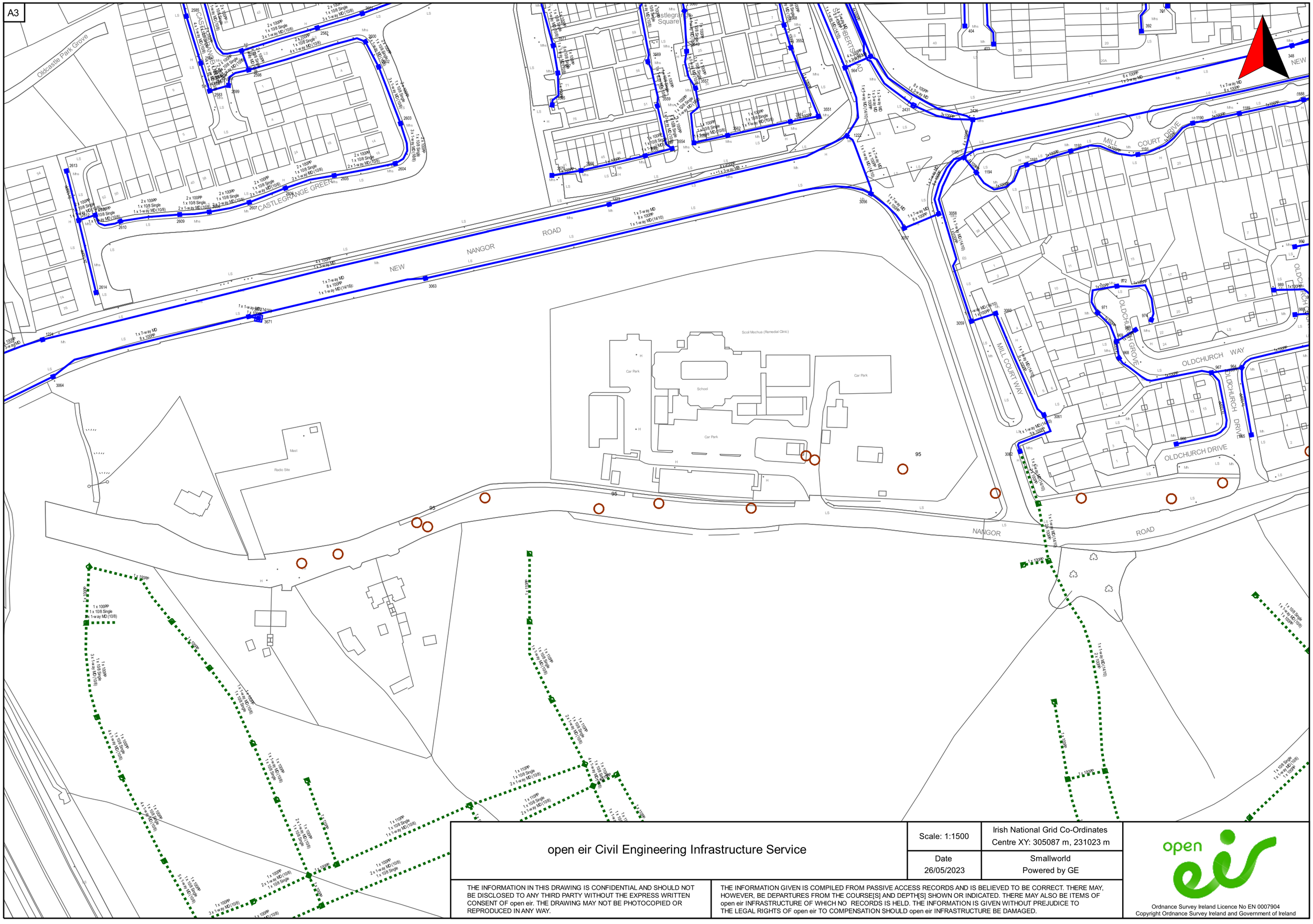
Scale: 1 : 4000.

MN

2°47'

