Waterman Moylan
Engineering Consultants

Engineering Assessment Report

Strategic Housing Development for Lands at Glenamuck Road North, Carrickmines, Dublin 18

April 2022

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This document has been prepared and checked in accordance with
Waterman Group's IMS (BS EN ISO 9001: 2015, BS EN ISO 14001: 2015)

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Comments

Disclaimer

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This report is confidential to the Client and we accept no responsibility of whatsoever nature to third parties to whom this report, or any part thereof, is made known. Any such party relies on the report at its own risk.

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1. Introduction

Waterman Moylan have been appointed by Moran Park Homebuilders Limited to provide engineering services for a proposed residential development, to be submitted to An Bord Pleanála via the Strategic Housing Development (SHD) route, for the proposed development of 118 No. residential units within 3 No. blocks, at Lands at Glenamuck Road North, Carrickmines, Dublin 18.

This report describes the criteria used to design the storm water discharge, disposal of foul water, water supply and vehicular access to the developed site. It also aims to address the comments received from DLRCC/An Bord Pleanala during the pre-application process with An Bord Pleanala.

2. Site Description

2.1 Site Location

The site is located in the administrative area of Dun Laoghaire Rathdown County Council.

Moran Park Homebuilders Limited intend to apply to An Bord Pleanála for planning permission for a strategic housing development on an overall site of c. 0.92 ha (c. 0.74ha relates to the main development site and c. 0.18ha relates to additional lands for drainage and access proposals) at Glenamuck Road North, Carrickmines, Dublin 18 (bounded by ‘Tullybeg’ to the north, ‘Chigwell’ to the northeast, ‘Stafford Lodge’ to the south and ‘Carricáil’ to the southeast). Refer to Figure 1 and Figure 2 for the location of the proposed development.

Figure 1: Site Location (image taken from Google Earth)

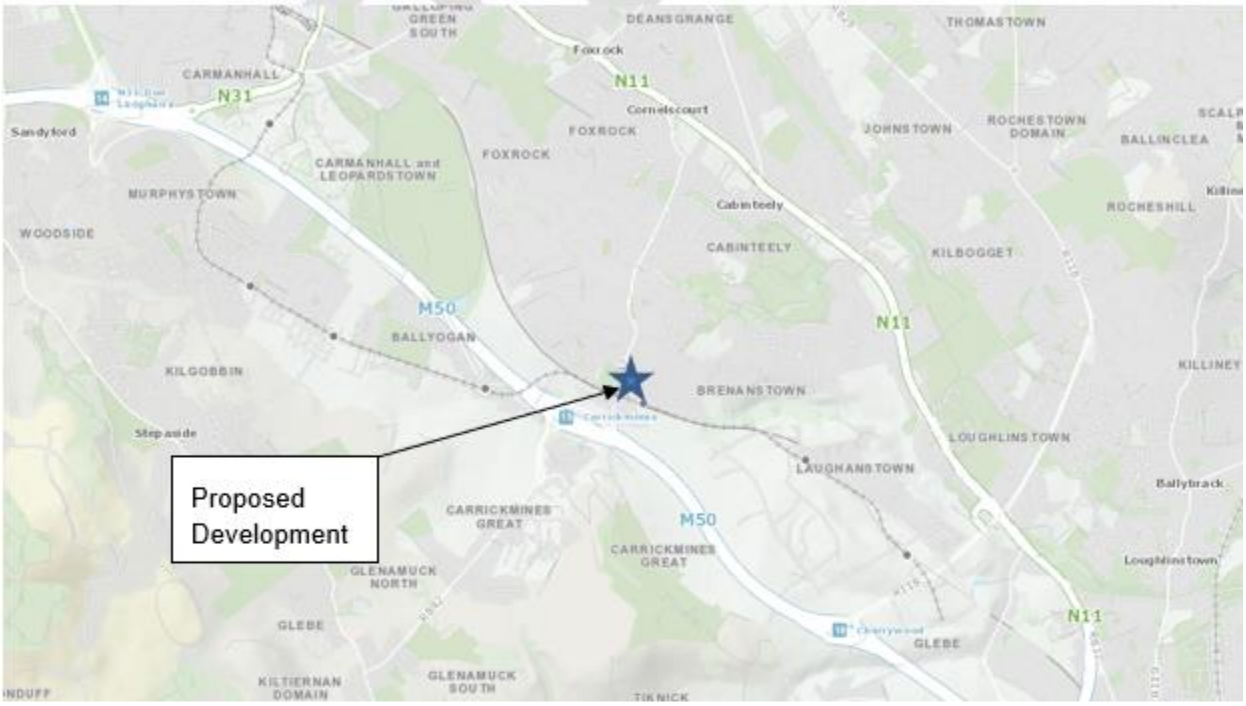


Figure 2: Site Location (image taken from Google Earth)

2.2 Background

A planning application for the subject site has been previously submitted and approved under Reg. Ref. D16A/0260 and An Bord Pleanala Reference No. PL06D.247822. The permission provided for the construction of 6 no. houses, 36 no. apartments over two apartment blocks, a total of 89 no. car parking spaces (73 undercroft and 16 surface level), 40 no. cycle parking spaces and a new priority-controlled T-junction on Glenamuck Road North to provide access to the scheme.

A committed residential development to the south of the proposed development site (approved under Reg. Ref. D18A/1187 and PL06D.304995) will also benefit from the approved site access junction, granting permeability between both developments. This committed development scheme comprises of a total of 30 no. residential units (8 no. apartments and 22 no. duplexes).

2.3 Proposed Development

The proposed development shall provide for the construction of 118 no. residential apartment units in the form of 3 no. residential blocks of apartments ranging in height from 4 storey’s and transitioning to 6-7 storeys overall

The overall development proposal shall provide for the following:

- Block A (7 storeys) comprising 44 no. units (13 no. 1 bed units, 28 no. 2 bed. units and 3 no. 3 bed units);
- Block B (6-7 storeys overall) comprising 38 no. units (11 no. 1 bed units, 26 no. 2 bed units and 1 no. 3 bed units); and

- Block C (6 storeys overall) comprising 36 units (10 no. 1 bed units; 22 no. 2 bed units and 4 no. 3 bed units);

Each new residential unit has an associated area of private open space in the form of balcony / terrace area and set back upper floor levels.

Open space is provided by one major centrally located public open space between blocks A and B which include a play area; two further communal open space areas are provided adjoining Block B & Block C.

Communal Area located at the ground floor of Block B comprising of a shared working space, meeting rooms, a gym and changing/tea stations is also proposed.

2 no. basement level areas (approx. 2,340.9 sqm) are also proposed at lower ground / ground floor level of Blocks A, B (1,470.0 sqm) and C (834.9 sqm) and include car parking, bicycle parking, refuse storage areas, plant areas and an ESB Substation which is located between Blocks B and C.

A total of 103 no. car parking spaces (67 no. at basement level and 36 no. at surface level to include 17 no. electric power points and 5 no. accessible parking spaces) are proposed. In addition, 5 no. motorcycle parking spaces (3 no. at basement level A and B, and 2 no. at basement level C). A total of 280 no. bicycle parking spaces (254 no. at basement level and 26 no. at surface level) are also proposed.

Proposals for vehicular and pedestrian access comprise via Glenamuck Road North and all associated upgrade works; The access point to the south (via Carricáil) is for pedestrians and cyclists only.

Associated site and infrastructural works including the provision for water services, foul and surface water drainage and connections; attenuation proposals; permeable paving; all landscaping works to include new tree and hedge planting; green roofs; boundary treatments; internal roads and footpaths; and electrical services.

The land naturally slopes significantly from the north (the highest point is c.79.60m) towards the south (the low point is c.74.0m).

The quantity of storm water discharged from the proposed development to the existing system will be restricted to 3.81 l/s/Ha based on the recommendations of the Greater Dublin Strategic Drainage Study, as required by Dun Laoghaire Rathdown County Council. This flow restriction is achieved by means of a Hydro-brake, or similar approved.

It is proposed that the surface water runoff from the site shall be attenuated before discharging, at a restricted rate, via a new surface water sewer to be laid from the subject site to the existing 225 mm diameter surface water sewer located at the southern boundary of the Carricail Site, to the south of the subject site.

It is proposed to drain the foul flows from the development to the existing 225 mm diameter foul sewer that located at the southern boundary of the Carricail site, to the south of the subject site.

The drainage system from the subject site will not be offered for Taking in Charge to Irish Water. The development shall be a private development maintained by an owner’s management company.

It is proposed to supply potable water to the site via a connection to the existing watermain laid along Glenamuck Road North.

The site’s main vehicular and pedestrian access is via Glenamuck Road North. The site shall be entered via a priority T junction.

2.4 Existing Ground Conditions

A Site investigation report was commissioned in 2016 as part of a previous planning application in the same site, and is detailed in Appendix A. In total 2 no infiltration tests were undertaken in accordance with

BRE Special Digest 365. The soakaway tests failed the specification and thus demonstrated the unsuitability of the soils for soakaway design.

Considering the above Site Investigation, the soil index used to determine the surface water design has been determined to be Soil Type 3. The site predominantly contains either made ground or cohesive deposits at a shallow level, with weathered bedrock beneath. Given the steep nature of the site, the nature of the soil and underlying ground conditions, it is considered that Type 3 is appropriate for this site and for the necessary calculations associated with the greenfield runoff analysis, further developed in Section 4 below.

3. Foul Water Drainage

3.1 Receiving Environment

At present, there are no foul flows from the site.

The proposed development will consist of 118 residential units. Based on Irish Waters Code of Practice, the peak foul flow from the proposed development will be as follows:

Table 1: Calculation of proposed Foul Water Flow

Description	No. of Units	Flow l/h/day	Population per Unit	Infiltration Factor	Total Discharge (l/d)
Residential Units	118	150	2.7	1.1	52,569
Amenity Shower Block & Toilet		50		1.1	876
				Totals	***53,445 l/d***

Calculation of Proposed Peak Foul Flow		
Total Daily Discharge *(from Table 1.)*	53,445	l/d
Dry Weather Flow (DWF)	0.618	l/s
Peak Foul Flow (=6 x DWF)	***3.71***	***l/s***

The proposed foul water outfall from the development is a 225mm diameter pipe laid at a minimum gradient of 1:40, giving a minimum capacity of 72 l/s. Therefore, the proposed outfall has adequate capacity to cater for the flows from the development.

3.2 Network Design

Drains will generally consist of Ductile Iron pipework fixed to the underside of the ground floor slab. Drains in other areas, i.e outside or under the basement, will be uPVC to Irish Water specification or concrete socket and spigot pipes (to IS 6).

Drains will be laid to comply with the Building Regulations 2010, and in accordance with the recommendations contained in the Technical Guidance Documents, Section H.

Foul water sewers outside the basement will consist of uPVC or concrete socket and spigot pipes (to IS 6) and will be laid strictly in accordance with Irish Waters code of practice for Wastewater Infrastructure and Dun-Laoghaire Rathdown County Council requirements for taking in charge.

All manholes will be constructed in block work or cast in-situ concrete. Construction details for the proposed drainage systems are included in the accompanying planning submission drawings.

3.3 Proposed Foul Water Strategy

It is proposed that the foul water from Blocks A, B and C discharge by gravity to the existing foul sewer located at the southern boundary of Carricail site, to the south of the subject site.

Please refer to Waterman Moylan Drawing No. 13-125-P220 and P221 for the location of the proposed foul sewer network and connection point.

A Pre-Connection Enquiry form was submitted to Irish Water on 12th of January 2021 which outlined the foul water discharge proposal as described above, and it was assessed under Irish Water Reference No. CDS21001100.

Confirmation of feasibility has been received from Irish Water, and connection of water and wastewater can be facilitated with no upgrade works needed on the existing network.

Please refer to Appendix D for the confirmation of Feasibility received from Irish Water.

A Statement of Design Acceptance has been obtained from Irish Water prior to formal submission of this application. Please Refer to Appendix E for the Statement Of Design Acceptance.

4. Surface Water Drainage

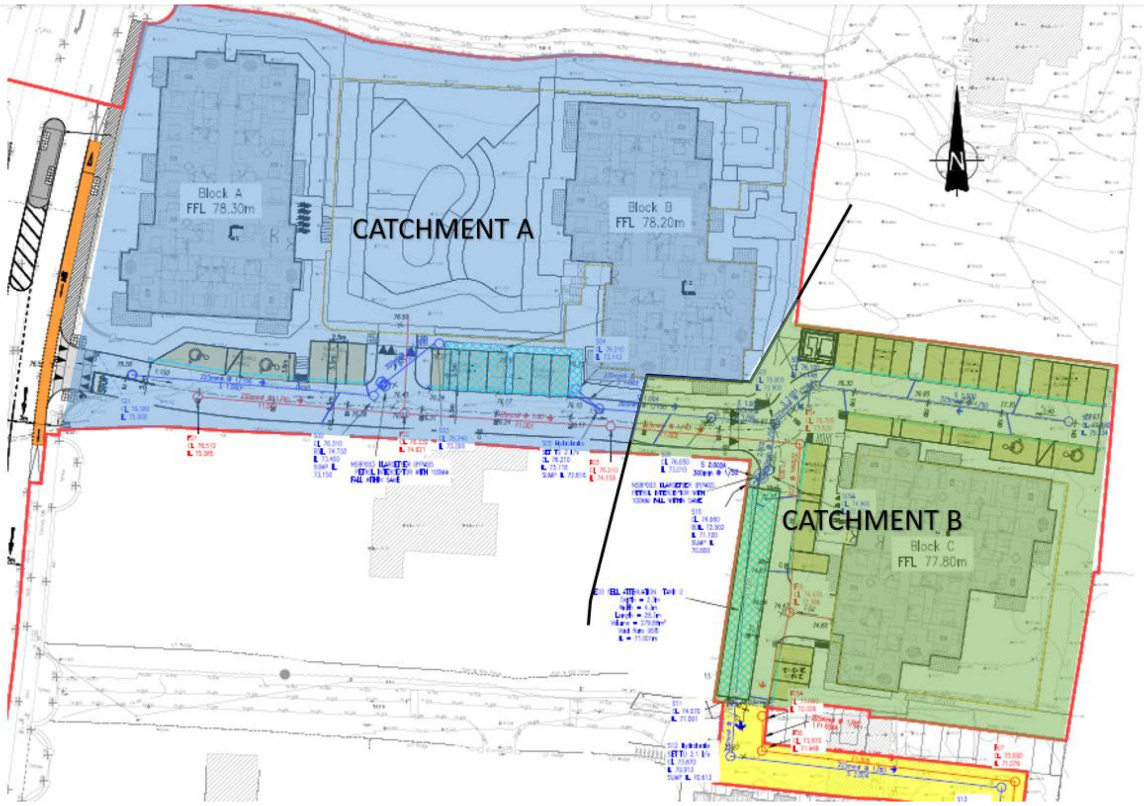
4.1 Introduction

The following section deals with surface water drainage design including details of the SUDS measures proposed as part of the development.

The development site will drain by gravity. Runoff will be restricted to the equivalent of the existing agricultural runoff. Excess storm water will be stored in an underground attenuation area which will be provided under parking area in front of Block B and under the road in front of Block C. Surface water runoff shall be restricted via a hydrobrake or similar approved.

Due to site topography, it is proposed to split the subject site into two sub-catchments. Catchment A will include Blocks A and B and associated infrastructure, and Catchment B will include Block C and associated infrastructure. Separate Underground attenuation storage will be provided for each Catchment.

Figure 3: Catchment Subdivision



It is proposed that, as part of this planning application, a new surface water sewer will be laid from the subject site and will drain by gravity at a restricted rate to an existing 225mm diameter surface water sewer located at the southern boundary of the Carricail site, to the south of the subject site.

The layout of the proposed surface water drainage network is shown on Waterman Moylan Drawing No’s 13-125-P220 and P221.

As recommended during the pre-application meetings with DLRCC and ABP, Waterman Moylan has engaged with the Drainage Department of Dun Laoghaire Rathdown County Council to agree the design of the subject site. Comments received from DLRCC have been addressed and documentation and drawings have been re-submitted to DLRCC Drainage Department on the 21/03/2022 for further agreement, addressing the comments raised.

4.2 Site Characteristics

The following parameters have been used in Attenuation Calculations which can been seen in Appendix B, and are reiterated in the following sections.

Table 2: Surface Water Catchment Details

	Catchment A	Catchment B	Total
Site Area (Catchment) – Ha	0.506	0.239	0.745
Impermeable Area – Ha	0.341	0.205	0.546
% Hardstanding	67.39%	85.77 %	73.28 %
SAAR – mm	892		
SOIL Index	0.37		
Climate Change	30%		

The total site Area is c. 0.92 ha, of which c. 0.74ha comprise the subject site, where the 3 no. apartment blocks are located. From this area, hardstanding area comprises c. 0.546ha, which includes roof, roads, parking spaces and podium area, that is drained through the surface water system.

The remaining c.0.18ha comprise area from Glenamuck Road that will be subject to a road upgrade and the area to the south of the development that will be used for the outfall of surface and foul water. This area has not been taken into consideration for surface water calculations.

The Dun Laoghaire Rathdown County Council Draft Development Plan 2022-2028, states that the attenuation calculation need to allow for a 30% climate change factor, an increase on the current Development Plan, that states that only a 20% allowance is required. The draft (at the time of writing) County Development Plan 2022-2028 will come into force on the 21st April 2022 and therefore a 30% Climate Change Factor has been allowed for.

4.3 Greenfield run-off rates

The Local Authority requirements are that post-development run-off rates are limited to greenfield run-off rates for the site. The greenfield run-off rates for the site have been calculated in accordance with the Institute of Hydrology report No 124 “Flood Estimation for Small Catchments”, for sites less than 50 Ha, where:

$\text{Qbar} = 0.00108(\text{Area})^{0.89} \times (\text{SAAR})^{1.17} \times (\text{SOIL})^{2.17}$

Greenfield Run-off = Qbar x ("n-year" factor)

Allowable Discharge = Greenfield Run-off x Area

Where:

- Area = Site area in km2 (Or 50 hectares if the site is less than 50 Hectares)
- SAAR = Standard Annual Average Rainfall, taken from Met Eireann 1981-2010 Annual Average Rainfall Grid
- SOIL = Runoff constant (Varies between 0.1 and 0.53: Given as 0.37 for a Type 3 soil)
  - ⇨ $Qbar_{rural} = 0.00108(0.5)^{0.89} \times (892)^{1.17} \times (0.37)^{2.17}$
  - ⇨ $Qbar_{rural}$ = 190.74 l/s (For a 50-hectare site)
  - ⇨ $Qbar_{rural}$ = 3.81 l/s/Ha

Therefore, the permitted outflow for the sites surface water catchment has been calculated as follows:

Table 3: Surface Water Catchment Details

	Catchment A	**Catchment B**	**Total**
Impermeable Area (Catchment) – Ha	0.341	0.205	0.546
$Qbar_{rural}$ – l/s	1.3	0.79	2.10

Both Catchments are connected in line. Catchment A will be limited to 2 l/s. The outflow of Catchment A is connected to Catchment B at manhole S09. A hydrobrake at the outfall of Catchment B will limit the discharge from site to 2.10 l/s. This limits the overall outflow for the subject site to 2.10 l/s.

4.4 SUDS Assessment

In accordance with the Dun-Laoghaire Rathdown County Council, Greater Dublin Strategic Drainage Study (GDSDS) guidelines and CIRIA documents, surface water run-off should be managed as close to its source as possible, with the re-use of rainwater within the building prioritised. Sustainable Urban Drainage systems (SUDS) have been developed and are in use to alleviate the detrimental effects of traditional urban storm water drainage practice that typically consisted of piping run-off of rainfall from developments to the nearest receiving watercourse. Surface water drainage methods that take account of quantity, quality and amenity issues are collectively referred to as sustainable urban drainage systems; they are typically made up of one or more structures built to manage surface water run-off.

The following drainage hierarchy was used to determine the most suitable and sustainable SUDS strategy. This is in accordance with the GDSDS initiative that all new developments will conform to Best Management Practices for urban storm water drainage.

1. The use of green roofs;
2. Store rainwater for later use;
3. Use infiltration techniques, such as porous surfaces in non-clay areas;
4. Attenuate rainwater in ponds or open water features for gradual release;
5. Attenuate rainwater by storing in tanks or sealed water features for gradual release;
6. Discharge rainwater direct to a watercourse;
7. Discharge rainwater to a surface water sewer/drain;
8. Discharge rainwater to the combined sewer.

As indicated on the Site Investigation, the ground conditions are not suitable for Infiltration to the ground, however, wherever the elements are located at least 5 m from foundations and 3m from boundaries, the design allows for infiltration.

4.4.1 Source Control

Green Roofs

Green Roofs have been considered and incorporated into the development proposals in accordance with Appendix 16 of DLRCC County Development Plan. The locations of the green roofs are illustrated on the accompanying Waterman Moylan SUDS Drawing 13-125-P222. The total roof area on site is 1,820.3m^2 and the area of green roof provided is 1,221.15m^2 providing a 67% coverage in green roof. This is in excess of the minimum requirement of 60% outlined in section 3.1 of DLRCC Green Roof guidance document.

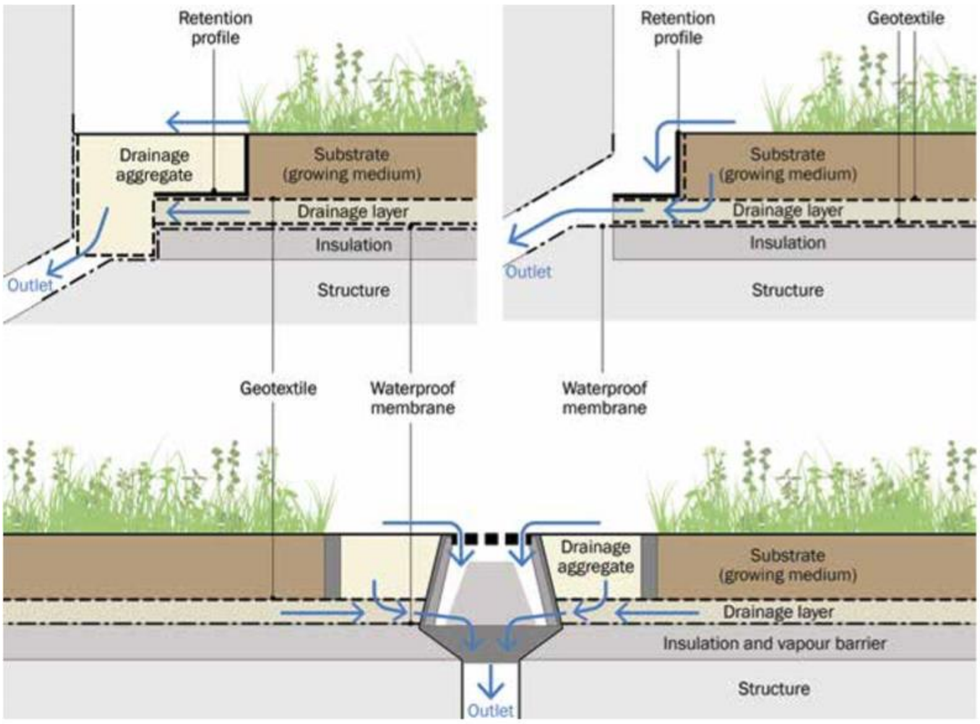
As well as providing ecological benefits, green roofs contribute the following positive effects to surface water drainage design:

- The retention of water, through storage in the growing medium and evapotranspiration from the roof's plants and substrate, reducing run-off volumes and the burden on the drainage network.
- Due to the time for water to infiltrate and permeate the substrate, there is also a reduction in peak rates of run-off, helping to reduce the risk of flooding.
- They improve water quality through the filtration of pollutants during the process of water infiltration. This provides treatment in line with CIRIA SUDS Manual management train.

Although green roof space can reduce peak flow rates in the small storm events and aid in reducing the volume of run-off from the site, they operate as conventional roofs in higher storm events. Therefore, green roofs cannot be considered in the surface water drainage run-off calculations for the development. As stated in CIRIA C697 *"although green roofs absorb most of the rainfall that they receive during ordinary events, there is still the need to discharge excess water to the building's drainage system. This is because their hydraulic performance during extreme events tends to be fairly similar to standard roofs."*

The green roofs proposed will not be accessed as amenity areas. With respect to maintenance access, we refer you to the accompanying architectural layouts and drawings. Maintenance access to those areas is via external mobile access from hard standing areas. A review of M&E plant space requirements document confirms that PV panels are not proposed for use on the apartment roofs and as such there is no requirement for compatibility between the two.

Figure 4: Example Details of outlets from a green roof (CIRIA C697)



The substrate and the plant layers in a sedum roof absorb large amounts of rainwater and release it back into the atmosphere by transpiration and evaporation. They also filter water as it passes through the layers, so the run-off, when it is produced, has fewer pollutants. Rainfall not retained by green roofs is detained, effectively increasing the time to peak and reducing peak flows.

A green roof can reduce annual percentage runoff by between 40% and 80% through this retention and evapotranspiration, with the impact dependent on a range of factors including the depth of substrate, the saturation of substrate at the onset of a rain event, the angle of the roof, the range of vegetation growing, intensity of rainfall and the time of year.

4.4.2 Site Control

As the site investigations have determined, infiltration techniques cannot be utilised on site. However, it is proposed the following site control measures before any discharge to the public surface water sewer.

Permeable Paving

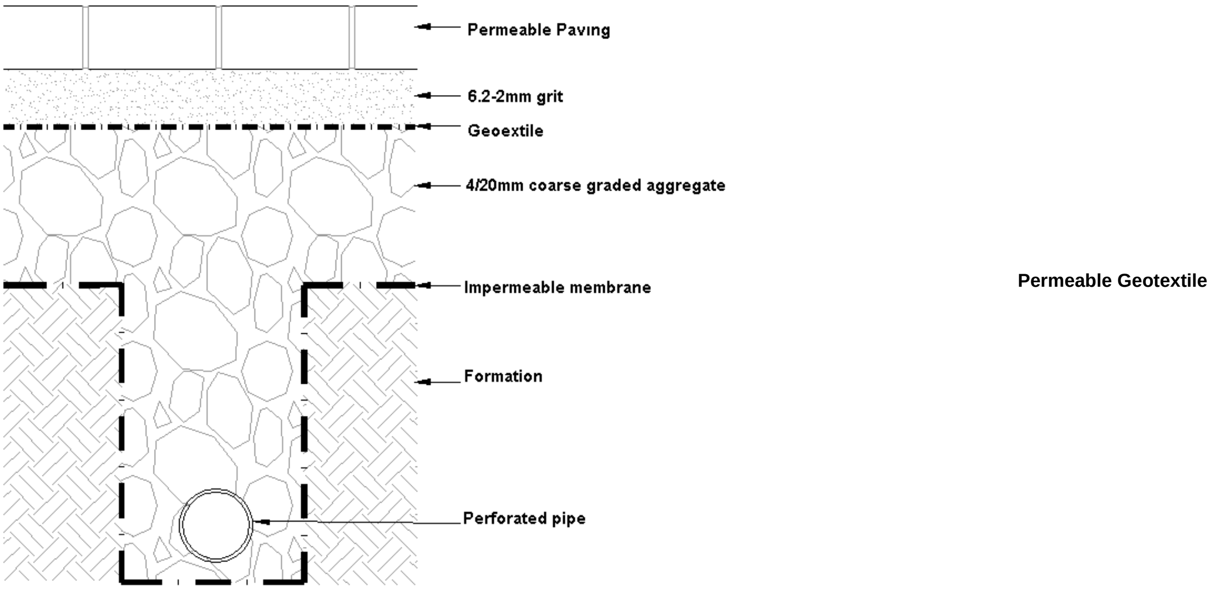
As indicated in the site investigation carried out by Site Investigations Ltd. in July 2016, infiltration techniques cannot be utilised on site. However, it is proposed to use both the treatment and storage properties of tree pits on site to improve the quality and reduce the volume of water to be discharged into the public surface water sewer.

Please refer to Appendix A for site investigation report.

Permeable paving (Tobermore Hydropave or similar approved) will be used on all surface level carparking to provide interception treatment to surface water run-off. Permeable pavements are very effective at removing a wide range of pollutants from surface water runoff as they are either retained on the pavement surface or flushed into the granular subbase where they become trapped and are degraded over time.

In the carparking area, instead of infiltrating, the permeable paving sub-base will be used for attenuation purposes. It will include a perforated pipe to convey surface water to the attenuation tank. The permeable paving build-up detail which will be used for the carpark is shown below in Figure 3. Note however that an impermeable membrane will only be utilised where within 5m of a structure or 3m of a boundary, otherwise it will be permeable to provide the opportunity for infiltration.

Figure 5: Proposed residential area permeable paving build-up



Porous Paving

Porous Asphalt and Porous Block Paving (Climapave or similar approved) is proposed as the paving for the internal roads for the development. This pavement allows for infiltration to the ground and favors the recharge of underground water where possible, mitigating the effects of including hard standing area on a field that previously was greenfield. The surface water that cannot infiltrate to the ground is directed towards tree pits for treatment prior to discharge to the proposed surface water network for the site.

Tree Pits

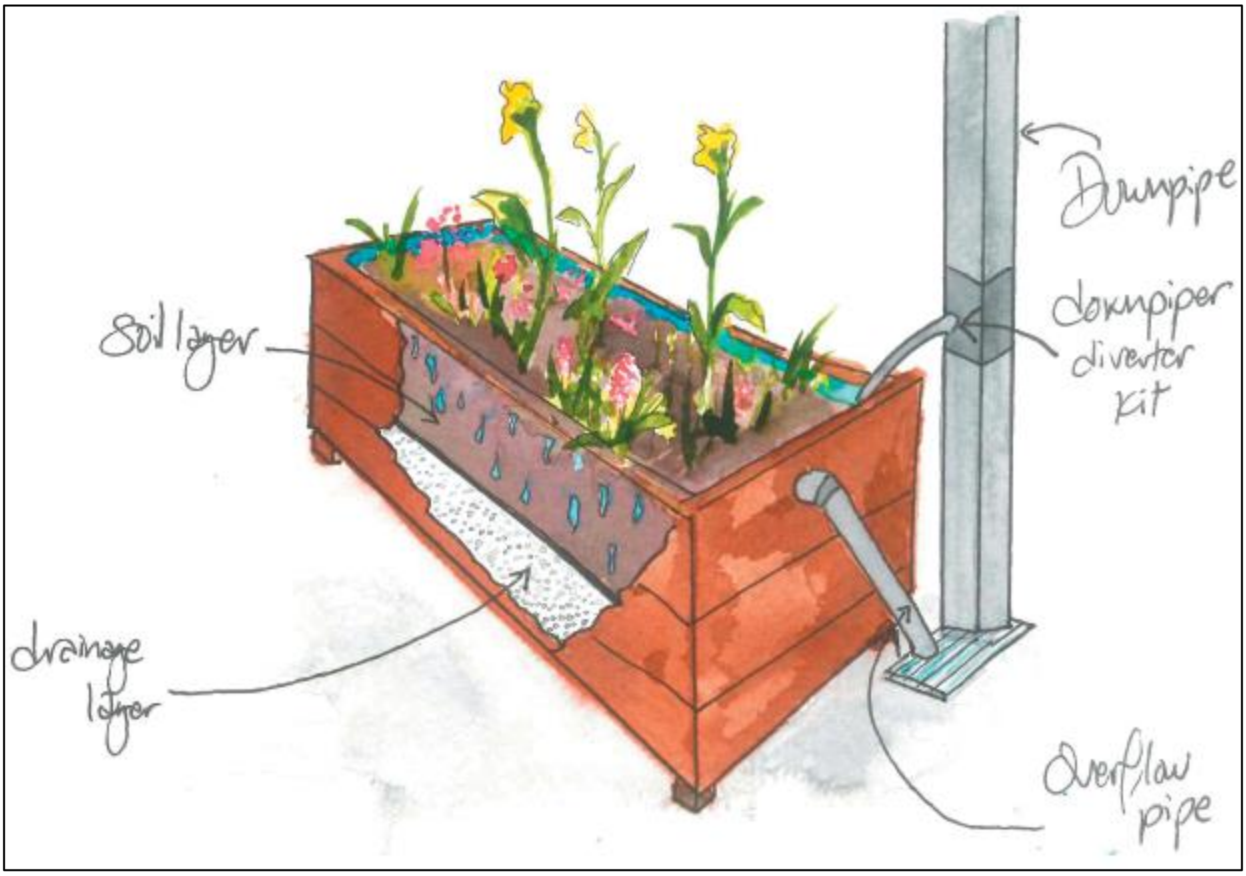
Where possible, surface water runoff from the roads will discharge to tree pits (via kerb inlets and connecting gullies to tree pits) located on the side of the road. Gullies will be positioned downstream of the tree pits to cater for overflow during high rainfall events. Tree pits are suitable for installation alongside carriage ways. The tree pit receives surface water runoff from the road via kerb and/or gully inlet. The surface water drains through the tree pit which is filled with engineered filter material to the underdrain system which discharges the treated surface water to the main surface water sewer in the roadway.

Bioretention System / Rain Garden / Rainwater Planters

Bioretention systems, including rain gardens, are shallow landscaped depressions that can reduce runoff. As part of the proposal for the subject site, it is proposed to utilize rain gardens and rainwater planters, rather than shallow vegetated depressions.

These are attractive landscape features that are mainly self irrigating and self-fertilising. Boxes/planters will use rainwater runoff originating from a building/house roof and in essence, slows the flow/runoff from the roof before it enters the main drainage. A downpipe would typically discharge into these and have an overflow into the main external drainage. The most common system is a flow-through rainwater planter and will be utilized where possible.

Figure 6: Flow Through Rainwater Planter



4.4.3 Regional Control

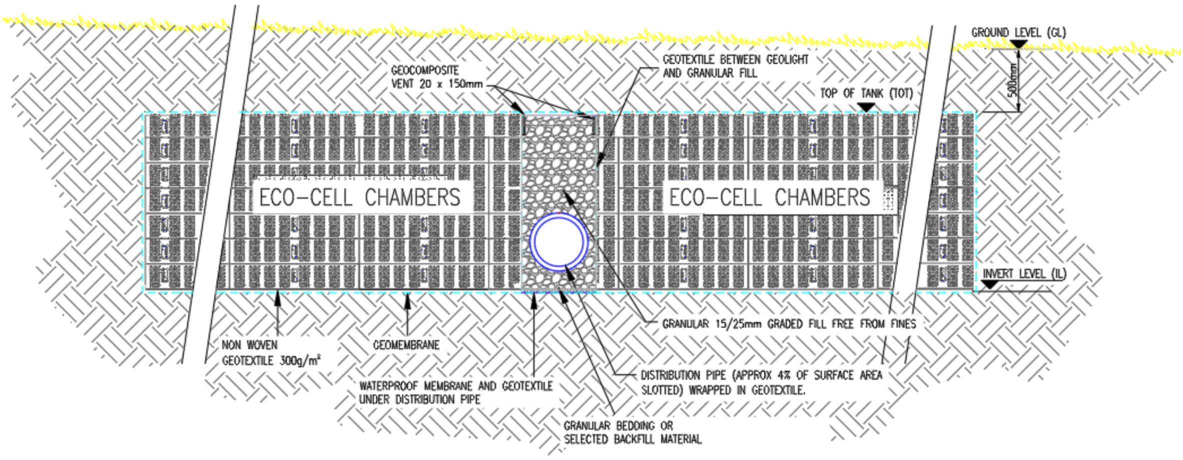
Flow Control

A Hydrobrake or similar approved flow control device is proposed before the outfall to the public network, with an online attenuation system provided to store excess rainwater during storm events. Flows will be limited to the greenfield equivalent runoff rate. It is proposed to provide a penstock on the inlet to the hydrobrake manhole, which shall be connected to the proposed upstream attenuation tanks. This will facilitate ease of maintenance for the proposed hydrobrake manhole.

Underground Attenuation Storage System

Private underground attenuation storage tanks are proposed to store excess surface water during storm events before discharging to the public network at the greenfield equivalent runoff rate. It is proposed to provide underground attenuation via 2 No. eco cell tanks, one per catchment on site. Waterman Moylan Drainage Drawing Nos. 13-125-P220 and P221 outline the proposals in greater detail. As indicated in the drawings the underground attenuation tanks will be Eco Cell Tanks. Minimum cover for trafficked areas recommended by suppliers is c.650mm for this kind of attenuation tank, and this minimum cover has been maintained for the tanks proposed.

Figure 7: Typical Section through Eco Cell Storage Tank



The attenuation tanks are to be located under the parking spaces in front of Block B and on the road in front of Block C. We refer you to attention cross sectional drawing 13-125-P225 & 226.

4.5 Proposed Surface Water Strategy

It is proposed that the overall development will outfall to the existing surface water drainage network. The development site is approximately 0.74 Ha in area. It is proposed that the development site will drain by gravity and discharge at a restricted rate to an existing surface water sewer at southern extent of the Carricail site, as indicated on drainage layout drawing 13-125-P221. As described in Section 4.3, run-off will be restricted to 3.81 l/s/Ha. It will be necessary to treat and then store excess storm water within the site. This will be achieved by using a sustainable drainage network of green roofs, tree pits and permeable paving all discharging the treated water to underground storage tanks. Surface water run-off will be restricted by two separate hydrobrakes, which equate to a total outfall rate for the proposed development of 2.1 l/s. The storm water system will be designed to cater for the 1 in 100-year storm plus a 30% allowance for climate change.

The proposed sustainable urban drainage system will:

- Treat runoff and remove pollutants to improve quality,
- Restrict outflow and to control quantity and
- Increase amenity value.

Strict separation of surface water and wastewater will be implemented within the development. Drains will be laid out to minimise the risk of inadvertent connection of waste pipes to the surface water system. To prevent surface water to enter the basement, ramps to access both basements, slope toward the road, so the water naturally will drain outside the basement. As an additional measure ACO drains have been proposed at the top of the ramps. These ACO drains are then connected to the nearest tree pit for treatment prior to enter the surface water network.

The calculations for the storage design are included in Appendix B. These indicate that for a return period of 100 years plus a 30% allowance for climate change, a total storage volume of c. 248.46m^3 is required in the eco cell tank for catchment A with a discharge rate of 2l/s. These tanks have a 95% void rate, so a tank with a minimum total volume of 261.5m^3 is required. An attenuation tank with a total volume of 265.7m^3 is proposed which equates to 252.45m^3 of proposed storage, in excess of the volume required.

An attenuation tank with a total volume of 262.84m^3 and a discharge rate of 2.1l/s is required to the southern section of the site. Eco Cells attenuation tanks with a 95% void ratio, therefore a tank with a minimum of 276.6m^3 is required. A tank with a total volume of 279.88m^3 has been provided for Catchment B, with equates to a storage volume of 265.88m^3, in excess of the minimum required. Please Refer to Waterman Moylan Drawings Nos 13-125-P220 and P221 for drainage strategy.

The surface water drainage design including the attenuation will cater for this development only. It is considered that any potential future development can be self-contained with its own attenuation and outfall to the existing drainage at the southern extent of Carricail site, as indicated on Drainage layout 13-125-P221. Surface Water Calculations can be seen in Appendix C.

As required by Dun Laoghaire Rathdown Drainage Department, a Surface Water Audit has been carried out on the proposed design by PUNCH Consulting, who have independently issued (21-03-2022) the signed completed Audit to DLRCC Drainage. The Surface Water Audit Report is supplied under separate cover.

It is noted that the documentation submitted as part of the Surface Water Audit included for an extended red line boundary for the drainage outfall through adjacent 3rd party lands. This drainage outfall route through 3rd party lands has been installed under the committed residential development to the south of the proposed development site (approved under Reg. Ref. D18A/1187 and PL06D.304995) with all necessary 3rd party consents in place. As such, the final drawings and reports submitted as part of this subject application have been adjusted to reflect the final point of connection to the existing drainage network. In this regard, we refer you to Waterman Moylan Drawings Nos 13-125-P220 and P221 showing the final agreed red line that forms part of this application.

4.6 Interception Storage

Interception storage is defined in the SUDS Manual as *“the capture and retention on site of the first 5mm of the majority of rainfall events”*. In accordance with the table 24.6 of the SUDS Manual CIRIA C753 the following guidelines have been used in calculating the area of the site benefiting from interception storage;

Table 4: Interception Mechanisms (Table 24.6 The SUDS Manual)

Systems	**Interception methods assumed compliant for zero runoff from the first 5mm of rainfall for 80% of events during the summer and 50% in winter.**
Green Roofs	All surfaces that have green roofs
Permeable Paving	All permeable pavements, whether lined or not, can be assumed to comply, provided there is no extra area drained to the permeable pavement. Where the pavement also drains an adjacent impermeable area, compliance can be assumed for all soil types where the pavement is unlined, as long as the extra paved area is no greater than the permeable pavement area
Filter strips/Swales	Roads drained by filters strips/swales, where the longitudinal gradient of the vegetated area is less than 1:100, are suitable for Interception delivery for impermeable surface areas up to 5 times the base of the vegetated surface area receiving the runoff. Components steeper than 1 in 100 cannot be deemed to provide Interception unless additional effective Interception design can be demonstrated.
Bioretention Areas and Rain Gardens	Areas of the site drained to unlined bioretention components can be assumed to comply where the impermeable surface area is less than 5 times the vegetated surface area receiving the runoff. They can be designed to deliver Interception for larger areas, where suitable infiltration capacity is available.

As described in section 4.4 and 4.5 the proposed development will provide, Green Roofs, Permeable Paving and Tree Pits. In order to calculate the percentage area of site benefiting from each form of interception storage the site areas are described in Table 5 below and demonstrated on Waterman Moylan drawing 13-125-P222, Proposed SUDS Attenuation Strategy.

Table 5: Interception Storage Provided

Area	Total Hard standing Area	Element intercepted	Interception mechanism	% Area Draining to Interception feature	Interception Provision	Percentage Benefiting
Block A	685.12 m^2	Roof Area (627.8 m2)	Green Roof (491.6m2 @ 78.3% coverage) Non-Green Roof Area draining to gravel filter strip/water butts/planters (136.2m2 @21.7%)	91.63%	685.12m^2	100%
		Terraces not in the roof area (57.32m2)	Non roof Terrace area draining to gravel filter strips/water butts/planters (57.32 m2)	8.37%		
Block B	1,865.49 m^2	Roof Area (640.8 m2)	Green Roof (350.6m2 @ 54.7% coverage) Non-Green Roof Area draining to gravel filter strip/water butts/planters (290.2m2 @45.3%)	36.20%	675.49 m^2	100 %
		Terraces not in the roof area (34.69m2)	Non roof Terrace area draining to gravel filter strips/water butts/planters (34.69 m2)			
		Podium Area (1,190 m2)	Podium Terrace area draining through drainage board (1,190m2)	63.80%	1,190 m^2	
Block C	894.29 m^2	Roof Area (551.7 m2)	Green Roof (378.95m2 @ 68.7% coverage) Non-Green Roof Area draining to gravel filter strip/water butts/planters (172.75m2 @31.3%)	73.83%	660.29 m^2	100 %
		Terraces not in the roof area (108.59m2)	Non roof Terrace area draining to gravel filter strips/water butts/planters (108.59 m2)			
		Podium Area (234 m2)	Podium Terrace area draining through drainage board (234m2)	26.17%	234 m^2	
Hard Standing – Road/Path/ Parking	2,295.79m^2	Road (1,158.77m2)	Road Area covered in Porous Asphalt (1,158.77m2)	50.47%	1,158.77m2	100%
		Parking Bays (551.13 m2)	Permeable Paving (551.13m2)	27.83%	638.93m^2	
		Paths/Footpaths (585.89m2)	Path draining to landscape open space (269.39 m2)	11.73%	269.39 m2	
		Path/Footpaths (585.89m2)	Tree Pts 140.91m2	9.97%	228.71m2	
Total	**5,740.69m^2**				**5,740.69m^2**	**100%**

Within the basement carpark area, any rainwater entering the system as a result of snow melt or raindrops from cars will pass through a petrol interceptor providing treatment.

5. SUDS Maintenance

For the SUDS strategy to work as designed it is important that the entire drainage system is well maintained. It will be the responsibility of the site management team to ensure the drainage system is maintained. Maintenance and cleaning of gullies, drain manholes (including catch pits) and attenuation tanks will ensure adequate performance. The recommended program is outlined in the tables below.

Table 6: Attenuation Tank Maintenance Schedule

SUDS Element	Maintenance		
Attenuation Tanks	Maintenance Issues	Failure of components, blockage from debris	
	Maintenance Period	Maintenance Task	Frequency
	Regular	Inspect and identify any elements that are not operating correctly. If required, take remedial action.	Monthly for three months, then annually
		Remove sediment/debris from catchment surface that may lead to blockage of structures.	Monthly or as required
		Remove sediment/debris from catch pits/ gullies and control structures.	Annually, after severe storms or as required
	Remedial Work	Repair inlets, outlets, vents, overflows and control structures.	As required
	Monitoring	Inspect all inlets, outlets, vents, overflows and control structures to ensure they are in good condition and operating as designed.	Annually or after severe storms
		Survey inside of tank for sediment build-up and remove if necessary	Every five years or as required

Table 7: Permeable Paving Maintenance Schedule

SUDS Element	Maintenance		
Permeable Paving	Maintenance period	Maintenance Task	Frequency
	Regular	Brushing and vacuuming (standard cosmetic sweep over whole surface)	Once a year, after autumn leaf fall, or as required, based on site specific observations of clogging or manufacturer's recommendations.
	Occasional	Removal of weeds	As required
	Remedial work	Remediation work to any depressions, rutting and cracked or broken blocks considered detrimental to the structural performance or a hazard to users	As required
	Monitoring	Inspect silt accumulation rates and establish appropriate brushing frequencies	Annually
		Monitor inspection chambers	Annually

Table 8: Green Roof Maintenance Schedule

SUDS Element	Maintenance		
Green Roof	Maintenance Issues	Vegetation becoming either overgrown or dying	
	Maintenance Period	Maintenance Task	Frequency
	Regular	Inspect all components including soil substrate, vegetation, drains, membranes and roof structure for proper operation, integrity of waterproofing and structural stability	Annually and after severe storms
		Inspect soil substrate for evidence of erosion channels and identify any sediment source	Annually and after severe storms
		Inspect drain inlets to ensure unrestricted run-off from the drainage layer to conveyance or roof drain system.	Annually and after severe storms
		Inspect underside of roof for evidence of leakage.	Annually and after severe storms
		Remove debris and litter to prevent clogging of inlet drains and interference with plant growth.	Six monthly and annually or as required
		During establishment (i.e. year one), replace dead plants as required.	Monthly
		Post-establishment, replace dead plants as required (where >5% of coverage)	Annually (in autumn)
		Remove fallen leaves and debris from deciduous plant foliage	Six monthly or as required
		Remove nuisance and invasive vegetation, including weeds	Six monthly or as required
		Mow grasses, prune shrubs and manage other planting (if appropriate) as required – clippings should be removed and not allowed to accumulate.	Six monthly or as required
	Remedial Work	If erosion channels are evident, these should be established with extra soil substrate similar to the original material, and sources of erosion damage should be identified and controlled	As required
		If drain inlet has settled, cracked or moved, investigate and repair as appropriate	As required

Table 9: Rain Garden Maintenance Schedule

SUDS Element	Maintenance		
Bioretention systems / Rain Gardens	Maintenance period	Maintenance Task	Frequency
	Monitoring	Inspection of infiltration surfaces for silting and ponding, record de-watering time of the facility and assess standing water levels in underdrain (if appropriate) to determine if maintenance is necessary	Quarterly
		Check operation of underdrains by inspection of flows after rain	Annually
		Assess plants for disease infection, poor growth, invasive species etc and replace as necessary	Quarterly
		Inspect inlets and Outlets for blockage	Quarterly

	Regular	Remove litter and surface debris and weeds	Quarterly (or more frequently for tidiness or aesthetic reasons)
		Replace any plants, to maintain planting destiny	As Required
		Remove sediment, litter and debris build-up from around inlets or from forebays	Quarterly to biannually
	Occasional	Infill any holes or scour in the filter medium, improve erosion protection if required	As Required
		Repair minor accumulations of silt by raking away surface mulch, scarifying surface of medium and replacing mulch	As Required
	Remedial work	Remove and replace filter medium and vegetation above	As required but likely to be more than 20 years

Table 10: Tree Pits Maintenance Schedule

SUDS Element	**Maintenance**		
Tree Pits	**Maintenance period**	Maintenance Task	Frequency
	Regular	Remove Litter and debris	Monthly (or as required)
		Manage other vegetation and remove nuisance plants	Monthly (at start, then as required)
		Inspect inlets and outlets	Inspect Monthly
	Occasional	Check tree health and manage tree appropriately	Annually
		Removes silt build up from inlets and surface and replace mulch as necessary	Annually or as required
		Water	As required (periods of drought)
	Monitoring	Inspect silt accumulation rates and establish appropriate brushing frequencies	Half yearly

6. Water Supply

6.1 Water Supply – General

There is an existing 210 mm diameter MOPVC main on Glenamuck Road to the west of the subject site. A Pre-Connection Enquiry form was submitted to Irish Water on 12th of January 2021 which outlined the proposals for the provision of water supply and the response received from Irish Water states that a new connection from the 210mm diameter MOPVC main on Glenamuck Road, is feasible without infrastructure upgrade by Irish Water.

Please refer to Appendix D for the Confirmation of Feasibility received from Irish Water.

A Statement of Design Acceptance has also been obtained from Irish Water prior to formal submission of this application. Please Refer to Appendix E for Statement Of Design Acceptance.

6.2 Water Demand Calculation

An estimate of water demand from the public water supply system for the proposed site has been based on the development of 118 residential units with an average occupancy of 2.7 persons. Details are shown below.

Table 11: Total Water Demand

Description	No. of Units	Flow l/h/day	Population per Unit	Total Discharge (l/d)
Residential Units	118	150	2.7	47,790
Amenity Shower Block & Toilet		50		797
Total				***48,587 l/d***

For the Amenity Shower Block and Toilet, an assumption that 5% of the resident will use these amenities has been made.

The total water requirement from the public supply, for the development, is estimated at 48.6 m^3/day.

Waterman Moylan Drawing No 13-125-P250 shows the proposed indicative water supply layout for the subject site.

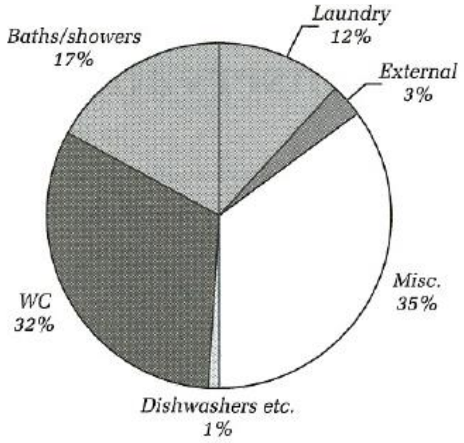
6.3 Water Conservation

The water demand for the development can be subdivided as follows:

- Potable / Non-potable Breakdown

Detailed studies have quantified the breakdown between potable and non-potable uses for residential uses.

The following diagram illustrates the current percentage breakdown of water usage in domestic circumstances and is from Griggs and Shouler 1994 as published in Chapter 11 of ‘Water, Sanitary & Waste Services for Buildings’ by Wise and Sheffield.



Water conservation measures will be used, to further reduce overall water demand, including:

- Low volume flush / dual flush WC's
- Aerated shower heads
- Spray taps
- Draw off tap controls
- Leak detection measures – through the metering of supply

7. Transport

7.1 Introduction

A site-specific Transport and Traffic Assessment (TTA) has been carried out by Waterman Moylan. This is included under separate cover as part of this application.

In addition, a Carparking Strategy and Mobility Management Plan, together with a preliminary Construction Management Plan, have been prepared and are provided under a separate cover.

This section provides a brief summary of site access, the Quality Audit process undertaken and the parking proposed.

7.2 Site Access

The proposed development will be accessed via a single vehicle access point off Glenamuck Road North. The site access from Glenamuck Road is located in a 50 km/h zone. A 2.4m x 49m sightline, which is in compliance with the requirements of the Department of Transport 'Design Manual for Urban Roads and Streets' recommendation for a road of design speed of 50 km/h, can provide safe access/egress at the access road junction onto Glenamuck Road. No development works will infringe upon this existing sightline provision.

Dun Laoghaire Rathdown County Council Transport Department has indicated that a signalised junction at the entrance to the development is premature and should only be implemented if/when the need arises. As a result, the junction entrance has been designed in accordance with Dun Laoghaire Rathdown County Council Transport Department's request for a priority T junction. This design is provided on accompanying drawing 13-125-P280 (Proposed Junction Layouts). This drawing has similarly been provided to Dun Laoghaire Rathdown County Council Transport Department for formal approval in principal, as requested as part of the pre-application departmental report. Approval in principle has been received from Sean Keane Dun Laoghaire Rathdown County Council Transport Department on 9 February 2022.

A subsequent meeting was held with Sean Keane and Dermot Fennell Dun Laoghaire Rathdown County Council Transport Department on 22 February 2022 to agree certain design elements, and which are summarised below:

- Waterman Moylan were requested to review / advise in respect of the through lane widths on the Glenamuck Road, and the potential to increase these beyond the currently proposed 3m, if space permits. It was advised at this meeting that the junction design worked boundary to boundary, however a review would be undertaken to see as to whether there was any opportunity to increase the widths further. Upon review, the lane widths as currently proposed, are maximised at 3m in width.

- Waterman Moylan were requested to provide an uncontrolled pedestrian crossing point north of the proposed priority T entrance to the development, along with ducting to facilitate future signalisation, should this become permanent. This has been incorporated within the design, as indicated on drawing 13-125-P280.

- Waterman Moylan were requested to afford pedestrians a short crossing path across the entrance, as opposed to crossing at the longer radius crossing point. This point was similarly raised in the Quality Audit discussed in section 7.3 below, and has been updated accordingly on layout plans.

The priority T (left-hand junction on layout 13-125-P280), junction comprises of a straight through lane for northbound traffic, a straight through/left turning lane for southbound traffic, a right turning lane to facilitate access to those entering the site from south via Glenamuck Road North and footpaths & cycle lanes along both sides of the road. The junction upgrades also include an uncontrolled crossing point across Glenamuck Road North, north of the entrance to the development, as agreed with DLRCC Traffic.

As indicted by Dun Laoghaire Rathdown County Council Transport Department, a signalised access junction to the site is currently premature. However, as a signalised junction may be required in the future, the provision of all infrastructure for future signalisation was required. The right-hand junction layout in drawing 13-125-P280 illustrates the signalised option that may be required in the future. It includes pedestrian crossings with dropped kerbs and advanced stop areas for cyclists on all approaches (including the site access), a signalised straight through lane for northbound traffic, a signalised straight through/left turning lane for southbound traffic and a signalised right turning lane to facilitate access to those entering the site from south via Glenamuck Road North. Dedicated footpaths and cycle lanes will continue to be provided along both sides of the road. All possible infrastructure for the proposed future signalisation shall be provided as part of the priority T junction upgrade works, including that to the pedestrian crossing point, north of the junction entrance.

7.3 Quality Audit

As required by Dun Laoghaire Rathdown Transport Department, an independent Quality Audit has been carried out on the proposed design by 'Traffico', the findings of which have been addressed within the submission report and drawings. The completed and signed Quality Audit Report has been supplied under separate cover.

7.4 Car Parking

Table 8.2.3 Residential Land Use – Car Parking Standards within Chapter 8.2 of the Dun Laoghaire Rathdown Development Plan 2016-2022 outlines the car parking standards for various types of developments.

It is stated in the Development Plan that quantitative Car Parking Standards should comply with Development Plan requirements. Section 8.2.4.5 of the Development Plan concerns Car Parking Standards. In this regard, see Table 8.2.3: Residential Land Use - Car Parking Standards. For apartments, these requirements comprise 1 space per 1-bed unit, 1.5 spaces per 2-bed unit, 2 spaces per 3-bed unit+. It further provides that the car parking standards set out for residential land uses in Table 8.2.3 shall be generally regarded as 'standard' parking provision. Table 8.2.4 concerns Non Residential Land Use – Maximum Car Parking Standards. Section 8.2.4.5 provides that reduced car parking standards for any development (residential and non-residential) may be acceptable, depending on:

- The location of the proposed development and specifically its proximity to Town Centres and District Centres and high density commercial/business areas.
- The proximity of the proposed development to public transport.
- The precise nature and characteristics of the proposed development.
- Appropriate mix of land uses within and surrounding the proposed development.
- The availability of on-street parking controls in the immediate area.
- The implementation of a Travel Plan for the proposed development where a significant modal shift towards sustainable travel modes can be achieved.
- Other agreed special circumstances where it can be justified on sustainability grounds.

Based on these standards Table 12 below details the car parking spaces required for the proposed development.

Land Use	Units	Parking Standards	Car Parking Required
Apartments – 1 Bed	34	1 per unit	34
Apartments – 2 Bed	76	1.5 per unit	114
Apartments – 3 Bed+	8	2 per unit	16
Total	118	-	164

Table 12**:** DLRCC Development Plan (2016-2022) Standards

Based on the current Development Plan the total number of spaces that would be required to serve the proposed development would be 164.

In the pending (at time of writing) draft DLRCC 2022-2028 development plan, the subject site (Zone 2, near public transport) development maximum parking standards require 1 space per 1-bed & 2-bed and 2 spaces per 3+ bed. This equates to a figure of 126 spaces overall.

7.4.1 Sustainable Urban Housing: Design Standards for New Apartments – Dec 2020

As per the Design Standards for New Apartments – Guidelines for Planning authorities – December 2020, the subject proposed development meets criteria for reasonable grounds to minimise car parking provisions. It is located within 2 minutes' walk of a bus stop and 2 minutes' walk of the LUAS station which provides direct access to the City Centre. The proposed development is located within a 14-minute walk of Carrickmines Park – a centre for various amenities and service. An extract from the Design Standards for New Apartments in provided below:

'In suburban/urban locations served by public transport or close to town centres or employment areas and particularly for housing schemes with more than 45 dwellings per hectare net (18 per acre), as per guidelines mentioned above, planning authorities must consider a reduced overall car parking standard and apply an appropriate maximum car parking standard.'

7.4.2 Car Parking Proposed

Based on the Dun Laoghaire Rathdown Development Plan 2016-2022 and the Sustainable Urban Housing: Design Standards for New Apartments – December 2020 as summarised above; the number of car parking spaces proposed is 103 spaces which equates to 0.87 spaces per unit. This is broken down further in Table 13 below.

Parking Area	No. of Car Parking
Basement Parking	67
Surface Parking	36
Total	103

Table 13**:** Proposed Car Parking

Based on the Dun Laoghaire Rathdown Development Plan and the Design Standards for new Apartments, the number of car parking spaces proposed is assumed to be sufficient to serve the proposed development due to the location of the site in relation to high quality (high capacity and frequent) public transport facilities and employment centres.

It is noted that 5% of all spaces (5 spaces) will be disabled parking spaces and 16.5% (17) will have electric power charging points.

7.5 Cycle Parking

7.5.1 Dun Laoghaire-Rathdown Council Cycling Policy Guidelines and Standards

Standards for cycle parking in a new development are set out in Table 4.1 of the Standards for Cycle Parking and associated Cycling Facilities for New Developments published by Dun Laoghaire Rathdown County Council Municipal Services Department in January 2018. The cycle parking standards for the subject proposed development are shown in Table 14 below.

Land Use	No. of Units	Standards	Spaces Required
Apartments 1 – Bed	34	1 space per unit	34
Apartments 2 – Bed	76	1.5 spaces per unit	114
Apartments 3 – Bed	8	2 spaces per unit	16
Total	118	-	164

Table 14**:** DLRCC Development Plan Standards

7.5.2 Sustainable Urban Housing: Design Standards for New Apartments - Dec 2020

The Design Standards for New Apartments – December 2020 sets out cycle parking standards for new apartments. Cycling provides a flexible, efficient and attractive transport option for urban living and these guidelines require that this transport mode is fully integrated into the design and operation of all new apartment development schemes.

An extract from the design standards – "*a general minimum standard of 1 cycle storage space per bedroom shall be applied. For studio units, at least 1 cycle storage space shall be provided. Visitor cycle parking shall also be provided at a standard of 1 space per 2 residential units. Any deviation from these standards shall be at the discretion of the planning authority and shall be justified with respect to factors such as location, quality of facilities proposed, flexibility for future enhancement/enlargement, etc.*"

Based on the standards set out above, the proposed development is required to provide a total of 269 cycle parking spaces (210 for residents and 59 for visitors).

7.5.3 Cycle Parking Proposed

A total of 280 cycle parking spaces (254 at basement level, 26 at surface level) and 5 motorcycle spaces are proposed. This proposal exceeds the requirements set out in both the Dun Laoghaire-Rathdown County Council Cycling Policy and Standards and the Design Standards for New Apartments and is considered appropriate to serve the subject proposed development. The cycle/motorcycle parking spaces are broken down in Table 15 below.

Parking Area	No. of Cycle Parking
Basement Parking (Blocks A & B)	202
Surface Parking (Block A)	10
Surface Parking (Block B)	8
Basement Parking (Block C)	52
Surface Parking (Block C)	8
Motorcycle Basement Parking (Blocks A & B)	3
Motorcycle Basement Parking (Blocks C)	2
Total	280 Cycle Parking Spaces and 5 Motorcycle Parking Spaces

Table 15**:** Cycle and Motorcycle Parking Spaces Proposed

APPENDICES

A. Site Investigation

S.I. Ltd Contract No: 5303

Client:	Moran Park Homebuilders
Engineer:	Waterman Moylan
Contractor:	Site Investigations Ltd

Chigwell, Glenamuck Road, Carrickmines, Co. Dublin

Site Investigation Report

Prepared by:

....

Stephen Letch

Issue Date:	08/08/2016
Status	Final
Revision	0

Contents: Page No.

Appendices:

1. Introduction

On the instructions of Waterman Moylan, Site Investigations Ltd (SIL) were appointed to complete a ground investigation at Chigwell, Glenamuck Road, Carrickmines, Co. Dublin. The investigation was completed for the residential development of the site and was completed on behalf of the Client, Moran Park Homebuilders.

The fieldworks comprised a programme of cable percussive boreholes, trial pits, dynamic probes, soakaways and California Bearing Ratio tests. All fieldwork was carried out in accordance with Eurocode 7: Geotechnical Design and the IEI Specification & Related Documents for Ground Investigation in Ireland (2006). Laboratory testing has been performed on representative soil samples recovered from the boreholes and trial pits and these were completed in accordance of BS1377: 1990.

This report presents the factual geotechnical data obtained from the field and laboratory testing with interpretation of the ground conditions discussed.

2. Fieldwork

The geotechnical fieldworks were started and completed in July 2016 and comprised the following:

- 5 No. cable percussive boreholes
- 2 No. trial pits
- 2 No. dynamic probes
- 3 No. soakaway tests
- 4 No. California Bearing Ratio tests

2.1. Cable Percussive Boreholes

Cable percussion boring was undertaken at 5 No. locations using a Dando 150 rig and constructed a 200mm diameter borehole. The boreholes terminated at relatively shallow depths from 1.60mbgl at BH04 to 3.60mbgl at BH01. It was not possible to collect undisturbed samples due to the gravel and cobble content of the strata so bulk disturbed samples were recovered at regular intervals.

In order to test the strength of the stratum, Standard Penetration Tests (SPT's) were performed at 1.00m intervals in accordance with BS 1377 (1990). In soils with high gravel and cobble content it is appropriate to use a solid cone (60°) (CPT) instead of the split spoon and this was used throughout the testing. The test is completed over 450mm and the cone is driven 150mm into the stratum to ensure that the test is conducted over an undisturbed zone. The cone is then driven the remaining 300mm and the blows recorded to report the N-Value.

The report shows the N-Value with the 75mm incremental blows listed in brackets (e.g. BH01 at 1.00mbgl where N=29-(10,6,6,7)). Where refusal of 50 blows across the test zone was encountered was achieved during testing, the penetration depth is also reported (e.g. BH01 at 3.60mbgl where N=50/0mm-(50/0mm)).

The logs are presented in Appendix 1.

2.2. Trial Pits

2 No. trial pits were completed using a tracked excavator and were logged by SIL geotechnical engineer. Representative disturbed bulk samples were recovered as the pits were excavated and they were returned to the laboratory for geotechnical testing.

The trial pit logs and photographs are presented in Appendix 2.

2.3. Dynamic Probes

Dynamic probes were carried out at 2 No. locations, adjacent to the trial pits, using a track mounted Competitor 130 machine. The testing complies with the requirements of BS1377: Part 9 (1990) and Eurocode 7: Part 3. The configuration utilised standard DPH (Heavy) probing method comprising a 50kg weight, 500mm drop height and a 43.7mm diameter (90°) cone. The number of blows required to drive the cone each 100mm increment into the sub soil is recorded in accordance with the standards. The dynamic probe provides no information regarding soil type or groundwater conditions.

The dynamic probe results can be used to analyse the strength of the soil strata encountered by the probe. 'Proceedings of the Trinity College Dublin Symposium of Field and Laboratory Testing of Soils for Foundations and Embankments' presents a paper by Foirbart that is most relevant to Irish soil conditions and within this paper the following equations were included:

$$\text{DPH } N_{100} \times 2.5 = \text{SPT N value (Granular Soils)}$$

$$C_u = 15 \times \text{DPH } N_{100} + 30 \text{ kPa (Cohesive Soils)}$$

These equations present a relationship between the probe N_{100} value and the SPT N value for granular soils and the shear strength of cohesive soils.

The probe results are presented in Appendix 3 and present the data both numerically and graphically.

2.4. Soakaway Tests

3 No. soakaway tests were completed using a tracked excavator and they were logged by SIL geotechnical engineer. The soakaway test is used to identify possible areas for storm water

drainage. The pit was filled with water and the level of the groundwater was recorded over time. As stipulated by BRE Special Digest 365, the pit should be filled three times and that the final cycle is used to provide the infiltration rate. The time taken for the water level to fall from 75% volume to 25% volume is required to calculate the rate of infiltration. However, if the water level does not fall at a steady rate then the test is deemed to have failed and the area is unsuitable for storm water drainage.

The soakaway logs are presented in Appendix 4.

2.5. California Bearing Ratio tests

At 4 No. locations, undisturbed cylindrical mould samples were taken to complete California Bearing Ratio tests in the laboratory. The results facilitate the designing of the access roads and associated areas. These tests were completed to BS1377: 1990: Part 4, Clause 7 ‘Determination of California Bearing Ratio’. The results are presented as part of Appendix 5 with the laboratory test data.

2.6. Surveying

Following the completion of all the fieldworks works, a survey of the exploratory hole locations was completed using a GeoMax GPS Rover. The data is supplied on each individual log and the locations are shown on the site plan in Appendix 6.

3. Laboratory Testing

Geotechnical laboratory testing has been carried out on representative soil samples in accordance with BS 1377 (1990). Testing included:

- 2 No. Moisture content
- 2 No. Atterberg limits
- 2 No. Particle size gradings
- 4 No. pH and sulphate
- 4 No. Chloride content
- 4 No. Organic content

Environmental testing was completed by Alcontrol Laboratories Ltd. and consisted of the following:

- 3 No. WAC Analysis

The laboratory test results are presented in Appendix 5.

4. Ground Conditions

4.1. Overburden

A generalised summary of the ground profile at BH02 is shown below. Reference should be made to the individual borehole and trial pit records in Appendices 1 and 2 for the full strata information at specific locations.

- TOPSOIL.
- Stiff brown slightly sandy slightly gravelly silty CLAY with low cobble content.
- Light brown fine to medium SAND.
- Obstruction - possible boulders or bedrock.

BH01 was slightly different to the rest of the locations as only CLAY was encountered whereas the other locations all encountered the SAND below the silty CLAY, which is the weathered granite bedrock.

The overburden deposits are of glacial origin and the particle size gradings of the cohesive soils display characteristic poorly-graded ‘straight-line’ profiles for the glacial material. Fines contents (i.e. silt & clay) from the gradings show the cohesive soils with 31% and 43% silt/clay and the Atterberg Limits tests show both clayey SILT and silty CLAY samples were tested.

4.2. Groundwater

Groundwater details in the boreholes and trial pits during the fieldworks are noted on the logs in Appendices 1 and 2. Groundwater was not encountered in any of the boreholes and trial pits during the investigation.

5.0. Recommendations and Conclusions

Please note the following caveats:

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 the exploratory hole locations or below the final level of excavation, this is for guidance only and no liability can be accepted for its accuracy. No responsibility can be accepted for adjacent unexpected conditions that have not been revealed by the exploratory holes. It is further recommended that all bearing surfaces when excavated should be inspected by a suitably qualified Engineer to verify the information given in this report.

Excavated surfaces in clay strata should be kept dry to avoid softening prior to foundation placement. Foundations should always be taken to a minimum depth of 0.50mBGL to avoid the effects of frost action and possible seasonal shrinkage/swelling.

If it is intended that on-site materials are to be used as fill, then the necessary laboratory testing should specified by the Client to confirm the suitability. Also, relevant lab testing should be specified where stability of side slopes to excavations is a concern, or where contamination may be an issue.

5.1. Foundations

Due to the unknown depth of foundation and no longer term groundwater information, this analysis assumes the groundwater will not have an effect on the construction or performance of these foundations.

The boreholes encountered stiff brown slightly sandy slightly gravelly CLAY with low cobble content from below the TOPSOIL. The SPT test results are good at 1.00mbgl with N-values between 21 and 29. For the analysis an N-value of 21 was chosen for the purposes of design in this stratum, in accordance with Eurocode 7 (EC 7).

Using an equation proposed by Stroud and Butler, the SPT N-value can be used to calculate the shear strength and this is Cu=5N. Therefore, using the value of 21, this indicates that the shear strength of the CLAY is 105kN/m^2. This can be used to calculate the allowable bearing capacity (ABC) and using a factor of safety of 3 an ABC of 175kN/m^2 would be anticipated.

The dynamic probes show that blow counts show that the CLAY has slightly lower shear strength and therefore it may be prudent to work on a slightly lower ABC of 150kN/m^2. Also it would be recommended that all foundation formations be inspected by a competent geotechnical engineer prior to construction so as to verify that the observations made during the ground investigation are consistent with the actual ground conditions at the time of construction.

With the possibility of bedrock at shallow depths, if higher capacities are required then foundations should be placed on the bedrock. If the design is to place the foundations on the bedrock then some rotary drilling should be completed to confirm the depth to the solid bedrock.

The following assumptions were made as part of these analyses. If any of these assumptions are not in accordance with detailed design or observations made during construction these recommendations should be re-evaluated.

- The foundation is to be 1m wide.
- Foundations are to be constructed on a level formation of uniform material type (described above).
- All man-made or filled material is to be removed prior to construction.

- The bulk unit weight of the material in this stratum has a minimum density of 19kN/m^3.
- Based on groundwater observations this analysis assumes the groundwater will not have an effect on the construction or performance of these foundations.

The trial pits indicate that excavations in the cohesive soils should be stable for a short while at least. However regular inspection of temporary excavations should be completed during construction to ensure that all slopes are stable. Temporary support should be used on any excavation that will be left open for an extended period of time.

5.2. Groundwater

The caveats overleaf relating to interpretation of groundwater levels should be noted:
There is always considerable uncertainty as to the likely rates of water ingress into excavations in clayey soil sites due to the possibility of localised unforeseen sand and gravel lenses acting as permeable conduits for unknown volumes of water.

Furthermore, water levels noted on the borehole and trial pit logs do not generally give an accurate indication of the actual groundwater conditions as the borehole or trial pit is rarely left open for sufficient time for the water level to reach equilibrium.

Also, during boring procedures, a permeable stratum may have been sealed off by the borehole casing, or water may have been added to aid drilling. Therefore, an extended period of groundwater monitoring using any constructed standpipes is required to provide more accurate information regarding groundwater conditions. Finally, groundwater levels vary with time of year, rainfall, nearby construction and tides.

Pumping tests would be required to determine likely seepage rates and persistence into excavations taken below the groundwater level. Deep trial pits also aid estimation of seepage rates.

As discussed previously there were no water strikes in the boreholes or the trial pits. There is always considerable uncertainty as to the likely rates of water ingress into excavations in cohesive soil sites due to the possibility of localised unforeseen sand and gravel lenses acting as permeable conduits for unknown volumes of water. However, based on this information at the exploratory hole locations to date, it is considered likely that any seepages into excavations of the CLAY will be at depth and generally will be slow.

If groundwater is encountered during excavations then mechanical pumps will be required to remove the groundwater from sumps. Sumps should be carefully located and constructed to ensure that groundwater is efficiently removed from excavations and trenches.

5.3. Pavement Design

The summary of the CBR test results in Appendix 5 indicates values generally of 6.4% or more. The CBR tests samples were collected at 0.50mbgl and inspection of the formation strata should be completed prior to construction of the pavement. Once the exact formation levels are finalised then additional in-situ testing could be completed to assist with the detailed pavement design.

5.4. Soakaway Design

The graphs in Appendix 4 show that the areas where the soakaways were completed are unsuitable for soakaway design. The BRE Digest stipulates that the pit should half empty within 24hrs, and extrapolation indicates this condition would not be satisfied. The test was terminated at the end of the first (of a possible three) fill/empty cycle since further testing would give even slower fall rates due to increased soil saturation.

The unsuitability of the site for soakaways is further suggested by the soil descriptions of the materials in the area of the site where the soakaway was completed, i.e. clay and silt soils.

5.5. Contamination

Environmental testing was carried out on three samples from the investigation and the results are shown in Appendix 5. For material to be removed from site, landfill acceptability testing (WAC) was carried out to determine whether the material on the site could be accepted as ‘inert material’ by an Irish landfill. The results were compared with the published waste acceptance limits of BS EN 12457-2.

The disposal suite results indicate that the material would generally be able to be treated as Inert Waste. However, discussions about the acceptance of the material must be undertaken with individual landfills before removal of any material from site.

Only three samples were tested for analysis and although no major contamination was noted at the fieldwork locations, any localised contamination may have been missed. Therefore, a testing regime designed by an environmental engineer should be designed on any material that is to be removed from site to ensure that the material stays within the landfill acceptance criteria.

5.6. Aggressive Ground Conditions

The chemical tests results in Appendix 5 indicate a general pH value between 8.15 and 8.90, which is close to neutral and below the level of 9, which could cause possible concern, therefore no special precautions are required.

5303 – Chigwell

The maximum value obtained for acid soluble sulphate was 119mg/l as SO_3. The BRE Special Digest 1:2005 – '*Concrete in Aggressive Ground'* guidelines require SO_4 values and after conversion ($SO_4 = SO_3 \times 1.2$), the maximum value of 143mg/l shows Class 1 conditions and no special precautions are required.

Appendix 1

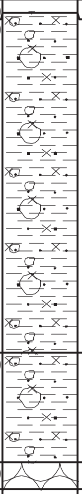
Cable Percussive Borehole Logs

CABLE PERCUSSIVE BOREHOLE RECORD

CONTRACT: Chigwell **HOLE ID:** **BH01**

Client:	**Moran Park Homebuilders**	**Co-ordinates:**	**E:721994.632**
Consultant:	**Waterman Moylan**		**N:724380.741**
Site Address:	**Glenamuck Road, Co. Dublin**	**Elevation:**	**77.06 m.O.D.**
Boring Started:	**11/07/2016**	**Hole Diameter:**	**200 mm**
Boring Completed:	**11/07/2016**	**Drilled by:**	**T. Tindall**
Rig Type:	**Dando 150**	**Logged by:**	**S. Letch**

Sheet 1 of 1



DESCRIPTION OF STRATA	Unit Depth (m)	Legend	Elevation (M.O.D.)	Samples/Tests			Progress/Water		
				Type	Depth (m)	Ref No.	Hole Depth (m)	Date	Water Depth (m)
TOPSOIL.	0.00		77.06						
Stiff brown slightly sandy slightly gravelly silty CLAY with low cobble content.	0.10		76.96	B	0.50	TT10			
				SPT(C)	1.00	N=29-(10,6,6,7)			
				B	1.50	TT11			
				SPT(C)	2.00	N=32-(8,10,7,7)			
				B	2.50	TT12			
Very stiff light brown slightly sandy slightly gravelly silty CLAY with low cobble content.	2.60		74.46	SPT(C)	3.00	N=40-(11,13,7,9)			
Obstruction - possible boulders or bedrock.	3.40		73.66						
Borehole terminated due to obstructions.	3.60		73.46	SPT(C)	3.60	N=50/0mm-(50/0mm)	3.60	11/07/2016	Dry(E)

Remarks: ***(Note: Stratum bands <200mm are not indicated pictorially)***

Chiselling: 3.50m to 3.60m: 1hr

Borehole backfilled - no installation.

Key to Symbols

B	Bulk Disturbed Sample	SPT(S)	Standard Penetration Test (Split Spoon)
D	Small disturbed sample	SPT(C)	Standard Penetration Test (Cone)
W	Water sample	▼ 3.50	Waterstrike depth
U(9)	Undisturbed sample (drive blows)	▽ 1.50(20)	Water level depth 20mins after strike
		5.00(E)	Depth to water (E)nd of shift
		5.00(S)	Depth to water (S)tart of shift

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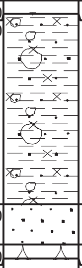
CABLE PERCUSSIVE BOREHOLE RECORD

CONTRACT: Chigwell **HOLE ID:** **BH02**

Client:	**Moran Park Homebuilders**	**Co-ordinates:**	**E:722029.879**
Consultant:	**Waterman Moylan**		**N:724408.656**
Site Address:	**Glenamuck Road, Co. Dublin**	**Elevation:**	**78.96 m.O.D.**
Boring Started:	**08/07/2016**	**Hole Diameter:**	**200 mm**
Boring Completed:	**08/07/2016**	**Drilled by:**	**T. Tindall**
Rig Type:	**Dando 150**	**Logged by:**	**S. Letch**

Sheet 1 of 1

DESCRIPTION OF STRATA	Unit Depth (m)	Legend	Elevation (M.O.D.)	Samples/Tests Type	Depth (m)	Ref No.	Progress/Water Hole Depth (m)	Date	Water Depth (m)
TOPSOIL.	0.00		78.96						
Stiff brown slightly sandy slightly gravelly silty CLAY with low cobble content.	0.10		78.86	B	0.50	TT08			
				SPT(C)	1.00	N=22-(5,5,6,6)			
Light brown fine to medium SAND.	1.50		77.46	B	1.50	TT09			
Obstruction - possible boulders or bedrock.	1.80		77.16	SPT(C)	1.90	N=50/0mm-(50/0mm)	1.90	08/07/2016	Dry(E)
Borehole terminated due to obstructions.	1.90		77.06						

Remarks: ***(Note: Stratum bands <200mm are not indicated pictorially)***

Chiselling: 1.80m to 1.90m: 1hr

Borehole backfilled - no installation.

Key to Symbols

B	Bulk Disturbed Sample	SPT(S)	Standard Penetration Test (Split Spoon)
D	Small disturbed sample	SPT(C)	Standard Penetration Test (Cone)
W	Water sample	▼ 3.50	Waterstrike depth
U(9)	Undisturbed sample (drive blows)	▽ 1.50(20)	Water level depth 20mins after strike
		5.00(E)	Depth to water (E)nd of shift
		5.00(S)	Depth to water (S)tart of shift

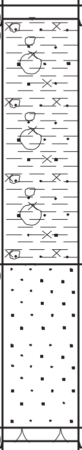
Site Investigations Ltd

CABLE PERCUSSIVE BOREHOLE RECORD

CONTRACT: Chigwell **HOLE ID:** **BH03**

Client:	**Moran Park Homebuilders**	**Co-ordinates:**	**E:722040.738**
Consultant:	**Waterman Moylan**		**N:724386.016**
Site Address:	**Glenamuck Road, Co. Dublin**	**Elevation:**	**77.71 m.O.D.**
Boring Started:	**07/07/2016**	**Hole Diameter:**	**200 mm**
Boring Completed:	**07/07/2016**	**Drilled by:**	**T. Tindall**
Rig Type:	**Dando 150**	**Logged by:**	**S. Letch**

Sheet 1 of 1



DESCRIPTION OF STRATA	Unit Depth (m)	Legend	Elevation (M.O.D.)	Samples/Tests Type	Samples/Tests Depth (m)	Samples/Tests Ref No.	Progress/Water Hole Depth (m)	Progress/Water Date	Progress/Water Water Depth (m)
TOPSOIL.	0.00		77.71						
Stiff brown slightly sandy slightly gravelly silty CLAY with low cobble content.	0.10		77.61	B	0.50	TT01			
				SPT(C)	1.00	N=23-(5,6,6,6)			
				B	1.50	TT02			
Dense light brown fine to medium SAND.	1.90		75.81	SPT(C)	2.00	N=38-(7,9,10,12)			
				B	2.50	TT03			
				SPT(C)	3.00	N=50/0mm-(50/0mm)			
Obstruction - possible boulders or bedrock.	3.10		74.61				3.20	07/07/2016	Dry(E)
Borehole terminated due to obstructions.	3.20		74.51						

0.0 1.0 2.0 3.0 4.0 5.0 6.0 7.0 8.0 9.0 10.0

Remarks: ***(Note: Stratum bands <200mm are not indicated pictorially)***

Chiselling: 3.10m to 3.20m: 1hr

Standpipe: Response zone: 1.00m to 3.20m.

Key to Symbols

B	Bulk Disturbed Sample	SPT(S)	Standard Penetration Test (Split Spoon)
D	Small disturbed sample	SPT(C)	Standard Penetration Test (Cone)
W	Water sample	▼ 3.50	Waterstrike depth
U(9)	Undisturbed sample (drive blows)	▽ 1.50(20)	Water level depth 20mins after strike
		5.00(E)	Depth to water (E)nd of shift
		5.00(S)	Depth to water (S)tart of shift

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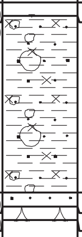
CABLE PERCUSSIVE BOREHOLE RECORD

CONTRACT: Chigwell **HOLE ID:** **BH04**

Client:	**Moran Park Homebuilders**	**Co-ordinates:**	**E:722074.410**
Consultant:	**Waterman Moylan**		**N:724400.710**
Site Address:	**Glenamuck Road, Co. Dublin**	**Elevation:**	**79.00 m.O.D.**
Boring Started:	**08/07/2016**	**Hole Diameter:**	**200 mm**
Boring Completed:	**08/07/2016**	**Drilled by:**	**T. Tindall**
Rig Type:	**Dando 150**	**Logged by:**	**S. Letch**

Sheet 1 of 1



DESCRIPTION OF STRATA	Unit Depth (m)	Legend	Elevation (M.O.D.)	Samples/Tests Type	Samples/Tests Depth (m)	Samples/Tests Ref No.	Progress/Water Hole Depth (m)	Progress/Water Date	Progress/Water Water Depth (m)
TOPSOIL.	0.00		79.00						
Stiff brown slightly sandy slightly gravelly silty CLAY with low cobble content.	0.10		78.90	B	0.50	TT06			
				SPT(C)	1.00	N=50/230mm- (4,5,5,35/5mm)			
Light brown fine to medium SAND.	1.40		77.60	B	1.50	TT07			
Obstruction - possible boulders or bedrock.	1.50		77.50	SPT(C)	1.60	N=50/0mm- (50/0mm)	1.60	08/07/2016	Dry(E)
Borehole terminated due to obstructions.	1.60		77.40						

Remarks: ***(Note: Stratum bands <200mm are not indicated pictorially)***

Chiselling: 1.50m to 1.60m: 1hr

Borehole backfilled - no installation.