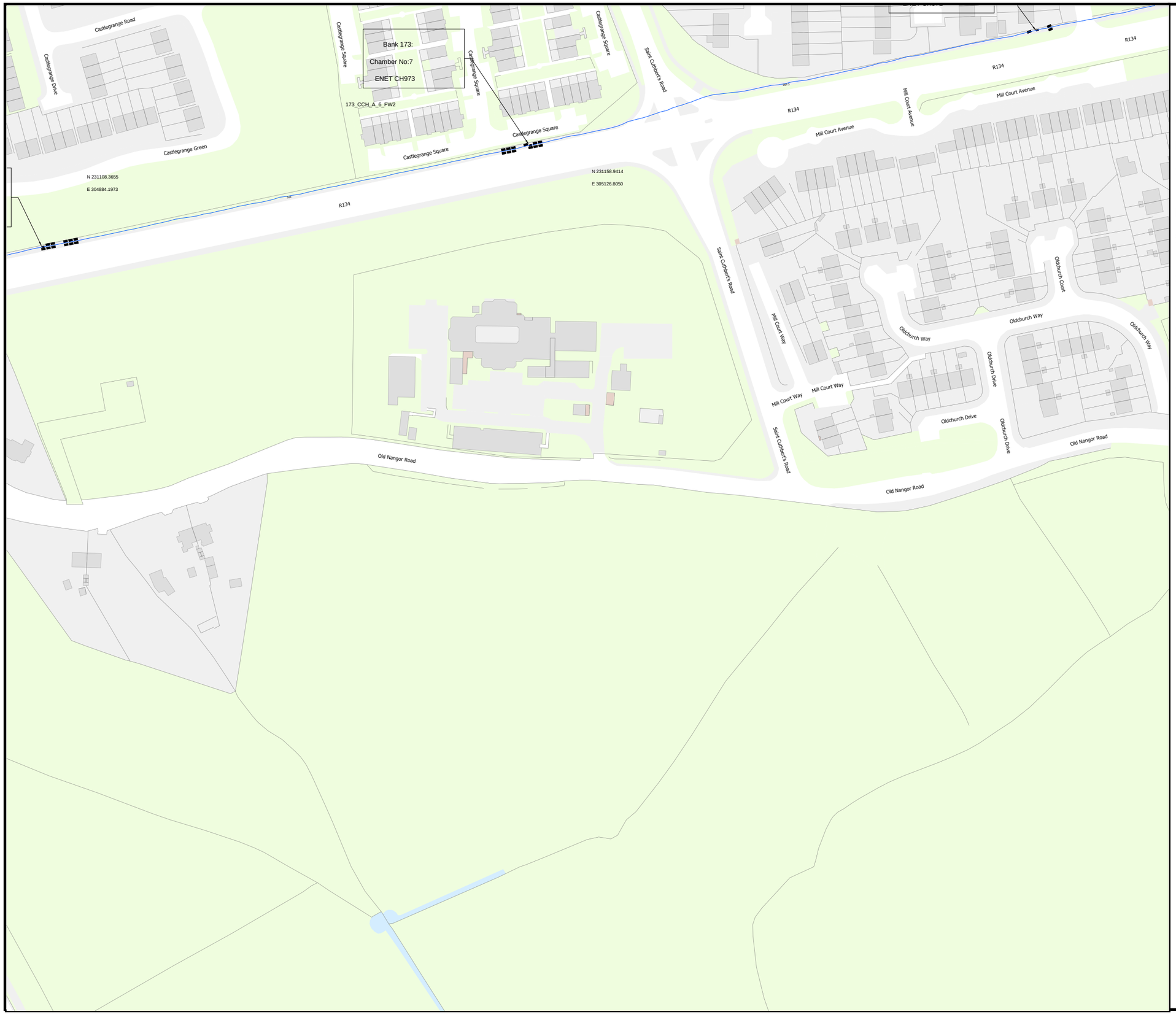
Appendix G : Existing Records

A3



open eir Civil Engineering Infrastructure Service

Scale: 1:1500	Irish National Grid Co-Ordinates Centre XY: 305087 m, 231023 m
Date 26/05/2023	Smallworld Powered by GE



Drawing Produced: 14/04/2023 10:58

Description of Works:

230414 - 230026

Project Reference:

School Site

Customer Name: Pierce Lynch

Company: DBFL

Disclaimer:

LEGEND

DUCT
THIRD PARTY DUCT
THIRD PARTY CHAMBER
CARRIAGEWAY CHAMBER (CW1)
CARRIAGEWAY CHAMBER (CW2)
CARRIAGEWAY CHAMBER (CW3)
FOOTWAY CHAMBER (FW1)
FOOTWAY CHAMBER (FW2)
FOOTWAY CHAMBER (FW3)
VERGECHAMBER (VW1)
VERGE CHAMBER (VW2)
VERGE CHAMBER (VW3)
CHAMBER LXXX
SWEPT T SWTXXX
CAP END CPXXX
SPLICE POINT
LOOPJOINT
DESCRIPTION
SPECIAL ENGINEERING DIFFICULTY
SWEPT TEE

NOTES:
ALL DUCTS AT STANDARD DEPTH
600mm IN CARRIAGEWAY
450mm IN FOOTWAY/GRASS
UNLESS OTHERWISE SHOWN eg
350

SHEET SCHEMATIC
nnn
CPnnn
CUSTOMER PREMISES

DUCT CONFIGURATION
(4 X110mm WITH 1 DUCT SUBDUCTED)
COR1CH00_nnn-00_nnn

TITLE: 20230607-031_A3

ESB Networks

COLOUR CODE:

- BLACK - 38KV & HIGHER VOLTAGE OVERHEAD LINES
- GREEN - MV(10KV/20KV) OVERHEAD LINES
- BLUE - LV (400V/230V) OVERHEAD LINES
- CYAN - 38KV & HIGHER VOLTAGE UNDERGROUND CABLE ROUTES
- RED - MV/LV (10KV/20KV/400V/230V) UNDERGROUND CABLE ROUTES

DATE: 07-Jun-2023

** SCALE: 1:1000

** SCALE WHEN PRINTED ON AN A3 PAGE
XY COORDINATES DISPLAYED IN IRISH GRID COORDINATE SYSTEM

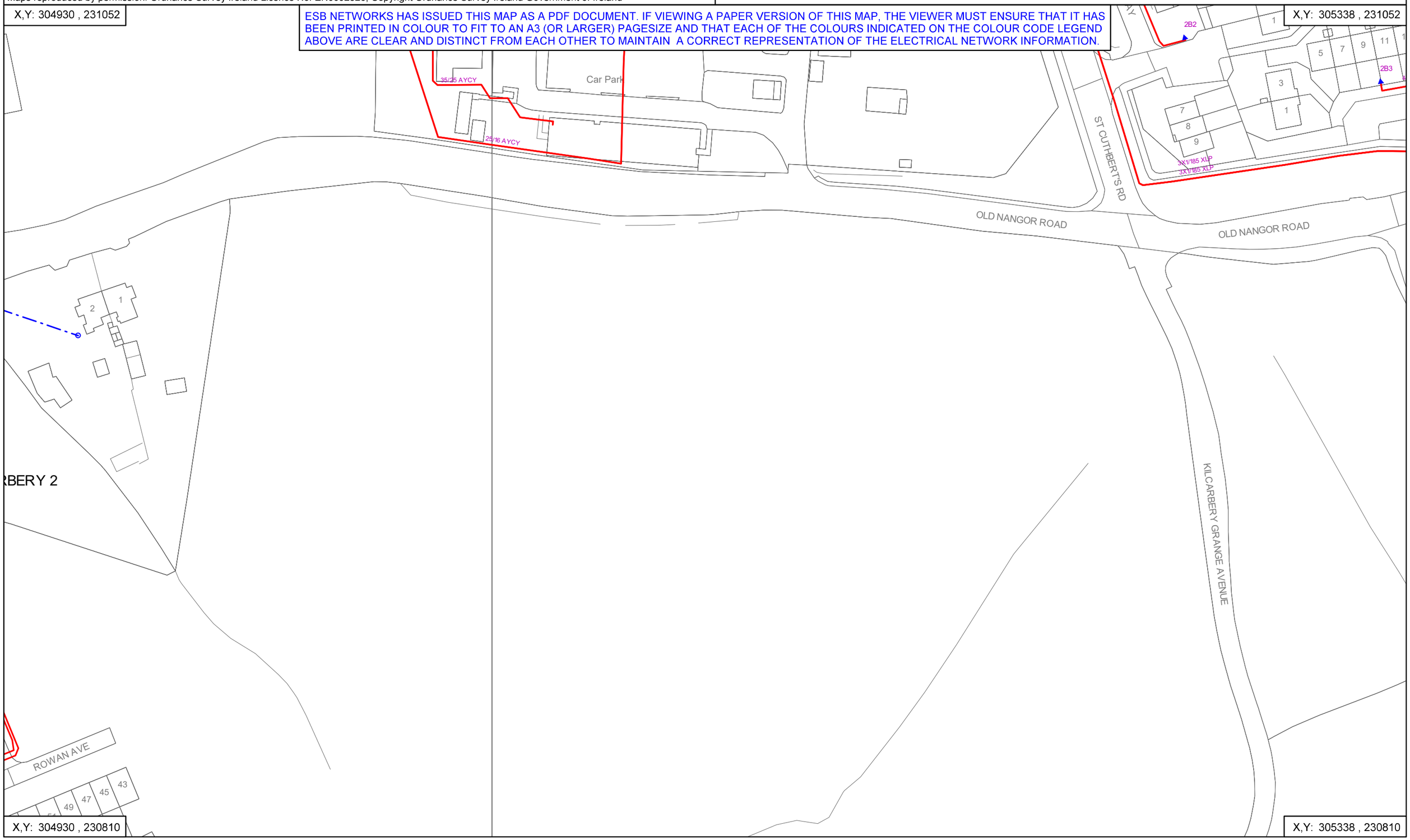
WARNING

THIS MAP INDICATES THE APPROXIMATE LOCATION OF ESB TRANSMISSION (400KV, 220KV, 110KV, 38KV) AND DISTRIBUTION (20KV, 10KV, 230V/400V) UNDERGROUND CABLES AND OVERHEAD LINES IN THE GENERAL AREA OF THE PROPOSED WORKS. ESB NETWORKS TAKES NO RESPONSIBILITY FOR THE ACCURACY OR COMPLETENESS OF THE MAP. IT IS THE USER'S RESPONSIBILITY TO INDEPENDENTLY VERIFY THE INFORMATION AND THE LOCATION OF UNDERGROUND CABLES AND OVERHEAD LINES. LOW VOLTAGE (230V/400V) SERVICE CABLES (E.G. HOUSE SERVICES, FACTORY/SHOP SERVICES, PUBLIC LIGHTING LAMP SERVICES, ETC) ARE NOT INCLUDED BUT THEIR PRESENCE SHOULD BE ANTICIPATED. THE DEPTHS OF UNDERGROUND CABLES MUST NEVER BE ASSUMED. ADDITIONAL MORE DETAILED INFORMATION IS AVAILABLE FOR HIGH VOLTAGE TRANSMISSION UNDERGROUND CABLES (38KV, 110KV, 220KV, 400KV) FROM THE LOCAL ESB NETWORKS TRANSMISSION REPRESENTATIVE - SEE ATTACHED LIST FOR CONTACT DETAILS OR CALL 1800 372 757. NO WORK SHOULD BE CARRIED OUT IN THE VICINITY OF 38KV OR HIGHER VOLTAGE UNDERGROUND CABLES WITHOUT PRIOR CONSULTATION WITH ESB NETWORKS. BEFORE ANY MECHANICAL EXCAVATION IS UNDERTAKEN, THE ACTUAL LOCATION OF ALL UNDERGROUND ELECTRICITY CABLES MUST BE ESTABLISHED AND VERIFIED ON THE SITE USING: (A) UP-TO-DATE MAP RECORDS; (B) CABLE LOCATER EQUIPMENT OPERATED IN BOTH POWER AND RADIO MODES; (C) CAREFUL HAND DIGGING OF TRIAL HOLES USING 'SAFE DIGGING PRACTICE'. REFER ALSO TO 'HSA CODE OF PRACTICE FOR AVOIDING DANGER FROM UNDERGROUND SERVICES'. ESB TAKES NO RESPONSIBILITY FOR AND SHALL BEAR NO LIABILITY, HOWSOEVER ARISING, IN RELATION TO ANY DAMAGE, INJURY/DEATH OR LOSS OF SUPPLY AS A RESULT OF DAMAGE OR INTERFERENCE WITH ITS NETWORKS.

ESB NETWORKS HAS ISSUED THIS MAP AS A PDF DOCUMENT. IF VIEWING A PAPER VERSION OF THIS MAP, THE VIEWER MUST ENSURE THAT IT HAS BEEN PRINTED IN COLOUR TO FIT TO AN A3 (OR LARGER) PAGESIZE AND THAT EACH OF THE COLOURS INDICATED ON THE COLOUR CODE LEGEND ABOVE ARE CLEAR AND DISTINCT FROM EACH OTHER TO MAINTAIN A CORRECT REPRESENTATION OF THE ELECTRICAL NETWORK INFORMATION.

X,Y: 304930 , 231052

X,Y: 305338 , 231052



X,Y: 304930 , 230810

X,Y: 305338 , 230810