Key to Symbols

B	Bulk Disturbed Sample	SPT(S)	Standard Penetration Test (Split Spoon)
D	Small disturbed sample	SPT(C)	Standard Penetration Test (Cone)
W	Water sample	▼ 3.50	Waterstrike depth
U(9)	Undisturbed sample (drive blows)	▽ 1.50(20)	Water level depth 20mins after strike
		5.00(E)	Depth to water (E)nd of shift
		5.00(S)	Depth to water (S)tart of shift

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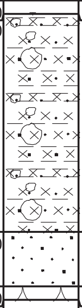
CABLE PERCUSSIVE BOREHOLE RECORD

CONTRACT:	**Chigwell**	**HOLE ID:**	**BH05**
Client:	**Moran Park Homebuilders**	**Co-ordinates:**	**E:722073.783**
Consultant:	**Waterman Moylan**		**N:724375.782**
Site Address:	**Glenamuck Road, Co. Dublin**	**Elevation:**	**77.31 m.O.D.**
Boring Started:	**08/07/2016**	**Hole Diameter:**	**200 mm**
Boring Completed:	**08/07/2016**	**Drilled by:**	**T. Tindall**
Rig Type:	**Dando 150**	**Logged by:**	**S. Letch**

Sheet 1 of 1

DESCRIPTION OF STRATA	Unit Depth (m)	Legend	Elevation (M.O.D.)	Samples/Tests Type	Depth (m)	Ref No.	Progress/Water Hole Depth (m)	Date	Water Depth (m)
TOPSOIL.	0.00		77.31						
Stiff brown slightly sandy gravelly clayey SILT with low cobble content.	0.10		77.21	B	0.50	TT04			
				SPT(C)	1.00	N=21-(5,5,6,5)			
				B	1.50	TT05			
Light brown fine to medium SAND.	1.70		75.61	SPT(C)	2.00	N=50/0mm- (50/0mm)			
Obstruction - possible boulders or bedrock.	2.10		75.21				2.20	08/07/2016	Dry(E)
Borehole terminated due to obstructions.	2.20		75.11						

Remarks: ***(Note: Stratum bands <200mm are not indicated pictorially)***

Chiselling: 2.10m to 2.20m: 1hr

Borehole backfilled - no installation.

Key to Symbols

B	Bulk Disturbed Sample	SPT(S)	Standard Penetration Test (Split Spoon)
D	Small disturbed sample	SPT(C)	Standard Penetration Test (Cone)
W	Water sample	▼ 3.50	Waterstrike depth
U(9)	Undisturbed sample (drive blows)	▽ 1.50(20)	Water level depth 20mins after strike
		5.00(E)	Depth to water (E)nd of shift
		5.00(S)	Depth to water (S)tart of shift

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Appendix 2

Trial Pit Logs and Photographs

TRIAL PIT RECORD

Contract: Chigwell **Hole ID:** **TP01**

Client:	**Moran Park Homebuilders**	**Co-ordinates:**	**E:722090.658**
Consultant:	**Waterman Moylan**		**N:724346.298**
Site Address:	**Glenamuck Road, Co. Dublin**	**Elevation:**	**75.74 m.O.D.**
Date Completed:	**12/07/2016**	**Logged by:**	**S. Letch**
Excavator:	**3T Tracked Excavator**		

Sheet 1 of 1

DESCRIPTION OF STRATA	Unit Depth (m)	Legend	Elevation (M.O.D.)	Samples/Tests Type	Samples/Tests Depth (m)	Samples/Tests Ref No.	Water Depth (m)	Date
TOPSOIL.	0.00		75.74					
Stiff brown slightly sandy slightly gravelly silty CLAY. Gravel is subangular to rounded, fine to coarse of limestone.	0.20		75.54	ENV B	0.50 1.00	SL03 SL04		
Light brown slightly gravelly medium to coarse SAND of granite with low cobble content. Gravel is angular to subrounded, fine to coarse of granite. Cobbles are angular of granite.	1.10		74.64					
Pit terminated due to obstruction.	1.30	Hole End	74.44					

Note: If deemed necessary, pit face sketches are given on the last sheet.
Strata descriptions refer to all faces unless otherwise specified.

Remarks:

Pit terminated due to possible boulders or bedrock obstruction.

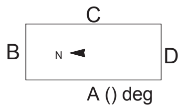
Pit walls stable.

No groundwater encountered.

Key to Symbols

B	Bulk disturbed sample
D	Small disturbed sample
U	Undisturbed sample
V(60)	In-situ hand shear vane test(kPa)
P	Hand Penetrometer Test(N value)
▼ 3.50	Waterstrike depth
▽ 1.50(20)	Water level depth 20mins after strike

Pit Orientation and Dimensions



Width: m
Length: m
Depth: 1.30m

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TRIAL PIT RECORD

Contract: Chigwell **Hole ID:** **TP02**

Client:	Moran Park Homebuilders	**Co-ordinates:**	E:722115.461
Consultant:	Waterman Moylan		N:724361.062
Site Address:	Glenamuck Road, Co. Dublin	**Elevation:**	77.00 m.O.D.
Date Completed:	12/07/2016	**Logged by:**	S. Letch
Excavator:	3T Tracked Excavator		

Sheet 1 of 1

DESCRIPTION OF STRATA	Unit Depth (m)	Legend	Elevation (M.O.D.)	Samples/Tests Type	Samples/Tests Depth (m)	Samples/Tests Ref No.	Water Depth (m)	Date
TOPSOIL.	0.00		77.00					
Stiff brown slightly sandy slightly gravelly silty CLAY with low cobble content. Gravel is subangular to rounded, fine to coarse of limestone. Cobbles are subangular to subrounded of limestone.	0.20		76.80	B	1.00	SL01		
Light brown slightly gravelly medium to coarse SAND of granite with low cobble content. Gravel is angular to subrounded, fine to coarse of granite. Cobbles are angular of granite.	1.40		75.60	B	1.50	SL02		
Pit terminated due to obstruction.	1.70	Hole End	75.30					

Depth scale: 0.0, 1.0, 2.0, 3.0, 4.0, 5.0

Note: If deemed necessary, pit face sketches are given on the last sheet. Strata descriptions refer to all faces unless otherwise specified.

Remarks:

Pit terminated due to possible boulders or bedrock obstruction.

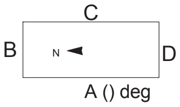
Pit walls stable.

No groundwater encountered.

Key to Symbols

B	Bulk disturbed sample
D	Small disturbed sample
U	Undisturbed sample
V(60)	In-situ hand shear vane test(kPa)
P	Hand Penetrometer Test(N value)
▼ 3.50	Waterstrike depth
▽ 1.50(20)	Water level depth 20mins after strike

Pit Orientation and Dimensions



Width: m
Length: m
Depth: 1.70m

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TP01 Pit

TP01 Sidewall

TP01 Spoil

TP02 Pit

TP02 Sidewall

TP02 Spoil

Appendix 3

Dynamic Probe Logs

PENNINE DYNAMIC PROBING

SITE	:	Chigwell	P.C. No	:	5303
CLIENT	:	Moran Park Homebuilders	PROBE No	:	DP01
SHEET No	:	1 OF 1	DATE	:	13/07/2016

DEPTH (m)	READING (Blows/100mm)
	1
	3
	2
	3
0.5	4
	4
	3
	3
	3
1.0	5
	3
	2
	6
	23
1.5	35
	-
	-
	-
	-
2.0	-
	-
	-
	-
	-
2.5	-
	-
	-
	-
	-
3.0	-
	-
	-
	-
	-
3.5	-
	-
	-
	-
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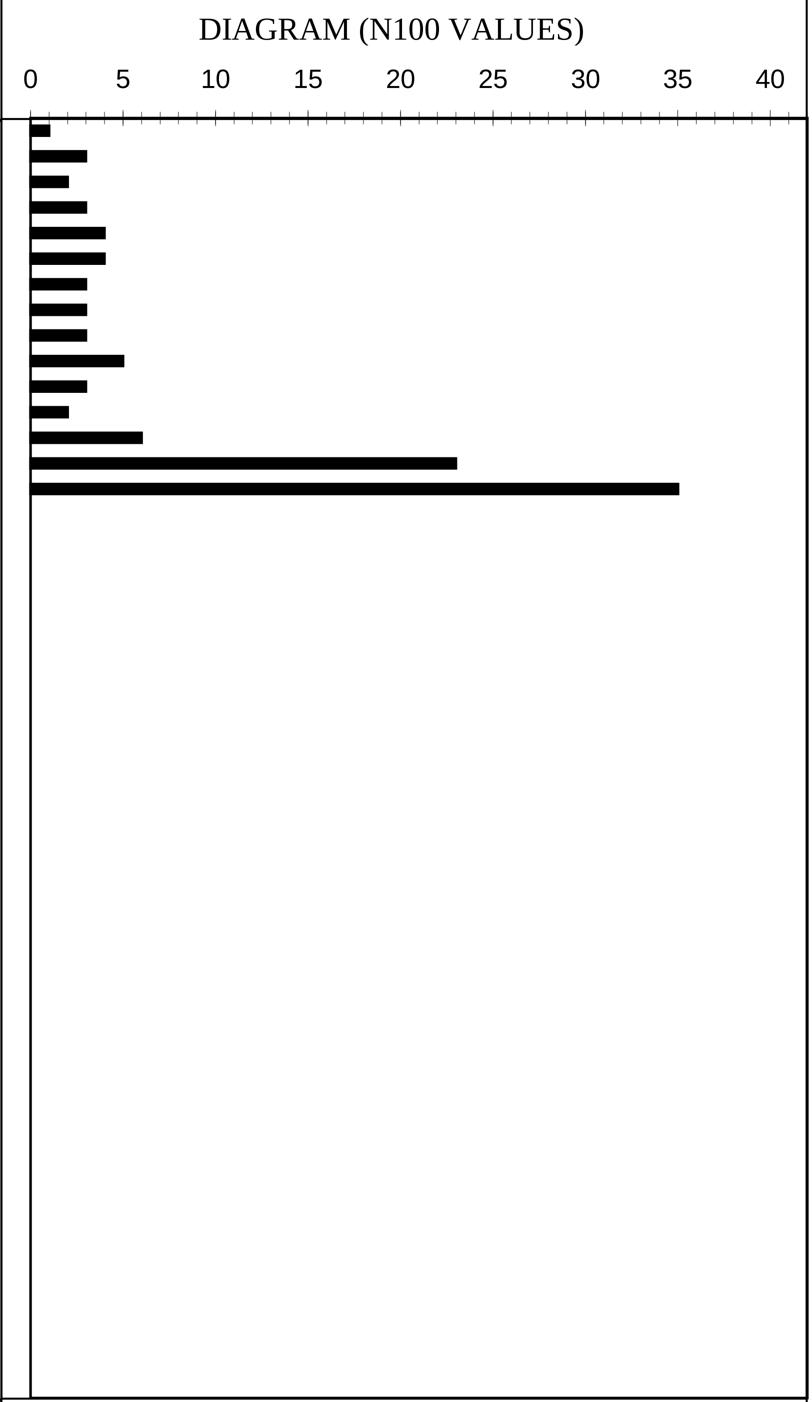
	-
	-
	-
	-
5.0	-



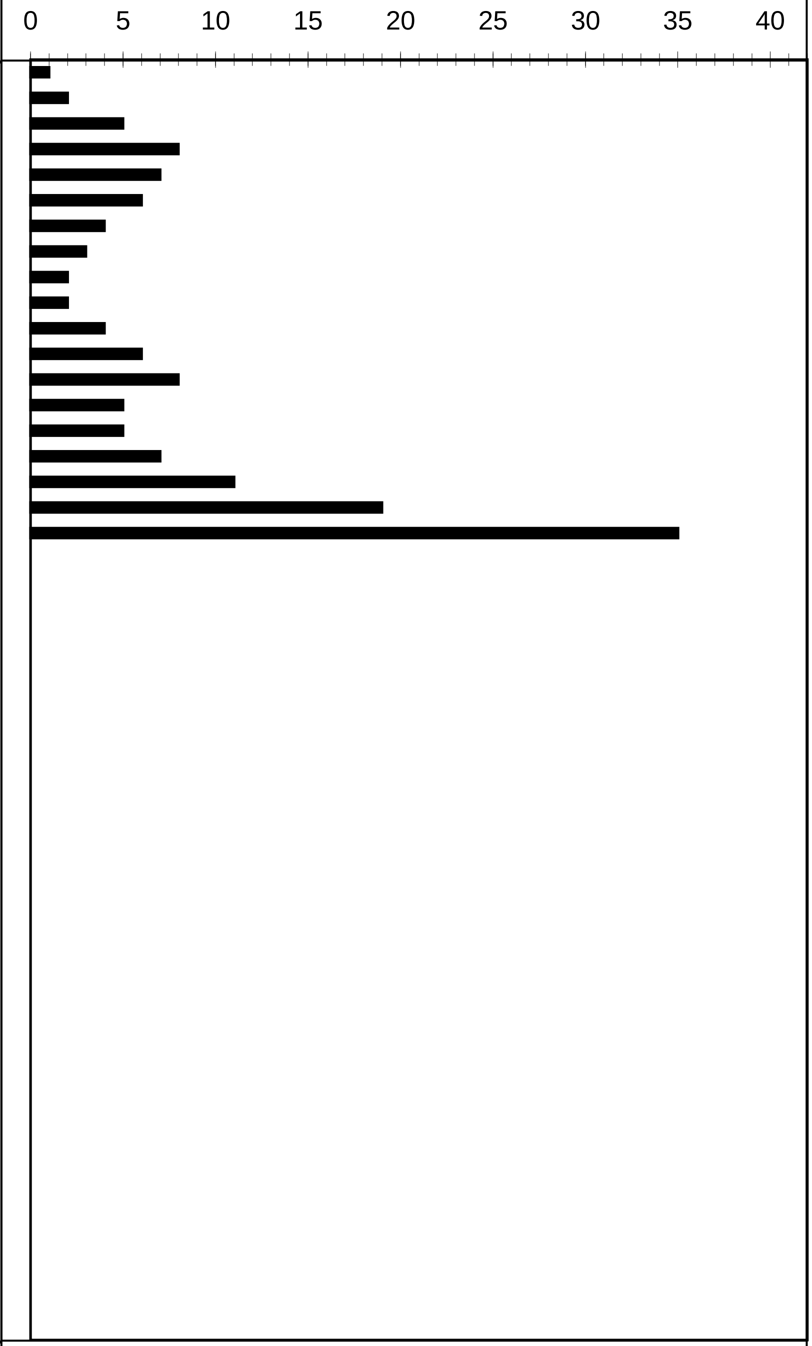
DEPTH (m)	TORQUE (Nm)	COMMENTS:
1.0		TYPE: DPH HAMMER MASS: 50kg DROP: 500mm CONE: 90°
2.0		
3.0		
4.0		Probe refusal at 1.50m
5.0		

PENNINE DYNAMIC PROBING

SITE	:	Chigwell	P.C. No	:	5303
CLIENT	:	Moran Park Homebuilders	PROBE No	:	DP02
SHEET No	:	1 OF 1	DATE	:	13/07/2016

DEPTH (m)	READING (Blows/100mm)
	1
	2
	5
	8
0.5	7
	6
	4
	3
	2
1.0	2
	4
	6
	8
	5
1.5	5
	7
	11
	19
	35
2.0	-
	-
	-
	-
	-
2.5	-
	-
	-
	-
	-
3.0	-
	-
	-
	-
	-
3.5	-
	-
	-
	-
	-
4.0	-
	-
	-
	-
	-
4.5	-
	-
	-
	-
	-
5.0	-

DIAGRAM (N100 VALUES)



DEPTH (m)	TORQUE (Nm)
1.0	
2.0	
3.0	
4.0	
5.0	

COMMENTS:

TYPE: DPH HAMMER MASS: 50kg DROP: 500mm CONE: 90°

Probe refusal at 1.90m

Appendix 4

Soakaway Test Results

SOAKAWAY TEST f-Value Calculations SIL

Project Reference:	5303
Contract name:	Chigwell
Location:	Glenamuck Road, Co. Dublin
Test No:	SA01
Date:	12/07/2016

Ground Conditions

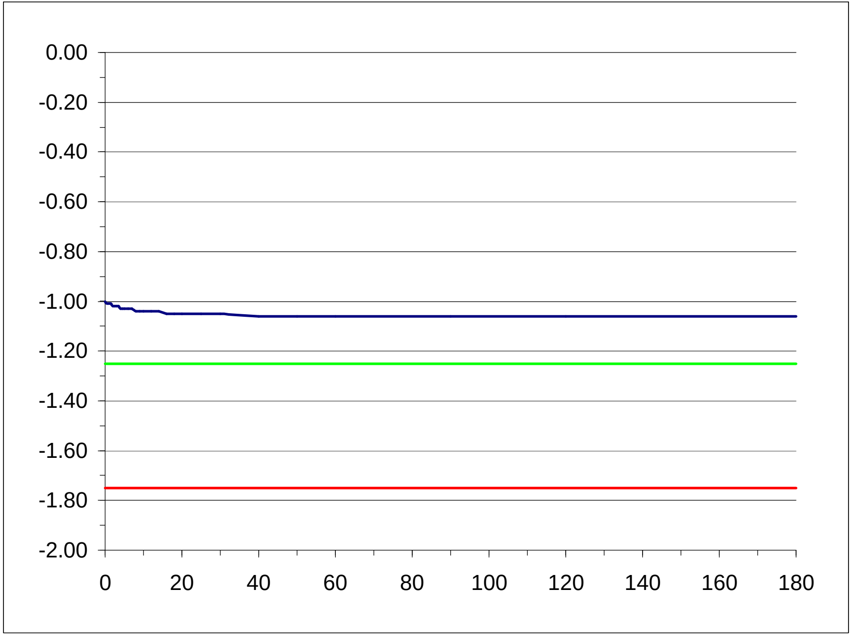
From	To	
0.00	0.20	TOPSOIL.
0.20	1.90	Firm brown sandy slightly gravelly silty CLAY with low cobble content.
1.90	2.00	Light brown slightly gravelly fine to coarse SAND of granite.

Comments:

Obstruction at 2.00m - pit terminated and test undertaken.

Elapsed Time (mins)	Fall of Water (m)
0	-1.00
0.5	-1.01
1	-1.01
1.5	-1.01
2	-1.02
2.5	-1.02
3	-1.02
3.5	-1.02
4	-1.03
4.5	-1.03
5	-1.03
6	-1.03
7	-1.03
8	-1.04
9	-1.04
10	-1.04
12	-1.04
14	-1.04
16	-1.05
18	-1.05
20	-1.05
25	-1.05
30	-1.05
40	-1.06
50	-1.06
60	-1.06
90	-1.06
120	-1.06
180	-1.06

Pit Dimensions (m)		
Length (m)	2.10	m
Width (m)	0.30	m
Depth	2.00	m
Water		
Start Depth of Water	1.00	m
Depth of Water	1.00	m
75% Full	1.25	m
25% Full	1.75	m
75%-25%	0.5	m
Volume of water (75%-25%)	**0.315**	m3
Area of Drainage	**9.6**	m2
Area of Drainage (75%-25%)	**3.03**	m2
Time		
75% Full	N/A	min
25% Full	N/A	min
Time 75% to 25%	**N/A**	min
Time 75% to 25% (sec)	**N/A**	sec



f = Fail or **Fail**

m/min **m/s**

SOAKAWAY TEST f-Value Calculations SIL

Project Reference:	5303
Contract name:	Chigwell
Location:	Glenamuck Road, Co. Dublin
Test No:	SA02
Date:	12/07/2016

Ground Conditions

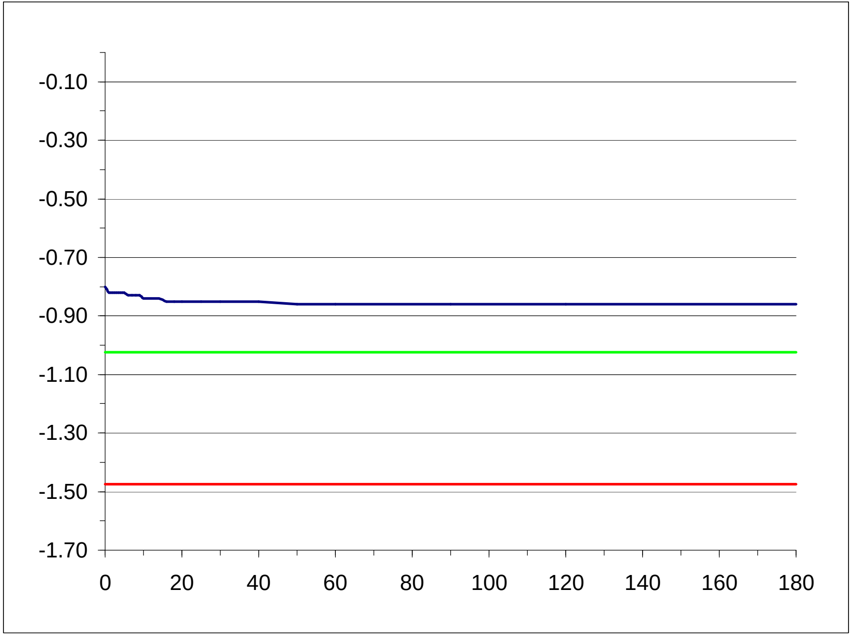
From	**To**	
0.00	0.20	TOPSOIL.
0.20	1.50	Firm brown sandy slightly gravelly silty CLAY with low cobble content.
1.50	1.70	Light brown slightly gravelly fine to coarse SAND of granite.

Comments:

Obstruction at 1.70m - pit terminated and test undertaken.

Elapsed Time (mins)	Fall of Water (m)
0	-0.80
0.5	-0.81
1	-0.82
1.5	-0.82
2	-0.82
2.5	-0.82
3	-0.82
3.5	-0.82
4	-0.82
4.5	-0.82
5	-0.82
6	-0.83
7	-0.83
8	-0.83
9	-0.83
10	-0.84
12	-0.84
14	-0.84
16	-0.85
18	-0.85
20	-0.85
25	-0.85
30	-0.85
40	-0.85
50	-0.86
60	-0.86
90	-0.86
120	-0.86
180	-0.86

Pit Dimensions (m)		
Length (m)	2.00	m
Width (m)	0.30	m
Depth	1.70	m
Water		
Start Depth of Water	0.80	m
Depth of Water	0.90	m
75% Full	1.025	m
25% Full	1.475	m
75%-25%	0.45	m
Volume of water (75%-25%)	**0.27**	m3
Area of Drainage	**7.82**	m2
Area of Drainage (75%-25%)	**2.67**	m2
Time		
75% Full	N/A	min
25% Full	N/A	min
Time 75% to 25%	**N/A**	min
Time 75% to 25% (sec)	**N/A**	sec



f =	**Fail**	or	**Fail**
	m/min		**m/s**

SOAKAWAY TEST f-Value Calculations SIL

Project Reference:	5303
Contract name:	Chigwell
Location:	Glenamuck Road, Co. Dublin
Test No:	SA03
Date:	12/07/2016

Ground Conditions

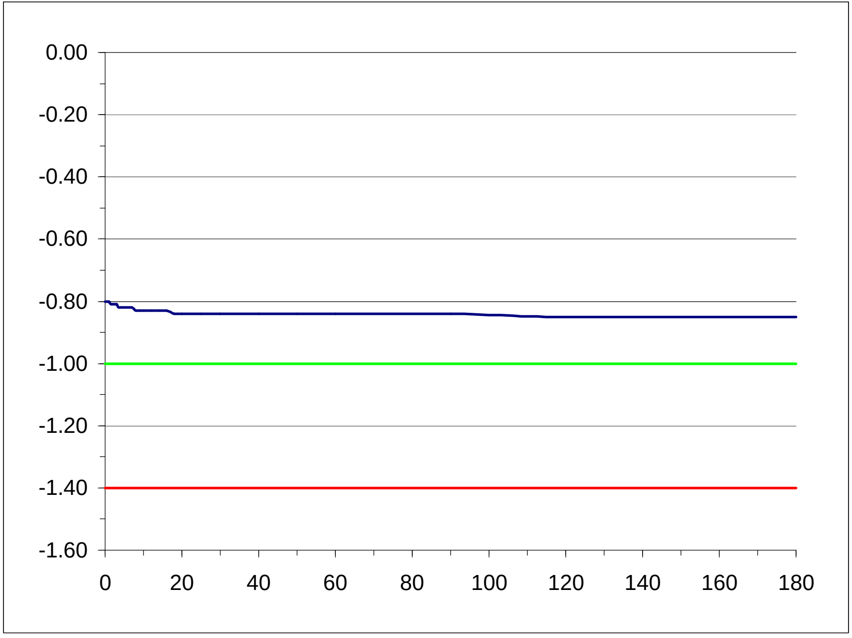
From	**To**	
0.00	0.20	TOPSOIL.
0.20	1.50	Firm brown sandy slightly gravelly silty CLAY.
1.50	1.60	Light brown slightly gravelly fine to coarse SAND of granite.

Comments:

Obstruction at 1.60m - pit terminated and test undertaken.

Elapsed Time (mins)	Fall of Water (m)
0	-0.80
0.5	-0.80
1	-0.80
1.5	-0.81
2	-0.81
2.5	-0.81
3	-0.81
3.5	-0.82
4	-0.82
4.5	-0.82
5	-0.82
6	-0.82
7	-0.82
8	-0.83
9	-0.83
10	-0.83
12	-0.83
14	-0.83
16	-0.83
18	-0.84
20	-0.84
25	-0.84
30	-0.84
40	-0.84
50	-0.84
60	-0.84
90	-0.84
120	-0.85
180	-0.85

Pit Dimensions (m)		
Length (m)	2.00	m
Width (m)	0.30	m
Depth	1.60	m
Water		
Start Depth of Water	0.80	m
Depth of Water	0.80	m
75% Full	1	m
25% Full	1.4	m
75%-25%	0.4	m
Volume of water (75%-25%)	**0.24**	m3
Area of Drainage	**7.36**	m2
Area of Drainage (75%-25%)	**2.44**	m2
Time		
75% Full	N/A	min
25% Full	N/A	min
Time 75% to 25%	**N/A**	min
Time 75% to 25% (sec)	**N/A**	sec



f = Fail or **Fail**

m/min **m/s**

Appendix 5

Laboratory Test Results

Classification Tests

Client	Moran Park Homebuilders
Site	Chigwell
S.I. File No	5303 / 16
Test Lab	Site Investigations Ltd., Carhugar The Grange, 12th Lock Rd., Lucan Co. Dublin. Tel (01) 6108768 Email siltd@indigo.ie
Report Date	8th August 2016

Hole ID	Depth	Sample No	Lab Ref No.	Sample Type	Natural Moisture Content %	Liquid Limit %	Plastic Limit %	Max. Dry Density Mg/m^3	Min. Dry Density Mg/m^3	Particle Density Mg/m^3	% passing 425um	Comments	**Remarks** **C**=Clay; **M**=Silt **Plasticity**: **L**=Low; **I**=Intermediate; **H**=High; **V**=Very High; **E**=Extremely High
BH01	1.50	TT1	16/603	B	12.3	36	22				59.9		CI
BH05	1.50	TT05	16/606	B	12.4	24	NP				47.7		

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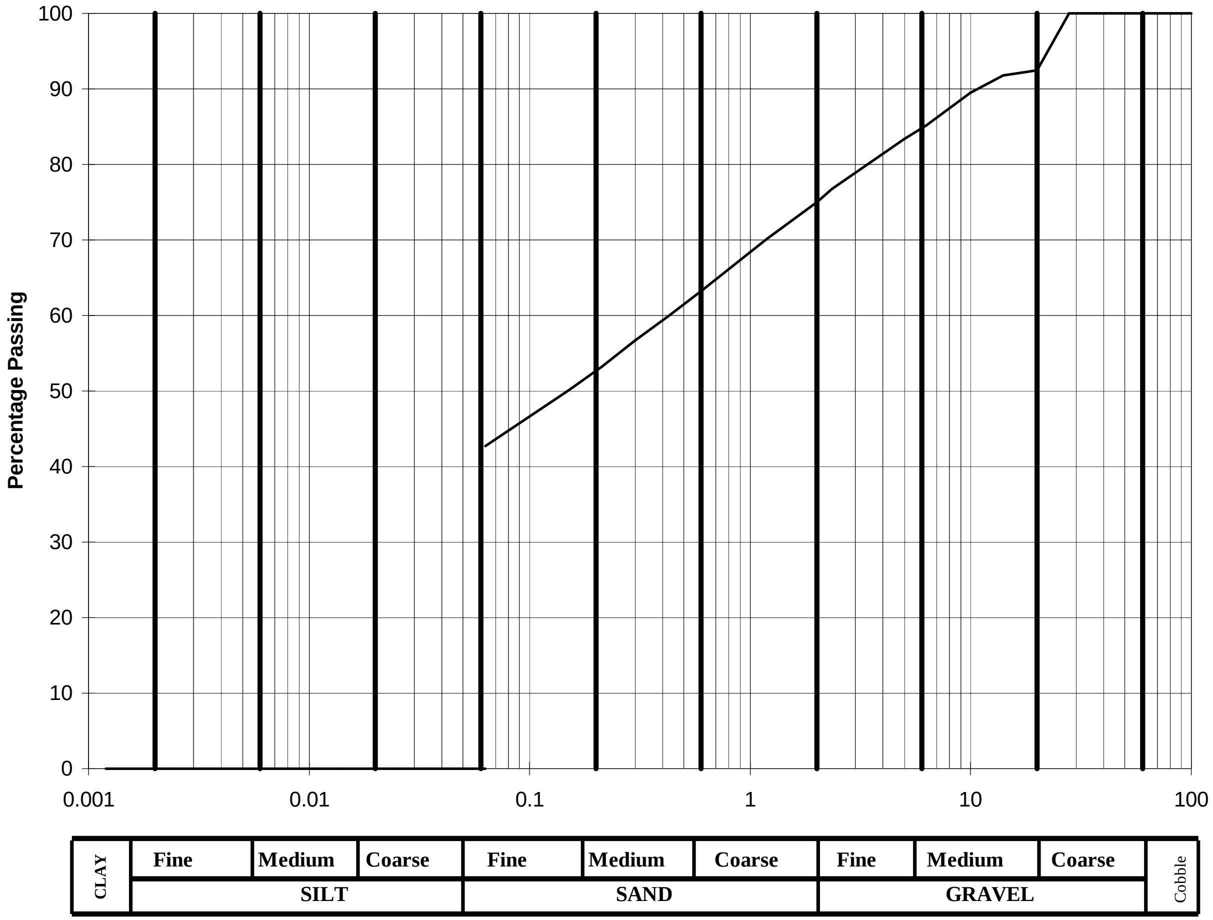
Site Investigations Ltd

BS 1377 Particle Size Analysis

Site Investigations Limited

BS Sieve size, mm	Percent passing	Hydrometer analysis	
		Diameter, mm	% passing
100	100	**0.0630**	
90	100	**0.0200**	
75	100	**0.0060**	
63	100	**0.0020**	
50	100		
37.5	100		
28	100		
20	92.5		
14	91.8		
10	89.5		
6.3	85.2		
5.0	83.4		
2.36	76.8		
2.00	75		
1.18	70.1		
0.600	63.2		
0.425	59.9		
0.300	56.7		
0.212	53.2		
0.150	50.1		
0.063	43		

Cobbles, %	0
Gravel, %	25
Sand, %	32
Clay / Silt, %	43



Client :	Moran Park Homebuilders	Lab. No :	16/603	Hole ID :	BH 01
Project :	Chigwell	Sample No :	TT11	Depth, m :	1.50

Material description :	slightly gravelly slightly sandy silty CLAY
Remarks :	Soils with clay or silt content between 15% - 35% can be classified as clay or silt depending on the field Engineers assessment of in-situ behaviour. Where material is for re-use and therefore disturbed, only soils with clay or silt >35% are classified as clay or silt

5303-16
Printed 08/08/2016

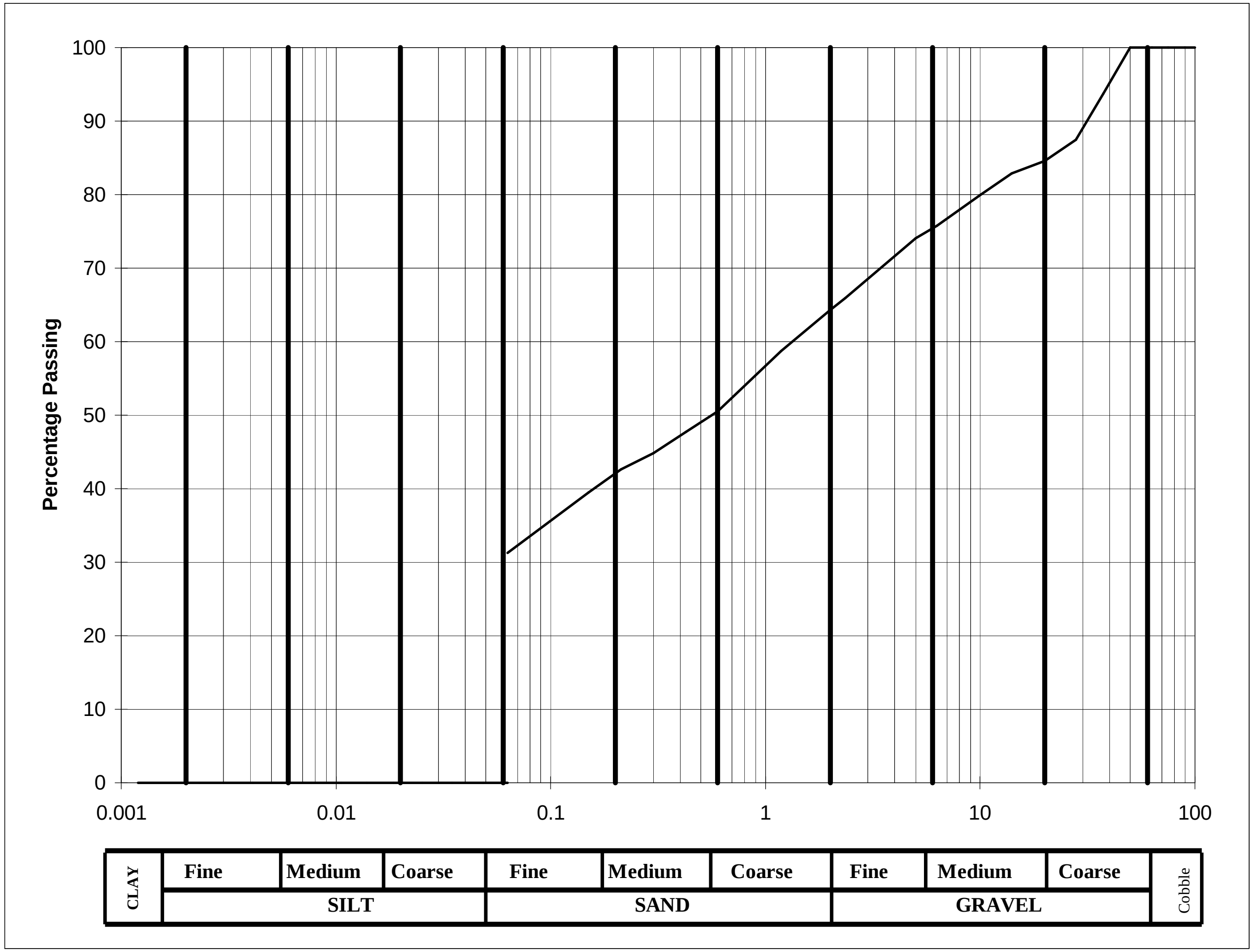
________________________Paddy McGonagle
Site Investigations Ltd

BS 1377 Particle Size Analysis

Site Investigations Limited

BS Sieve size, mm	Percent passing	Hydrometer analysis	
		Diameter, mm	% passing
100	100	**0.0630**	
90	100	**0.0200**	
75	100	**0.0060**	
63	100	**0.0020**	
50	100		
37.5	93.7		
28	87.5		
20	84.6		
14	82.9		
10	79.9		
6.3	75.8		
5.0	74.1		
2.36	65.9		
2.00	64.3		
1.18	58.7		
0.600	50.5		
0.425	47.7		
0.300	44.8		
0.212	42.6		
0.150	39.5		
0.063	31		

Cobbles, %	0
Gravel, %	36
Sand, %	33
Clay / Silt, %	31



Client :	Moran Park Homebuilders		Lab. No :	16/606		Hole ID :	BH 05
Project :	Chigwell		Sample No :	TT05		Depth, m :	1.50

Material description :	slightly sandy gravelly clayey SILT
Remarks :	Soils with clay or silt content between 15% - 35% can be classified as clay or silt depending on the field Engineers assessment of in-situ behaviour. Where material is for re-use and therefore disturbed, only soils with clay or silt >35% are classified as clay or silt

5303-16
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Site Investigations Ltd

California Bearing Ratio (CBR) In accordance with BS1377: Part 4: Method 7

Client	Moran Park Homebuilders
Site	Chigwell
S.I. File No	5303 / 16
Test Lab	Site Investigations Ltd., Carhugar The Grange, 12th Lock Rd., Lucan Co. Dublin. Tel (01) 6108768 Email siltd@indigo.ie
Report Date	8th August 2016

Hole ID	Depth (mBGL)	Sample No	Sample Type	Lab Ref	Moisture Content (%)	CBR Value (%)	Remarks / Material Type
CBR01	0.50	SL01	B	16/607	4.7	7.9	
CBR02	0.50	SL02	B	16/608	1.6	8.5	
CBR03	0.50	SL03	B	16/609	6.6	8.2	
CBR04	0.50	SL04	B	16/610	13.8	6.4	

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Site Investigations Ltd

Printed 08/08/2016

Chemical Testing
In accordance with BS 1377: Part 3

Client	Moran Park Homebuilders
Site	Chigwell
S.I. File No	5303 / 16
Test Lab	Site Investigations Ltd., Carhugar The Grange, 12th Lock Rd., Lucan Co. Dublin. Tel (01) 6108768 Email siltd@indigo.ie
Report Date	8th August 2016

Hole Id	Depth (mBGL)	Sample No	Lab Ref	pH Value	Sulphate Content Acid Soluble (SO_3) g/L	Sulphate Content Acid Soluble (SO_3) %	Organic Content **%**	Chloride ion Content (soil:water ratio 2:1) **%**	% passing 2mm	Remarks
BH01	1.50	TT11	16/6030	8.90	0.105	0.079	2.34	0.20	75.0	
BH03	0.50	TT01	16/6031	8.32	0.103	0.044	2.22	0.19	43.1	
BH04	0.50	TT06	16/6032	8.15	0.119	0.057	4.73	0.22	48.0	
BH05	1.50	TT05	16/6033	8.47	0.112	0.072	2.04	0.17	64.3	

Printed 08/08/2016

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Site Investigations Ltd.

ALcontrol Laboratories

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email: mkt@alcontrol.com
Website: www.alcontrol.com

Site Investigations Ltd
The Grange
Carhugar
12th Lock Road
Lucan
Co. Dublin

Attention: Stephen Letch

CERTIFICATE OF ANALYSIS

Date:	26 July 2016
Customer:	D_SITEINV_NCS
Sample Delivery Group (SDG):	160716-1
Your Reference:	
Location:	Chigwell
Report No:	370642

This report has been revised and directly supersedes 370510 in its entirety.

We received 3 samples on Friday July 15, 2016 and 3 of these samples were scheduled for analysis which was completed on Tuesday July 26, 2016. Accredited laboratory tests are defined within the report, but opinions, interpretations and on-site data expressed herein are outside the scope of ISO 17025 accreditation.

Should this report require incorporation into client reports, it must be used in its entirety and not simply with the data sections alone.

All chemical testing (unless subcontracted) is performed at ALcontrol Hawarden Laboratories.

Approved By:

Sonia McWhan
Operations Manager

mCERTS
THE ENVIRONMENT AGENCY'S MONITORING CERTIFICATION SCHEME

ilac-MRA

UKAS TESTING
1291

Alcontrol Laboratories is a trading division of ALcontrol UK Limited
Registered Office: Units 7 & 8 Hawarden Business Park, Manor Road, Hawarden, Deeside, CH5 3US. Registered in England and Wales No. 4057291.

Received Sample Overview

Lab Sample No(s)	Customer Sample Ref.	AGS Ref.	Depth (m)	Sampled Date
13785932	BH01		0.50	13/07/2016
13785933	BH04		0.50	13/07/2016
13785934	TP01		0.50	13/07/2016

Only received samples which have had analysis scheduled will be shown on the following pages.