Important Safety Notice: Damage to gas pipelines can result in serious injury or death. Gas network information is provided as a general guide. The exact location and depth of medium or low pressure distribution gas pipes must be verified on site by carrying out necessary investigations, including, for example, hand digging trial holes along the route of the pipe. Service pipes are not generally shown but their presence should always be anticipated.

High pressure transmission pipelines are shown in red. If a transmission pipeline is identified within 10m of any intended excavations then work must not proceed before GNI has been consulted. The true location and depth of a transmission pipeline must be verified on site by a representative of GNI. Contact can be made through 1800 427 747.

All work in the vicinity of the gas network must be completed in accordance with the current edition of the Health and Safety Authority publication, 'Code of Practice For Avoiding Danger From Underground Services' which is available from the Health and Safety Authority (0818 289 389) or can be downloaded at www.hsa.ie.

Legal Notice: Gas Networks Ireland (GNI) and its affiliates, accept no responsibility for the accuracy of any information contained in this document including data concerning location and technical designation of the gas distribution and transmission network (the"Information"). The Information should not be relied on for accurate distance or depth of cover measurements.

Any representations and warranties, express or implied, are excluded to the fullest extent permitted by law. No liability shall be accepted for any loss or damage including, without limitation,direct, indirect or consequential loss, arising out of or in connection with the use or re-use of the Information.

Aurora Telecom Duct
Aurora Telecom Sub Duct
Aurora Telecom Inserted Gas Pipe

Aurora TELECOM

Aurora Telecom Queries - 01-8926166 (Office Hours)
Aurora_Network_Queries@gasnetworks.ie
Aurora Telecom Emergency Only 1800 427399 / 01 2030120

- Transmission Pipe (High Pressure)
- Transmission Pipe (Construction Issue)
- Distribution Pipe (Medium Pressure)
- Distribution Pipe (Low Pressure)
- Service Pipe (Medium Pressure)
- Service Pipe (Low Pressure)
- Strategic Pipe (Medium Pressure)
- Strategic Pipe (Low Pressure)
- Inserted
- Abandoned Pipe

C=?	Cover (depth in metres)		Pressure Monitor
CP	CP Test Point		Protection (Slabbing)
	End Cap		Protection (Sleeve)
	Hot Tap		Reducer
	Installation		Service Terminator
	Valve		Tee
	Mains Verification**		Transition

** Please contact GNI on 1800-427747 for specific information

DIAL BEFORE YOU DIG 1800 427 747 — In Emergency call 1800 20 50 50 — Gas Networks Ireland