CERTIFICATE OF ANALYSIS

SDG: 160716-1
Job: D_SITEINV_NCS-85
Client Reference:
Location: Chigwell
Customer: Site Investigations Ltd
Attention: Stephen Letch
Order Number:
Report Number: 370642
Superseded Report: 370510

SOLID

Results Legend

X **Test**

N **No Determination Possible**

Lab Sample No(s)			137785932			137785933			137785934	
Customer Sample Reference			BH01			BH04			TP01	
AGS Reference										
Depth (m)			0.50			0.50			0.50	
Container			1kg TUB	250g Amber Jar	60g VOC (ALE215)	1kg TUB	250g Amber Jar	60g VOC (ALE215)	1kg TUB	250g Amber Jar	60g VOC (ALE215)
ANC at pH4 and ANC at pH 6	All	NDPs: 0 Tests: 3		X			X			X	
Anions by Kone (w)	All	NDPs: 0 Tests: 3	X			X			X		
CEN Readings	All	NDPs: 0 Tests: 3	X			X			X		
Dissolved Metals by ICP-MS	All	NDPs: 0 Tests: 3	X			X			X		
Dissolved Organic/Inorganic Carbon	All	NDPs: 0 Tests: 3	X			X			X		
Fluoride	All	NDPs: 0 Tests: 3	X			X			X		
GRO by GC-FID (S)	All	NDPs: 0 Tests: 3			X			X			X
Loss on Ignition in soils	All	NDPs: 0 Tests: 3		X			X			X	
Mercury Dissolved	All	NDPs: 0 Tests: 3	X			X			X		
Mineral Oil	All	NDPs: 0 Tests: 3		X			X			X	
PAH Value of soil	All	NDPs: 0 Tests: 3		X			X			X	
PCBs by GCMS	All	NDPs: 0 Tests: 3		X			X			X	
pH	All	NDPs: 0 Tests: 3	X			X			X		
Phenols by HPLC (W)	All	NDPs: 0 Tests: 3	X			X			X		
Sample description	All	NDPs: 0 Tests: 3		X			X			X	

SDG: 160716-1
Job: D_SITEINV_NCS-85
Client Reference:

Location: Chigwell
Customer: Site Investigations Ltd
Attention: Stephen Letch

Order Number:
Report Number: 370642
Superseded Report: 370510

SOLID

Results Legend

X **Test**

N **No Determination Possible**

Lab Sample No(s)			137785932			137785933			137785934		
Customer Sample Reference			BH01			BH04			TP01		
AGS Reference											
Depth (m)			0.50			0.50			0.50		
Container			1kg TUB	250g Amber Jar	60g VOC (ALE215)	1kg TUB	250g Amber Jar	60g VOC (ALE215)	1kg TUB	250g Amber Jar	60g VOC (ALE215)
Total Dissolved Solids	All	NDPs: 0 Tests: 3	X			X			X		
Total Organic Carbon	All	NDPs: 0 Tests: 3		X			X			X	

SDG:	160716-1	**Location:**	Chigwell	**Order Number:**	
Job:	D_SITEINV_NCS-85	**Customer:**	Site Investigations Ltd	**Report Number:**	370642
Client Reference:		**Attention:**	Stephen Letch	**Superseded Report:**	370510

Sample Descriptions

Grain Sizes

very fine	<0.063mm	**fine**	0.063mm - 0.1mm	**medium**	0.1mm - 2mm	**coarse**	2mm - 10mm	**very coarse**	>10mm

Lab Sample No(s)	Customer Sample Ref.	Depth (m)	Colour	Description	Grain size	Inclusions	Inclusions 2
13785932	BH01	0.50	Dark Brown	Sandy Clay	0.063 - 2.00 mm	Stones	Vegetation
13785933	BH04	0.50	Dark Brown	Sandy Loam	0.063 - 2.00 mm	Stones	Vegetation
13785934	TP01	0.50	Dark Brown	Sandy Clay	0.063 - 2.00 mm	Stones	Vegetation

These descriptions are only intended to act as a cross check if sample identities are questioned, and to provide a log of sample matrices with respect to MCERTS validation. They are not intended as full geological descriptions.

We are accredited to MCERTS for sand, clay and loam/topsoil, or any of these materials - whether these are derived from naturally ocurring soil profiles, or from fill/made ground, as long as these materials constitute the major part of the sample.

Other coarse granular materials such as concrete, gravel and brick are not accredited if they comprise the major part of the sample.

CERTIFICATE OF ANALYSIS

Validated

SDG:	160716-1	**Location:**	Chigwell	**Order Number:**	
Job:	D_SITEINV_NCS-85	**Customer:**	Site Investigations Ltd	**Report Number:**	370642
Client Reference:		**Attention:**	Stephen Letch	**Superseded Report:**	370510

Results Legend

#	ISO17025 accredited.
M	*m*CERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted test.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-5&♦§@	Sample deviation (see appendix)

Customer Sample Ref.	BH01	BH04	TP01			
Depth (m)	0.50	0.50	0.50			
Sample Type	Soil/Solid	Soil/Solid	Soil/Solid			
Date Sampled	13/07/2016	13/07/2016	13/07/2016			
Sample Time	.	.	.			
Date Received	15/07/2016	15/07/2016	15/07/2016			
SDG Ref	160716-1	160716-1	160716-1			
Lab Sample No.(s)	13785932	13785933	13785934			
AGS Reference						

Component	LOD/Units	Method	BH01	BH04	TP01			
Moisture Content Ratio (% of as received sample)	%	PM024	4.1	9.8	9.1			
Loss on ignition	<0.7 %	TM018	3.31 M	4.05 M	5.67 M			
Mineral oil >C10-C40	<1 mg/kg	TM061	16.3	14.6	19.6			
Mineral Oil Surrogate % recovery**	%	TM061	90.2	93.6	91.7			
Organic Carbon, Total	<0.2 %	TM132	0.568 M	0.702 M	0.902 M			
pH	1 pH Units	TM133	8.31 M	8.19 M	7.31 M			
PCB congener 28	<3 µg/kg	TM168	<3 M	<3 M	<3 M			
PCB congener 52	<3 µg/kg	TM168	<3 M	<3 M	<3 M			
PCB congener 101	<3 µg/kg	TM168	<3 M	<3 M	<3 M			
PCB congener 118	<3 µg/kg	TM168	<3 M	<3 M	<3 M			
PCB congener 138	<3 µg/kg	TM168	<3 M	<3 M	<3 M			
PCB congener 153	<3 µg/kg	TM168	<3 M	<3 M	<3 M			
PCB congener 180	<3 µg/kg	TM168	<3 M	<3 M	<3 M			
Sum of detected PCB 7 Congeners	<21 µg/kg	TM168	<21	<21	<21			
ANC @ pH 4	<0.03 mol/kg	TM182	2.83	1.48	0.124			
ANC @ pH 6	<0.03 mol/kg	TM182	0.449	0.272	0.0457			
Polyaromatic hydrocarbons, Total 17	<10 mg/kg	TM213	<10	<10	<10			

17:11:04 26/07/2016

CERTIFICATE OF ANALYSIS

SDG:	160716-1	**Location:**	Chigwell	**Order Number:**	
Job:	D_SITEINV_NCS-85	**Customer:**	Site Investigations Ltd	**Report Number:**	370642
Client Reference:		**Attention:**	Stephen Letch	**Superseded Report:**	370510

GRO by GC-FID (S)

Results Legend	
#	ISO17025 accredited.
M	*m*CERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted test.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-5&♦§@	Sample deviation (see appendix)

		Customer Sample Ref.	BH01	BH04	TP01
		Depth (m)	0.50	0.50	0.50
		Sample Type	Soil/Solid	Soil/Solid	Soil/Solid
		Date Sampled	13/07/2016	13/07/2016	13/07/2016
		Sample Time	.	.	.
		Date Received	15/07/2016	15/07/2016	15/07/2016
		SDG Ref	160716-1	160716-1	160716-1
		Lab Sample No.(s)	13785932	13785933	13785934
		AGS Reference			
Component	**LOD/Units**	**Method**			
Methyl tertiary butyl ether (MTBE)	<5 µg/kg	TM089	<5 #	<5 #	<5 #
Benzene	<10 µg/kg	TM089	<10 M	<10 M	<10 M
Toluene	<2 µg/kg	TM089	<2 M	2.22 M	<2 M
Ethylbenzene	<3 µg/kg	TM089	<3 M	<3 M	<3 M
m,p-Xylene	<6 µg/kg	TM089	<6 M	<6 M	<6 M
o-Xylene	<3 µg/kg	TM089	<3 M	<3 M	<3 M
sum of detected mpo xylene by GC	<9 µg/kg	TM089	<9	<9	<9
sum of detected BTEX by GC	<24 µg/kg	TM089	<24	<24	<24

CEN 10:1 SINGLE STAGE LEACHATE TEST

WAC ANALYTICAL RESULTS

REF : BS EN 12457/2

Client Reference		**Site Location**	Chigwell
Mass Sample taken (kg)	0.094	**Natural Moisture Content (%)**	4.28
Mass of dry sample (kg)	0.090	**Dry Matter Content (%)**	95.9
Particle Size <4mm	>95%		

Case	
SDG	160716-1
Lab Sample Number(s)	13785932
Sampled Date	13-Jul-2016
Customer Sample Ref.	BH01
Depth (m)	0.50

Landfill Waste Acceptance Criteria Limits

Solid Waste Analysis	Result	Inert Waste Landfill	Stable Non-reactive Hazardous Waste in Non-Hazardous Landfill	Hazardous Waste Landfill
Total Organic Carbon (%)	0.568	3	5	6
Loss on Ignition (%)	3.31	-	-	10
Sum of BTEX (mg/kg)	<0.024	6	-	-
Sum of 7 PCBs (mg/kg)	<0.021	1	-	-
Mineral Oil (mg/kg)	16.3	500	-	-
PAH Sum of 17 (mg/kg)	<10	100	-	-
pH (pH Units)	8.31	-	>6	-
ANC to pH 6 (mol/kg)	0.449	-	-	-
ANC to pH 4 (mol/kg)	2.83	-	-	-

Eluate Analysis	C2 Conc^n in 10:1 eluate (mg/l)		A2 10:1 conc^n leached (mg/kg)		Limit values for compliance leaching test using BS EN 12457-3 at L/S 10 l/kg		
	Result	Limit of Detection	Result	Limit of Detection			
Arsenic	<0.00012	<0.00012	<0.0012	<0.0012	0.5	2	25
Barium	0.0035	<0.00003	0.035	<0.0003	20	100	300
Cadmium	<0.0001	<0.0001	<0.001	<0.001	0.04	1	5
Chromium	0.00191	<0.00022	0.0191	<0.0022	0.5	10	70
Copper	<0.00085	<0.00085	<0.0085	<0.0085	2	50	100
Mercury Dissolved (CVAF)	<0.00001	<0.00001	<0.0001	<0.0001	0.01	0.2	2
Molybdenum	0.00175	<0.00024	0.0175	<0.0024	0.5	10	30
Nickel	0.00047	<0.00015	0.0047	<0.0015	0.4	10	40
Lead	0.00005	<0.00002	0.0005	<0.0002	0.5	10	50
Antimony	<0.00016	<0.00016	<0.0016	<0.0016	0.06	0.7	5
Selenium	<0.00039	<0.00039	<0.0039	<0.0039	0.1	0.5	7
Zinc	0.000586	<0.00041	0.00586	<0.0041	4	50	200
Chloride	<2	<2	<20	<20	800	15000	25000
Fluoride	<0.5	<0.5	<5	<5	10	150	500
Sulphate (soluble)	<2	<2	<20	<20	1000	20000	50000
Total Dissolved Solids	82.9	<5	829	<50	4000	60000	100000
Total Monohydric Phenols (W)	<0.016	<0.016	<0.16	<0.16	1	-	-
Dissolved Organic Carbon	<3	<3	<30	<30	500	800	1000

Leach Test Information

Date Prepared	21-Jul-2016
pH (pH Units)	8.89
Conductivity (µS/cm)	102.00
Temperature (ºC)	20.80
Volume Leachant (Litres)	0.896

Solid Results are expressed on a dry weight basis, after correction for moisture content where applicable
Stated limits are for guidance only and ALcontrol cannot be held responsible for any discrepancies with current legislation
Mcerts Certification does not apply to leachates
26/07/2016 17:11:12

CEN 10:1 SINGLE STAGE LEACHATE TEST

WAC ANALYTICAL RESULTS

REF : BS EN 12457/2

Client Reference		**Site Location**	Chigwell
Mass Sample taken (kg)	0.100	**Natural Moisture Content (%)**	10.9
Mass of dry sample (kg)	0.090	**Dry Matter Content (%)**	90.2
Particle Size <4mm	>95%		

Case	
SDG	160716-1
Lab Sample Number(s)	13785933
Sampled Date	13-Jul-2016
Customer Sample Ref.	BH04
Depth (m)	0.50

Landfill Waste Acceptance Criteria Limits

Solid Waste Analysis	**Result**	**Inert Waste Landfill**	**Stable Non-reactive Hazardous Waste in Non-Hazardous Landfill**	**Hazardous Waste Landfill**
Total Organic Carbon (%)	0.702	3	5	6
Loss on Ignition (%)	4.05	-	-	10
Sum of BTEX (mg/kg)	<0.024	6	-	-
Sum of 7 PCBs (mg/kg)	<0.021	1	-	-
Mineral Oil (mg/kg)	14.6	500	-	-
PAH Sum of 17 (mg/kg)	<10	100	-	-
pH (pH Units)	8.19	-	>6	-
ANC to pH 6 (mol/kg)	0.272	-	-	-
ANC to pH 4 (mol/kg)	1.48	-	-	-

Eluate Analysis	**C_2 Conc^n in 10:1 eluate (mg/l)**		**A_2 10:1 conc^n leached (mg/kg)**		**Limit values for compliance leaching test using BS EN 12457-3 at L/S 10 l/kg**		
	Result	**Limit of Detection**	**Result**	**Limit of Detection**			
Arsenic	0.000122	<0.00012	0.00122	<0.0012	0.5	2	25
Barium	0.00211	<0.00003	0.0211	<0.0003	20	100	300
Cadmium	<0.0001	<0.0001	<0.001	<0.001	0.04	1	5
Chromium	0.00233	<0.00022	0.0233	<0.0022	0.5	10	70
Copper	<0.00085	<0.00085	<0.0085	<0.0085	2	50	100
Mercury Dissolved (CVAF)	<0.00001	<0.00001	<0.0001	<0.0001	0.01	0.2	2
Molybdenum	0.00184	<0.00024	0.0184	<0.0024	0.5	10	30
Nickel	0.000656	<0.00015	0.00656	<0.0015	0.4	10	40
Lead	0.000041	<0.00002	0.00041	<0.0002	0.5	10	50
Antimony	<0.00016	<0.00016	<0.0016	<0.0016	0.06	0.7	5
Selenium	<0.00039	<0.00039	<0.0039	<0.0039	0.1	0.5	7
Zinc	<0.00041	<0.00041	<0.0041	<0.0041	4	50	200
Chloride	<2	<2	<20	<20	800	15000	25000
Fluoride	<0.5	<0.5	<5	<5	10	150	500
Sulphate (soluble)	<2	<2	<20	<20	1000	20000	50000
Total Dissolved Solids	103	<5	1030	<50	4000	60000	100000
Total Monohydric Phenols (W)	<0.016	<0.016	<0.16	<0.16	1	-	-
Dissolved Organic Carbon	6.65	<3	66.5	<30	500	800	1000

Leach Test Information

Date Prepared	21-Jul-2016
pH (pH Units)	8.23
Conductivity (µS/cm)	127.00
Temperature (ºC)	20.90
Volume Leachant (Litres)	0.890

Solid Results are expressed on a dry weight basis, after correction for moisture content where applicable
Stated limits are for guidance only and ALcontrol cannot be held responsible for any discrepancies with current legislation
Mcerts Certification does not apply to leachates
26/07/2016 17:11:12

17:11:04 26/07/2016

SDG:	160716-1	**Location:**	Chigwell	**Order Number:**	
Job:	D_SITEINV_NCS-85	**Customer:**	Site Investigations Ltd	**Report Number:**	370642
Client Reference:		**Attention:**	Stephen Letch	**Superseded Report:**	370510

CEN 10:1 SINGLE STAGE LEACHATE TEST

WAC ANALYTICAL RESULTS

REF : BS EN 12457/2

Client Reference		**Site Location**	Chigwell
Mass Sample taken (kg)	0.099	**Natural Moisture Content (%)**	10
Mass of dry sample (kg)	0.090	**Dry Matter Content (%)**	90.9
Particle Size <4mm	>95%		

Case	
SDG	160716-1
Lab Sample Number(s)	13785934
Sampled Date	13-Jul-2016
Customer Sample Ref.	TP01
Depth (m)	0.50

Landfill Waste Acceptance Criteria Limits

Solid Waste Analysis	Result	Inert Waste Landfill	Stable Non-reactive Hazardous Waste in Non-Hazardous Landfill	Hazardous Waste Landfill
Total Organic Carbon (%)	0.902	3	5	6
Loss on Ignition (%)	5.67	-	-	10
Sum of BTEX (mg/kg)	<0.024	6	-	-
Sum of 7 PCBs (mg/kg)	<0.021	1	-	-
Mineral Oil (mg/kg)	19.6	500	-	-
PAH Sum of 17 (mg/kg)	<10	100	-	-
pH (pH Units)	7.31	-	>6	-
ANC to pH 6 (mol/kg)	0.0457	-	-	-
ANC to pH 4 (mol/kg)	0.124	-	-	-

Eluate Analysis	C_2 Conc^n in 10:1 eluate (mg/l)		A_2 10:1 conc^n leached (mg/kg)		Limit values for compliance leaching test using BS EN 12457-3 at L/S 10 l/kg		
	Result	Limit of Detection	Result	Limit of Detection			
Arsenic	0.000186	<0.00012	0.00186	<0.0012	0.5	2	25
Barium	0.00244	<0.00003	0.0244	<0.0003	20	100	300
Cadmium	<0.0001	<0.0001	<0.001	<0.001	0.04	1	5
Chromium	0.000826	<0.00022	0.00826	<0.0022	0.5	10	70
Copper	<0.00085	<0.00085	<0.0085	<0.0085	2	50	100
Mercury Dissolved (CVAF)	<0.00001	<0.00001	<0.0001	<0.0001	0.01	0.2	2
Molybdenum	<0.00024	<0.00024	<0.0024	<0.0024	0.5	10	30
Nickel	0.000737	<0.00015	0.00737	<0.0015	0.4	10	40
Lead	0.000179	<0.00002	0.00179	<0.0002	0.5	10	50
Antimony	<0.00016	<0.00016	<0.0016	<0.0016	0.06	0.7	5
Selenium	<0.00039	<0.00039	<0.0039	<0.0039	0.1	0.5	7
Zinc	0.00227	<0.00041	0.0227	<0.0041	4	50	200
Chloride	<2	<2	<20	<20	800	15000	25000
Fluoride	<0.5	<0.5	<5	<5	10	150	500
Sulphate (soluble)	<2	<2	<20	<20	1000	20000	50000
Total Dissolved Solids	13.8	<5	138	<50	4000	60000	100000
Total Monohydric Phenols (W)	<0.016	<0.016	<0.16	<0.16	1	-	-
Dissolved Organic Carbon	<3	<3	<30	<30	500	800	1000

Leach Test Information

Date Prepared	21-Jul-2016
pH (pH Units)	8.36
Conductivity (µS/cm)	9.33
Temperature (°C)	20.70
Volume Leachant (Litres)	0.891

Solid Results are expressed on a dry weight basis, after correction for moisture content where applicable
Stated limits are for guidance only and ALcontrol cannot be held responsible for any discrepancies with current legislation
Mcerts Certification does not apply to leachates
26/07/2016 17:11:12

CERTIFICATE OF ANALYSIS

SDG: 160716-1
Job: D_SITEINV_NCS-85
Client Reference:
Location: Chigwell
Customer: Site Investigations Ltd
Attention: Stephen Letch
Order Number:
Report Number: 370642
Superseded Report: 370510

Table of Results - Appendix

Method No	Reference	Description	Wet/Dry Sample [1]	Surrogate Corrected
PM024	Modified BS 1377	Soil preparation including homogenisation, moisture screens of soils for Asbestos Containing Material		
PM115		Leaching Procedure for CEN One Stage Leach Test 2:1 & 10:1 1 Step		
TM018	BS 1377: Part 3 1990	Determination of Loss on Ignition		
TM061	Method for the Determination of EPH,Massachusetts Dept.of EP, 1998	Determination of Extractable Petroleum Hydrocarbons by GC-FID (C10-C40)		
TM089	Modified: US EPA Methods 8020 & 602	Determination of Gasoline Range Hydrocarbons (GRO) and BTEX (MTBE) compounds by Headspace GC-FID (C4-C12)		
TM090	Method 5310, AWWA/APHA, 20th Ed., 1999 / Modified: US EPA Method 415.1 & 9060	Determination of Total Organic Carbon/Total Inorganic Carbon in Water and Waste Water		
TM104	Method 4500F, AWWA/APHA, 20th Ed., 1999	Determination of Fluoride using the Kone Analyser		
TM123	BS 2690: Part 121:1981	The Determination of Total Dissolved Solids in Water		
TM132	In - house Method	ELTRA CS800 Operators Guide		
TM133	BS 1377: Part 3 1990;BS 6068-2.5	Determination of pH in Soil and Water using the GLpH pH Meter		
TM152	Method 3125B, AWWA/APHA, 20th Ed., 1999	Analysis of Aqueous Samples by ICP-MS		
TM168	EPA Method 8082, Polychlorinated Biphenyls by Gas Chromatography	Determination of WHO12 and EC7 Polychlorinated Biphenyl Congeners by GC-MS in Soils		
TM182	CEN/TC 292 - WI 292046-chacterization of waste-leaching Behaviour Tests- Acid and Base Neutralization Capacity Test	Determination of Acid Neutralisation Capacity (ANC) Using Autotitration in Soils		
TM183	BS EN 23506:2002, (BS 6068-2.74:2002) ISBN 0 580 38924 3	Determination of Trace Level Mercury in Waters and Leachates by PSA Cold Vapour Atomic Fluorescence Spectrometry		
TM184	EPA Methods 325.1 & 325.2,	The Determination of Anions in Aqueous Matrices using the Kone Spectrophotometric Analysers		
TM213	In-house Method	Rapid Determination of PAHs by GC-FID		
TM259	by HPLC	Determination of Phenols in Waters and Leachates by HPLC		

[1] Applies to Solid samples only. DRY indicates samples have been dried at 35°C. NA = not applicable.

Test Completion Dates

Lab Sample No(s)	13785932	13785933	13785934
Customer Sample Ref.	BH01	BH04	TP01
AGS Ref.			
Depth	0.50	0.50	0.50
Type	SOLID	SOLID	SOLID
ANC at pH4 and ANC at pH 6	22-Jul-2016	22-Jul-2016	22-Jul-2016
Anions by Kone (w)	22-Jul-2016	22-Jul-2016	22-Jul-2016
CEN 10:1 Leachate (1 Stage)	21-Jul-2016	21-Jul-2016	21-Jul-2016
CEN Readings	25-Jul-2016	25-Jul-2016	25-Jul-2016
Dissolved Metals by ICP-MS	26-Jul-2016	26-Jul-2016	26-Jul-2016
Dissolved Organic/Inorganic Carbon	25-Jul-2016	25-Jul-2016	25-Jul-2016
Fluoride	22-Jul-2016	22-Jul-2016	22-Jul-2016
GRO by GC-FID (S)	23-Jul-2016	23-Jul-2016	23-Jul-2016
Loss on Ignition in soils	22-Jul-2016	22-Jul-2016	22-Jul-2016
Mercury Dissolved	22-Jul-2016	22-Jul-2016	22-Jul-2016
Mineral Oil	23-Jul-2016	23-Jul-2016	23-Jul-2016
PAH Value of soil	21-Jul-2016	21-Jul-2016	22-Jul-2016
PCBs by GCMS	25-Jul-2016	25-Jul-2016	25-Jul-2016
pH	25-Jul-2016	25-Jul-2016	25-Jul-2016
Phenols by HPLC (W)	25-Jul-2016	25-Jul-2016	25-Jul-2016
Sample description	19-Jul-2016	19-Jul-2016	19-Jul-2016
Total Dissolved Solids	25-Jul-2016	25-Jul-2016	25-Jul-2016
Total Organic Carbon	22-Jul-2016	22-Jul-2016	22-Jul-2016

Appendix

General

1. Results are expressed on a dry weight basis (dried at 35ºC) for all soil analyses except for the following: NRA and CEN Leach tests, flash point LOI, pH, ammonium as NH4 by the BRE method, VOC TICs and SVOC TICs.

2. Samples will be run in duplicate upon request, but an additional charge may be incurred

3. If sufficient sample is received a sub sample will be retained free of charge for 30 days after analysis is completed (e-mailed) for all sample types unless the sample is destroyed on testing. The prepared soil sub sample that is analysed for asbestos will be retained for a period of 6 months after the analysis date. All bulk samples will be retained for a period of 6 months after the analysis date. All samples received and not scheduled will be disposed of one month after the date of receipt unless we are instructed to the contrary. Once the initial period has expired, a storage charge will be applied for each month or part thereof until the client cancels the request for sample storage. ALcontrol Laboratories reserve the right to charge for samples received and stored but not analysed.

4. With respect to turnaround, we will always endeavour to meet client requirements wherever possible, but turnaround times cannot be absolutely guaranteed due to so many variables beyond our control.

5. We take responsibility for any test performed by sub-contractors (marked with an asterisk). We endeavour to use UKAS/MCERTS Accredited Laboratories, who either complete a quality questionnaire or are audited by ourselves. For some determinands there are no UKAS/MCERTS Accredited Laboratories, in this instance a laboratory with a known track record will be utilised.

6. When requested, the individual sub sample scheduled will be analysed in house for the presence of asbestos fibres and asbestos containing material by our documented in house method TM048 based on HSG 248 (2005), which is accredited to ISO17025. If a specific asbestos fibre type is not found this will be reported as "Not detected". If no asbestos fibre types are found all will be reported as "Not detected" and the sub sample analysed deemed to be clear of asbestos. If an asbestos fibre type is found it will be reported as detected (for each fibre type found). Testing can be carried out on asbestos positive samples, but, due to Health and Safety considerations, may be replaced by alternative tests or reported as No Determination Possible (NDP). The quantity of asbestos present is not determined unless specifically requested.

7. If no separate volatile sample is supplied by the client, or if a headspace or sediment is present in the volatile sample, the integrity of the data may be compromised. This will be flagged up as an invalid VOC on the test schedule and the result marked as deviating on the test certificate.

8. If appropriate preserved bottles are not received preservation will take place on receipt. However, the integrity of the data may be compromised.

9. NDP - No determination possible due to insufficient/unsuitable sample.

10. Metals in water are performed on a filtered sample, and therefore represent dissolved metals - total metals must be requested separately.

11. Results relate only to the items tested.

12. LoDs (Limit of Detection) for wet tests reported on a dry weight basis are not corrected for moisture content.

13. **Surrogate recoveries** - Surrogates are added to your sample to monitor recovery of the test requested. A % recovery is reported, results are not corrected for the recovery measured. Typical recoveries for organics tests are 70-130%, they are generally wider for volatiles analysis, 50-150%. Recoveries in soils are affected by organic rich or clay rich matrices. Waters can be affected by remediation fluids or high amounts of sediment. Test results are only ever reported if all of the associated quality checks pass; it is assumed that all recoveries outside of the values above are due to matrix affect.

14. **Product analyses** - Organic analyses on products can only be semi-quantitative due to the matrix effects and high dilution factors
employed.

15. Phenols monohydric by HPLC include phenol, cresols (2-Methylphenol, 3-Methylphenol and 4-Methylphenol) and Xylenols (2,3 Dimethylphenol, 2,4 Dimethylphenol, 2,5 Dimethylphenol, 2,6 Dimethylphenol, 3,4 Dimethyphenol, 3,5 Dimethylphenol).

16. Total of 5 speciated phenols by HPLC includes Phenol, 2,3,5-Trimethyl Phenol, 2-Isopropylphenol, Cresols and Xylenols (as detailed in 15).

17. Stones/debris are not routinely removed. We always endeavour to take a representative sub sample from the received sample.

18. In certain circumstances the method detection limit may be elevated due to the sample being outside the calibration range. Other factors that may contribute to this include possible interferences. In both cases the sample would be diluted which would cause the method detection limit to be raised.

19. Mercury results quoted on soils will not include volatile mercury as the analysis is performed on a dried and crushed sample.

20. For the BSEN 12457-3 two batch process to allow the cumulative release to be calculated, the volume of the leachate produced is measured and filtered for all tests. We therefore cannot carry out any unfiltered analysis. The tests affected include volatiles GCFID/GCMS and all subcontracted analysis.

21. For leachate preparations other than Zero Headspace Extraction (ZHE) volatile loss may occur.

22. We are accredited to MCERTS for sand, clay and loam/topsoil, or any of these materials - whether these are derived from naturally occurring soil profiles, or from fill/made ground, as long as these materials constitute the major part of the sample. Other coarse granular material such as concrete, gravel and brick are not accredited if they comprise the major part of the sample.

23. Analysis and identification of specific compounds using GCFID is by retention time only, and we routinely calibrate and quantify for benzene, toluene, ethylbenzenes and xylenes (BTEX). For total volatiles in the C5-C12 range, the total area of the chromatogram is integrated and expressed as ug/kg or ug/l. Although this analysis is commonly used for the quantification of gasoline range organics (GRO), the system will also detect other compounds such as chlorinated solvents, and this may lead to a falsely high result with respect to hydrocarbons only. It is not possible to specifically identify these non-hydrocarbons, as standards are not routinely run for any other compounds, and for more definitive identification, volatiles by GCMS should be utilised.

24. **Tentatively Identified Compounds (TICs)** are non-target peaks in VOC and SVOC analysis. All non-target peaks detected with a concentration above the LoD are subjected to a mass spectral library search. Non-target peaks with a library search confidence of >75% are reported based on the best mass spectral library match. When a non-target peak with a library search confidence of <75% is detected it is reported as "mixed hydrocarbons". Non-target compounds identified from the scan data are semi-quantified relative to one of the deuterated internal standards, under the same chromatographic conditions as the target compounds. This result is reported as a semi-quantitative value and reported as Tentatively Identified Compounds (TICs). TICs are outside the scope of UKAS accreditation and are not moisture corrected.

Sample Deviations

1	**Container with Headspace provided for volatiles analysis**
2	**Incorrect container received**
3	**Deviation from method**
4	**Holding time exceeded before sample received**
5	**Samples exceeded holding time before presevation was performed**
§	**Sampled on date not provided**
♦	**Sample holding time exceeded in laboratory**
@	**Sample holding time exceeded due to sampled on date**
&	**Sample Holding Time exceeded - Late arrival of instructions.**

Asbestos

Identification of Asbestos in Bulk Materials & Soils

The results for identification of asbestos in bulk materials are obtained from supplied bulk materials which have been examined to determine the presence of asbestos fibres using ALcontrol Laboratories (Hawarden) in-house method of transmitted/polarised light microscopy and central stop dispersion staining, based on HSG 248 (2005).

The results for identification of asbestos in soils are obtained from a homogenised sub sample which has been examined to determine the presence of asbestos fibres using ALcontrol Laboratories (Hawarden) in-house method of transmitted/polarised light microscopy and central stop dispersion staining, based on HSG 248 (2005).

Asbestos Type	Common Name
Chrysotile	White Asbestos
Amosite	Brown Asbestos
Crocidolite	Blue Asbestos
Fibrous Actinolite	-
Fibrous Anthophyllite	-
Fibrous Tremolite	-

Visual Estimation Of Fibre Content

Estimation of fibre content is not permitted as part of our UKAS accredited test other than:
- Trace - Where only one or two asbestos fibres were identified.

Further guidance on typical asbestos fibre content of manufactured products can be found in HSG 264.

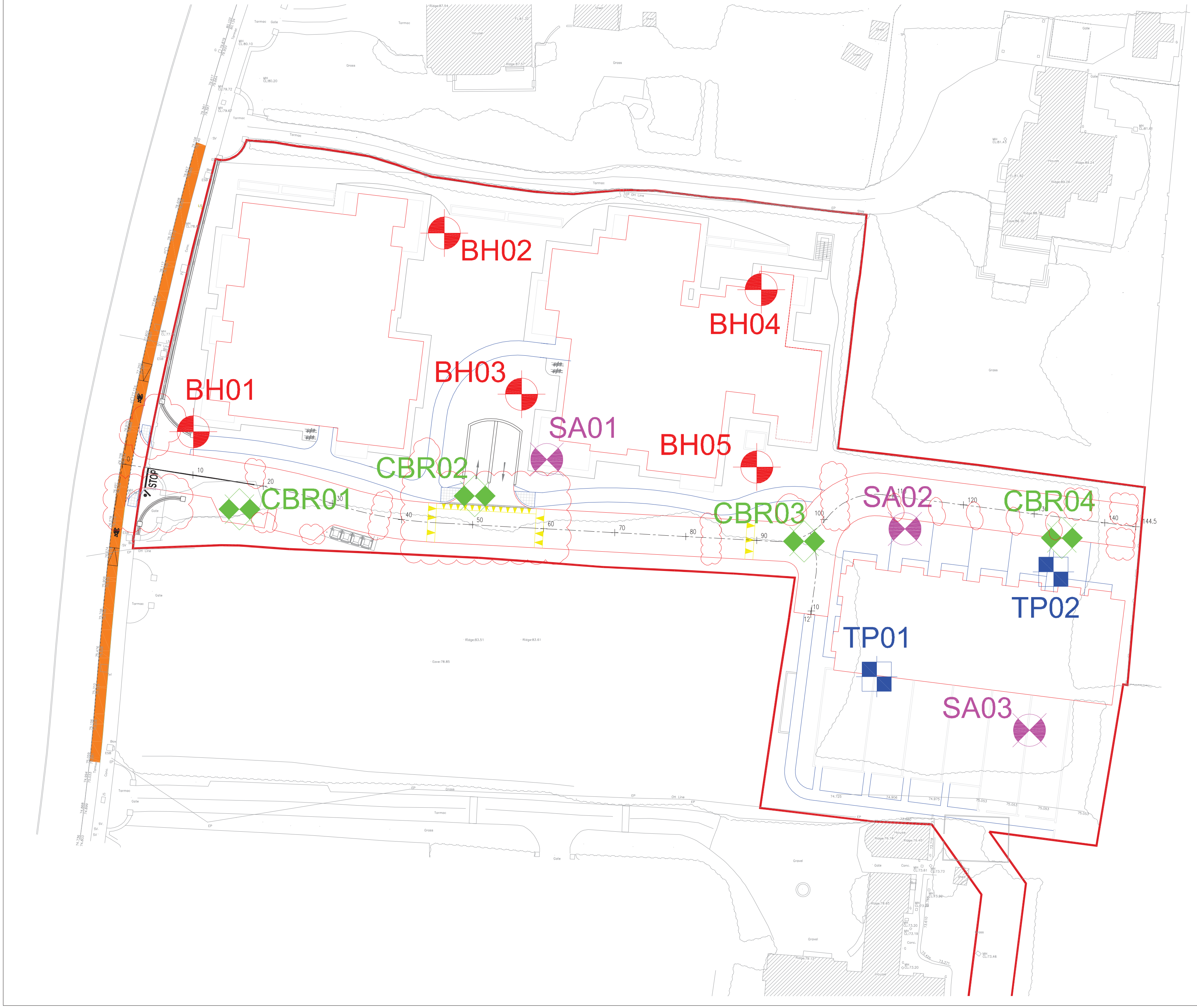
The identification of asbestos containing materials and soils falls within our schedule of tests for which we hold UKAS accreditation, however opinions, interpretations and all other information contained in the report are outside the scope of UKAS accreditation.

Appendix 6

Survey Data

Site Survey

Location	Irish National Grid		Level	Irish Transverse Mercator	
	Easting	Northing		Easting	Northing
Boreholes					
BH01	322070.424	224352.386	77.06	721994.632	724380.741
BH02	322105.679	224380.308	78.96	722029.879	724408.656
BH03	322116.540	224357.663	77.71	722040.738	724386.016
BH04	322150.219	224372.360	79.00	722074.410	724400.710
BH05	322149.593	224347.427	77.31	722073.783	724375.782
Trial Pits					
TP01	322166.471	224317.936	75.74	722090.658	724346.298
TP02	322191.280	224332.704	77.00	722115.461	724361.062
Soakaways					
SA01	322120.091	224348.470	77.22	722044.288	724376.825
SA02	322170.420	224338.732	77.10	722094.606	724367.089
SA03	322187.910	224310.448	75.56	722112.092	724338.811
California Bearing Ratio Tests					
CBR01	322076.905	224341.501	76.54	722001.111	724369.858
CBR02	322109.959	224343.364	76.78	722034.158	724371.720
CBR03	322156.231	224336.991	76.69	722080.420	724365.348
CBR04	322192.484	224337.491	77.22	722116.665	724365.848



Legend:

⊕	Cable Percussive Borehole
▚	Trial Pit
◆◆	California Bearing Ratio Test
◆◆	Soakaway Test

Client:	Moran Park Homebuilders
Engineer:	Waterman Moylan
Project:	Chigwell
Date:	08-08-2016
Description:	Site Investigation Plan
Drawing Number:	**SIL5303:01**
Scale:	NTS
Rev:	1
Drawn by:	SL

Site Investigations Ltd
Carhugar
The Grange
Lucan
Co. Dublin
T: 01 6108768
E: siltd@indigo.ie

S.I. Ltd Contract No: 5942

Client:	Carracail Development Company Ltd
Engineer:	Waterman Moylan
Contractor:	Site Investigations Ltd

Carracail,
Glenamuck Road North, Carrickmines, Dublin 18
Site Investigation Report

Prepared by:

....

Stephen Letch

Issue Date:	03/03/2022
Status	Final
Revision	1

Contents: Page No.

Appendices:

1. Cable Percussive Borehole Logs
2. Trial Pit Logs with Dynamic Probe Results and Photographs
3. Geotechnical Laboratory Test Results
4. Environmental Laboratory Test Results
5. Waste Classification Report
6. Survey Data

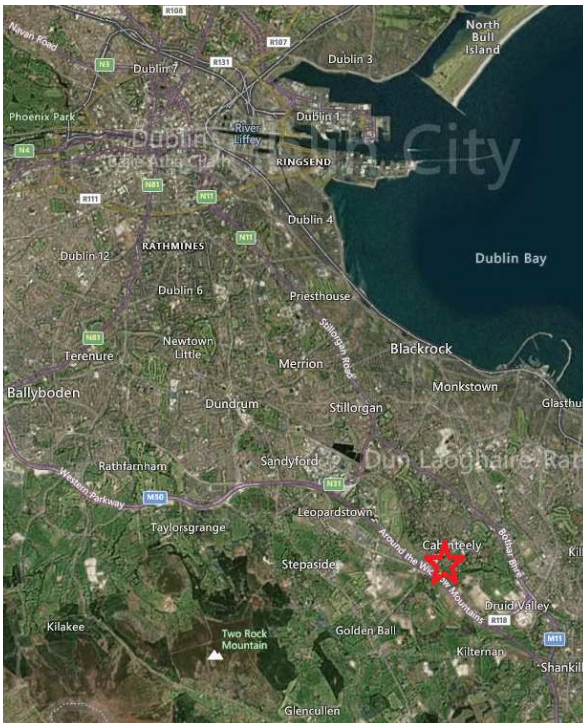
1. Introduction

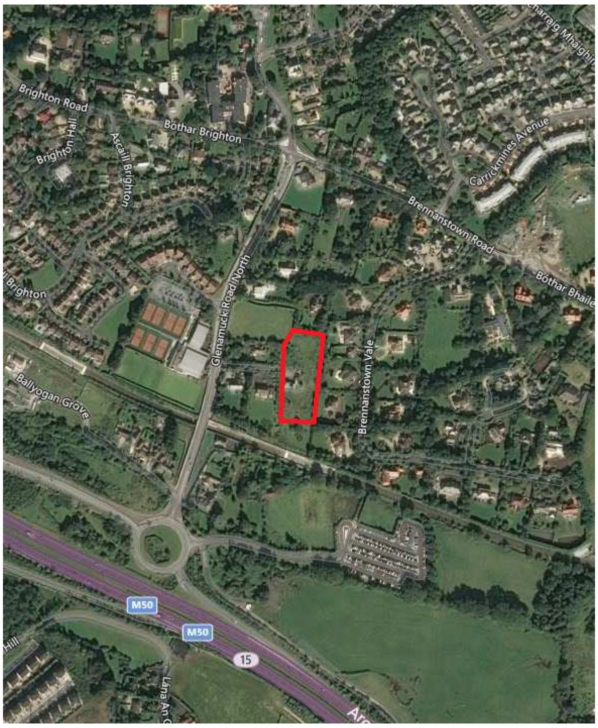
On the instructions of Waterman Moylan, Site Investigations Ltd (SIL) was appointed to complete a ground investigation at Carracail, Glenamuck Road North, Carrickmines, Dublin 18. The investigation was for a residential development on the site and was completed on behalf of the Client, Carracail Development Company Ltd. This investigation was completed in February 2022.

This report presents the factual geotechnical data obtained from the field and laboratory testing with interpretation of the ground conditions discussed.

2. Site Location

Glenamuck Road North is located off Junction 15 of the M50 carriageway and runs to Cabinteely village. Carracail is located on the Glenamuck Road North opposite the Carrickmines Croquet & Lawn Tennis Club and the Luas line runs to the south of the site. The first map below shows the location of the site to the south east of Dublin city centre and the second map shows the location of the site in the local area.





3. Fieldwork

The fieldworks comprised a programme of cable percussive boreholes, trial pits with dynamic probes and California Bearing Ratio tests. All fieldwork was carried out in accordance with BS

5930:2015, Engineers Ireland GI Specification and Related Document 2nd Edition 2016 and Eurocode 7: Geotechnical Design. The fieldworks comprised of the following:

- 3 No. cable percussive boreholes
- 2 No. trial pits with dynamic probes
- 3 No. California Bearing Ratio tests

3.1. Cable Percussive Boreholes

Cable percussion boring was undertaken at 3 No. locations using a Dando 150 rig and constructed 200mm diameter boreholes. The boreholes terminated at shallow depths ranging from 1.60mbgl (BH01) to 2.90mbgl (BH02). It was not possible to collect undisturbed samples due to the granular soils encountered so bulk disturbed samples were recovered at regular intervals.

To test the strength of the stratum, Standard Penetration Tests (SPT's) were performed at 1.00m intervals in accordance with BS 1377 (1990). In soils with high gravel and cobble content it is appropriate to use a solid cone (60°) (CPT) instead of the split spoon and this was used throughout the testing. The test is completed over 450mm and the cone is driven 150mm into the stratum to ensure that the test is conducted over an undisturbed zone. The cone is then driven the remaining 300mm and the blows recorded to report the N-Value. The report shows the N-Value with the 75mm incremental blows listed in brackets (e.g., BH01 at 1.00mbgl where N=9-(1,1/2,2,2,3)). Where refusal of 50 blows across the test zone was encountered was achieved during testing, the penetration depth is also reported (e.g., BH01 at 1.60mbgl where N=50-(25 for 5mm/50 for 5mm)).

The logs are presented in Appendix 1.

3.2. Trial Pits with Dynamic Probes

2 No. trial pits were excavated using a wheeled excavator. The pits were logged and photographed by SIL geotechnical engineer and representative disturbed bulk samples were recovered as the pits were excavated, which were returned to the laboratory for geotechnical testing.

Adjacent to the trial pits, dynamic probes were completed using a track mounted Competitor 130 machine. The testing complies with the requirements of BS1377: Part 9 (1990) and Eurocode 7: Part 3. The configuration utilised standard DPH (Heavy) probing method comprising a 50kg weight, 500mm drop height and a 50mm diameter (90°) cone. The number of blows required to drive the cone each 100mm increment into the sub soil is recorded in accordance with the standards. The dynamic probe provides no information regarding soil type or groundwater conditions.

The dynamic probe results can be used to analyse the strength of the soil strata encountered by the probe. 'Proceedings of the Trinity College Dublin Symposium of Field and Laboratory Testing of Soils for Foundations and Embankments' presents a paper by Foirbart that is most relevant to Irish soil conditions and within this paper the following equations were included:

Granular Soils: DPH N_{100} x 2.5 = SPT N value

Cohesive Soils: C_u = 15 x DPH N_{100} + 30 kN/m^2

These equations present a relationship between the probe N_{100} value and the SPT N value for granular soils and the undrained shear strength of cohesive soils.

The trial pit logs with the dynamic probe results are presented in Appendix 2 along with the photographs.

3.3. California Bearing Ratio Tests

At 3 No. locations, undisturbed cylindrical mould samples will be recovered to complete California Bearing Ratio tests in the laboratory. The results facilitate the designing of the access roads and associated areas and are completed to BS1377: 1990: Part 4, Clause 7 ‘Determination of California Bearing Ratio’. The results are presented as part of Appendix 3 with the geotechnical laboratory test data.

3.4. Surveying

Following completion of all the fieldworks, a survey of the exploratory hole locations was completed using a GeoMax GPS Rover. The data is supplied on each individual log and along with a site plan in Appendix 6.

4. Laboratory Testing

Geotechnical laboratory testing was completed on representative soil samples in accordance with BS 1377 (1990). Testing included:

- 5 No. Moisture contents
- 5 No. Atterberg limits
- 5 No. Particle size gradings
- 2 No. pH, sulphate and chloride content

Environmental testing was completed by ALS Environmental Ltd. and this allows for a Waste Classification report to be produced. The environmental testing consists of the following:

- 2 No. Suite I analysis

- 2 No. loss on ignition tests

The geotechnical laboratory test results are presented in Appendix 3 with the environmental test results and Waste Classification report in Appendix 4 and 5 respectively.

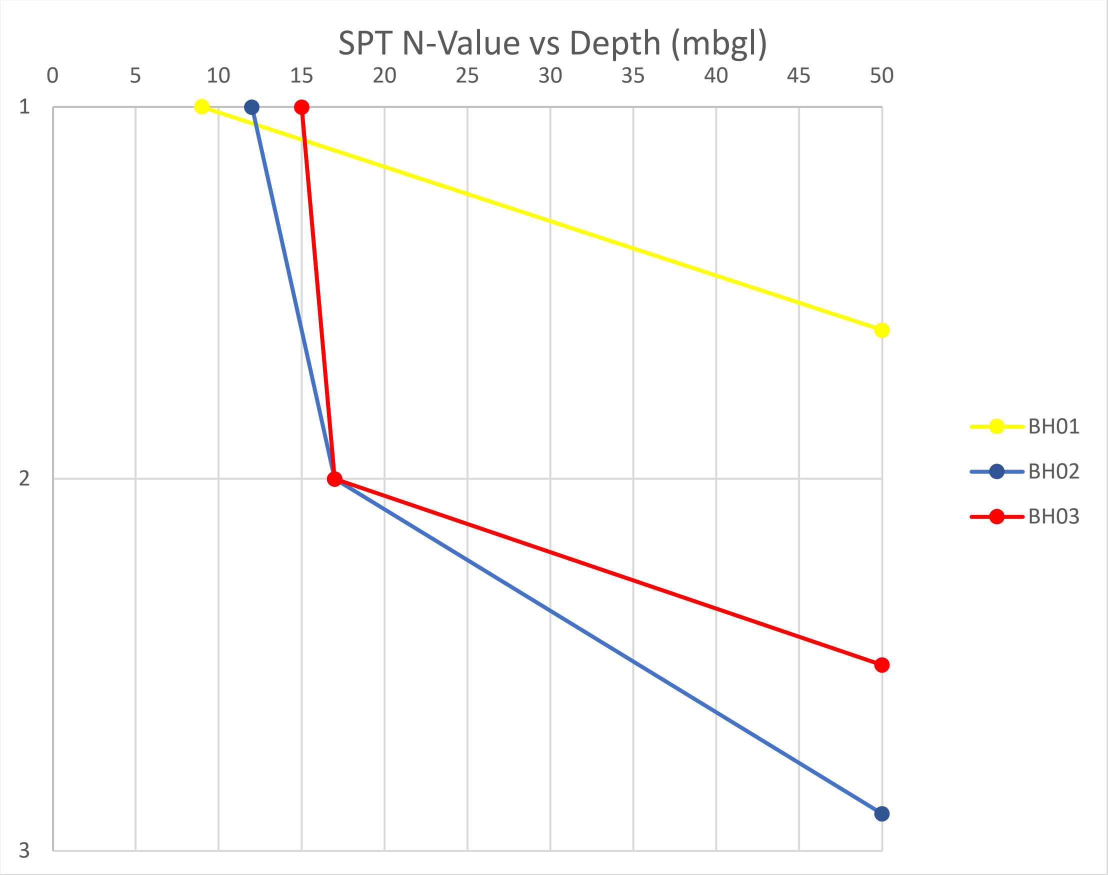
5. Ground Conditions

5.1. Overburden

The natural ground conditions are consistent with cohesive soils encountered across the site. This includes brown, light brown and brown grey slightly sandy slightly gravelly silty CLAY with low cobble content soils. The boreholes terminated at similar depths ranging from 1.60mbgl to 2.90mbgl with the probes reaching depths of 1.20mbgl and 3.20mbgl on boulder obstructions.

A thin layer of SAND was recorded in BH01 and BH02 and GRAVEL was recorded in TP02. This is possibly weathered bedrock but rotary core drilling would be required to confirm the presence of shallow bedrock.

The SPT N-values in the boreholes recorded values ranging from 9 to 15 at 1.00mbgl indicating firm soils. The tests completed at 2.00mbgl in BH02 and BH03 recorded N-values of 17 indicating stiff soils. The graph below shows the SPT N-value against depth.



Laboratory tests of the shallow cohesive soils confirm that CLAY soils dominate the site with low to intermediate plasticity indexes of 14% to 16% recorded. The particle size distribution curves were poorly sorted straight-line curves with 43% to 60% fines content.

5.2. Groundwater

Groundwater details in the boreholes and trial pits during the fieldworks are noted on the logs in Appendix 1 and 2. No groundwater was recorded in the boreholes or trial pits during the fieldworks period.

6. Recommendations and Conclusions

Please note the following caveats:

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 the exploratory hole locations or below the final level of excavation, this is for guidance only and no liability can be accepted for its accuracy. No responsibility can be accepted for adjacent unexpected conditions that have not been revealed by the exploratory holes. It is further recommended that all bearing surfaces when excavated should be inspected by a suitably qualified Engineer to verify the information given in this report.

Excavated surfaces in clay strata should be kept dry to avoid softening prior to foundation placement. Foundations should always be taken to a minimum depth of 0.50mBGL to avoid the effects of frost action and possible seasonal shrinkage/swelling.

If it is intended that on-site materials are to be used as fill, then the necessary laboratory testing should be specified by the Client to confirm the suitability. Also, relevant lab testing should be specified where stability of side slopes to excavations is a concern, or where contamination may be an issue.

6.1. Shallow Foundations

Due to the unknown depth of foundation and no longer-term groundwater information, this analysis assumes the groundwater will not influence the construction or performance of these foundations.

The boreholes encountered firm brown and brown grey slightly sandy gravelly silty CLAY at 1.00mbgl and the SPT N-values at these depths range from 9 to 15.

Using a correlation proposed by Stroud and Butler between SPT N-values and plasticity indices, the SPT N-value can be used to calculate the undrained shear strength. With the low to intermediate plasticity indexes recorded in the laboratory for the soils encountered on site, this correlation is C_u=6N. Therefore, using the lower value of 9, this indicates that the undrained shear strength of the CLAY is 54kN/m^2. This can be used to calculate the ultimate bearing capacity, and this has been calculated to be 295kN/m^2. Finally, a factor of safety is applied and with a factor of 3, an allowable bearing capacity of 100kN/m^2 would be anticipated using the lower SPT values.

The SPT N-values increase at 2.00mbgl to 17 at BH02 and BH03 and this indicates a C_u value of 102kN/m^2, an ultimate bearing capacity of 555kN/m^2 and an allowable bearing capacity of 185kN/m^2.

The dynamic probes generally recorded good values of 3 or greater at 1.00mbgl. As discussed in Section 3.2., the C_u value is calculated using the N_{100} value and then this is applied to the same calculations as the SPT N-value method.

The table below shows the allowable bearing capacities for N_{100} values 1 to 10 at 1.00mbgl and these can be used provide the allowable bearing capacity at each probe location.

N_{100} Value	Cohesive Soils		
	C_u	ULS	ABC
1	45	245	82
2	60	324	110
3	75	400	135
4	90	480	160
5	105	555	185
6	120	630	210
7	135	705	235
8	150	780	260
9	165	855	285
10	180	930	310

The following assumptions were made as part of these analyses. If any of these assumptions are not in accordance with detailed design or observations made during construction these recommendations should be re-evaluated.

- Foundations are to be constructed on a level formation of uniform material type (described above).
- The bulk unit weight of the material in this stratum has a minimum density of 19kN/m^3.
- All bearing capacity calculations allow for a settlement of 25mm.

The trial pit walls generally remained stable during excavation but it would still be recommended that all excavations should be checked immediately with regular inspection of temporary excavations completed during construction to ensure that all slopes are stable. Temporary support should be used on any excavation that will be left open for an extended period.

6.2. Groundwater

The caveats below relating to interpretation of groundwater levels should be noted:
There is always considerable uncertainty as to the likely rates of water ingress into excavations in clayey soil sites due to the possibility of localised unforeseen sand and gravel lenses acting as permeable conduits for unknown volumes of water.

Furthermore, water levels noted on the borehole and trial pit logs do not generally give an accurate indication of the actual groundwater conditions as the borehole or trial pit is rarely left open for sufficient time for the water level to reach equilibrium.

Also, during boring procedures, a permeable stratum may have been sealed off by the borehole casing, or water may have been added to aid drilling. Therefore, an extended period of groundwater monitoring using any constructed standpipes is required to provide more accurate information regarding groundwater conditions. Finally, groundwater levels vary with time of year, rainfall, nearby construction and tides.

Pumping tests would be required to determine likely seepage rates and persistence into excavations taken below the groundwater level. Deep trial pits also aid estimation of seepage rates.

As discussed previously, no groundwater was encountered during the fieldworks. There is always considerable uncertainty as to the likely rates of water ingress into excavations in cohesive soil sites due to the possibility of localised unforeseen sand and gravel lenses acting as permeable conduits for unknown volumes of water. Based on this information at the exploratory hole locations to date, it is considered likely that any shallow ingress (less than 2.00mbgl) into excavations of the CLAY will be slow to medium. If granular soils are encountered in shallow excavations, then the possibility of water ingressing into an excavation increase.

If groundwater is encountered during excavations then mechanical pumps will be required to remove the groundwater from sumps. Sumps should be carefully located and constructed to ensure that groundwater is efficiently removed from excavations and trenches.

6.3. Pavement Design

The CBR test results in Appendix 3 indicate CBR values ranging from 6.2% to 6.7%.

The CBR samples were recovered at 0.50mbgl and inspection of the formation strata should be completed prior to construction of the pavement. Once the exact formation levels are finalised then additional in-situ testing could be completed to assist with the detailed pavement design.

6.4. Contamination

Environmental testing was carried out on two samples from the investigation and the results are shown in Appendix 4. For material to be removed from site, Suite I testing was carried out to determine if the material is hazardous or non-hazardous and then the leachate results were compared with the published waste acceptance limits of BS EN 12457-2 to determine whether the material on the site could be accepted as 'inert material' by an Irish landfill.

The Waste Classification report in Appendix 5, created using HazWasteOnline^{TM} software, shows that the material tested can be classified as non-hazardous material.

Following this analysis of the solid test results, the leachate disposal suite results showed that the determinands generally remained within the Inert waste thresholds.

Two samples were tested for analysis but it cannot be discounted that any localised contamination may have been missed. Any MADE GROUND excavated on site should be stockpiled separately to natural soils to avoid any potential cross contamination of the soils. Additional testing of these soils may be requested by the individual landfill before acceptance and a testing regime designed by an environmental engineer would be recommended to satisfy the landfill.

6.5. Aggressive Ground Conditions

The chemical test results in Appendix 3 indicate a general pH value between 8.71 and 8.80, which is close to neutral and below the level of 9, therefore no special precautions are required.

The maximum value obtained for water soluble sulphate was 123mg/l as SO_3. The BRE Special Digest 1:2005 – '*Concrete in Aggressive Ground'* guidelines require SO_4 values and after conversion ($SO_4 = SO_3 \times 1.2$), the maximum value of 148mg/l shows Class 1 conditions and no special precautions are required.

Appendix 1

Cable Percussive Borehole Logs

Contract No: 5942	Cable Percussion Borehole Log	Borehole No: **BH01**

Contract:	Carricail	Easting:	722117.586	Date Started:	08/02/2022
Location:	Glenamuck Road North, Carrickmines, Dublin 18	Northing:	724360.108	Date Completed:	07/02/2022
Client:	Carricail Development Company Ltd	Elevation:	76.99	Drilled By:	J. O'Toole
Engineer:	Waterman Moylan	Borehole Diameter:	200mm	Status:	FINAL

Depth (m)		Stratum Description	Legend	Level (mOD)		Samples and Insitu Tests			Water Strike	Backfill
Scale	Depth			Scale	Depth	Depth	Type	Result		
		TOPSOIL.								
	0.20	Firm brown slightly sandy slightly gravelly silty CLAY.			76.79					
0.5				76.5						
1.0				76.0		1.00	B	JOT05		
						1.00	C	N=9 (1,1/2,2,2,3)		
	1.30	Medium dense light brown slightly silty gravelly SAND with low cobble content.			75.69					
1.5	1.50	Obstruction - possible boulders.		75.5	75.49					
	1.60	End of Borehole at 1.60m			75.39	1.60	C	50 (25 for 5mm/50 for 5mm)		
2.0				75.0						
2.5				74.5						
3.0				74.0						
3.5				73.5						
4.0				73.0						
4.5				72.5						

Chiselling:			Water Strikes:			Water Details:			Installation:			Backfill:			Remarks:
From:	To:	Time:	Strike:	Rose:	Depth Sealed	Date:	Hole Depth:	Water Depth:	From:	To:	Pipe:	From:	To:	Type:	
1.50	1.60	01:00				08/02	1.60	Dry				0.00	1.60	Arisings	Borehole terminated due to obstruction.

Legend:
B: Bulk
D: Disturbed
U: Undisturbed
ES: Environmental
W: Water
C: Cone SPT
S: Split spoon SPT

Contract No: 5942	Cable Percussion Borehole Log				Borehole No: **BH02**
Contract:	Carricail	Easting:	722074.667	Date Started:	07/02/2022
Location:	Glenamuck Road North, Carrickmines, Dublin 18	Northing:	724307.451	Date Completed:	07/02/2022
Client:	Carricail Development Company Ltd	Elevation:	72.99	Drilled By:	J. O'Toole
Engineer:	Waterman Moylan	Borehole Diameter:	200mm	Status:	FINAL

Depth (m)	Stratum Description	Level (mOD)	Samples and Insitu Tests: Depth	Type	Result	Water Strike	Backfill
	TOPSOIL.						
0.20	Firm light brown slightly sandy slightly gravelly silty CLAY.	72.79					
			1.00 1.00	B C	JOT03 N=12 (1,2/2,3,3,4)		
1.50	Medium dense light brown slightly silty gravelly SAND with low cobble content.	71.49					
			2.00 2.00	B C	JOT04 N=17 (2,3/4,4,4,5)		
2.80	Obstruction - possible boulders.	70.19					
2.90	End of Borehole at 2.90m	70.09	2.90	C	50 (25 for 5mm/50 for 0mm)		

Depth scale: 0.5, 1.0, 1.5, 2.0, 2.5, 3.0, 3.5, 4.0, 4.5

Level scale: 72.5, 72.0, 71.5, 71.0, 70.5, 70.0, 69.5, 69.0, 68.5

Chiselling: From:	To:	Time:	Water Strikes: Strike:	Rose:	Depth Sealed	Water Details: Date:	Hole Depth:	Water Depth:	Installation: From:	To:	Pipe:	Backfill: From:	To:	Type:	Remarks:
2.80	2.90	01:30				07/02	2.90	Dry				0.00	2.90	Arisings	Borehole terminated due to obstruction.

Legend:
B: Bulk
D: Disturbed
U: Undisturbed
ES: Environmental
W: Water
C: Cone SPT
S: Split spoon SPT

Contract No:	# Cable Percussion Borehole Log	Borehole No:
5942		**BH03**

Contract:	Carricail	Easting:	722094.334	Date Started:	07/02/2022
Location:	Glenamuck Road North, Carrickmines, Dublin 18	Northing:	724278.123	Date Completed:	07/02/2022
Client:	Carricail Development Company Ltd	Elevation:	71.53	Drilled By:	J. O'Toole
Engineer:	Waterman Moylan	Borehole Diameter:	200mm	Status:	FINAL

Depth (m)		Stratum Description	Legend	Level (mOD)		Samples and Insitu Tests			Water Strike	Backfill
Scale	Depth			Scale	Depth	Depth	Type	Result		
		TOPSOIL.	▨							▨
	0.20	Firm light brown slightly sandy slightly gravelly silty CLAY.	▨		71.33					
0.5				71.0						
1.0				70.5		1.00 1.00	B C	JOT01 N=15 (2,2/3,3,4,5)		
	1.40	Stiff brown slightly sandy gravelly silty CLAY with high cobble content.	▨		70.13					
1.5				70.0						
2.0				69.5		2.00 2.00	B C	JOT02 N=17 (1,2/3,4,4,6)		
	2.40	Obstruction - possible boulders.	○		69.13					
2.5	2.50	End of Borehole at 2.50m		69.0	69.03	2.50	C	50 (25 for 5mm/50 for 0mm)		
3.0				68.5						
3.5				68.0						
4.0				67.5						
4.5				67.0						

Chiselling:			Water Strikes:			Water Details:			Installation:			Backfill:			Remarks:	Legend:
From:	To:	Time:	Strike:	Rose:	Depth Sealed	Date:	Hole Depth:	Water Depth:	From:	To:	Pipe:	From:	To:	Type:	Borehole terminated due to obstruction.	B: Bulk D: Disturbed U: Undisturbed ES: Environmental W: Water C: Cone SPT S: Split spoon SPT
2.40	2.50	01:30				07/02	2.50	Dry				0.00	2.50	Arisings		

Appendix 2

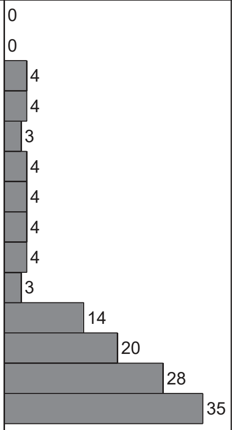
Trial Pit Logs with Dynamic Probe Results and Photographs

Contract No: 5942	# Trial Pit and Dynamic Probe Log				Trial Pit No: **TP01**
Contract:	Carricail	Easting:	722110.735	Date:	07/02/2022
Location:	Glenamuck Road North, Carrickmines, Dublin 18	Northing:	724299.073	Excavator:	JCB 3CX
Client:	Carricail Development Company Ltd	Elevation:	72.99	Logged By:	M. Kaliski
Engineer:	Waterman Moylan	Dimensions (LxWxD) (m):	4.80 x 0.60 x 1.20	Scale:	1:25

Level (mbgl) Depth	Stratum Description	Level (mOD) Depth	Samples Depth	Samples Type	Water Strike
	TOPSOIL.				
0.20	Firm becoming stiff brown slightly sandy slightly gravelly silty CLAY with low cobble content. Sand is fine to coarse. Gravel is angular to subangulr of granite. Cobbles are subangular to subrounded of granite.	72.79	0.50	ES	
0.90	Light brown sandy fine to coarse, angular to subrounded GRAVEL of granite with medium cobble and low boulder content. Sand is fine to coarse. Cobbles and boulders are angular to subrounded of granite (up to 400mm diameter).	72.09	0.90	B	
1.20	Obstruction - possible boulders.	71.79			

Pit terminated at 1.20m

Probe



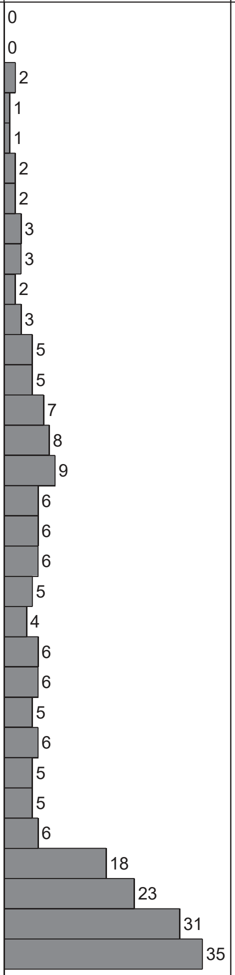
Termination:	Pit Wall Stability:	Groundwater Rate:	Remarks:	Key:
Obstruction - boulders.	Pit walls stable.	Dry	-	B = Bulk disturbed D = Small disturbed CBR = Undisturbed CBR ES = Environmental

Contract No: 5942	# Trial Pit and Dynamic Probe Log	Trial Pit No: **TP02**

Contract:	Carricail	Easting:	722073.854	Date:	07/02/2022
Location:	Glenamuck Road North, Carrickmines, Dublin 18	Northing:	724272.291	Excavator:	JCB 3CX
Client:	Carricail Development Company Ltd	Elevation:	71.24	Logged By:	M. Kaliski
Engineer:	Waterman Moylan	Dimensions (LxWxD) (m):	5.10 x 0.60 x 3.00	Scale:	1:25

Level (mbgl) Depth	Stratum Description	Level (mOD) Depth:	Samples Depth	Samples Type	Water Strike
	TOPSOIL.				
0.20	Firm brown slightly sandy slightly gravelly silty CLAY with low cobble content. Sand is fine to coarse. Gravel is angular to subangulr of granite. Cobbles are subangular to subrounded of granite.	71.04	0.50	ES	
0.80	Stiff grey brown slightly sandy slightly gravelly silty CLAY with medium cobble content. Sand is fine to coarse. Gravel is angular to subangulr of granite. Cobbles are subangular to subrounded of granite.	70.44	1.00	B	
3.00	**Pit terminated at 3.00m**	68.24			

Probe



Termination:	Pit Wall Stability:	Groundwater Rate:	Remarks:	Key:
Obstruction - boulders.	Pit walls stable.	Dry	-	B = Bulk disturbed D = Small disturbed CBR = Undisturbed CBR ES = Environmental

TP01 Sidewall

TP01 Spoil

TP02 Sidewall

TP02 Spoil

Appendix 3

Geotechnical Laboratory Test Results

Classification Tests
In accordance with BS 1377: Part 2

Client	Carricail Development Company Ltd.
Site	Carricail
S.I. File No	5942 / 22
Test Lab	Site Investigations Ltd., Carhugar The Grange, 12th Lock Rd., Lucan Co. Dublin. Tel (01) 6108768 Email:info@siteinvestigations.ie
Report Date	22nd February 2022

Hole ID	Depth	Sample No	Lab Ref No.	Sample Type	Natural Moisture Content %	Liquid Limit %	Plastic Limit %	Plastic Index %	Min. Dry Density Mg/m^3	Bulk Density Mg/m^3	% passing 425um	Comments	**Remarks** **C**=Clay; **M**=Silt **Plasticity**: **L**=Low; **I**=Intermediate; **H**=High; **V**=Very High; **E**=Extremely High
BH01	1.00	JOT05	22/165	B	17.1	34	20	14			57.9		CL
BH02	1.00	JOT03	22/166	B	13.9	33	18	15			56.3		CL
BH03	1.00	JOT01	22/167	B	16.2	36	20	16			73.0		CI
TP01	0.90	MK02	22/168	B	20.0	34	19	15			71.1		CL
TP02	1.00	MK04	22/169	B	21.2	37	21	16			72.2		CI

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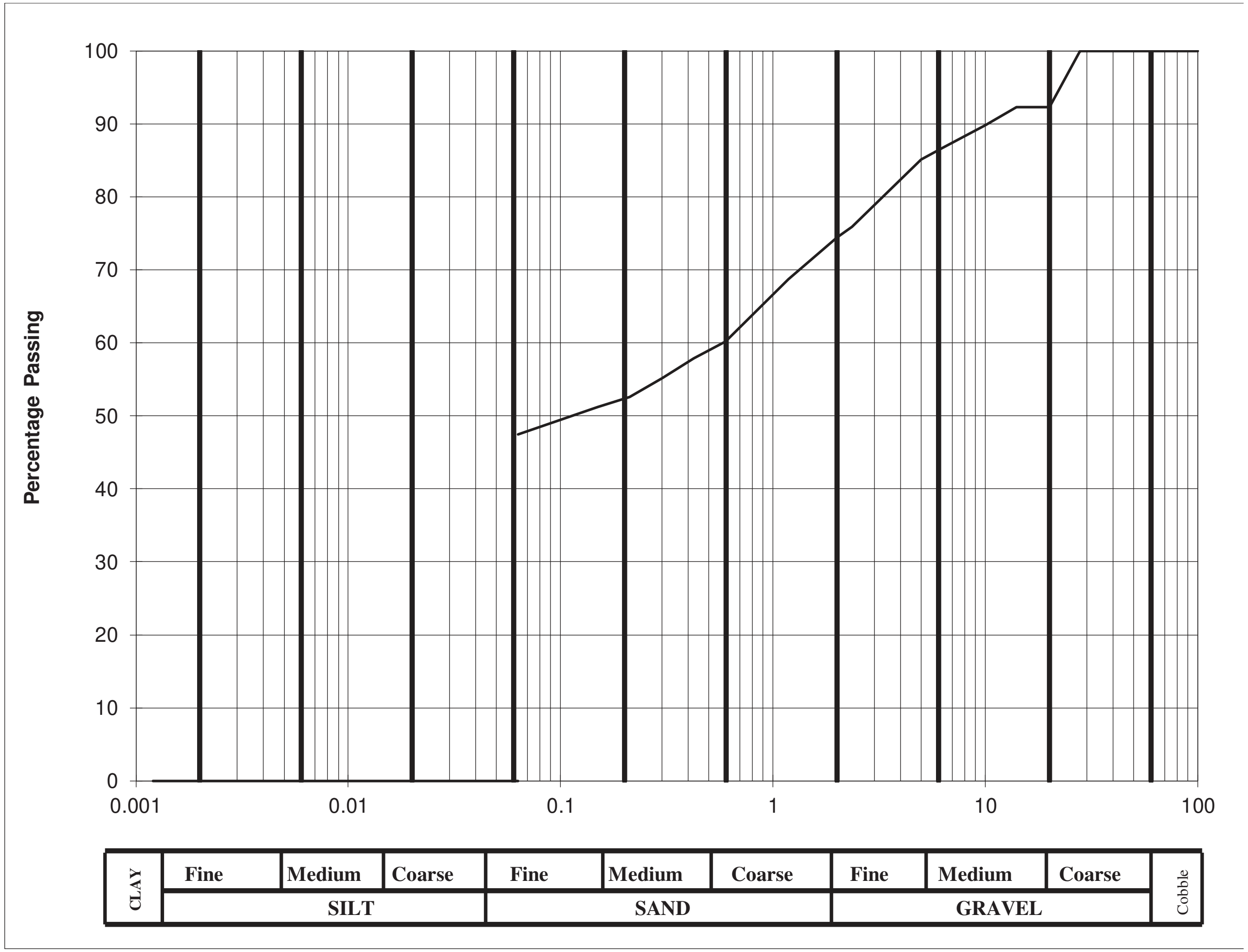
Site Investigations Ltd

BS 1377 Particle Size Analysis

Site Investigations Limited

BS Sieve size, mm	Percent passing	Hydrometer analysis	
		Diameter, mm	% passing
100	100	**0.0630**	
90	100	**0.0200**	
75	100	**0.0060**	
63	100	**0.0020**	
50	100		
37.5	100		
28	100		
20	92.3		
14	92.3		
10	89.8		
6.3	86.7		
5.0	85.1		
2.36	75.9		
2.00	74.4		
1.18	68.7		
0.600	60.2		
0.425	57.9		
0.300	55.1		
0.212	52.6		
0.150	51.2		
0.063	48		

Cobbles, %	0
Gravel, %	26
Sand, %	26
Clay / Silt, %	48



Client :	Carricail Development Company Ltd.	Lab. No :	22/165	Hole ID :	BH 01
Project :	Carricail	Sample No :	JOT05	Depth, m :	1.00

Material description :	slightly sandy slightly gravelly silty CLAY
Remarks :	Soils with clay or silt content between 15% - 35% can be classified as clay or silt depending on the field Engineers assessment of in-situ behaviour. Where material is for re-use and therefore disturbed, only soils with clay or silt >35% are classified as clay or silt

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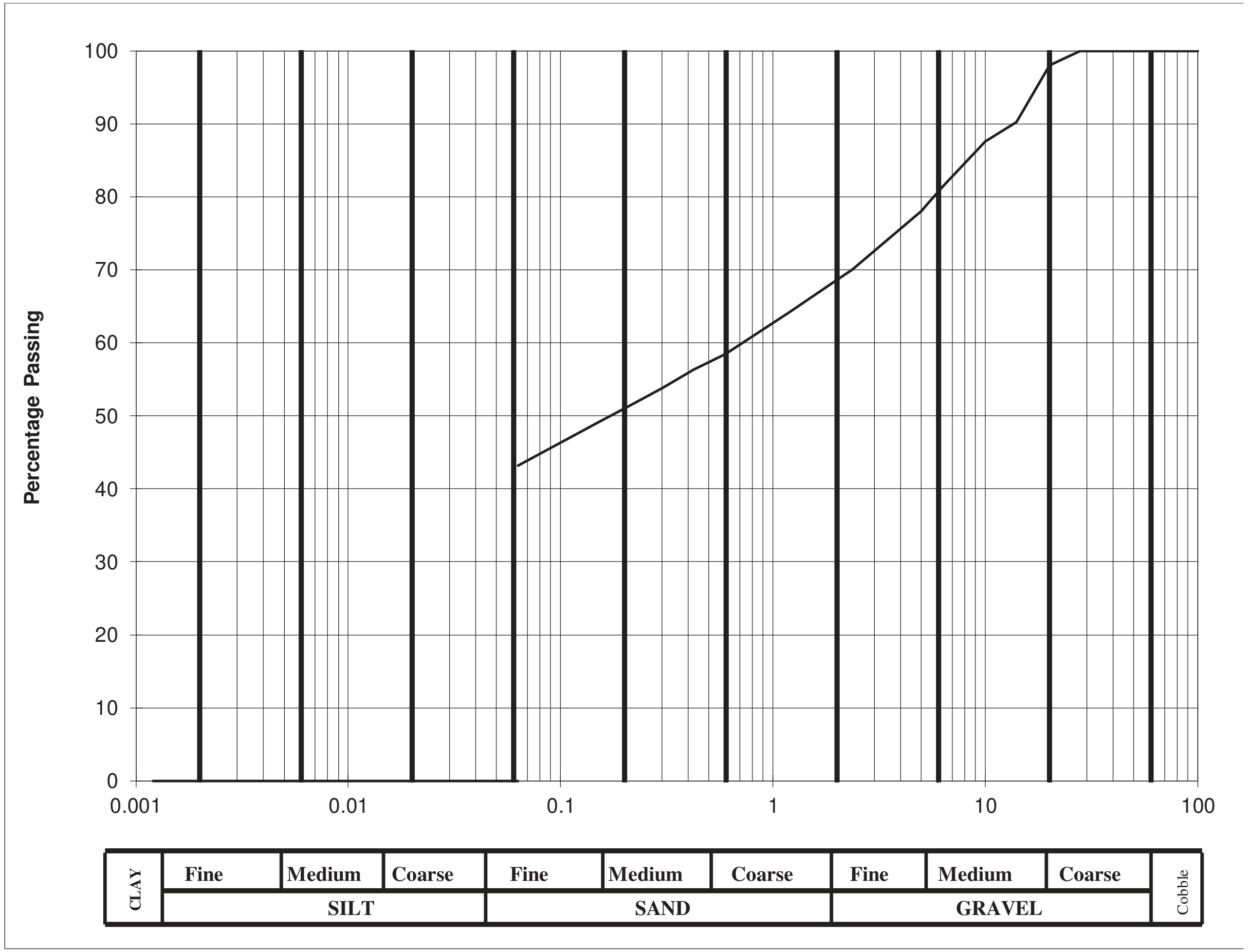
BS 1377 Particle Size Analysis

Site Investigations Limited

BS Sieve size, mm	Percent passing	Hydrometer analysis Diameter, mm	Hydrometer analysis % passing
100	100	**0.0630**	
90	100	**0.0200**	
75	100	**0.0060**	
63	100	**0.0020**	
50	100		
37.5	100		
28	100		
20	98		
14	90.2		
10	87.6		
6.3	81.4		
5.0	78		
2.36	70		
2.00	68.6		
1.18	64.1		
0.600	58.5		
0.425	56.3		
0.300	53.8		
0.212	51.4		
0.150	49.1		
0.063	43		

Cobbles, %	0
Gravel, %	31
Sand, %	26
Clay / Silt, %	43



Client :	Carricail Development Company Ltd.	Lab. No :	22/166	Hole ID :	BH 02
Project :	Carricail	Sample No :	JOT03	Depth, m :	1.00

Material description :	slightly sandy slightly gravelly silty CLAY
Remarks :	Soils with clay or silt content between 15% - 35% can be classified as clay or silt depending on the field Engineers assessment of in-situ behaviour. Where material is for re-use and therefore disturbed, only soils with clay or silt >35% are classified as clay or silt

File No: 5502
Printed 02/03/2022

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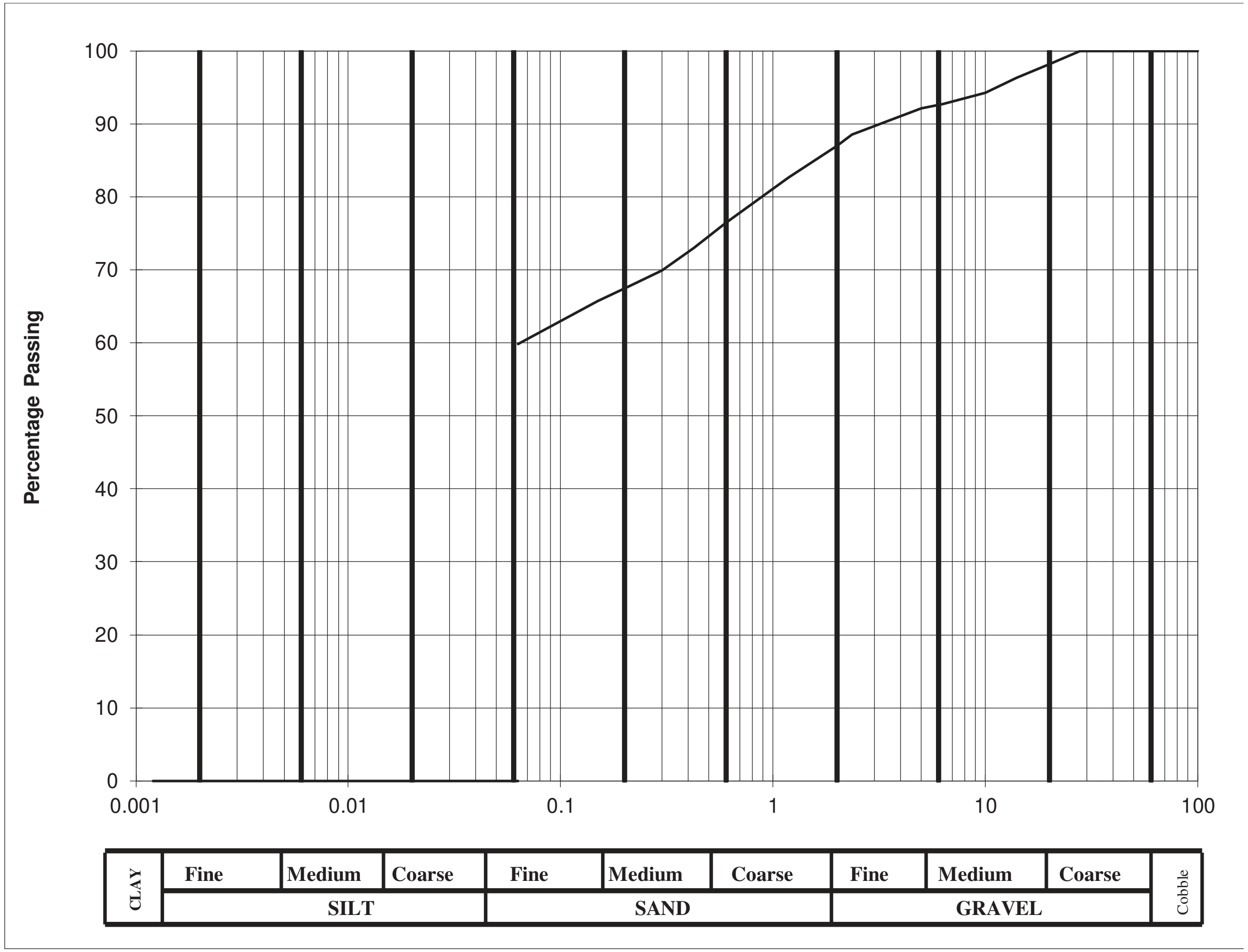
BS 1377 Particle Size Analysis

Site Investigations Limited

BS Sieve size, mm	Percent passing	Hydrometer analysis Diameter, mm	Hydrometer analysis % passing
100	100	**0.0630**	
90	100	**0.0200**	
75	100	**0.0060**	
63	100	**0.0020**	
50	100		
37.5	100		
28	100		
20	98.2		
14	96.3		
10	94.2		
6.3	92.7		
5.0	92.1		
2.36	88.5		
2.00	87		
1.18	82.6		
0.600	76.4		
0.425	73		
0.300	69.9		
0.212	67.8		
0.150	65.7		
0.063	60		

Cobbles, %	0
Gravel, %	13
Sand, %	27
Clay / Silt, %	60



Client :	Carricail Development Company Ltd.	Lab. No :	22/167	Hole ID :	BH 03
Project :	Carricail	Sample No :	JOT01	Depth, m :	1.00

Material description :	slightly sandy slightly gravelly silty CLAY
Remarks :	Soils with clay or silt content between 15% - 35% can be classified as clay or silt depending on the field Engineers assessment of in-situ behaviour. Where material is for re-use and therefore disturbed, only soils with clay or silt >35% are classified as clay or silt

File No: 5502
Printed 02/03/2022

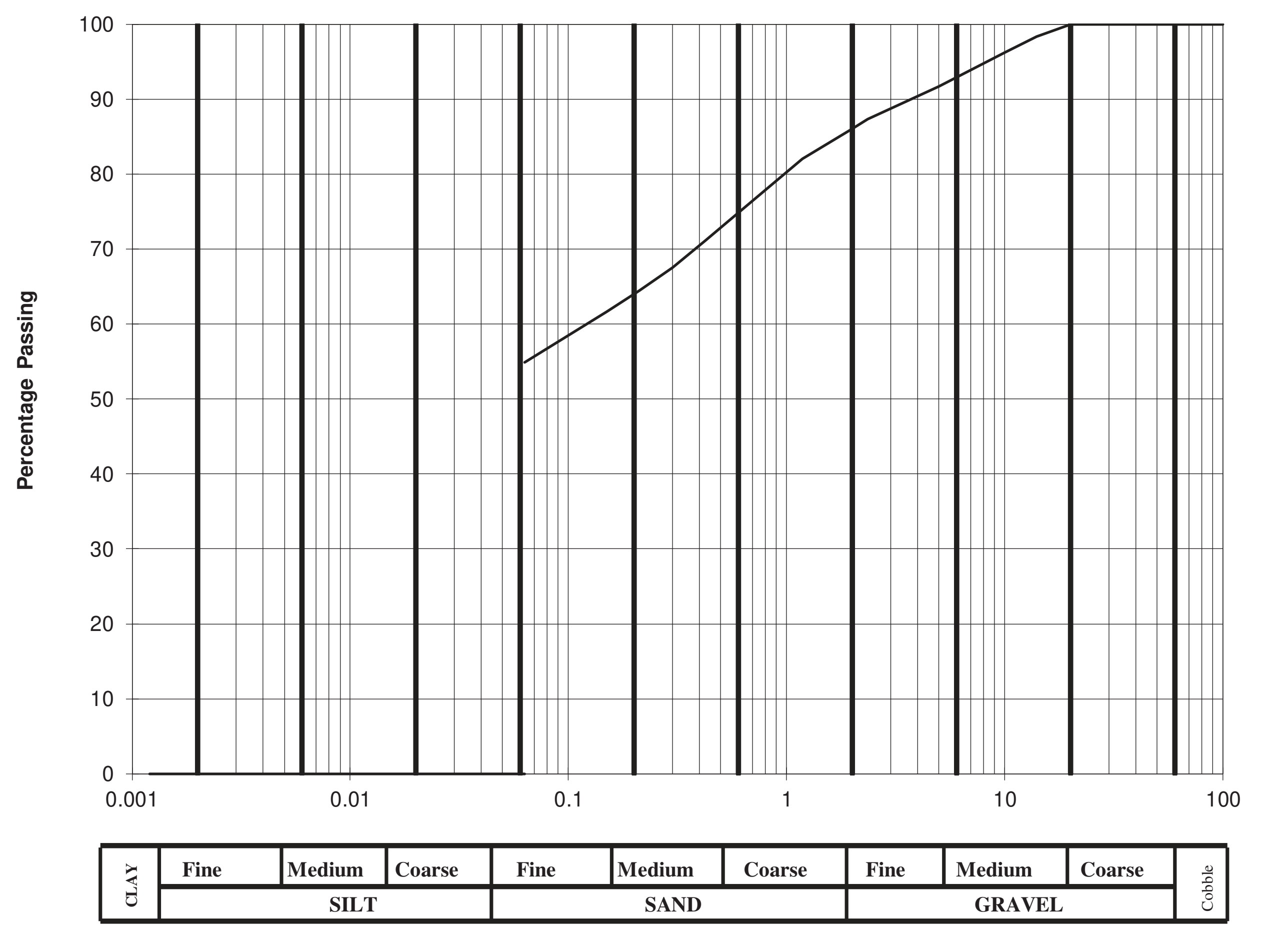
_________________________Paddy McGonagle
Site Investigations Ltd