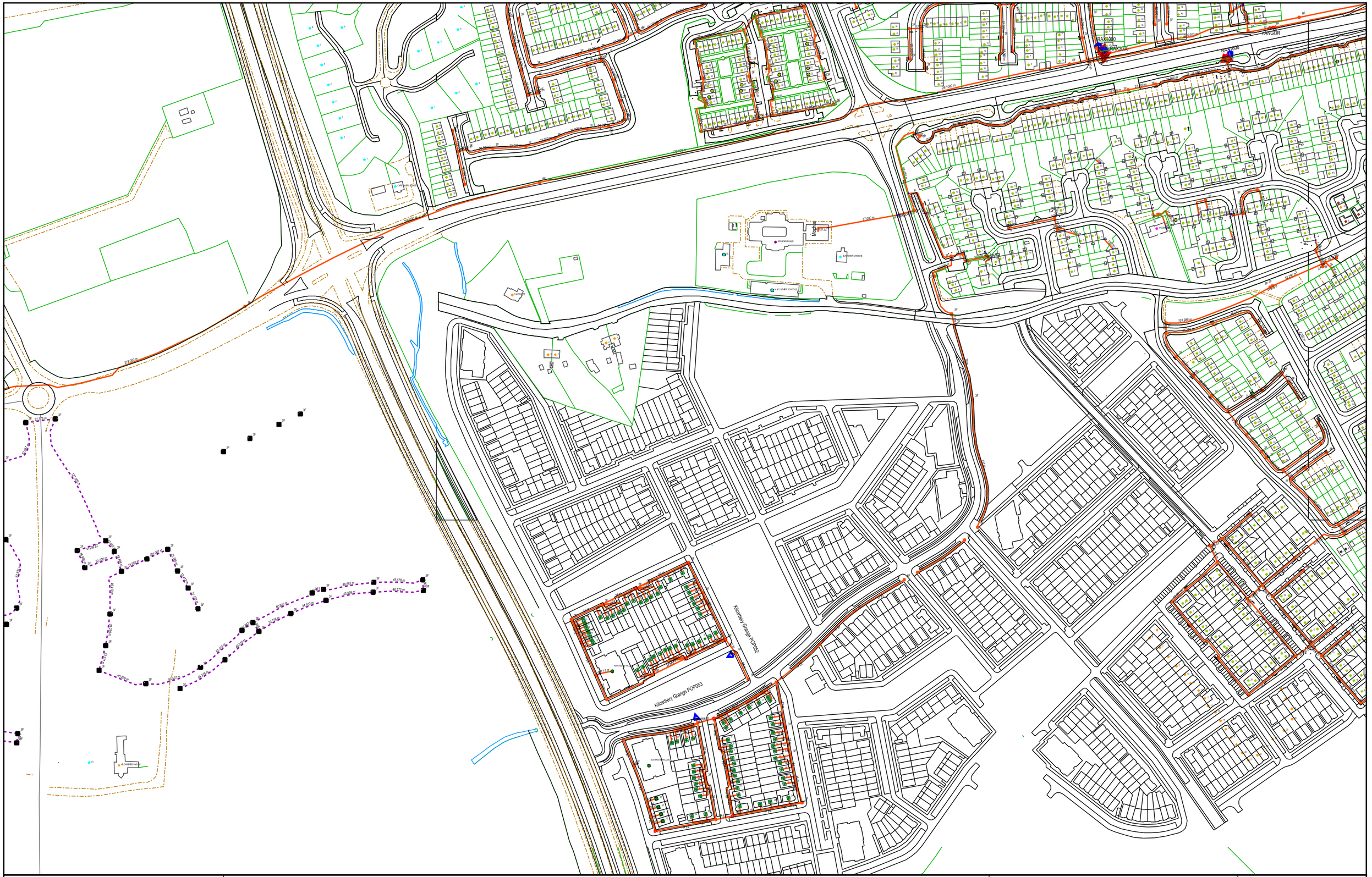
Gas Networks Ireland

GAS NETWORK INFORMATION

Description: 230414 - 230026

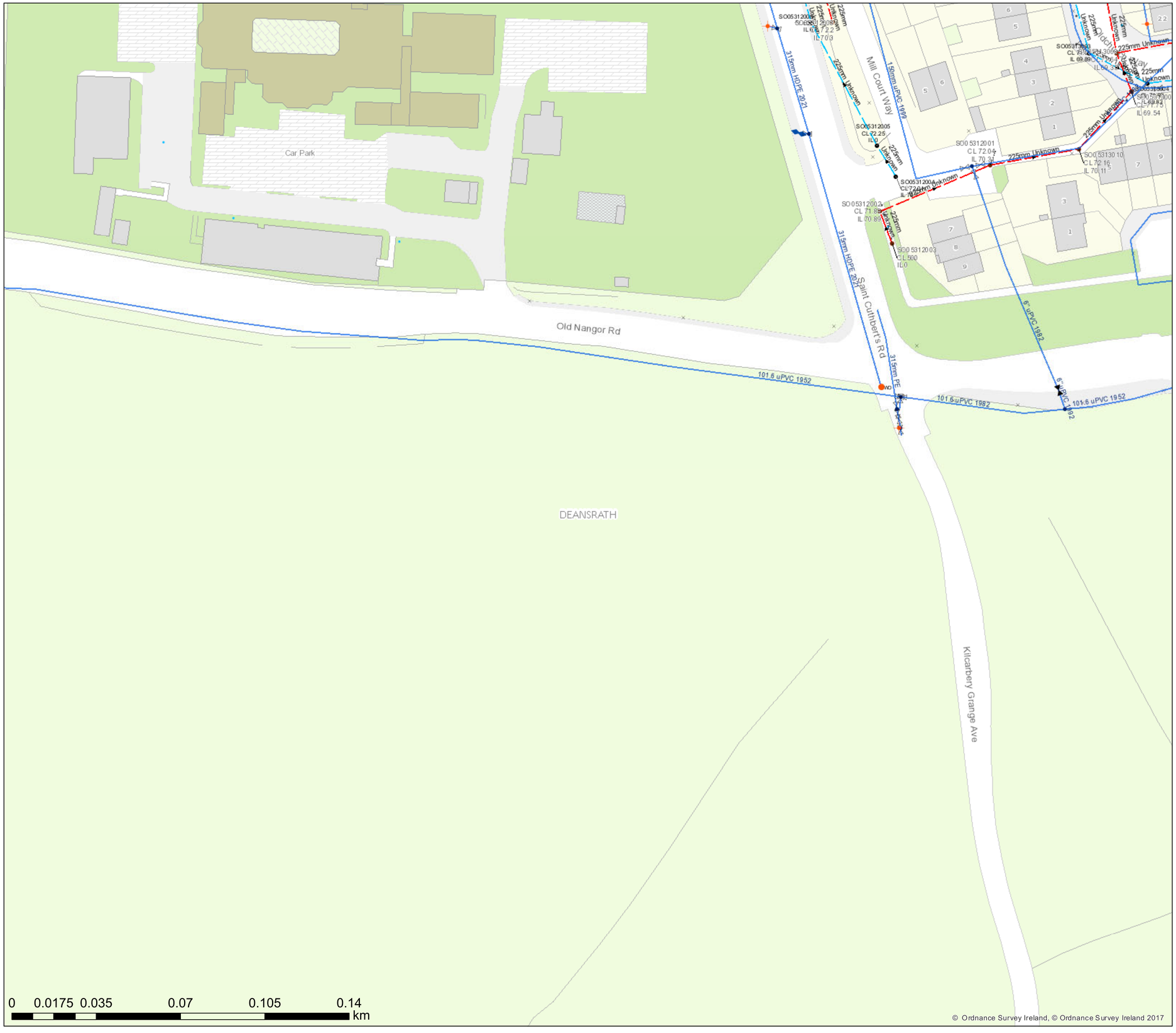
Location: 705029,731038

Plot Date: 14/04/2023 09:53	Scale: 2500 @ A3
Plotted By: 1327	Ref ID: *1327_14042023095350*



Unit 7, Westgate Business Park, Ballymount, Dublin 24.	PROJECT NAME DESIGNED BY:	Ordnance Survey Ireland Licence No. EN0023805 (c) Ordnance Survey Ireland and Government of Ireland Produced on: 29/05/2023	@ A3

Irish Water Web Map



UISCE ÉIREANN : IRISH WATER

Print Date: 26/05/2023

Printed by:Irish Water

Water Distribution Network
- Water Treatment Plant
- Water Pump Station
- Storage Cell/Tower
- Dosing Point
- Meter Station
- Abstraction Point
- Telemetry Kiosk

Reservoir
- Potable
- Raw Water

Water Distribution Mains
- Irish Water
- Private

Trunk Water Mains
- Irish Water
- Private

Water Lateral Lines
- Irish Water
- Non IW
- Water Casings
- Water Abandoned Lines
- Boundary Meter
- Bulk/Check Meter
- Group Scheme
- Source Meter
- Waste Meter
- Unknown Meter ; Other Meter
- Non-Return
- PRV
- PSV
- Sluice Line Valve Open/Closed