BS 1377 Particle Size Analysis

Site Investigations Limited

BS Sieve size, mm	Percent passing	Hydrometer analysis	
		Diameter, mm	% passing
100	100	**0.0630**	
90	100	**0.0200**	
75	100	**0.0060**	
63	100	**0.0020**	
50	100		
37.5	100		
28	100		
20	100		
14	98.3		
10	96.2		
6.3	93.2		
5.0	91.7		
2.36	87.3		
2.00	86		
1.18	82		
0.600	74.8		
0.425	71.1		
0.300	67.5		
0.212	64.4		
0.150	61.6		
0.063	55		

Cobbles, %	0
Gravel, %	14
Sand, %	31
Clay / Silt, %	55



Client :	Carricail Development Company Ltd.		Lab. No :	22/168		Hole ID :	TP 01
Project :	Carricail		Sample No :	MK02		Depth, m :	0.90

Material description :	slightly sandy slightly gravelly silty CLAY
Remarks :	Soils with clay or silt content between 15% - 35% can be classified as clay or silt depending on the field Engineers assessment of in-situ behaviour. Where material is for re-use and therefore disturbed, only soils with clay or silt >35% are classified as clay or silt

File No: 5502
Printed 02/03/2022

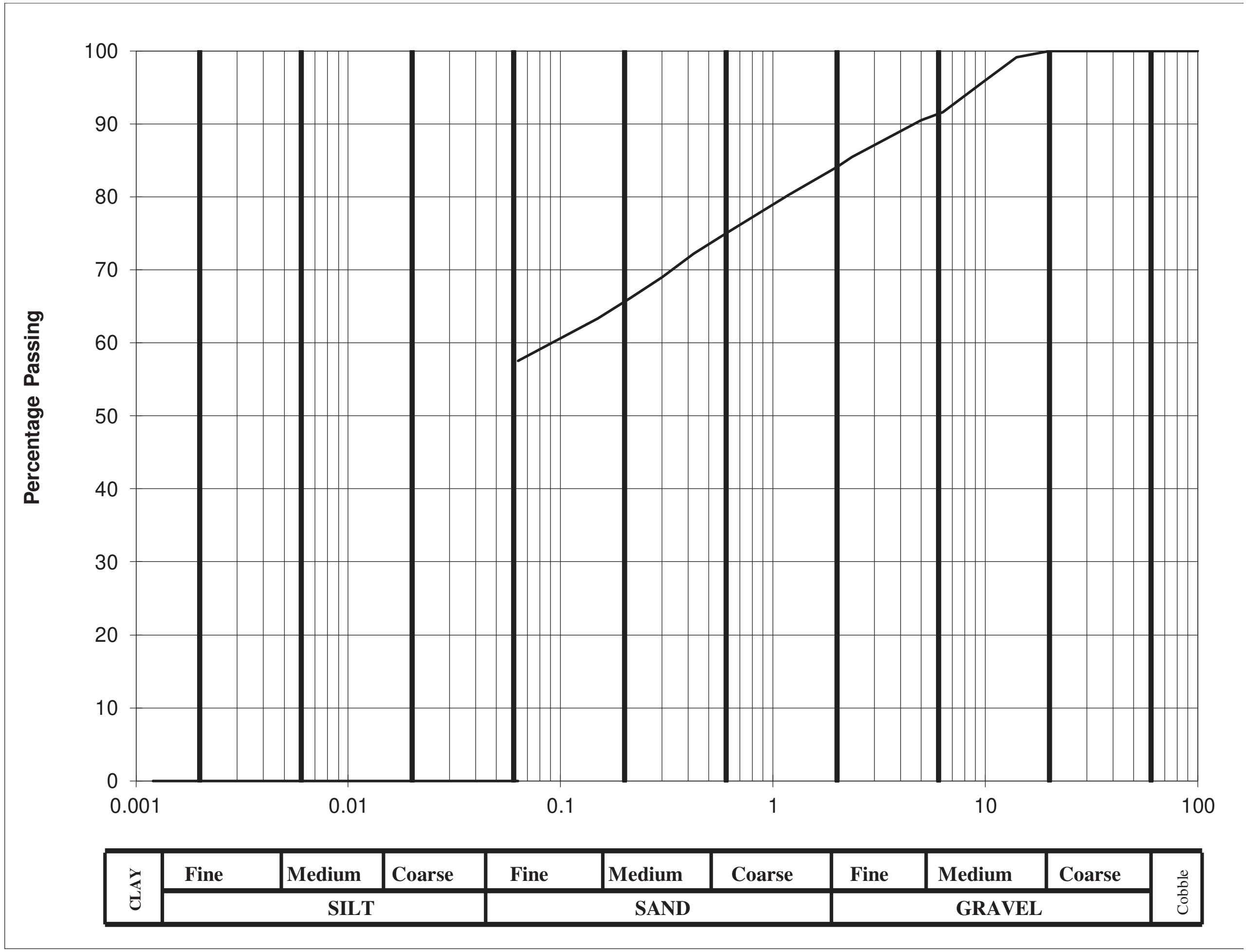
Paddy McGonagle
Site Investigations Ltd

BS 1377 Particle Size Analysis

Site Investigations Limited

BS Sieve size, mm	Percent passing	Hydrometer analysis	
		Diameter, mm	% passing
100	100	**0.0630**	
90	100	**0.0200**	
75	100	**0.0060**	
63	100	**0.0020**	
50	100		
37.5	100		
28	100		
20	100		
14	99.1		
10	95.9		
6.3	91.6		
5.0	90.5		
2.36	85.4		
2.00	84.1		
1.18	80.2		
0.600	74.9		
0.425	72.2		
0.300	69		
0.212	66.1		
0.150	63.3		
0.063	58		

Cobbles, %	0
Gravel, %	16
Sand, %	26
Clay / Silt, %	58



Client :	Carricail Development Company Ltd.	Lab. No :	22/169	Hole ID :	TP 02
Project :	Carricail	Sample No :	MK04	Depth, m :	1.00

Material description :	slightly sandy slightly gravelly silty CLAY
Remarks :	Soils with clay or silt content between 15% - 35% can be classified as clay or silt depending on the field Engineers assessment of in-situ behaviour. Where material is for re-use and therefore disturbed, only soils with clay or silt >35% are classified as clay or silt

File No: 5502
Printed 02/03/2022

_________________________Paddy McGonagle
Site Investigations Ltd

California Bearing Ratio (CBR) In accordance with BS1377: Part 4: Method 7

Client	Carricail Development Company Ltd.
Site	Carricail
S.I. File No	5942 / 22
Test Lab	Site Investigations Ltd., Carhugar The Grange, 12th Lock Rd., Lucan Co. Dublin. Tel (01) 6108768 Email info@siteinvestigations.ie
Report Date	22nd February 2022

CBR No	Depth (mBGL)	Sample No	Sample Type	Lab Ref	Moisture Content (%)	CBR Value (%)	Location / Remarks
CBR01	0.50	MK10	CBR	22/191	14.6	6.4	
CBR02	0.50	MK11	CBR	22/192	18.3	6.2	
CBR03	0.50	MK12	CBR	22/193	17.0	6.7	

Printed 02/03/2022

_________________________Paddy McGonagle
Site Investigations Ltd

Chemical Testing
In accordance with BS 1377: Part 3

Client	Carricail Development Company Ltd.
Site	Carricail
S.I. File No	5942 / 22
Test Lab	Site Investigations Ltd., Carhugar The Grange, 12th Lock Rd., Lucan Co. Dublin. Tel (01) 6108768 Email:info@siteinvestigations.ie
Report Date	22nd February 2022

Hole Id	Depth (mBGL)	Sample No	Lab Ref	pH Value	Water Soluble Sulphate Content (2:1 Water-soil extract) (SO_3) g/L	Water Soluble Sulphate Content (2:1 Water-soil extract) (SO_3) %	Loss on Ignition (Organic Content) %	Chloride ion Content (water:soil ratio 2:1) %	% passing 2mm	Remarks
TP01	0.90	MK02	22/168	8.71	0.122	0.105		0.25	86.0	
TP02	1.00	MK04	22/169	8.80	0.123	0.103		0.27	84.1	

Printed 02/03/2022

________________________Paddy McGonagle
Site Investigations Ltd.

Appendix 4

Environmental Laboratory Test Results

Unit 7-8 Hawarden Business Park
Manor Road (off Manor Lane)
Hawarden
Deeside
CH5 3US
Tel: (01244) 528700
Fax: (01244) 528701
email: hawardencustomerservices@alsglobal.com
Website: www.alsenvironmental.co.uk

Site Investigations Ltd
The Grange
Carhugar
12th Lock Road
Lucan
Co. Dublin

Attention: Stephen Letch

CERTIFICATE OF ANALYSIS

Date of report Generation:	01 March 2022
Customer:	Site Investigations Ltd
Sample Delivery Group (SDG):	220219-38
Your Reference:	5942
Location:	Carricail
Report No:	635661
Order Number:	11/A/22

We received 4 samples on Friday February 18, 2022 and 4 of these samples were scheduled for analysis which was completed on Tuesday March 01, 2022. Accredited laboratory tests are defined within the report, but opinions, interpretations and on-site data expressed herein are outside the scope of ISO 17025 accreditation.

Should this report require incorporation into client reports, it must be used in its entirety and not simply with the data sections alone.

Chemical testing (unless subcontracted) performed at ALS Life Sciences Ltd Hawarden.

All sample data is provided by the customer. The reported results relate to the sample supplied, and on the basis that this data is correct.
Incorrect sampling dates and/or sample information will affect the validity of results.
The customer is not permitted to reproduce this report except in full without the approval of the laboratory.

Approved By:

Sonia McWhan
Operations Manager

MCERTS
THE ENVIRONMENT AGENCY'S MONITORING CERTIFICATION SCHEME

ilac-MRA

UKAS TESTING
1291

ALS Life Sciences Limited. Registered Office: Units 7 & 8 Hawarden Business Park, Manor Road, Hawarden, Deeside, CH5 3US. Registered in England and Wales No. 4057291.
Version: 3.1 Version Issued: 01/03/2022

Received Sample Overview

Lab Sample No(s)	Customer Sample Ref.	AGS Ref.	Depth (m)	Sampled Date
25848070	TP1		0.50 - 0.50	15/02/2022
25848068	TP1		0.90 - 0.90	15/02/2022
25848071	TP2		0.50 - 0.50	15/02/2022
25848069	TP2		1.00 - 1.00	15/02/2022

Only received samples which have had analysis scheduled will be shown on the following pages.

Validated

CERTIFICATE OF ANALYSIS

SDG: 220219-38
Client Ref.: 5942
Report Number: 635661
Location: Carricail
Superseded Report:

Results Legend

- X **Test**
- N **No Determination Possible**

Sample Types -

- S - Soil/Solid
- UNS - Unspecified Solid
- GW - Ground Water
- SW - Surface Water
- LE - Land Leachate
- PL - Prepared Leachate
- PR - Process Water
- SA - Saline Water
- TE - Trade Effluent
- TS - Treated Sewage
- US - Untreated Sewage
- RE - Recreational Water
- DW - Drinking Water Non-regulatory
- UNL - Unspecified Liquid
- SL - Sludge
- G - Gas
- OTH - Other

Lab Sample No(s)			25848070			25848068	25848071			25848069
Customer Sample Reference			TP1			TP1	TP2			TP2
AGS Reference										
Depth (m)			0.50 - 0.50			0.90 - 0.90	0.50 - 0.50			1.00 - 1.00
Container			1kg TUB with Handle (ALE260)	250g Amber Jar (ALE210)	60g VOC (ALE215)	250g Amber Jar (ALE210)	1kg TUB with Handle (ALE260)	250g Amber Jar (ALE210)	60g VOC (ALE215)	250g Amber Jar (ALE210)
Sample Type			S	S	S	S	S	S	S	S
Anions by Kone (w)	All	NDPs: 0 Tests: 2	X				X			
CEN Readings	All	NDPs: 0 Tests: 2	X				X			
Chromium III	All	NDPs: 0 Tests: 2		X				X		
Coronene	All	NDPs: 0 Tests: 2		X				X		
Dissolved Metals by ICP-MS	All	NDPs: 0 Tests: 2	X				X			
Dissolved Organic/Inorganic Carbon	All	NDPs: 0 Tests: 2	X				X			
EPH by GCxGC-FID	All	NDPs: 0 Tests: 2		X				X		
EPH CWG GC (S)	All	NDPs: 0 Tests: 2		X				X		
Fluoride	All	NDPs: 0 Tests: 2	X				X			
GRO by GC-FID (S)	All	NDPs: 0 Tests: 2			X				X	
Hexavalent Chromium (s)	All	NDPs: 0 Tests: 2		X				X		
Loss on Ignition in soils	All	NDPs: 0 Tests: 4		X		X		X		X
Mercury Dissolved	All	NDPs: 0 Tests: 2	X				X			
Metals in solid samples by OES	All	NDPs: 0 Tests: 2		X				X		
PAH 16 & 17 Calc	All	NDPs: 0 Tests: 2		X				X		

Validated

CERTIFICATE OF ANALYSIS

SDG: 220219-38
Client Ref.: 5942
Report Number: 635661
Location: Carricail
Superseded Report:

Results Legend

- X Test
- N No Determination Possible

Sample Types -

S - Soil/Solid
UNS - Unspecified Solid
GW - Ground Water
SW - Surface Water
LE - Land Leachate
PL - Prepared Leachate
PR - Process Water
SA - Saline Water
TE - Trade Effluent
TS - Treated Sewage
US - Untreated Sewage
RE - Recreational Water
DW - Drinking Water Non-regulatory
UNL - Unspecified Liquid
SL - Sludge
G - Gas
OTH - Other

Lab Sample No(s)			25848070			25848068	25848071			25848069
Customer Sample Reference			TP1			TP1	TP2			TP2
AGS Reference										
Depth (m)			0.50 - 0.50			0.90 - 0.90	0.50 - 0.50			1.00 - 1.00
Container			1kg TUB with Handle (ALE260)	250g Amber Jar (ALE210)	60g VOC (ALE215)	250g Amber Jar (ALE210)	1kg TUB with Handle (ALE260)	250g Amber Jar (ALE210)	60g VOC (ALE215)	250g Amber Jar (ALE210)
Sample Type			S	S	S	S	S	S	S	S
PAH by GCMS	All	NDPs: 0 Tests: 2		X				X		
PCBs by GCMS	All	NDPs: 0 Tests: 2		X				X		
pH	All	NDPs: 0 Tests: 2		X				X		
Phenols by HPLC (W)	All	NDPs: 0 Tests: 2	X				X			
Sample description	All	NDPs: 0 Tests: 4		X		X		X		X
Total Dissolved Solids on Leachates	All	NDPs: 0 Tests: 2	X				X			
Total Organic Carbon	All	NDPs: 0 Tests: 2		X				X		
TPH CWG GC (S)	All	NDPs: 0 Tests: 2		X				X		
VOC MS (S)	All	NDPs: 0 Tests: 2			X				X	

Sample Descriptions

Grain Sizes

very fine	<0.063mm	fine	0.063mm - 0.1mm	medium	0.1mm - 2mm	coarse	2mm - 10mm	very coarse	>10mm

Lab Sample No(s)	Customer Sample Ref.	Depth (m)	Colour	Description	Inclusions	Inclusions 2
25848068	TP1	0.90 - 0.90	Dark Brown	Loamy Sand	Stones	Vegetation
25848070	TP1	0.50 - 0.50	Dark Brown	Loamy Sand	Stones	Vegetation
25848069	TP2	1.00 - 1.00	Dark Brown	Loamy Sand	Stones	Vegetation
25848071	TP2	0.50 - 0.50	Dark Brown	Loamy Sand	Stones	Vegetation

These descriptions are only intended to act as a cross check if sample identities are questioned, and to provide a log of sample matrices with respect to MCERTS validation. They are not intended as full geological descriptions.

We are accredited to MCERTS for sand, clay and loam/topsoil, or any of these materials - whether these are derived from naturally ocurring soil profiles, or from fill/made ground, as long as these materials constitute the major part of the sample.

Other coarse granular materials such as concrete, gravel and brick are not accredited if they comprise the major part of the sample.

Validated

CERTIFICATE OF ANALYSIS

SDG: 220219-38
Client Ref.: 5942
Report Number: 635661
Location: Carricail
Superseded Report:

Results Legend

- # ISO17025 accredited.
- M mCERTS accredited.
- aq Aqueous / settled sample.
- diss.filt Dissolved / filtered sample.
- tot.unfilt Total / unfiltered sample.
- * Subcontracted - refer to subcontractor report for accreditation status.
- ** % recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
- (F) Trigger breach confirmed
- 1-4♦§@ Sample deviation (see appendix)

Customer Sample Ref.	TP1	TP1	TP2	TP2		
Depth (m)	0.50 - 0.50	0.90 - 0.90	0.50 - 0.50	1.00 - 1.00		
Sample Type	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)		
Date Sampled	15/02/2022	15/02/2022	15/02/2022	15/02/2022		
Sample Time	.	.	.	.		
Date Received	18/02/2022	18/02/2022	18/02/2022	18/02/2022		
SDG Ref	220219-38	220219-38	220219-38	220219-38		
Lab Sample No.(s)	25848070	25848068	25848071	25848069		
AGS Reference						

Component	LOD/Units	Method	TP1	TP1	TP2	TP2		
Moisture Content Ratio (% of as received sample)	%	PM024	16	33	13	5.7		
Loss on ignition	<0.7 %	TM018	4.72 M	4.53 M	2.33 M	3.76 M		
Organic Carbon, Total	<0.2 %	TM132	0.774 M		0.433 M			
pH	1 pH Units	TM133	7.58 M		8.66 M			
Chromium, Hexavalent	<0.6 mg/kg	TM151	<0.6 #		<0.6 #			
PCB congener 28	<3 µg/kg	TM168	<3 M		<3 M			
PCB congener 52	<3 µg/kg	TM168	<3 M		<3 M			
PCB congener 101	<3 µg/kg	TM168	<3 M		<3 M			
PCB congener 118	<3 µg/kg	TM168	<3 M		<3 M			
PCB congener 138	<3 µg/kg	TM168	<3 M		<3 M			
PCB congener 153	<3 µg/kg	TM168	<3 M		<3 M			
PCB congener 180	<3 µg/kg	TM168	<3 M		<3 M			
Sum of detected PCB 7 Congeners	<21 µg/kg	TM168	<21		<21			
Chromium, Trivalent	<0.9 mg/kg	TM181	10.7		5.38			
Antimony	<0.6 mg/kg	TM181	1.86 #		1.57 #			
Arsenic	<0.6 mg/kg	TM181	17 M		11.1 M			
Barium	<0.6 mg/kg	TM181	66.1 #		43.3 #			
Cadmium	<0.02 mg/kg	TM181	2.9 M		2 M			
Chromium	<0.9 mg/kg	TM181	10.7 M		5.38 M			
Copper	<1.4 mg/kg	TM181	43.6 M		26.7 M			
Lead	<0.7 mg/kg	TM181	29.6 M		15.8 M			
Mercury	<0.1 mg/kg	TM181	<0.1 M		<0.1 M			
Molybdenum	<0.1 mg/kg	TM181	4.21 #		2.4 #			
Nickel	<0.2 mg/kg	TM181	58.2 M		38.4 M			
Selenium	<1 mg/kg	TM181	2.82 #		2.06 #			
Zinc	<1.9 mg/kg	TM181	126 M		88.3 M			
PAH Total 17 (inc Coronene) Moisture Corrected	<10 mg/kg	TM410	<10		<10			
Coronene	<200 µg/kg	TM410	<200		<200			
Mineral Oil >C10-C40 (EH_2D_AL)	<5 mg/kg	TM415	<5		<5			

14:11:37 01/03/2022

Validated

CERTIFICATE OF ANALYSIS

SDG: 220219-38
Client Ref.: 5942
Report Number: 635661
Location: Carricail
Superseded Report:

PAH by GCMS

Results Legend

#	ISO17025 accredited.
M	mCERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted - refer to subcontractor report for accreditation status.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-4♦§@	Sample deviation (see appendix)

		Customer Sample Ref.	TP1	TP2				
		Depth (m)	0.50 - 0.50	0.50 - 0.50				
		Sample Type	Soil/Solid (S)	Soil/Solid (S)				
		Date Sampled	15/02/2022	15/02/2022				
		Sample Time	.	.				
		Date Received	18/02/2022	18/02/2022				
		SDG Ref	220219-38	220219-38				
		Lab Sample No.(s)	25848070	25848071				
		AGS Reference						
Component	**LOD/Units**	**Method**						
Naphthalene	<9 µg/kg	TM218	<9 M	<9 M				
Acenaphthylene	<12 µg/kg	TM218	<12 M	<12 M				
Acenaphthene	<8 µg/kg	TM218	<8 M	<8 M				
Fluorene	<10 µg/kg	TM218	<10 M	<10 M				
Phenanthrene	<15 µg/kg	TM218	<15 M	<15 M				
Anthracene	<16 µg/kg	TM218	<16 M	<16 M				
Fluoranthene	<17 µg/kg	TM218	<17 M	<17 M				
Pyrene	<15 µg/kg	TM218	<15 M	<15 M				
Benz(a)anthracene	<14 µg/kg	TM218	<14 M	<14 M				
Chrysene	<10 µg/kg	TM218	<10 M	<10 M				
Benzo(b)fluoranthene	<15 µg/kg	TM218	<15 M	<15 M				
Benzo(k)fluoranthene	<14 µg/kg	TM218	<14 M	<14 M				
Benzo(a)pyrene	<15 µg/kg	TM218	<15 M	<15 M				
Indeno(1,2,3-cd)pyrene	<18 µg/kg	TM218	<18 M	<18 M				
Dibenzo(a,h)anthracene	<23 µg/kg	TM218	<23 M	<23 M				
Benzo(g,h,i)perylene	<24 µg/kg	TM218	<24 M	<24 M				
PAH, Total Detected USEPA 16	<118 µg/kg	TM218	<118	<118				

Validated

CERTIFICATE OF ANALYSIS

SDG: 220219-38
Client Ref.: 5942
Report Number: 635661
Location: Carricail
Superseded Report:

TPH CWG (S)

Results Legend

#	ISO17025 accredited.
M	mCERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted - refer to subcontractor report for accreditation status.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-4♦§@	Sample deviation (see appendix)

Customer Sample Ref.			TP1	TP2				
Depth (m)			0.50 - 0.50	0.50 - 0.50				
Sample Type			Soil/Solid (S)	Soil/Solid (S)				
Date Sampled			15/02/2022	15/02/2022				
Sample Time			.	.				
Date Received			18/02/2022	18/02/2022				
SDG Ref			220219-38	220219-38				
Lab Sample No.(s)			25848070	25848071				
AGS Reference								
Component	**LOD/Units**	**Method**						
GRO Surrogate % recovery**	%	TM089	117	97.4				
Aliphatics >C5-C6 (HS_1D_AL)	<10 µg/kg	TM089	<10	<10				
Aliphatics >C6-C8 (HS_1D_AL)	<10 µg/kg	TM089	<10	<10				
Aliphatics >C8-C10 (HS_1D_AL)	<10 µg/kg	TM089	<10	<10				
Aliphatics >C10-C12 (EH_2D_AL_#1)	<1000 µg/kg	TM414	<1000 #	<1000 #				
Aliphatics >C12-C16 (EH_2D_AL_#1)	<1000 µg/kg	TM414	<1000 #	<1000 #				
Aliphatics >C16-C21 (EH_2D_AL_#1)	<1000 µg/kg	TM414	<1000 #	<1000 #				
Aliphatics >C21-C35 (EH_2D_AL_#1)	<1000 µg/kg	TM414	<1000 #	<1000 #				
Aliphatics >C35-C44 (EH_2D_AL_#1)	<1000 µg/kg	TM414	<1000	<1000				
Total Aliphatics >C10-C44 (EH_2D_AR_#1)	<5000 µg/kg	TM414	<5000	<5000				
Total Aliphatics & Aromatics >C10-C44 (EH_2D_Total_#1)	<10000 µg/kg	TM414	<10000	<10000				
Aromatics >EC5-EC7 (HS_1D_AR)	<10 µg/kg	TM089	<10	<10				
Aromatics >EC7-EC8 (HS_1D_AR)	<10 µg/kg	TM089	<10	<10				
Aromatics >EC8-EC10 (HS_1D_AR)	<10 µg/kg	TM089	<10	<10				
Aromatics > EC10-EC12 (EH_2D_AR_#1)	<1000 µg/kg	TM414	<1000 #	<1000 #				
Aromatics > EC12-EC16 (EH_2D_AR_#1)	<1000 µg/kg	TM414	<1000 #	<1000 #				
Aromatics > EC16-EC21 (EH_2D_AR_#1)	<1000 µg/kg	TM414	<1000 #	<1000 #				
Aromatics > EC21-EC35 (EH_2D_AR_#1)	<1000 µg/kg	TM414	<1000 #	7730 #				
Aromatics >EC35-EC44 (EH_2D_AR_#1)	<1000 µg/kg	TM414	<1000	1220				
Aromatics > EC40-EC44 (EH_2D_AR_#1)	<1000 µg/kg	TM414	<1000	<1000				
Total Aromatics > EC10-EC44 (EH_2D_AR_#1)	<5000 µg/kg	TM414	<5000	9080				
Total Aliphatics & Aromatics >C5-C44 (EH_2D_Total_#1+HS_1D_Total)	<10000 µg/kg	TM414	<10000	<10000				
GRO >C5-C6 (HS_1D)	<20 µg/kg	TM089	<20	<20				
GRO >C6-C7 (HS_1D)	<20 µg/kg	TM089	<20	<20				
GRO >C7-C8 (HS_1D)	<20 µg/kg	TM089	<20	<20				
GRO >C8-C10 (HS_1D)	<20 µg/kg	TM089	<20	<20				
GRO >C10-C12 (HS_1D)	<20 µg/kg	TM089	<20	<20				
Total Aliphatics >C5-C10 (HS_1D_AL_TOTAL)	<50 µg/kg	TM089	<50	<50				
Total Aromatics >EC5-EC10 (HS_1D_AR_TOTAL)	<50 µg/kg	TM089	<50	<50				
GRO >C5-C10 (HS_1D_TOTAL)	<20 µg/kg	TM089	<20	<20				

Validated

CERTIFICATE OF ANALYSIS

SDG: 220219-38
Client Ref.: 5942
Report Number: 635661
Location: Carricail
Superseded Report:

VOC MS (S)

Results Legend	
#	ISO17025 accredited.
M	mCERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted - refer to subcontractor report for accreditation status.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-4♦§@	Sample deviation (see appendix)

		Customer Sample Ref.	TP1	TP2
		Depth (m)	0.50 - 0.50	0.50 - 0.50
		Sample Type	Soil/Solid (S)	Soil/Solid (S)
		Date Sampled	15/02/2022	15/02/2022
		Sample Time	.	.
		Date Received	18/02/2022	18/02/2022
		SDG Ref	220219-38	220219-38
		Lab Sample No.(s)	25848070	25848071
		AGS Reference		
Component	**LOD/Units**	**Method**		
Dibromofluoromethane**	%	TM116	110	109
Toluene-d8**	%	TM116	106	97.7
4-Bromofluorobenzene**	%	TM116	73.1	73.1
Methyl Tertiary Butyl Ether	<10 µg/kg	TM116	<10 M	<10 M
Benzene	<9 µg/kg	TM116	<9 M	<9 M
Toluene	<7 µg/kg	TM116	<7 M	<7 M
Ethylbenzene	<4 µg/kg	TM116	<4 M	<4 M
p/m-Xylene	<10 µg/kg	TM116	<10 #	<10 #
o-Xylene	<10 µg/kg	TM116	<10 M	<10 M

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CEN 10:1 SINGLE STAGE LEACHATE TEST

WAC ANALYTICAL RESULTS

REF : BS EN 12457/2

Client Reference		**Site Location**	Carricail
Mass Sample taken (kg)	0.204	**Natural Moisture Content (%)**	127
Mass of dry sample (kg)	0.090	**Dry Matter Content (%)**	44
Particle Size <4mm	>95%		

Case	
SDG	220219-38
Lab Sample Number(s)	25848070
Sampled Date	15-Feb-2022
Customer Sample Ref.	TP1
Depth (m)	0.50 - 0.50

Landfill Waste Acceptance Criteria Limits

Solid Waste Analysis	**Result**	**Inert Waste Landfill**	**Stable Non-reactive Hazardous Waste in Non-Hazardous Landfill**	**Hazardous Waste Landfill**
Total Organic Carbon (%)	0.774	3	5	6
Loss on Ignition (%)	4.72	-	-	10
Sum of BTEX (mg/kg)	-	-	-	-
Sum of 7 PCBs (mg/kg)	<0.021	1	-	-
Mineral Oil (mg/kg) (EH_2D_AL)	<5	500	-	-
PAH Sum of 17 (mg/kg)	<10	100	-	-
pH (pH Units)	7.58	-	>6	-
ANC to pH 6 (mol/kg)	-	-	-	-
ANC to pH 4 (mol/kg)	-	-	-	-

Eluate Analysis	**C2** Conc^{n} in 10:1 eluate (mg/l)		**A2** 10:1 conc^{n} leached (mg/kg)		Limit values for compliance leaching test using BS EN 12457-3 at L/S 10 l/kg		
	Result	**Limit of Detection**	**Result**	**Limit of Detection**			
Arsenic	<0.0005	<0.0005	<0.005	<0.005	0.5	2	25
Barium	0.00414	<0.0002	0.0414	<0.002	20	100	300
Cadmium	<0.00008	<0.00008	<0.0008	<0.0008	0.04	1	5
Chromium	<0.001	<0.001	<0.01	<0.01	0.5	10	70
Copper	0.00241	<0.0003	0.0241	<0.003	2	50	100
Mercury Dissolved (CVAF)	<0.00001	<0.00001	<0.0001	<0.0001	0.01	0.2	2
Molybdenum	<0.003	<0.003	<0.03	<0.03	0.5	10	30
Nickel	0.000598	<0.0004	0.00598	<0.004	0.4	10	40
Lead	<0.0002	<0.0002	<0.002	<0.002	0.5	10	50
Antimony	<0.001	<0.001	<0.01	<0.01	0.06	0.7	5
Selenium	<0.001	<0.001	<0.01	<0.01	0.1	0.5	7
Zinc	0.0111	<0.001	0.111	<0.01	4	50	200
Chloride	4.7	<2	47	<20	800	15000	25000
Fluoride	<0.5	<0.5	<5	<5	10	150	500
Sulphate (soluble)	91.3	<2	913	<20	1000	20000	50000
Total Dissolved Solids	209	<10	2090	<100	4000	60000	100000
Total Monohydric Phenols (W)	<0.016	<0.016	<0.16	<0.16	1	-	-
Dissolved Organic Carbon	5.06	<3	50.6	<30	500	800	1000

Leach Test Information

Date Prepared	19-Feb-2022
pH (pH Units)	7.89
Conductivity (µS/cm)	262.00
Temperature (°C)	19.50
Volume Leachant (Litres)	0.786

Solid Results are expressed on a dry weight basis, after correction for moisture content where applicable
Stated limits are for guidance only and ALS Environmental cannot be held responsible for any discrepancies with current legislation

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Validated

CERTIFICATE OF ANALYSIS

SDG: 220219-38
Client Ref.: 5942
Report Number: 635661
Location: Carricail
Superseded Report:

CEN 10:1 SINGLE STAGE LEACHATE TEST

WAC ANALYTICAL RESULTS

REF : BS EN 12457/2

Client Reference		**Site Location**	Carricail
Mass Sample taken (kg)	0.137	**Natural Moisture Content (%)**	52
Mass of dry sample (kg)	0.090	**Dry Matter Content (%)**	65.8
Particle Size <4mm	>95%		

Case	
SDG	220219-38
Lab Sample Number(s)	25848071
Sampled Date	15-Feb-2022
Customer Sample Ref.	TP2
Depth (m)	0.50 - 0.50

Landfill Waste Acceptance Criteria Limits

Solid Waste Analysis	**Result**	**Inert Waste Landfill**	**Stable Non-reactive Hazardous Waste in Non-Hazardous Landfill**	**Hazardous Waste Landfill**
Total Organic Carbon (%)	0.433	3	5	6
Loss on Ignition (%)	2.33	-	-	10
Sum of BTEX (mg/kg)	-	-	-	-
Sum of 7 PCBs (mg/kg)	<0.021	1	-	-
Mineral Oil (mg/kg) (EH_2D_AL)	<5	500	-	-
PAH Sum of 17 (mg/kg)	<10	100	-	-
pH (pH Units)	8.66	-	>6	-
ANC to pH 6 (mol/kg)	-	-	-	-
ANC to pH 4 (mol/kg)	-	-	-	-

Eluate Analysis	**C_2 Conc^n in 10:1 eluate (mg/l)**		**A_2 10:1 conc^n leached (mg/kg)**		**Limit values for compliance leaching test using BS EN 12457-3 at L/S 10 l/kg**		
	Result	**Limit of Detection**	**Result**	**Limit of Detection**			
Arsenic	<0.0005	<0.0005	<0.005	<0.005	0.5	2	25
Barium	0.00292	<0.0002	0.0292	<0.002	20	100	300
Cadmium	<0.00008	<0.00008	<0.0008	<0.0008	0.04	1	5
Chromium	<0.001	<0.001	<0.01	<0.01	0.5	10	70
Copper	<0.0003	<0.0003	<0.003	<0.003	2	50	100
Mercury Dissolved (CVAF)	<0.00001	<0.00001	<0.0001	<0.0001	0.01	0.2	2
Molybdenum	<0.003	<0.003	<0.03	<0.03	0.5	10	30
Nickel	<0.0004	<0.0004	<0.004	<0.004	0.4	10	40
Lead	<0.0002	<0.0002	<0.002	<0.002	0.5	10	50
Antimony	<0.001	<0.001	<0.01	<0.01	0.06	0.7	5
Selenium	<0.001	<0.001	<0.01	<0.01	0.1	0.5	7
Zinc	0.00557	<0.001	0.0557	<0.01	4	50	200
Chloride	<2	<2	<20	<20	800	15000	25000
Fluoride	<0.5	<0.5	<5	<5	10	150	500
Sulphate (soluble)	<2	<2	<20	<20	1000	20000	50000
Total Dissolved Solids	88.8	<10	888	<100	4000	60000	100000
Total Monohydric Phenols (W)	<0.016	<0.016	<0.16	<0.16	1	-	-
Dissolved Organic Carbon	3.31	<3	33.1	<30	500	800	1000

Leach Test Information

Date Prepared	19-Feb-2022
pH (pH Units)	8.63
Conductivity (µS/cm)	113.00
Temperature (°C)	17.90
Volume Leachant (Litres)	0.854

Solid Results are expressed on a dry weight basis, after correction for moisture content where applicable
Stated limits are for guidance only and ALS Environmental cannot be held responsible for any discrepancies with current legislation

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Table of Results - Appendix

Method No	Reference	Description
PM024	Modified BS 1377	Soil preparation including homogenisation, moisture screens of soils for Asbestos Containing Material
PM115		Leaching Procedure for CEN One Stage Leach Test 2:1 & 10:1 1 Step
TM018	BS 1377: Part 3 1990	Determination of Loss on Ignition
TM089	Modified: US EPA Methods 8020 & 602	Determination of Gasoline Range Hydrocarbons (GRO) by Headspace GC-FID (C4-C12)
TM090	Method 5310, AWWA/APHA, 20th Ed., 1999 / Modified: US EPA Method 415.1 & 9060	Determination of Total Organic Carbon/Total Inorganic Carbon in Water and Waste Water
TM104	Method 4500F, AWWA/APHA, 20th Ed., 1999	Determination of Fluoride using the Kone Analyser
TM116	Modified: US EPA Method 8260, 8120, 8020, 624, 610 & 602	Determination of Volatile Organic Compounds by Headspace / GC-MS
TM123	BS 2690: Part 121:1981	The Determination of Total Dissolved Solids in Water
TM132	In - house Method	ELTRA CS800 Operators Guide
TM133	BS 1377: Part 3 1990;BS 6068-2.5	Determination of pH in Soil and Water using the GLpH pH Meter
TM151	Method 3500D, AWWA/APHA, 20th Ed., 1999	Determination of Hexavalent Chromium using Kone analyser
TM152	ISO 17294-2:2016 Water quality - Application of inductively coupled plasma mass spectrometry (ICP-MS)	Analysis of Aqueous Samples by ICP-MS
TM168	EPA Method 8082, Polychlorinated Biphenyls by Gas Chromatography	Determination of WHO12 and EC7 Polychlorinated Biphenyl Congeners by GC-MS in Soils
TM181	US EPA Method 6010B	Determination of Routine Metals in Soil by iCap 6500 Duo ICP-OES
TM183	BS EN 23506:2002, (BS 6068-2.74:2002) ISBN 0 580 38924 3	Determination of Trace Level Mercury in Waters and Leachates by PSA Cold Vapour Atomic Fluorescence Spectrometry
TM184	EPA Methods 325.1 & 325.2,	The Determination of Anions in Aqueous Matrices using the Kone Spectrophotometric Analysers
TM218	Shaker extraction - EPA method 3546.	The determination of PAH in soil samples by GC-MS
TM259	by HPLC	Determination of Phenols in Waters and Leachates by HPLC
TM410	Shaker extraction-In house coronene method	Determination of Coronene in soils by GCMS
TM414	Analysis of Petroleum Hydrocarbons in Environmental Media – Total Petroleum Hydrocarbon Criteria	Determination of Speciated Extractable Petroleum Hydrocarbons in Soils by GCxGC-FID
TM415	Analysis of Petroleum Hydrocarbons in Environmental Media.	Determination of Extractable Petroleum Hydrocarbons in Soils by GCxGC-FID

NA = not applicable.

Chemical testing (unless subcontracted) performed at ALS Life Sciences Ltd Hawarden.

Test Completion Dates

Lab Sample No(s)	25848068	25848070	25848069	25848071
Customer Sample Ref.	TP1	TP1	TP2	TP2
AGS Ref.				
Depth	0.90 - 0.90	0.50 - 0.50	1.00 - 1.00	0.50 - 0.50
Type	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)	Soil/Solid (S)
Anions by Kone (w)		23-Feb-2022		25-Feb-2022
CEN 10:1 Leachate (1 Stage)		20-Feb-2022		23-Feb-2022
CEN Readings		24-Feb-2022		24-Feb-2022
Chromium III		25-Feb-2022		25-Feb-2022
Coronene		23-Feb-2022		23-Feb-2022
Dissolved Metals by ICP-MS		23-Feb-2022		25-Feb-2022
Dissolved Organic/Inorganic Carbon		28-Feb-2022		27-Feb-2022
EPH by GCxGC-FID		24-Feb-2022		23-Feb-2022
EPH CWG GC (S)		23-Feb-2022		23-Feb-2022
Fluoride		24-Feb-2022		24-Feb-2022
GRO by GC-FID (S)		25-Feb-2022		25-Feb-2022
Hexavalent Chromium (s)		23-Feb-2022		23-Feb-2022
Loss on Ignition in soils	24-Feb-2022	24-Feb-2022	24-Feb-2022	24-Feb-2022
Mercury Dissolved		23-Feb-2022		25-Feb-2022
Metals in solid samples by OES		25-Feb-2022		25-Feb-2022
Moisture at 105C		19-Feb-2022		19-Feb-2022
PAH 16 & 17 Calc		23-Feb-2022		23-Feb-2022
PAH by GCMS		23-Feb-2022		23-Feb-2022
PCBs by GCMS		22-Feb-2022		22-Feb-2022
pH		24-Feb-2022		21-Feb-2022
Phenols by HPLC (W)		24-Feb-2022		01-Mar-2022
Sample description	19-Feb-2022	19-Feb-2022	19-Feb-2022	19-Feb-2022
Total Dissolved Solids on Leachates		23-Feb-2022		25-Feb-2022
Total Organic Carbon		28-Feb-2022		25-Feb-2022
TPH CWG GC (S)		25-Feb-2022		25-Feb-2022
VOC MS (S)		24-Feb-2022		24-Feb-2022

Appendix

General

1. Results are expressed on a dry weight basis (dried at 35ºC) for all soil analyses except for the following: NRA and CEN Leach tests, flash point LOI, pH, ammonium as NH4 by the BRE method, VOC TICs and SVOC TICs.

2. If sufficient sample is received a sub sample will be retained free of charge for 30 days after analysis is completed (e-mailed) for all sample types unless the sample is destroyed on testing. The prepared soil sub sample that is analysed for asbestos will be retained for a period of 6 months after the analysis date. All bulk samples will be retained for a period of 6 months after the analysis date. All samples received and not scheduled will be disposed of one month after the date of receipt unless we are instructed to the contrary. Once the initial period has expired, a storage charge will be applied for each month or part thereof until the client cancels the request for sample storage. ALS reserve the right to charge for samples received and stored but not analysed.