- Butterfly Line Valve Open/Closed
- Sluice Boundary Valve Open/Closed
- Butterfly Boundary Valve Open/Closed
- Scour Valves
- Single Air Control Valve
- Double Air Control Valve
- Water Stop Valves
- Water Service Connections
- Water Distribution Chambers
- Water Network Junctions
- Pressure Monitoring Point
- Fire Hydrant
- Fire Hydrant/Washout

Water Fittings
- Cap
- Reducer
- Tap
- Other Fittings

Sewer Foul Combined Network
- Waste Water Treatment Plant
- Waste Water Pump station

Sewer Mains Irish Water
- Gravity - Combined
- Gravity - Foul
- Gravity - Unknown
- Pumping - Combined
- Pumping - Foul
- Pumping - Unknown
- Syphon - Combined
- Syphon - Foul
- Overflow

Sewer Mains Private
- Gravity - Combined
- Gravity - Foul
- Gravity - Unknown
- Pumping - Combined
- Pumping - Foul
- Pumping - Unknown
- Syphon - Combined
- Syphon - Foul
- Overflow
- Sewer Lateral Lines
- Sewer Casings

Sewer Manholes
- Standard
- Backdrop
- Cascade
- Catchpit
- Bifurcation
- Hatchbox
- Lamphole
- Hydrobrake
- Other; Unknown

Discharge Type
- Outfall
- Overflow
- Soakaway
- Standard Outlet
- Other; Unknown