3. With respect to turnaround, we will always endeavour to meet client requirements wherever possible, but turnaround times cannot be absolutely guaranteed due to so many variables beyond our control.

4. We take responsibility for any test performed by sub-contractors (marked with an asterisk). We endeavour to use UKAS/MCERTS Accredited Laboratories, who either complete a quality questionnaire or are audited by ourselves. For some determinands there are no UKAS/MCERTS Accredited Laboratories, in this instance a laboratory with a known track record will be utilised.

5. If no separate volatile sample is supplied by the client, or if a headspace or sediment is present in the volatile sample, the integrity of the data may be compromised. This will be flagged up as an invalid VOC on the test schedule and the result marked as deviating on the test certificate.

6. NDP - No determination possible due to insufficient/unsuitable sample.

7. Results relate only to the items tested.

8. LoDs (Limit of Detection) for wet tests reported on a dry weight basis are not corrected for moisture content.

9. **Surrogate recoveries** - Surrogates are added to your sample to monitor recovery of the test requested. A % recovery is reported, results are not corrected for the recovery measured. Typical recoveries for organics tests are 70-130%. Recoveries in soils are affected by organic rich or clay rich matrices. Waters can be affected by remediation fluids or high amounts of sediment. Test results are only ever reported if all of the associated quality checks pass; it is assumed that all recoveries outside of the values above are due to matrix affect.

10. Stones/debris are not routinely removed. We always endeavour to take a representative sub sample from the received sample.

11. In certain circumstances the method detection limit may be elevated due to the sample being outside the calibration range. Other factors that may contribute to this include possible interferences. In both cases the sample would be diluted which would cause the method detection limit to be raised.

12. For dried and crushed preparations of soils volatile loss may occur e.g volatile mercury.

13. For leachate preparations other than Zero Headspace Extraction (ZHE) volatile loss may occur.

14. For the BSEN 12457-3 two batch process to allow the cumulative release to be calculated, the volume of the leachate produced is measured and filtered for all tests. We therefore cannot carry out any unfiltered analysis. The tests affected include volatiles GCFID/GCMS and all subcontracted analysis.

15. Analysis and identification of specific compounds using GCFID is by retention time only, and we routinely calibrate and quantify for benzene, toluene, ethylbenzenes and xylenes (BTEX). For total volatiles in the C5-C12 range, the total area of the chromatogram is integrated and expressed as ug/kg or ug/l. Although this analysis is commonly used for the quantification of gasoline range organics (GRO), the system will also detect other compounds such as chlorinated solvents, and this may lead to a falsely high result with respect to hydrocarbons only. It is not possible to specifically identify these non-hydrocarbons, as standards are not routinely run for any other compounds, and for more definitive identification, volatiles by GCMS should be utilised.

16. We are accredited to MCERTS for sand, clay and loam/topsoil, or any of these materials - whether these are derived from naturally occurring soil profiles, or from fill/made ground, as long as these materials constitute the major part of the sample. Other coarse granular material such as concrete, gravel and brick are not accredited if they comprise the major part of the sample.

17 Data retention. All records, communications and reports pertaining to the analysis are archived for seven years from the date of issue of the final report.

18. **Tentatively Identified Compounds (TICs)** are non-target peaks in VOC and SVOC analysis. All non-target peaks detected with a concentration above the LoD are subjected to a mass spectral library search. Non-target peaks with a library search confidence of >75% are reported based on the best mass spectral library match. When a non-target peak with a library search confidence of <75% is detected it is reported as “mixed hydrocarbons”. Non-target compounds identified from the scan data are semi-quantified relative to one of the deuterated internal standards, under the same chromatographic conditions as the target compounds. This result is reported as a semi-quantitative value and reported as Tentatively Identified Compounds (TICs). TICs are outside the scope of UKAS accreditation and are not moisture corrected.

19. **Sample Deviations**

If a sample is classed as deviated then the associated results may be compromised.

1	**Container with Headspace provided for volatiles analysis**
2	**Incorrect container received**
3	**Deviation from method**
4	**Matrix interference**
♦	**Sample holding time exceeded in laboratory**
@	**Sample holding time exceeded due to late arrival of instructions or samples**
§	**Sampled on date not provided**

20. **Asbestos**

When requested, the individual sub sample scheduled will be analysed in house for the presence of asbestos fibres and asbestos containing material by our documented in house method TM048 based on HSG 248 (2021), which is accredited to ISO17025. If a specific asbestos fibre type is not found this will be reported as “Not detected”. If no asbestos fibre types are found all will be reported as “Not detected” and the sub sample analysed deemed to be clear of asbestos. If an asbestos fibre type is found it will be reported as detected (for each fibre type found). Testing can be carried out on asbestos positive samples, but, due to Health and Safety considerations, may be replaced by alternative tests or reported as No Determination Possible (NDP). The quantity of asbestos present is not determined unless specifically requested.

Identification of Asbestos in Bulk Materials & Soils

The results for identification of asbestos in bulk materials and soils are obtained from supplied bulk materials andd soils which have been examined to determine the presence of asbestos fibres using ALS (Hawarden) in-house method of transmitted/polarised light microscopy and central stop dispersion staining, based on HSG 248 (2021).

The results for identification of asbestos in soils are obtained from a homogenised sub sample which has been examined to determine the presence of asbestos fibres using ALS (Hawarden) in-house method of transmitted/polarised light microscopy and central

Asbestos Type	Common Name
Chrysotile	White Asbestos
Amosite	Brown Asbestos
Crocidolite	Blue Asbestos
Fibrous Actinolite	-
Fibrous Anthophyllite	-
Fibrous Tremolite	-

Visual Estimation Of Fibre Content

Estimation of fibre content is not permitted as part of our UKAS accredited test other than: - Trace - Where only one or two asbestos fibres were identified.

Respirable Fibres

Respirable fibres are defined as fibres of <3 µm diameter, longer than 5 µm and with aspect ratios of at least 3:1 that can be inhaled into the lower regions of the lung and are generally acknowledged to be most important predictor of hazard and risk for cancers of the lung.

Further guidance on typical asbestos fibre content of manufactured products can be found in HSG 264.

The identification of asbestos containing materials and soils falls within our schedule of tests for which we hold UKAS accreditation, however opinions, interpretations and all other information contained in the report are outside the scope of UKAS accreditation.

Appendix 5

Waste Classification Report

Waste Classification Report

HazWasteOnline™ classifies waste as either **hazardous** or **non-hazardous** based on its chemical composition, related legislation and the rules and data defined in the current UK or EU technical guidance (Appendix C) (note that HP 9 Infectious is not assessed). It is the responsibility of the classifier named below to:

a) understand the origin of the waste
b) select the correct List of Waste code(s)
c) confirm that the list of determinands, results and sampling plan are fit for purpose
d) select and justify the chosen metal species (Appendix B)
e) correctly apply moisture correction and other available corrections
f) add the meta data for their user-defined substances (Appendix A)
g) check that the classification engine is suitable with respect to the national destination of the waste (Appendix C)

To aid the reviewer, the laboratory results, assumptions and justifications managed by the classifier are highlighted in pale yellow.

Z9C44-GH1VU-S80II

Job name

5942

Description/Comments

Client: Carricail Development Company Ltd
Engineer: Waterman Moylan

Project

Carricail

Site

Glenamuck Road, Carrickmines, Co. Dublin

Classified by

Name:
Stephen Letch
Date:
02 Mar 2022 12:43 GMT
Telephone:
00353 86817 9449

Company:
Site Investigations Ltd

HazWasteOnline™ provides a two day, hazardous waste classification course that covers the use of the software and both basic and advanced waste classification techniques. Certification has to be renewed every 3 years.

HazWasteOnline™ Certification: CERTIFIED

Course	**Date**
Hazardous Waste Classification	09 Oct 2019

Next 3 year Refresher due by Oct 2022

Job summary

#	Sample name	Depth [m]	Classification Result	Hazard properties	WAC Results		Page
					Inert	Non Haz	
1	TP1-0.50	0.5	Non Hazardous		Pass	Pass	2
2	TP2-0.50	0.5	Non Hazardous		Pass	Pass	6

Related documents

#	Name	Description
1	220219-38.hwol	.hwol file used to create the Job
2	Rilta Suite NEW	waste stream template used to create this Job

WAC results

WAC Settings: samples in this Job constitute a single population.

WAC limits used to evaluate the samples in this Job: "Ireland"
The WAC used in this report are the WAC defined for the inert and non-hazardous classes of landfill in the Republic of Ireland. You should check the actual acceptance criteria when the disposal site is identified as they may differ from the generic WAC used in this report.

Report

Created by: Stephen Letch

Created date: 02 Mar 2022 12:43 GMT

Classification of sample: TP1-0.50

Non Hazardous Waste
Classified as **17 05 04**
in the List of Waste

Sample details

Sample name:		LoW Code:	
TP1-0.50		Chapter:	17: Construction and Demolition Wastes (including excavated soil from contaminated sites)
Sample Depth:			
0.5 m		Entry:	17 05 04 (Soil and stones other than those mentioned in 17 05 03)
Moisture content:			
16% (wet weight correction)			

Hazard properties

None identified

Determinands

Moisture content: 16% Wet Weight Moisture Correction applied (MC)

#	Determinand	EU CLP index number	EC Number	CAS Number	CLP Note	User entered data	Conv. Factor	Compound conc.	Classification value	MC Applied	Conc. Not Used
1	TPH (C6 to C40) petroleum group			TPH		<10 mg/kg		<10 mg/kg	<0.001 %		**<LOD**
2	confirm TPH has NOT arisen from diesel or petrol					☑					
3	antimony { antimony trioxide }	051-005-00-X	215-175-0	1309-64-4		1.86 mg/kg	1.197	1.87 mg/kg	0.000187 %	✓	
4	arsenic { arsenic pentoxide }	033-004-00-6	215-116-9	1303-28-2		17 mg/kg	1.534	21.904 mg/kg	0.00219 %	✓	
5	barium { barium sulphide }	016-002-00-X	244-214-4	21109-95-5		66.1 mg/kg	1.233	68.489 mg/kg	0.00685 %	✓	
6	cadmium { cadmium sulfate }	048-009-00-9	233-331-6	10124-36-4		2.9 mg/kg	1.855	4.518 mg/kg	0.000452 %	✓	
7	copper { dicopper oxide; copper (I) oxide }	029-002-00-X	215-270-7	1317-39-1		43.6 mg/kg	1.126	41.235 mg/kg	0.00412 %	✓	
8	lead { lead compounds with the exception of those specified elsewhere in this Annex (worst case) }	082-001-00-6			1	29.6 mg/kg		24.864 mg/kg	0.00249 %	✓	
9	mercury { mercury dichloride }	080-010-00-X	231-299-8	7487-94-7		<0.1 mg/kg	1.353	<0.135 mg/kg	<0.0000135 %		**<LOD**
10	molybdenum { molybdenum(VI) oxide }	042-001-00-9	215-204-7	1313-27-5		4.21 mg/kg	1.5	5.305 mg/kg	0.000531 %	✓	
11	nickel { nickel sulfate }	028-009-00-5	232-104-9	7786-81-4		58.2 mg/kg	2.637	128.902 mg/kg	0.0129 %	✓	
12	selenium { selenium compounds with the exception of cadmium sulphoselenide and those specified elsewhere in this Annex }	034-002-00-8				2.82 mg/kg	1.405	3.328 mg/kg	0.000333 %	✓	
13	zinc { zinc sulphate }	030-006-00-9	231-793-3 [1] 231-793-3 [2]	7446-19-7 [1] 7733-02-0 [2]		126 mg/kg	2.469	261.35 mg/kg	0.0261 %	✓	
14	chromium in chromium(III) compounds { chromium(III) oxide (worst case) }		215-160-9	1308-38-9		10.7 mg/kg	1.462	13.136 mg/kg	0.00131 %	✓	

#		Determinand	EU CLP index number	EC Number	CAS Number	CLP Note	User entered data		Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
15		chromium in chromium(VI) compounds { chromium(VI) oxide }	024-001-00-0	215-607-8	1333-82-0		<0.6	mg/kg	1.923	<1.154	mg/kg	<0.000115 %		**<LOD**
16		naphthalene	601-052-00-2	202-049-5	91-20-3		<0.009	mg/kg		<0.009	mg/kg	<0.0000009 %		**<LOD**
17	●	acenaphthylene		205-917-1	208-96-8		<0.012	mg/kg		<0.012	mg/kg	<0.0000012 %		**<LOD**
18	●	acenaphthene		201-469-6	83-32-9		<0.008	mg/kg		<0.008	mg/kg	<0.0000008 %		**<LOD**
19	●	fluorene		201-695-5	86-73-7		<0.01	mg/kg		<0.01	mg/kg	<0.000001 %		**<LOD**
20	●	phenanthrene		201-581-5	85-01-8		<0.015	mg/kg		<0.015	mg/kg	<0.0000015 %		**<LOD**
21	●	anthracene		204-371-1	120-12-7		<0.016	mg/kg		<0.016	mg/kg	<0.0000016 %		**<LOD**
22	●	fluoranthene		205-912-4	206-44-0		<0.017	mg/kg		<0.017	mg/kg	<0.0000017 %		**<LOD**
23	●	pyrene		204-927-3	129-00-0		<0.015	mg/kg		<0.015	mg/kg	<0.0000015 %		**<LOD**
24		benzo[a]anthracene	601-033-00-9	200-280-6	56-55-3		<0.014	mg/kg		<0.014	mg/kg	<0.0000014 %		**<LOD**
25		chrysene	601-048-00-0	205-923-4	218-01-9		<0.01	mg/kg		<0.01	mg/kg	<0.000001 %		**<LOD**
26		benzo[b]fluoranthene	601-034-00-4	205-911-9	205-99-2		<0.015	mg/kg		<0.015	mg/kg	<0.0000015 %		**<LOD**
27		benzo[k]fluoranthene	601-036-00-5	205-916-6	207-08-9		<0.014	mg/kg		<0.014	mg/kg	<0.0000014 %		**<LOD**
28		benzo[a]pyrene; benzo[def]chrysene	601-032-00-3	200-028-5	50-32-8		<0.015	mg/kg		<0.015	mg/kg	<0.0000015 %		**<LOD**
29	●	indeno[123-cd]pyrene		205-893-2	193-39-5		<0.018	mg/kg		<0.018	mg/kg	<0.0000018 %		**<LOD**
30		dibenz[a,h]anthracene	601-041-00-2	200-181-8	53-70-3		<0.023	mg/kg		<0.023	mg/kg	<0.0000023 %		**<LOD**
31	●	benzo[ghi]perylene		205-883-8	191-24-2		<0.024	mg/kg		<0.024	mg/kg	<0.0000024 %		**<LOD**
32	●	polychlorobiphenyls; PCB	602-039-00-4	215-648-1	1336-36-3		<0.021	mg/kg		<0.021	mg/kg	<0.0000021 %		**<LOD**
33		tert-butyl methyl ether; MTBE; 2-methoxy-2-methylpropane	603-181-00-X	216-653-1	1634-04-4		<0.01	mg/kg		<0.01	mg/kg	<0.000001 %		**<LOD**
34		benzene	601-020-00-8	200-753-7	71-43-2		<0.009	mg/kg		<0.009	mg/kg	<0.0000009 %		**<LOD**
35		toluene	601-021-00-3	203-625-9	108-88-3		<0.007	mg/kg		<0.007	mg/kg	<0.0000007 %		**<LOD**
36	●	ethylbenzene	601-023-00-4	202-849-4	100-41-4		<0.004	mg/kg		<0.004	mg/kg	<0.0000004 %		**<LOD**
37	●	coronene		205-881-7	191-07-1		<0.2	mg/kg		<0.2	mg/kg	<0.00002 %		**<LOD**
38	●	pH			PH		7.58	pH		7.58	pH	7.58 pH		
39		o-xylene; [1] p-xylene; [2] m-xylene; [3] xylene [4]	601-022-00-9	202-422-2 [1] 203-396-5 [2] 203-576-3 [3] 215-535-7 [4]	95-47-6 [1] 106-42-3 [2] 108-38-3 [3] 1330-20-7 [4]		<0.02	mg/kg		<0.02	mg/kg	<0.000002 %		**<LOD**
											Total:	0.0587 %		

Key

🟨	User supplied data
▨	Determinand values ignored for classification, see column 'Conc. Not Used' for reason
●	Determinand defined or amended by HazWasteOnline (see Appendix A)
⚛	Speciated Deteminand - Unless the Determinand is Note 1, the Conversion Factor is used to calculate the compound concentration
<LOD	Below limit of detection
ND	Not detected
CLP: Note 1	Only the metal concentration has been used for classification

WAC results for sample: TP1-0.50

WAC Settings: samples in this Job constitute a single population.

WAC limits used to evaluate this sample: "Ireland"
The WAC used in this report are the WAC defined for the inert and non-hazardous classes of landfill in the Republic of Ireland. You should check the actual acceptance criteria when the disposal site is identified as they may differ from the generic WAC used in this report.

The sample PASSES the Inert (Inert waste landfill) criteria.

The sample PASSES the Non Haz (Non hazardous waste landfill) criteria.

WAC Determinands

Solid Waste Analysis				Landfill Waste Acceptance Criteria Limits	
#	Determinand		User entered data	Inert waste landfill	Non hazardous waste landfill
1	TOC (total organic carbon)	%	0.774	3	5
2	LOI (loss on ignition)	%	4.72	-	-
3	BTEX (benzene, toluene, ethylbenzene and xylenes)	mg/kg	<0.04	6	-
4	PCBs (polychlorinated biphenyls, 7 congeners)	mg/kg	<0.021	1	-
5	Mineral oil (C10 to C40)	mg/kg	<5	500	-
6	PAHs (polycyclic aromatic hydrocarbons)	mg/kg	<10	100	-
7	pH	pH	7.58	-	>6
8	ANC (acid neutralisation capacity)	mol/kg		-	-
Eluate Analysis 10:1					
9	arsenic	mg/kg	<0.005	0.5	2
10	barium	mg/kg	0.0414	20	100
11	cadmium	mg/kg	<0.0008	0.04	1
12	chromium	mg/kg	<0.01	0.5	10
13	copper	mg/kg	0.0241	2	50
14	mercury	mg/kg	<0.0001	0.01	0.2
15	molybdenum	mg/kg	<0.03	0.5	10
16	nickel	mg/kg	0.0059	0.4	10
17	lead	mg/kg	<0.002	0.5	10
18	antimony	mg/kg	<0.01	0.06	0.7
19	selenium	mg/kg	<0.01	0.1	0.5
20	zinc	mg/kg	0.111	4	50
21	chloride	mg/kg	47	800	15,000
22	fluoride	mg/kg	<5	10	150
23	sulphate	mg/kg	913	1,000	20,000
24	phenol index	mg/kg	<0.16	1	-
25	DOC (dissolved organic carbon)	mg/kg	50.6	500	800
26	TDS (total dissolved solids)	mg/kg	2090	4,000	60,000

Key

🟨 User supplied data

Classification of sample: TP2-0.50

✓ Non Hazardous Waste
Classified as **17 05 04**
in the List of Waste

Sample details

Sample name:		LoW Code:	
TP2-0.50		Chapter:	17: Construction and Demolition Wastes (including excavated soil from contaminated sites)
Sample Depth:			
0.5 m		Entry:	17 05 04 (Soil and stones other than those mentioned in 17 05 03)
Moisture content:			
13% (wet weight correction)			

Hazard properties

None identified

Determinands

Moisture content: 13% Wet Weight Moisture Correction applied (MC)

#		Determinand			CLP Note	User entered data	Conv. Factor	Compound conc.	Classification value	MC Applied	Conc. Not Used
		EU CLP index number	EC Number	CAS Number							
1	●	TPH (C6 to C40) petroleum group				<10 mg/kg		<10 mg/kg	<0.001 %		**<LOD**
				TPH							
2	●	confirm TPH has NOT arisen from diesel or petrol				☑					
3		antimony { antimony trioxide }				1.57 mg/kg	1.197	1.635 mg/kg	0.000164 %	✓	
		051-005-00-X	215-175-0	1309-64-4							
4		arsenic { arsenic pentoxide }				11.1 mg/kg	1.534	14.813 mg/kg	0.00148 %	✓	
		033-004-00-6	215-116-9	1303-28-2							
5		barium { ● barium sulphide }				43.3 mg/kg	1.233	46.467 mg/kg	0.00465 %	✓	
		016-002-00-X	244-214-4	21109-95-5							
6		cadmium { cadmium sulfate }				2 mg/kg	1.855	3.227 mg/kg	0.000323 %	✓	
		048-009-00-9	233-331-6	10124-36-4							
7		copper { dicopper oxide; copper (I) oxide }				26.7 mg/kg	1.126	26.153 mg/kg	0.00262 %	✓	
		029-002-00-X	215-270-7	1317-39-1							
8		lead { ● lead compounds with the exception of those specified elsewhere in this Annex (worst case) }			1	15.8 mg/kg		13.746 mg/kg	0.00137 %	✓	
		082-001-00-6									
9		mercury { mercury dichloride }				<0.1 mg/kg	1.353	<0.135 mg/kg	<0.0000135 %		**<LOD**
		080-010-00-X	231-299-8	7487-94-7							
10		molybdenum { molybdenum(VI) oxide }				2.4 mg/kg	1.5	3.132 mg/kg	0.000313 %	✓	
		042-001-00-9	215-204-7	1313-27-5							
11		nickel { nickel sulfate }				38.4 mg/kg	2.637	88.086 mg/kg	0.00881 %	✓	
		028-009-00-5	232-104-9	7786-81-4							
12		selenium { selenium compounds with the exception of cadmium sulphoselenide and those specified elsewhere in this Annex }				2.06 mg/kg	1.405	2.518 mg/kg	0.000252 %	✓	
		034-002-00-8									
13		zinc { zinc sulphate }				88.3 mg/kg	2.469	189.694 mg/kg	0.019 %	✓	
		030-006-00-9	231-793-3 [1] 231-793-3 [2]	7446-19-7 [1] 7733-02-0 [2]							
14		chromium in chromium(III) compounds { ● chromium(III) oxide (worst case) }				5.38 mg/kg	1.462	6.841 mg/kg	0.000684 %	✓	
			215-160-9	1308-38-9							

#		Determinand	EU CLP index number	EC Number	CAS Number	CLP Note	User entered data	Conv. Factor	Compound conc.	Classification value	MC Applied	Conc. Not Used
15		chromium in chromium(VI) compounds { chromium(VI) oxide }	024-001-00-0	215-607-8	1333-82-0		<0.6 mg/kg	1.923	<1.154 mg/kg	<0.000115 %		<LOD
16		naphthalene	601-052-00-2	202-049-5	91-20-3		<0.009 mg/kg		<0.009 mg/kg	<0.0000009 %		<LOD
17	●	acenaphthylene		205-917-1	208-96-8		<0.012 mg/kg		<0.012 mg/kg	<0.0000012 %		<LOD
18	●	acenaphthene		201-469-6	83-32-9		<0.008 mg/kg		<0.008 mg/kg	<0.0000008 %		<LOD
19	●	fluorene		201-695-5	86-73-7		<0.01 mg/kg		<0.01 mg/kg	<0.000001 %		<LOD
20	●	phenanthrene		201-581-5	85-01-8		<0.015 mg/kg		<0.015 mg/kg	<0.0000015 %		<LOD
21	●	anthracene		204-371-1	120-12-7		<0.016 mg/kg		<0.016 mg/kg	<0.0000016 %		<LOD
22	●	fluoranthene		205-912-4	206-44-0		<0.017 mg/kg		<0.017 mg/kg	<0.0000017 %		<LOD
23	●	pyrene		204-927-3	129-00-0		<0.015 mg/kg		<0.015 mg/kg	<0.0000015 %		<LOD
24		benzo[a]anthracene	601-033-00-9	200-280-6	56-55-3		<0.014 mg/kg		<0.014 mg/kg	<0.0000014 %		<LOD
25		chrysene	601-048-00-0	205-923-4	218-01-9		<0.01 mg/kg		<0.01 mg/kg	<0.000001 %		<LOD
26		benzo[b]fluoranthene	601-034-00-4	205-911-9	205-99-2		<0.015 mg/kg		<0.015 mg/kg	<0.0000015 %		<LOD
27		benzo[k]fluoranthene	601-036-00-5	205-916-6	207-08-9		<0.014 mg/kg		<0.014 mg/kg	<0.0000014 %		<LOD
28		benzo[a]pyrene; benzo[def]chrysene	601-032-00-3	200-028-5	50-32-8		<0.015 mg/kg		<0.015 mg/kg	<0.0000015 %		<LOD
29	●	indeno[123-cd]pyrene		205-893-2	193-39-5		<0.018 mg/kg		<0.018 mg/kg	<0.0000018 %		<LOD
30		dibenz[a,h]anthracene	601-041-00-2	200-181-8	53-70-3		<0.023 mg/kg		<0.023 mg/kg	<0.0000023 %		<LOD
31	●	benzo[ghi]perylene		205-883-8	191-24-2		<0.024 mg/kg		<0.024 mg/kg	<0.0000024 %		<LOD
32	●	polychlorobiphenyls; PCB	602-039-00-4	215-648-1	1336-36-3		<0.021 mg/kg		<0.021 mg/kg	<0.0000021 %		<LOD
33		tert-butyl methyl ether; MTBE; 2-methoxy-2-methylpropane	603-181-00-X	216-653-1	1634-04-4		<0.01 mg/kg		<0.01 mg/kg	<0.000001 %		<LOD
34		benzene	601-020-00-8	200-753-7	71-43-2		<0.009 mg/kg		<0.009 mg/kg	<0.0000009 %		<LOD
35		toluene	601-021-00-3	203-625-9	108-88-3		<0.007 mg/kg		<0.007 mg/kg	<0.0000007 %		<LOD
36	●	ethylbenzene	601-023-00-4	202-849-4	100-41-4		<0.004 mg/kg		<0.004 mg/kg	<0.0000004 %		<LOD
37	●	coronene		205-881-7	191-07-1		<0.2 mg/kg		<0.2 mg/kg	<0.00002 %		<LOD
38	●	pH			PH		8.66 pH		8.66 pH	8.66 pH		
39		o-xylene; [1] p-xylene; [2] m-xylene; [3] xylene [4]	601-022-00-9	202-422-2 [1] 203-396-5 [2] 203-576-3 [3] 215-535-7 [4]	95-47-6 [1] 106-42-3 [2] 108-38-3 [3] 1330-20-7 [4]		<0.02 mg/kg		<0.02 mg/kg	<0.000002 %		<LOD
									Total:	0.0408 %		

Key

🟨	User supplied data
▨	Determinand values ignored for classification, see column 'Conc. Not Used' for reason
●	Determinand defined or amended by HazWasteOnline (see Appendix A)
⚛	Speciated Deteminand - Unless the Determinand is Note 1, the Conversion Factor is used to calculate the compound concentration
<LOD	Below limit of detection
ND	Not detected
CLP: Note 1	Only the metal concentration has been used for classification

WAC results for sample: TP2-0.50

WAC Settings: samples in this Job constitute a single population.

WAC limits used to evaluate this sample: "Ireland"
The WAC used in this report are the WAC defined for the inert and non-hazardous classes of landfill in the Republic of Ireland. You should check the actual acceptance criteria when the disposal site is identified as they may differ from the generic WAC used in this report.

The sample PASSES the Inert (Inert waste landfill) criteria.

The sample PASSES the Non Haz (Non hazardous waste landfill) criteria.

WAC Determinands

Solid Waste Analysis				Landfill Waste Acceptance Criteria Limits	
#	Determinand		User entered data	Inert waste landfill	Non hazardous waste landfill
1	TOC (total organic carbon)	%	0.433	3	5
2	LOI (loss on ignition)	%	2.33	-	-
3	BTEX (benzene, toluene, ethylbenzene and xylenes)	mg/kg	<0.04	6	-
4	PCBs (polychlorinated biphenyls, 7 congeners)	mg/kg	<0.021	1	-
5	Mineral oil (C10 to C40)	mg/kg	<5	500	-
6	PAHs (polycyclic aromatic hydrocarbons)	mg/kg	<10	100	-
7	pH	pH	8.66	-	>6
8	ANC (acid neutralisation capacity)	mol/kg		-	-
Eluate Analysis 10:1					
9	arsenic	mg/kg	<0.005	0.5	2
10	barium	mg/kg	0.0292	20	100
11	cadmium	mg/kg	<0.0008	0.04	1
12	chromium	mg/kg	<0.01	0.5	10
13	copper	mg/kg	<0.003	2	50
14	mercury	mg/kg	<0.0001	0.01	0.2
15	molybdenum	mg/kg	<0.03	0.5	10
16	nickel	mg/kg	<0.004	0.4	10
17	lead	mg/kg	<0.002	0.5	10
18	antimony	mg/kg	<0.01	0.06	0.7
19	selenium	mg/kg	<0.01	0.1	0.5
20	zinc	mg/kg	0.0557	4	50
21	chloride	mg/kg	<20	800	15,000
22	fluoride	mg/kg	<5	10	150
23	sulphate	mg/kg	<20	1,000	20,000
24	phenol index	mg/kg	<0.16	1	-
25	DOC (dissolved organic carbon)	mg/kg	33.1	500	800
26	TDS (total dissolved solids)	mg/kg	888	4,000	60,000

Key

🟨 User supplied data

Appendix A: Classifier defined and non EU CLP determinands

TPH (C6 to C40) petroleum group (CAS Number: TPH)

Description/Comments: Hazard statements taken from WM3 1st Edition 2015; Risk phrases: WM2 3rd Edition 2013
Data source: WM3 1st Edition 2015
Data source date: 25 May 2015
Hazard Statements: Flam. Liq. 3; H226 , Asp. Tox. 1; H304 , STOT RE 2; H373 , Muta. 1B; H340 , Carc. 1B; H350 , Repr. 2; H361d , Aquatic Chronic 2; H411

confirm TPH has NOT arisen from diesel or petrol

Description/Comments: Chapter 3, section 4b requires a positive confirmation for benzo[a]pyrene to be used as a marker in evaluating Carc. 1B; H350 (HP 7) and Muta. 1B; H340 (HP 11)
Data source: WM3 1st Edition 2015
Data source date: 25 May 2015
Hazard Statements: None.

barium sulphide (EC Number: 244-214-4, CAS Number: 21109-95-5)

EU CLP index number: 016-002-00-X
Description/Comments:
Additional Hazard Statement(s): EUH031 >= 0.8 %
Reason for additional Hazards Statement(s):
14 Dec 2015 - EUH031 >= 0.8 % hazard statement sourced from: WM3, Table C12.2

lead compounds with the exception of those specified elsewhere in this Annex (worst case)

EU CLP index number: 082-001-00-6
Description/Comments: Worst Case: IARC considers lead compounds Group 2A; Probably carcinogenic to humans; Lead REACH Consortium, following CLP protocols, considers lead compounds from smelting industries, flue dust and similar to be Carcinogenic category 1A
Additional Hazard Statement(s): Carc. 1A; H350
Reason for additional Hazards Statement(s):
03 Jun 2015 - Carc. 1A; H350 hazard statement sourced from: IARC Group 2A (Sup 7, 87) 2006; Lead REACH Consortium www.reach-lead.eu/substanceinformation.html (worst case lead compounds). Review date 29/09/2015

chromium(III) oxide (worst case) (EC Number: 215-160-9, CAS Number: 1308-38-9)

Description/Comments: Data from C&L Inventory Database
Data source: https://echa.europa.eu/information-on-chemicals/cl-inventory-database/-/discli/details/33806
Data source date: 17 Jul 2015
Hazard Statements: Acute Tox. 4; H332 , Acute Tox. 4; H302 , Eye Irrit. 2; H319 , STOT SE 3; H335 , Skin Irrit. 2; H315 , Resp. Sens. 1; H334 , Skin Sens. 1; H317 , Repr. 1B; H360FD , Aquatic Acute 1; H400 , Aquatic Chronic 1; H410

acenaphthylene (EC Number: 205-917-1, CAS Number: 208-96-8)

Description/Comments: Data from C&L Inventory Database
Data source: http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database
Data source date: 17 Jul 2015
Hazard Statements: Acute Tox. 4; H302 , Acute Tox. 1; H330 , Acute Tox. 1; H310 , Eye Irrit. 2; H319 , STOT SE 3; H335 , Skin Irrit. 2; H315

acenaphthene (EC Number: 201-469-6, CAS Number: 83-32-9)

Description/Comments: Data from C&L Inventory Database
Data source: http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database
Data source date: 17 Jul 2015
Hazard Statements: Eye Irrit. 2; H319 , STOT SE 3; H335 , Skin Irrit. 2; H315 , Aquatic Acute 1; H400 , Aquatic Chronic 1; H410 , Aquatic Chronic 2; H411

fluorene (EC Number: 201-695-5, CAS Number: 86-73-7)

Description/Comments: Data from C&L Inventory Database
Data source: http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database
Data source date: 06 Aug 2015
Hazard Statements: Aquatic Acute 1; H400 , Aquatic Chronic 1; H410

phenanthrene (EC Number: 201-581-5, CAS Number: 85-01-8)

Description/Comments: Data from C&L Inventory Database
Data source: http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database
Data source date: 06 Aug 2015
Hazard Statements: Acute Tox. 4; H302 , Eye Irrit. 2; H319 , STOT SE 3; H335 , Carc. 2; H351 , Skin Sens. 1; H317 , Aquatic Acute 1; H400 , Aquatic Chronic 1; H410 , Skin Irrit. 2; H315

anthracene (EC Number: 204-371-1, CAS Number: 120-12-7)

Description/Comments: Data from C&L Inventory Database
Data source: http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database
Data source date: 17 Jul 2015
Hazard Statements: Eye Irrit. 2; H319 , STOT SE 3; H335 , Skin Irrit. 2; H315 , Skin Sens. 1; H317 , Aquatic Acute 1; H400 , Aquatic Chronic 1; H410

fluoranthene (EC Number: 205-912-4, CAS Number: 206-44-0)

Description/Comments: Data from C&L Inventory Database
Data source: http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database
Data source date: 21 Aug 2015
Hazard Statements: Acute Tox. 4; H302 , Aquatic Acute 1; H400 , Aquatic Chronic 1; H410

pyrene (EC Number: 204-927-3, CAS Number: 129-00-0)

Description/Comments: Data from C&L Inventory Database; SDS Sigma Aldrich 2014
Data source: http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database
Data source date: 21 Aug 2015
Hazard Statements: Skin Irrit. 2; H315 , Eye Irrit. 2; H319 , STOT SE 3; H335 , Aquatic Acute 1; H400 , Aquatic Chronic 1; H410

indeno[123-cd]pyrene (EC Number: 205-893-2, CAS Number: 193-39-5)

Description/Comments: Data from C&L Inventory Database
Data source: http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database
Data source date: 06 Aug 2015
Hazard Statements: Carc. 2; H351

benzo[ghi]perylene (EC Number: 205-883-8, CAS Number: 191-24-2)

Description/Comments: Data from C&L Inventory Database; SDS Sigma Aldrich 28/02/2015
Data source: http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database
Data source date: 23 Jul 2015
Hazard Statements: Aquatic Acute 1; H400 , Aquatic Chronic 1; H410

polychlorobiphenyls; PCB (EC Number: 215-648-1, CAS Number: 1336-36-3)

EU CLP index number: 602-039-00-4
Description/Comments: Worst Case: IARC considers PCB Group 1; Carcinogenic to humans; POP specific threshold from ATP1 (Regulation 756/2010/EU) to POPs Regulation (Regulation 850/2004/EC). Where applicable, the calculation method laid down in European standards EN 12766-1 and EN 12766-2 shall be applied.
Additional Hazard Statement(s): Carc. 1A; H350
Reason for additional Hazards Statement(s):
29 Sep 2015 - Carc. 1A; H350 hazard statement sourced from: IARC Group 1 (23, Sup 7, 100C) 2012

ethylbenzene (EC Number: 202-849-4, CAS Number: 100-41-4)

EU CLP index number: 601-023-00-4
Description/Comments:
Additional Hazard Statement(s): Carc. 2; H351
Reason for additional Hazards Statement(s):
03 Jun 2015 - Carc. 2; H351 hazard statement sourced from: IARC Group 2B (77) 2000

coronene (EC Number: 205-881-7, CAS Number: 191-07-1)

Description/Comments: Data from C&L Inventory Database; no entries in Registered Substances or Pesticides Properties databases; SDS: Sigma Aldrich, 1907/2006 compliant, dated 2012 - no entries; IARC – Group 3, not carcinogenic.
Data source: http://clp-inventory.echa.europa.eu/SummaryOfClassAndLabelling.aspx?SubstanceID=17010&HarmOnly=no?fc=true&lang=en
Data source date: 16 Jun 2014
Hazard Statements: STOT SE 2; H371

pH (CAS Number: PH)

Description/Comments: Appendix C4
Data source: WM3 1st Edition 2015
Data source date: 25 May 2015
Hazard Statements: None.

Appendix B: Rationale for selection of metal species

antimony {antimony trioxide}

Worst case scenario.

arsenic {arsenic pentoxide}

Arsenic pentoxide used as most hazardous species.

barium {barium sulphide}

Chromium VII at limits of detection. Barium sulphide used as the next most hazardous species. No chromate present.

cadmium {cadmium sulfate}

Cadmium sulphate used as the most hazardous species.

copper {dicopper oxide; copper (I) oxide}

Reasonable case CLP species based on hazard statements/molecular weight and insolubility in water. Worse case copper sulphate is very soluble and likely to have been leached away if ever present and/or not enough soluble sulphate detected.

lead {lead compounds with the exception of those specified elsewhere in this Annex (worst case)}

Chromium VII at limits of detection. Lead compounds used as the next most hazardous species. No chromate present.

mercury {mercury dichloride}

Worst case CLP species based on hazard statements/molecular weight

molybdenum {molybdenum(VI) oxide}

Worst case CLP species based on hazard statements/molecular weight.

nickel {nickel sulfate}

Chromium VII at limits of detection. Nickel sulphate used as the next most hazardous species. No chromate present.

selenium {selenium compounds with the exception of cadmium sulphoselenide and those specified elsewhere in this Annex}

Harmonised group entry used as most reasonable case. Pigment cadmium sulphoselenide not likely to be present in this soil. No evidence for the other CLP entries: sodium selenite, nickel II selenite and nickel selenide, to be present in this soil.

zinc {zinc sulphate}

Chromium VII at limits of detection. Zinc sulphate used as the next most hazardous species. No chromate present.

chromium in chromium(III) compounds {chromium(III) oxide (worst case)}

Reasonable case species based on hazard statements/molecular weight. Industrial sources include: tanning, pigment in paint, inks and glass

chromium in chromium(VI) compounds {chromium(VI) oxide}

Worst case CLP species based on hazard statements/molecular weight. Industrial sources include: production stainless steel, electroplating, wood preservation, anti-corrosion agents or coatings, pigments.