Cleanout Type
- Rodding Eye
- Flushing Structure
- Other; Unknown

Sewer Inlets
- Catchpit
- Gully
- Standard
- Other; Unknown

Sewer Fittings
- Vent/Col
- Other; Unknown

Storm Water Network

Surface Water Mains
- Surface Gravity Mains
- Surface Gravity Mains Private
- Surface Water Pressurised Mains
- Surface Water Pressurised Mains Private

Inlet Type
- Gully
- Standard
- Other; Unknown

Storm Manholes
- Standard
- Backdrop
- Cascade
- Catchpit
- Bifurcation
- Hatchbox
- Lamphole
- Hydrobrake
- Other; Unknown
- Storm Culverts
- Storm Clean Outs
- Stormwater Chambers

Discharge Type
- Outfall
- Overflow
- Soakaway
- Other; Unknown

Gas Networks Ireland
- Transmission High Pressure Gasline
- Distribution Medium Pressure Gasline
- Distribution Low Pressure Gasline

ESB Networks

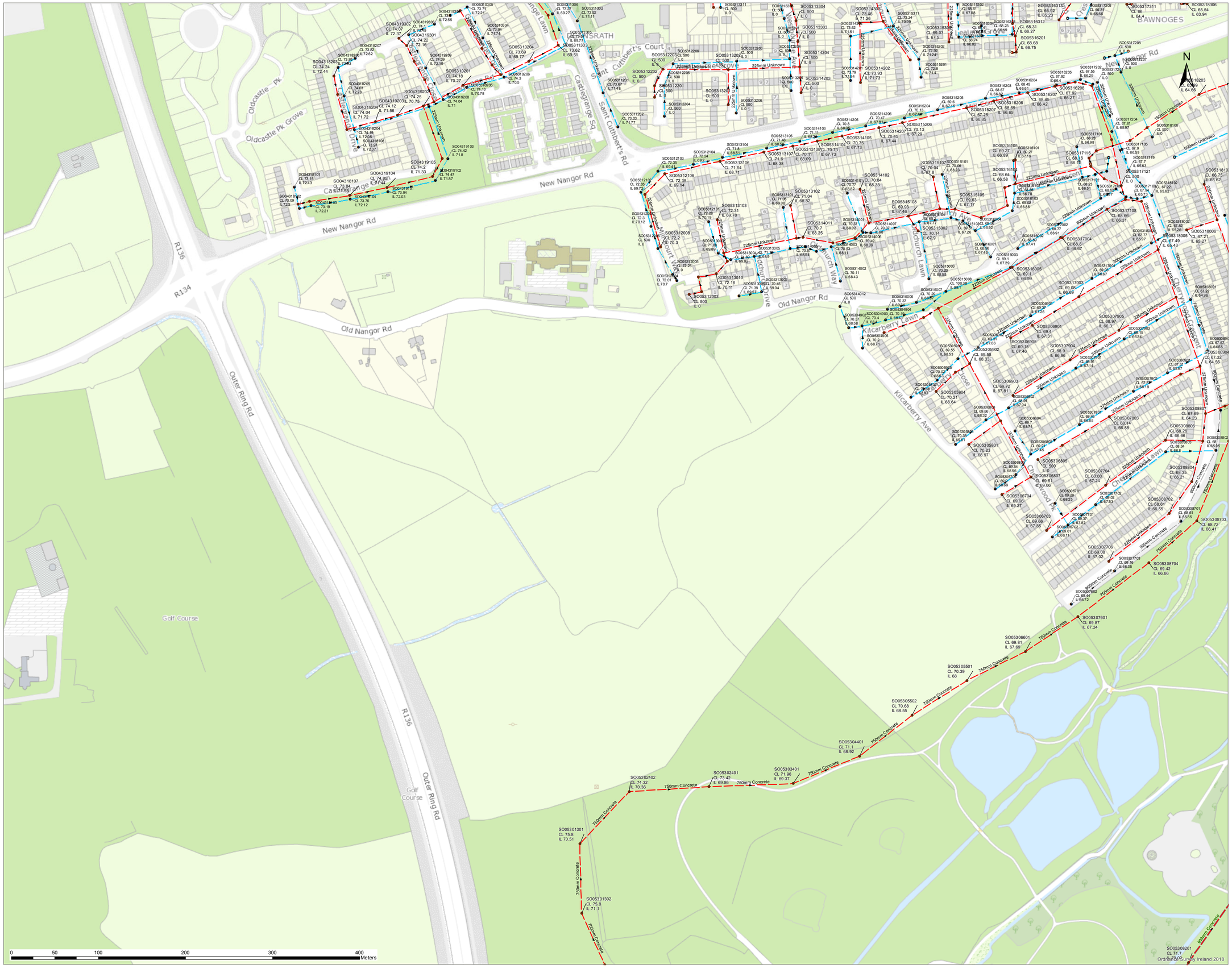
ESB HV Lines
- HV Underground
- HV Overhead
- HV Abandoned

ESB MVLV Lines
- MV Overhead Three Phase
- MV Overhead Single Phase
- LV Overhead Three Phase
- LV Overhead Single Phase
- MVLV Underground
- Abandoned

Non Service Categories
- Proposed
- Under Construction
- Out of Service
- Decommissioned

Water Non Service Assets
- Water Point Feature
- Water Pipe
- Water Structure

Waste Non Service Assets
- Waste Point Feature
- Sewer
- Waste Structure

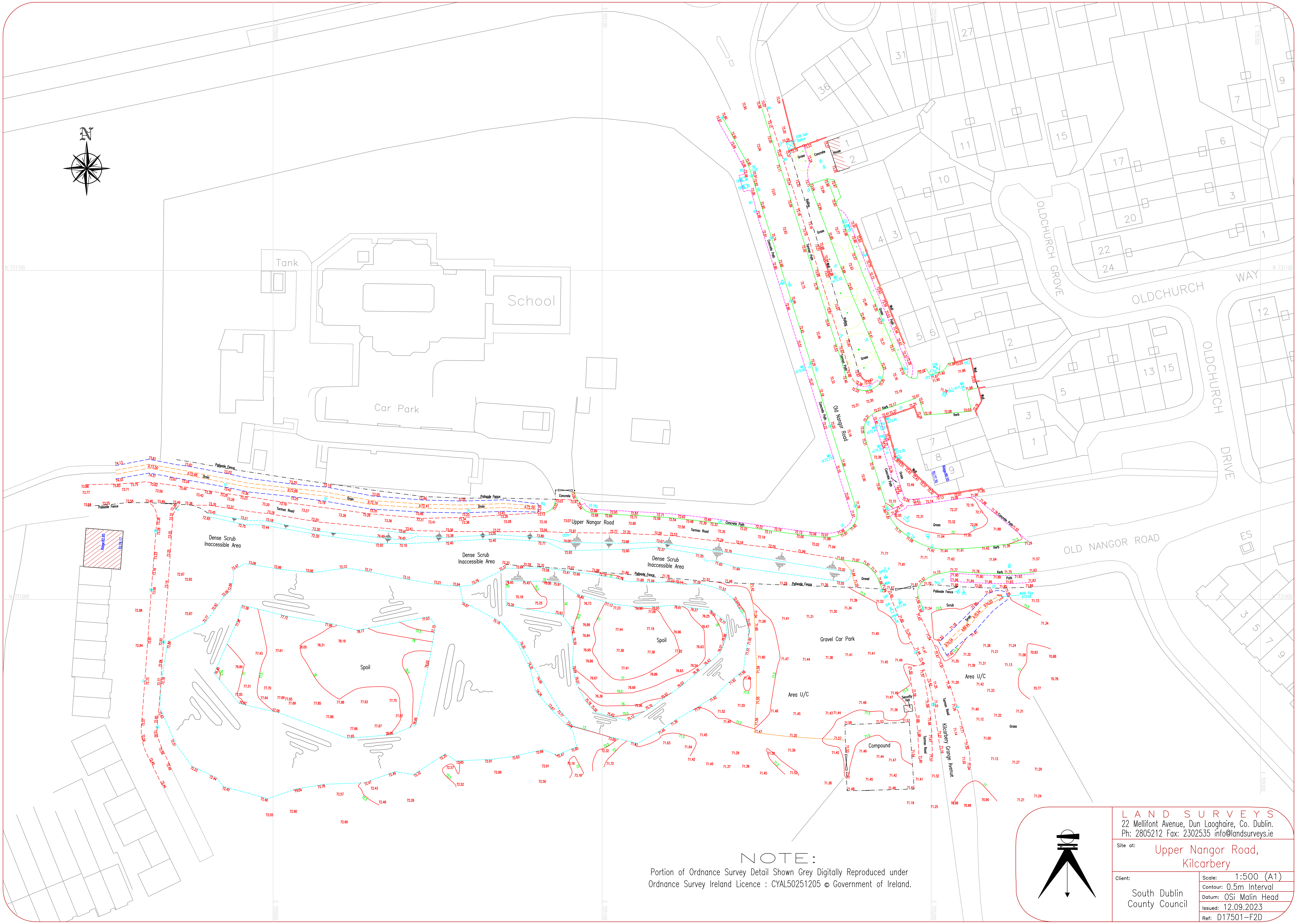


UISCE ÉIREANN : IRISH WATER

Legend

- Gravity - Combined
- Gravity - Foul
- Gravity - Overflow
- Gravity - Unknown
- Pumping - Combined
- Pumping - Foul
- Pumping - Overflow
- Pumping - Unknown
- Syphon - Combined
- Syphon - Foul
- Syphon - Overflow
- Overflow
- Surface Gravity Mains
- Surface Gravity Mains Private
- Surface Water Pressurised Mains
- Surface Water Pressurised Mains Private

Appendix H : Topo



NOTE:

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LAND SURVEYS
22 Mellifont Avenue, Dun Laoghaire, Co. Dublin.
Ph: 2805212 Fax: 2302535 info@landsurveys.ie

Site at: Upper Nangor Road, Kilcarbery

Client: South Dublin County Council

Scale:	1:500 (A1)
Contour:	0.5m Interval
Datum:	OSi Malin Head
Issued:	12.09.2023
Ref:	D17501-F2D

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