Appendix C: Version

HazWasteOnline Classification Engine: WM3 1st Edition v1.1.NI - Jan 2021
HazWasteOnline Classification Engine Version: 2022.25.4995.9469 (25 Jan 2022)
HazWasteOnline Database: 2022.25.4995.9469 (25 Jan 2022)

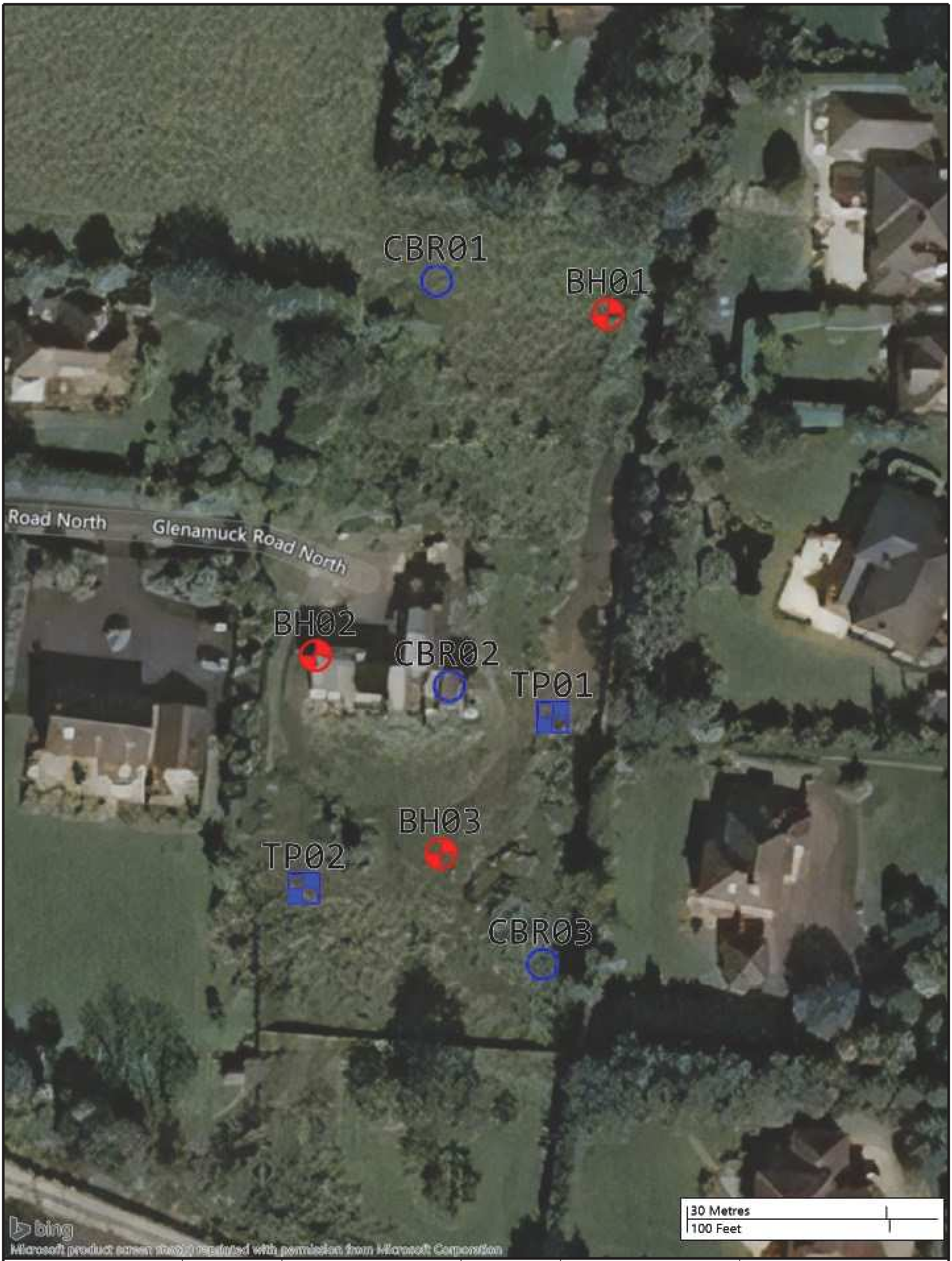
This classification utilises the following guidance and legislation:
WM3 v1.1.NI - Waste Classification - 1st Edition v1.1.NI - Jan 2021
CLP Regulation - Regulation 1272/2008/EC of 16 December 2008
1st ATP - Regulation 790/2009/EC of 10 August 2009
2nd ATP - Regulation 286/2011/EC of 10 March 2011
3rd ATP - Regulation 618/2012/EU of 10 July 2012
4th ATP - Regulation 487/2013/EU of 8 May 2013
Correction to 1st ATP - Regulation 758/2013/EU of 7 August 2013
5th ATP - Regulation 944/2013/EU of 2 October 2013
6th ATP - Regulation 605/2014/EU of 5 June 2014
WFD Annex III replacement - Regulation 1357/2014/EU of 18 December 2014
Revised List of Waste 2014 - Decision 2014/955/EU of 18 December 2014
7th ATP - Regulation 2015/1221/EU of 24 July 2015
8th ATP - Regulation (EU) 2016/918 of 19 May 2016
9th ATP - Regulation (EU) 2016/1179 of 19 July 2016
10th ATP - Regulation (EU) 2017/776 of 4 May 2017
HP14 amendment - Regulation (EU) 2017/997 of 8 June 2017
13th ATP - Regulation (EU) 2018/1480 of 4 October 2018
14th ATP - Regulation (EU) 2020/217 of 4 October 2019
15th ATP - Regulation (EU) 2020/1182 of 19 May 2020
The Chemicals (Health and Safety) and Genetically Modified Organisms (Contained Use)(Amendment etc.) (EU Exit) Regulations 2020 - UK: 2020 No. 1567 of 16th December 2020
The Waste and Environmental Permitting etc. (Legislative Functions and Amendment etc.) (EU Exit) Regulations 2020 - UK: 2020 No. 1540 of 16th December 2020
17th ATP - Regulation (EU) 2021/849 of 11 March 2021

Appendix 6

Survey Data

Survey Data

Location	**Irish Transverse Mercator**		**Elevation**	**Irish National Grid**	
	Easting	**Northing**		**Easting**	**Northing**
Boreholes					
BH01	722117.586	724360.108	76.99	322193.405	224331.750
BH02	722074.667	724307.451	72.99	322150.477	224279.081
BH03	722094.334	724278.123	71.53	322170.149	224249.747
Trial Pits					
TP01	722110.735	724299.073	72.99	322186.553	224270.701
TP02	722073.854	724272.291	71.24	322149.665	224243.913
California Bearing Ratio Tests					
CBR01	722091.547	724364.425	76.89	322167.360	224336.067
CBR02	722094.796	724303.359	73.11	322170.611	224274.988
CBR03	722110.014	724261.793	71.09	322185.832	224233.413



Microsoft product screen shot(s) reprinted with permission from Microsoft Corporation

Contract No:	5942	Client:	Carricail Development Company Ltd
Contract:	Carricail	Engineer:	Waterman Moylan
Location:	Glenamuck Road North, Carrickmines, Dublin 18	Scale:	1:750
Title:	Site Plan	Drawn By:	SL

Legend Key

🟥	Locations By Type - CP
○	Locations By Type - ICBR
🟦	Locations By Type - TP

B. Attenuation Calculations

Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	5	Maximum Rainfall (mm/hr)	50.0
Additional Flow (%)	0	Minimum Velocity (m/s)	1.00
FSR Region	Scotland and Ireland	Connection Type	Level Soffits
M5-60 (mm)	16.800	Minimum Backdrop Height (m)	0.200
Ratio-R	0.272	Preferred Cover Depth (m)	1.200
CV	1.000	Include Intermediate Ground	✓
Time of Entry (mins)	4.00	Enforce best practice design rules	✓

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
S01	0.080	4.00	76.580	1200	721996.080	724371.744	1.580
S02	0.160	4.00	76.350	1200	722028.522	724368.946	2.900
S03	0.008	4.00	76.400	1200	722037.332	724376.129	3.200
S04	0.087	4.00	76.400	1200	722055.627	724369.838	3.264
S05			76.210	1200	722058.792	724367.213	3.101
S06	0.015	4.00	76.050	1200	722073.846	724366.022	3.042
S07	0.031	4.00	77.450	1200	722121.870	724365.461	2.316
S08	0.022	4.00	76.100	1200	722087.892	724370.316	1.652
S09	0.013	4.00	75.800	1200	722082.417	724365.153	2.900
S09A			74.960	1350	722081.641	724358.923	2.358
S10	0.118	4.00	74.960	1350	722079.540	724357.261	3.860
S11	0.005	4.00	74.070	1350	722077.275	724329.207	3.158
S12			73.870	1200	722076.437	724320.471	3.013
S13			73.050	1200	722112.202	724316.307	2.643
S14			71.200	1200	722107.058	724252.499	2.073
EX.S8			71.195	1200	722108.763	724250.279	2.096

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
S1.000	32.563	150.0	225	Circular	76.580	75.000	1.355	76.350	74.783	1.342
S1.001	11.367	150.0	300	Circular	76.350	73.450	2.600	76.400	73.374	2.726
TANK 1	19.346	300.0	300	Circular	76.400	73.200	2.900	76.400	73.136	2.964
S1.003	4.115	150.0	300	Circular	76.400	73.136	2.964	76.210	73.109	2.801
S1.004	15.104	150.0	300	Circular	76.210	73.109	2.801	76.050	73.008	2.742
S1.005	8.615	80.0	300	Circular	76.050	73.008	2.742	75.800	72.900	2.600
S2.000	34.323	50.0	225	Circular	77.450	75.134	2.091	76.100	74.448	1.427
S2.001	7.525	50.0	225	Circular	76.100	74.448	1.427	75.800	74.297	1.278

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
S1.000	S01	1200	Manhole	Adoptable	S02	1200	Manhole	Adoptable
S1.001	S02	1200	Manhole	Adoptable	S03	1200	Manhole	Adoptable
TANK 1	S03	1200	Manhole	Adoptable	S04	1200	Manhole	Adoptable
S1.003	S04	1200	Manhole	Adoptable	S05	1200	Manhole	Adoptable
S1.004	S05	1200	Manhole	Adoptable	S06	1200	Manhole	Adoptable
S1.005	S06	1200	Manhole	Adoptable	S09	1200	Manhole	Adoptable
S2.000	S07	1200	Manhole	Adoptable	S08	1200	Manhole	Adoptable
S2.001	S08	1200	Manhole	Adoptable	S09	1200	Manhole	Adoptable

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
S2.002	6.279	50.0	300	Circular	75.800	72.900	2.600	74.960	72.774	1.886
S2.002A	2.679	297.6	300	Circular	74.960	72.602	2.058	74.960	72.593	2.067
TANK 2	28.145	150.0	375	Circular	74.960	71.100	3.485	74.070	70.912	2.783
S2.003	8.776	100.0	300	Circular	74.070	70.945	2.825	73.870	70.857	2.713
S2.004	36.007	80.0	225	Circular	73.870	70.857	2.788	73.050	70.407	2.418
S2.005	64.015	50.0	225	Circular	73.050	70.407	2.418	71.200	69.127	1.848
S2.006	2.799	100.0	225	Circular	71.200	69.127	1.848	71.195	69.099	1.871

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
S2.002	S09	1200	Manhole	Adoptable	S09A	1350	Manhole	Adoptable
S2.002A	S09A	1350	Manhole	Adoptable	S10	1350	Manhole	Adoptable
TANK 2	S10	1350	Manhole	Adoptable	S11	1350	Manhole	Adoptable
S2.003	S11	1350	Manhole	Adoptable	S12	1200	Manhole	Adoptable
S2.004	S12	1200	Manhole	Adoptable	S13	1200	Manhole	Adoptable
S2.005	S13	1200	Manhole	Adoptable	S14	1200	Manhole	Adoptable
S2.006	S14	1200	Manhole	Adoptable	EX.S8	1200	Manhole	Adoptable

Simulation Settings

Rainfall Methodology	FSR	Analysis Speed	Normal
FSR Region	Scotland and Ireland	Skip Steady State	x
M5-60 (mm)	16.800	Drain Down Time (mins)	240
Ratio-R	0.272	Additional Storage (m³/ha)	20.0
Summer CV	1.000	Check Discharge Rate(s)	x
Winter CV	1.000	Check Discharge Volume	x

Storm Durations

15	60	180	360	600	960	2160	4320	7200	10080
30	120	240	480	720	1440	2880	5760	8640	

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
100	30	0	0

Node S05 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	73.109	Product Number	CTL-SHE-0056-2000-2227-2000
Design Depth (m)	2.227	Min Outlet Diameter (m)	0.075
Design Flow (l/s)	2.0	Min Node Diameter (mm)	1200

Node S12 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	70.857	Product Number	CTL-SHE-0056-2100-2388-2100
Design Depth (m)	2.388	Min Outlet Diameter (m)	0.075
Design Flow (l/s)	2.1	Min Node Diameter (mm)	1200

Node S04 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	5.0	Invert Level (m)	73.136
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	

Depth (m)	**Area (m²)**	**Inf Area (m²)**	**Depth (m)**	**Area (m²)**	**Inf Area (m²)**	**Depth (m)**	**Area (m²)**	**Inf Area (m²)**
0.000	114.1	0.0	2.200	114.1	0.0	2.201	0.0	0.0

Node S11 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	5.0	Invert Level (m)	70.912
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	

Depth (m)	**Area (m²)**	**Inf Area (m²)**	**Depth (m)**	**Area (m²)**	**Inf Area (m²)**	**Depth (m)**	**Area (m²)**	**Inf Area (m²)**
0.000	113.0	0.0	2.300	113.0	0.0	2.301	0.0	0.0

Results for 100 year +30% CC Critical Storm Duration. Lowest mass balance: 99.65%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
1440 minute winter	S01	1230	75.282	0.282	2.7	0.6056	0.0000	SURCHARGED
1440 minute winter	S02	1230	75.282	1.832	8.0	4.0936	0.0000	SURCHARGED
1440 minute winter	S03	1230	75.282	2.082	8.1	2.4593	0.0000	SURCHARGED
1440 minute winter	S04	1230	75.282	2.146	10.9	248.4689	0.0000	SURCHARGED
1440 minute winter	S05	1230	75.282	2.173	2.0	2.4580	0.0000	SURCHARGED
4320 minute winter	S06	4080	73.209	0.201	2.4	0.2477	0.0000	OK
15 minute summer	S07	10	75.211	0.077	18.9	0.1081	0.0000	OK
15 minute summer	S08	10	74.567	0.119	32.3	0.1661	0.0000	OK
4320 minute winter	S09	4080	73.210	0.310	2.9	0.3789	0.0000	SURCHARGED
4320 minute winter	S09A	4080	73.210	0.607	3.5	0.8693	0.0000	SURCHARGED
4320 minute winter	S10	4080	73.207	2.107	6.4	4.3039	0.0000	SURCHARGED
4320 minute winter	S11	4080	73.208	2.296	4.9	262.8422	0.0000	SURCHARGED
4320 minute winter	S12	4080	73.208	2.351	4.9	2.6593	0.0000	SURCHARGED
4320 minute winter	S13	4080	70.433	0.026	2.1	0.0295	0.0000	OK
4320 minute winter	S14	4080	69.160	0.033	2.1	0.0375	0.0000	OK
4320 minute winter	EX.S8	4080	69.130	0.031	2.1	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
1440 minute winter	S01	S1.000	S02	2.7	0.599	0.064	1.2951	
1440 minute winter	S02	S1.001	S03	7.8	0.587	0.086	0.8005	
1440 minute winter	S03	TANK 1	S04	8.0	0.470	0.126	1.3623	
1440 minute winter	S04	S1.003	S05	2.0	0.143	0.022	0.2898	
1440 minute winter	S05	Hydro-Brake®	S06	2.0				
4320 minute winter	S06	S1.005	S09	2.4	0.642	0.019	0.5195	
15 minute summer	S07	S2.000	S08	18.9	1.144	0.256	0.5719	
15 minute summer	S08	S2.001	S09	32.3	1.653	0.438	0.1469	
4320 minute winter	S09	S2.002	S09A	3.5	0.847	0.022	0.4422	
4320 minute winter	S09A	S2.002A	S10	5.5	0.470	0.085	0.1887	
4320 minute winter	S10	TANK 2	S11	4.9	0.425	0.030	3.1043	
4320 minute winter	S11	S2.003	S12	4.9	0.254	0.044	0.6180	
4320 minute winter	S12	Hydro-Brake®	S13	2.1				
4320 minute winter	S13	S2.005	S14	2.1	0.682	0.028	0.1973	
4320 minute winter	S14	S2.006	EX.S8	2.1	0.610	0.040	0.0096	423.5

C. Surface Water Network Calculations

Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	5	Maximum Rainfall (mm/hr)	50.0
Additional Flow (%)	0	Minimum Velocity (m/s)	1.00
FSR Region	Scotland and Ireland	Connection Type	Level Soffits
M5-60 (mm)	16.800	Minimum Backdrop Height (m)	0.200
Ratio-R	0.272	Preferred Cover Depth (m)	1.200
CV	1.000	Include Intermediate Ground	✓
Time of Entry (mins)	4.00	Enforce best practice design rules	✓

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
S01	0.080	4.00	76.580	1200	721996.080	724371.744	1.580
S02	0.160	4.00	76.350	1200	722028.522	724368.946	2.900
S03	0.008	4.00	76.400	1200	722037.332	724376.129	3.200
S04	0.087	4.00	76.400	1200	722055.627	724369.838	3.264
S05			76.210	1200	722058.792	724367.213	3.101
S06	0.015	4.00	76.050	1200	722073.846	724366.022	3.042
S07	0.031	4.00	77.450	1200	722121.870	724365.461	2.316
S08	0.022	4.00	76.100	1200	722087.892	724370.316	1.652
S09	0.013	4.00	75.800	1200	722082.417	724365.153	2.900
S09A			74.960	1350	722081.641	724358.923	2.358
S10	0.118	4.00	74.960	1350	722079.540	724357.261	3.860
S11	0.005	4.00	74.070	1350	722077.275	724329.207	3.158
S12			73.870	1200	722076.437	724320.471	3.013
S13			73.050	1200	722112.202	724316.307	2.643
S14			71.200	1200	722107.058	724252.499	2.073
EX.S8			71.195	1200	722108.763	724250.279	2.096

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
S1.000	S01	S02	32.563	0.600	75.000	74.783	0.217	150.0	225	4.51	50.0
S1.001	S02	S03	11.367	0.600	73.450	73.374	0.076	150.0	300	4.66	50.0
TANK 1	S03	S04	19.346	0.600	73.200	73.136	0.064	300.0	300	5.01	50.0
S1.003	S04	S05	4.115	0.600	73.136	73.109	0.027	150.0	300	5.07	50.0
S1.004	S05	S06	15.104	0.600	73.109	73.008	0.101	150.0	300	5.26	50.0
S1.005	S06	S09	8.615	0.600	73.008	72.900	0.108	80.0	300	5.35	50.0
S2.000	S07	S08	34.323	0.600	75.134	74.448	0.686	50.0	225	4.31	50.0
S2.001	S08	S09	7.525	0.600	74.448	74.297	0.151	50.0	225	4.38	50.0

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)
S1.000	1.065	42.3	14.5	1.355	1.342	0.080	0.0
S1.001	1.281	90.6	43.4	2.600	2.726	0.240	0.0
TANK 1	0.902	63.8	44.8	2.900	2.964	0.248	0.0
S1.003	1.281	90.6	60.5	2.964	2.801	0.335	0.0
S1.004	1.281	90.6	60.5	2.801	2.742	0.335	0.0
S1.005	1.759	124.3	63.2	2.742	2.600	0.350	0.0
S2.000	1.854	73.7	5.6	2.091	1.427	0.031	0.0
S2.001	1.854	73.7	9.6	1.427	1.278	0.053	0.0

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
S2.002	S09	S09A	6.279	0.600	72.900	72.774	0.126	50.0	300	5.39	50.0
S2.002A	S09A	S10	2.679	0.600	72.602	72.593	0.009	297.6	300	5.44	50.0
TANK 2	S10	S11	28.145	0.600	71.100	70.912	0.188	150.0	375	5.76	50.0
S2.003	S11	S12	8.776	0.600	70.945	70.857	0.088	100.0	300	5.85	50.0
S2.004	S12	S13	36.007	0.600	70.857	70.407	0.450	80.0	225	6.26	50.0
S2.005	S13	S14	64.015	0.600	70.407	69.127	1.280	50.0	225	6.84	50.0
S2.006	S14	EX.S8	2.799	0.600	69.127	69.099	0.028	100.0	225	6.87	50.0

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)
S2.002	2.228	157.5	75.2	2.600	1.886	0.416	0.0
S2.002A	0.906	64.0	75.2	2.058	2.067	0.416	0.0
TANK 2	1.477	163.1	96.5	3.485	2.783	0.534	0.0
S2.003	1.572	111.1	97.4	2.825	2.713	0.539	0.0
S2.004	1.463	58.2	97.4	2.788	2.418	0.539	0.0
S2.005	1.854	73.7	97.4	2.418	1.848	0.539	0.0
S2.006	1.307	52.0	97.4	1.848	1.871	0.539	0.0

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
S1.000	32.563	150.0	225	Circular	76.580	75.000	1.355	76.350	74.783	1.342
S1.001	11.367	150.0	300	Circular	76.350	73.450	2.600	76.400	73.374	2.726
TANK 1	19.346	300.0	300	Circular	76.400	73.200	2.900	76.400	73.136	2.964
S1.003	4.115	150.0	300	Circular	76.400	73.136	2.964	76.210	73.109	2.801
S1.004	15.104	150.0	300	Circular	76.210	73.109	2.801	76.050	73.008	2.742
S1.005	8.615	80.0	300	Circular	76.050	73.008	2.742	75.800	72.900	2.600
S2.000	34.323	50.0	225	Circular	77.450	75.134	2.091	76.100	74.448	1.427
S2.001	7.525	50.0	225	Circular	76.100	74.448	1.427	75.800	74.297	1.278
S2.002	6.279	50.0	300	Circular	75.800	72.900	2.600	74.960	72.774	1.886
S2.002A	2.679	297.6	300	Circular	74.960	72.602	2.058	74.960	72.593	2.067
TANK 2	28.145	150.0	375	Circular	74.960	71.100	3.485	74.070	70.912	2.783
S2.003	8.776	100.0	300	Circular	74.070	70.945	2.825	73.870	70.857	2.713
S2.004	36.007	80.0	225	Circular	73.870	70.857	2.788	73.050	70.407	2.418

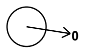
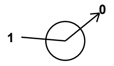
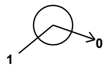
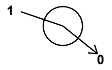
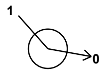
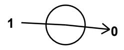
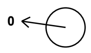
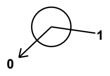
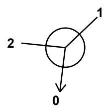
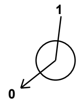
Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
S1.000	S01	1200	Manhole	Adoptable	S02	1200	Manhole	Adoptable
S1.001	S02	1200	Manhole	Adoptable	S03	1200	Manhole	Adoptable
TANK 1	S03	1200	Manhole	Adoptable	S04	1200	Manhole	Adoptable
S1.003	S04	1200	Manhole	Adoptable	S05	1200	Manhole	Adoptable
S1.004	S05	1200	Manhole	Adoptable	S06	1200	Manhole	Adoptable
S1.005	S06	1200	Manhole	Adoptable	S09	1200	Manhole	Adoptable
S2.000	S07	1200	Manhole	Adoptable	S08	1200	Manhole	Adoptable
S2.001	S08	1200	Manhole	Adoptable	S09	1200	Manhole	Adoptable
S2.002	S09	1200	Manhole	Adoptable	S09A	1350	Manhole	Adoptable
S2.002A	S09A	1350	Manhole	Adoptable	S10	1350	Manhole	Adoptable
TANK 2	S10	1350	Manhole	Adoptable	S11	1350	Manhole	Adoptable
S2.003	S11	1350	Manhole	Adoptable	S12	1200	Manhole	Adoptable
S2.004	S12	1200	Manhole	Adoptable	S13	1200	Manhole	Adoptable

Pipeline Schedule

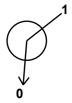
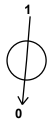
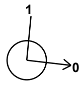
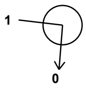
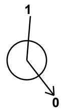
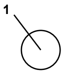
Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
S2.005	64.015	50.0	225	Circular	73.050	70.407	2.418	71.200	69.127	1.848
S2.006	2.799	100.0	225	Circular	71.200	69.127	1.848	71.195	69.099	1.871

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
S2.005	S13	1200	Manhole	Adoptable	S14	1200	Manhole	Adoptable
S2.006	S14	1200	Manhole	Adoptable	EX.S8	1200	Manhole	Adoptable

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections		Link	IL (m)	Dia (mm)
S01	721996.080	724371.744	76.580	1.580	1200		0	S1.000	75.000	225
S02	722028.522	724368.946	76.350	2.900	1200		1	S1.000	74.783	225
							0	S1.001	73.450	300
S03	722037.332	724376.129	76.400	3.200	1200		1	S1.001	73.374	300
							0	TANK 1	73.200	300
S04	722055.627	724369.838	76.400	3.264	1200		1	TANK 1	73.136	300
							0	S1.003	73.136	300
S05	722058.792	724367.213	76.210	3.101	1200		1	S1.003	73.109	300
							0	S1.004	73.109	300
S06	722073.846	724366.022	76.050	3.042	1200		1	S1.004	73.008	300
							0	S1.005	73.008	300
S07	722121.870	724365.461	77.450	2.316	1200		0	S2.000	75.134	225
S08	722087.892	724370.316	76.100	1.652	1200		1	S2.000	74.448	225
							0	S2.001	74.448	225
S09	722082.417	724365.153	75.800	2.900	1200		1	S2.001	74.297	225
							2	S1.005	72.900	300
							0	S2.002	72.900	300
S09A	722081.641	724358.923	74.960	2.358	1350		1	S2.002	72.774	300
							0	S2.002A	72.602	300

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections		Link	IL (m)	Dia (mm)
S10	722079.540	724357.261	74.960	3.860	1350		1	S2.002A	72.593	300
							0	TANK 2	71.100	375
S11	722077.275	724329.207	74.070	3.158	1350		1	TANK 2	70.912	375
							0	S2.003	70.945	300
S12	722076.437	724320.471	73.870	3.013	1200		1	S2.003	70.857	300
							0	S2.004	70.857	225
S13	722112.202	724316.307	73.050	2.643	1200		1	S2.004	70.407	225
							0	S2.005	70.407	225
S14	722107.058	724252.499	71.200	2.073	1200		1	S2.005	69.127	225
							0	S2.006	69.127	225
EX.S8	722108.763	724250.279	71.195	2.096	1200		1	S2.006	69.099	225

Simulation Settings

Rainfall Methodology	FSR	Analysis Speed	Normal
FSR Region	Scotland and Ireland	Skip Steady State	x
M5-60 (mm)	16.800	Drain Down Time (mins)	240
Ratio-R	0.272	Additional Storage (m³/ha)	20.0
Summer CV	1.000	Check Discharge Rate(s)	x
Winter CV	1.000	Check Discharge Volume	x

Storm Durations

15	60	180	360	600	960	2160	4320	7200	10080
30	120	240	480	720	1440	2880	5760	8640	

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
5	0	0	0
30	30	0	0
100	30	0	0

Results for 5 year Critical Storm Duration. Lowest mass balance: 99.65%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m^3)	Flood (m^3)	Status
15 minute summer	S01	10	75.111	0.111	19.8	0.2383	0.0000	OK
1440 minute summer	S02	1050	73.916	0.466	5.4	1.0415	0.0000	SURCHARGED
1440 minute summer	S03	1050	73.916	0.716	5.4	0.8458	0.0000	SURCHARGED
1440 minute summer	S04	1050	73.916	0.780	7.3	90.3162	0.0000	SURCHARGED
1440 minute summer	S05	1050	73.916	0.807	1.3	0.9129	0.0000	SURCHARGED
15 minute summer	S06	10	73.048	0.040	4.9	0.0497	0.0000	OK
15 minute summer	S07	10	75.183	0.049	7.7	0.0684	0.0000	OK
15 minute summer	S08	10	74.518	0.070	13.1	0.0972	0.0000	OK
15 minute summer	S09	10	72.983	0.083	21.2	0.1011	0.0000	OK
15 minute summer	S09A	10	72.730	0.128	21.1	0.1829	0.0000	OK
7200 minute winter	S10	5280	71.893	0.793	2.4	1.6205	0.0000	SURCHARGED
7200 minute winter	S11	5280	71.893	0.981	2.8	112.3109	0.0000	SURCHARGED
7200 minute winter	S12	5280	71.893	1.036	4.3	1.1719	0.0000	SURCHARGED
7200 minute winter	S13	5280	70.429	0.022	1.4	0.0247	0.0000	OK
7200 minute winter	S14	5280	69.154	0.027	1.4	0.0310	0.0000	OK
7200 minute winter	EX.S8	5280	69.125	0.026	1.4	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m^3)	Discharge Vol (m^3)
15 minute summer	S01	S1.000	S02	19.7	1.033	0.464	0.6199	
1440 minute summer	S02	S1.001	S03	5.2	0.661	0.057	0.8005	
1440 minute summer	S03	TANK 1	S04	5.3	0.393	0.083	1.3623	
1440 minute summer	S04	S1.003	S05	1.3	0.152	0.014	0.2898	
1440 minute summer	S05	Hydro-Brake®	S06	1.3				
15 minute summer	S06	S1.005	S09	4.9	0.593	0.039	0.0924	
15 minute summer	S07	S2.000	S08	7.7	0.927	0.104	0.2876	
15 minute summer	S08	S2.001	S09	13.0	1.329	0.177	0.0739	
15 minute summer	S09	S2.002	S09A	21.1	1.448	0.134	0.0916	
15 minute summer	S09A	S2.002A	S10	21.0	0.809	0.329	0.0698	
7200 minute winter	S10	TANK 2	S11	2.3	0.371	0.014	3.1043	
7200 minute winter	S11	S2.003	S12	4.3	0.160	0.039	0.6180	
7200 minute winter	S12	Hydro-Brake®	S13	1.4				
7200 minute winter	S13	S2.005	S14	1.4	0.617	0.020	0.1507	
7200 minute winter	S14	S2.006	EX.S8	1.4	0.550	0.028	0.0073	447.2

Results for 30 year +30% CC Critical Storm Duration. Lowest mass balance: 99.65%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m^3)	Flood (m^3)	Status
15 minute summer	S01	10	75.173	0.173	37.6	0.3710	0.0000	OK
1440 minute winter	S02	1140	74.805	1.355	6.5	3.0265	0.0000	SURCHARGED
1440 minute winter	S03	1140	74.805	1.605	6.6	1.8952	0.0000	SURCHARGED
1440 minute winter	S04	1140	74.805	1.669	8.9	193.1732	0.0000	SURCHARGED
1440 minute winter	S05	1140	74.805	1.696	1.8	1.9178	0.0000	SURCHARGED
15 minute summer	S06	10	73.060	0.052	8.3	0.0643	0.0000	OK
15 minute summer	S07	10	75.202	0.068	14.6	0.0945	0.0000	OK
15 minute summer	S08	10	74.549	0.101	25.0	0.1415	0.0000	OK
15 minute summer	S09	10	73.019	0.119	39.4	0.1448	0.0000	OK
15 minute summer	S09A	10	72.783	0.181	39.4	0.2587	0.0000	OK
4320 minute winter	S10	3960	72.750	1.650	4.0	3.3710	0.0000	SURCHARGED
4320 minute winter	S11	3960	72.750	1.838	4.1	210.3809	0.0000	SURCHARGED
4320 minute winter	S12	3960	72.750	1.893	4.2	2.1409	0.0000	SURCHARGED
4320 minute winter	S13	3960	70.432	0.025	1.9	0.0281	0.0000	OK
4320 minute winter	S14	3960	69.159	0.032	1.9	0.0356	0.0000	OK
4320 minute winter	EX.S8	3960	69.128	0.029	1.9	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m^3)	Discharge Vol (m^3)
15 minute summer	S01	S1.000	S02	37.3	1.179	0.880	1.0302	
1440 minute winter	S02	S1.001	S03	6.4	0.605	0.070	0.8005	
1440 minute winter	S03	TANK 1	S04	6.5	0.452	0.102	1.3623	
1440 minute winter	S04	S1.003	S05	1.8	0.158	0.020	0.2898	
1440 minute winter	S05	Hydro-Brake®	S06	1.8				
15 minute summer	S06	S1.005	S09	8.3	0.587	0.067	0.1468	
15 minute summer	S07	S2.000	S08	14.6	1.079	0.198	0.4691	
15 minute summer	S08	S2.001	S09	25.0	1.558	0.339	0.1206	
15 minute summer	S09	S2.002	S09A	39.4	1.685	0.250	0.1469	
15 minute summer	S09A	S2.002A	S10	39.4	0.978	0.614	0.1078	
4320 minute winter	S10	TANK 2	S11	4.0	0.407	0.024	3.1043	
4320 minute winter	S11	S2.003	S12	4.2	0.162	0.038	0.6180	
4320 minute winter	S12	Hydro-Brake®	S13	1.9				
4320 minute winter	S13	S2.005	S14	1.9	0.662	0.026	0.1836	
4320 minute winter	S14	S2.006	EX.S8	1.9	0.594	0.036	0.0089	390.0

Results for 100 year +30% CC Critical Storm Duration. Lowest mass balance: 99.65%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
1440 minute winter	S01	1230	75.282	0.282	2.7	0.6056	0.0000	SURCHARGED
1440 minute winter	S02	1230	75.282	1.832	8.0	4.0936	0.0000	SURCHARGED
1440 minute winter	S03	1230	75.282	2.082	8.1	2.4593	0.0000	SURCHARGED
1440 minute winter	S04	1230	75.282	2.146	10.9	248.4689	0.0000	SURCHARGED
1440 minute winter	S05	1230	75.282	2.173	2.0	2.4580	0.0000	SURCHARGED
4320 minute winter	S06	4080	73.209	0.201	2.4	0.2477	0.0000	OK
15 minute summer	S07	10	75.211	0.077	18.9	0.1081	0.0000	OK
15 minute summer	S08	10	74.567	0.119	32.3	0.1661	0.0000	OK
4320 minute winter	S09	4080	73.210	0.310	2.9	0.3789	0.0000	SURCHARGED
4320 minute winter	S09A	4080	73.210	0.607	3.5	0.8693	0.0000	SURCHARGED
4320 minute winter	S10	4080	73.207	2.107	6.4	4.3039	0.0000	SURCHARGED
4320 minute winter	S11	4080	73.208	2.296	4.9	262.8422	0.0000	SURCHARGED
4320 minute winter	S12	4080	73.208	2.351	4.9	2.6593	0.0000	SURCHARGED
4320 minute winter	S13	4080	70.433	0.026	2.1	0.0295	0.0000	OK
4320 minute winter	S14	4080	69.160	0.033	2.1	0.0375	0.0000	OK
4320 minute winter	EX.S8	4080	69.130	0.031	2.1	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
1440 minute winter	S01	S1.000	S02	2.7	0.599	0.064	1.2951	
1440 minute winter	S02	S1.001	S03	7.8	0.587	0.086	0.8005	
1440 minute winter	S03	TANK 1	S04	8.0	0.470	0.126	1.3623	
1440 minute winter	S04	S1.003	S05	2.0	0.143	0.022	0.2898	
1440 minute winter	S05	Hydro-Brake®	S06	2.0				
4320 minute winter	S06	S1.005	S09	2.4	0.642	0.019	0.5195	
15 minute summer	S07	S2.000	S08	18.9	1.144	0.256	0.5719	
15 minute summer	S08	S2.001	S09	32.3	1.653	0.438	0.1469	
4320 minute winter	S09	S2.002	S09A	3.5	0.847	0.022	0.4422	
4320 minute winter	S09A	S2.002A	S10	5.5	0.470	0.085	0.1887	
4320 minute winter	S10	TANK 2	S11	4.9	0.425	0.030	3.1043	
4320 minute winter	S11	S2.003	S12	4.9	0.254	0.044	0.6180	
4320 minute winter	S12	Hydro-Brake®	S13	2.1				
4320 minute winter	S13	S2.005	S14	2.1	0.682	0.028	0.1973	
4320 minute winter	S14	S2.006	EX.S8	2.1	0.610	0.040	0.0096	423.5

D. Confirmation of Feasibility

Esaivani Naicker

Block S
East Point Business Park
Dublin 3
Co. Dublin
D03H3F4

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

26 May 2021

Re: CDS21001100 pre-connection enquiry - Subject to contract | Contract denied

Connection for Housing Development of 140 units at Option 2, Glenamuck Road, Chigwell, Co. Dublin

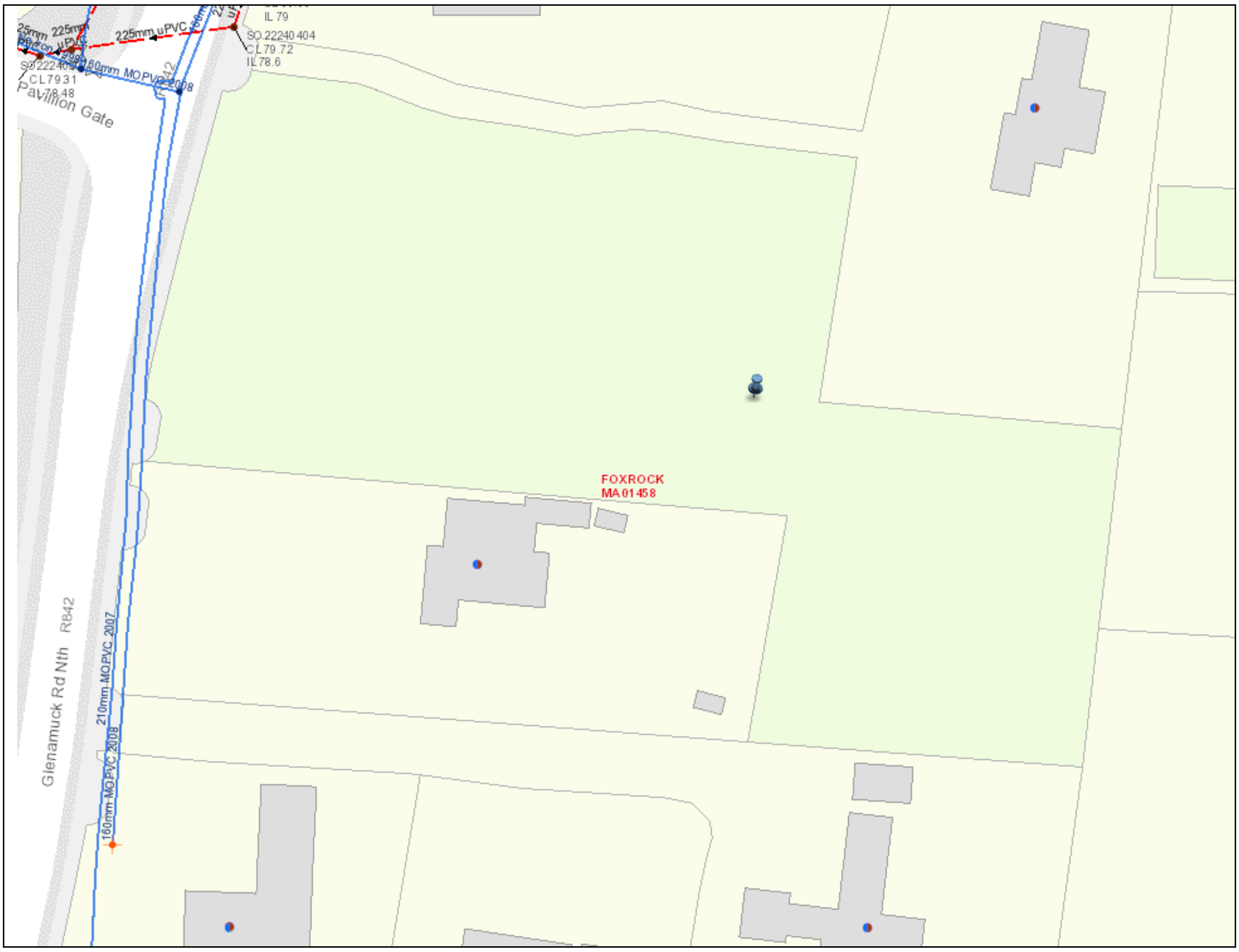
Dear Sir/Madam,

Irish Water has reviewed your pre-connection enquiry in relation to a Water & Wastewater connection at Option 2, Glenamuck Road, Chigwell, Co. Dublin (the **Premises**). Based upon the details you have provided with your pre-connection enquiry and on our desk top analysis of the capacity currently available in the Irish Water network(s) as assessed by Irish Water, we wish to advise you that your proposed connection to the Irish Water network(s) can be facilitated at this moment in time.

SERVICE	**OUTCOME OF PRE-CONNECTION ENQUIRY** **THIS IS NOT A CONNECTION OFFER. YOU MUST APPLY FOR A CONNECTION(S) TO THE IRISH WATER NETWORK(S) IF YOU WISH TO PROCEED.**
Water Connection	Feasible without infrastructure upgrade by Irish Water
Wastewater Connection	Feasible without infrastructure upgrade by Irish Water
SITE SPECIFIC COMMENTS	
Water Connection	The Development should be supplied from 210mm MOPVC main in Glenamuck Road via 150mm connection pipe.
Wastewater Connection	Connection to the Irish Water networks may be through third party infrastructure and/or lands and all relevant wayleave and permissions would need to be obtained by the Developer. Storm water from the Site can not be discharged to the Network. Proposed basement car park should be designed such that surface water from the Site and/or surrounding areas cannot flow down to the car park.

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 that are available on the Irish Water website. Irish Water reserves the right to supplement these requirements with Codes of Practice and these will be issued with the connection agreement.

The map included below outlines the current Irish Water infrastructure adjacent to your site:



Reproduced from the Ordnance Survey of Ireland by Permission of the Government. License No. 3-3-34

Whilst every care has been taken in its compilation Irish Water gives this information as to the position of its underground network as a general guide only on the strict understanding that it is based on the best available information provided by each Local Authority in Ireland to Irish Water. Irish Water can assume no responsibility for and give no guarantees, undertakings or warranties concerning the accuracy, completeness or up to date nature of the information provided and does not accept any liability whatsoever arising from any errors or omissions. This information should not be relied upon in the event of excavations or any other works being carried out in the vicinity of the Irish Water underground network. The onus is on the parties carrying out excavations or any other works to ensure the exact location of the Irish Water underground network 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.

General Notes:

1) The initial assessment referred to above is carried out taking into account water demand and wastewater discharge volumes and infrastructure details on the date of the assessment. **The availability of capacity may change at any date after this assessment.**
2) This feedback does not constitute a contract in whole or in part to provide a connection to any Irish Water infrastructure. All feasibility assessments are subject to the constraints of the Irish Water Capital Investment Plan.
3) The feedback provided is subject to a Connection Agreement/contract being signed at a later date.
4) A Connection Agreement will be required to commencing the connection works associated with the enquiry this can be applied for at https://www.water.ie/connections/get-connected/
5) A Connection Agreement cannot be issued until all statutory approvals are successfully in place.
6) Irish Water Connection Policy/ Charges can be found at https://www.water.ie/connections/information/connection-charges/
7) Please note the Confirmation of Feasibility does not extend to your fire flow requirements.
8) Irish Water is not responsible for the management or disposal of storm water or ground waters. You are advised to contact the relevant Local Authority to discuss the management or disposal of proposed storm water or ground water discharges
9) To access Irish Water Maps email datarequests@water.ie
10) All works to the Irish Water infrastructure, including works in the Public Space, shall have to be carried out by Irish Water.

If you have any further questions, please contact Marina Byrne from the design team via email mzbyrne@water.ie For further information, visit **www.water.ie/connections.**

Yours sincerely,

Yvonne Harris

Yvonne Harris

Head of Customer Operations

E. Statement of Design Acceptance

Jairo Rivero
Block S
East Point Business Park
Dublin 3, Co. Dublin D03H3F4

28 March 2022

Re: Design Submission for Option 1-Glenamuck Road, Chigwell, Co. Dublin (the "Development")
(the "Design Submission") / Connection Reference No: CDS21000212

Dear Jairo Rivero,

Many thanks for your recent Design Submission.

We have reviewed your proposal for the connection(s) at the Development. Based on the information provided, which included the documents outlined in Appendix A to this letter, Irish Water has no objection to your proposals.

This letter does not constitute an offer, in whole or in part, to provide a connection to any Irish Water infrastructure. Before you can connect to our network you must sign a connection agreement with Irish Water. This can be applied for by completing the connection application form at www.water.ie/connections. Irish Water's current charges for water and wastewater connections are set out in the Water Charges Plan as approved by the Commission for Regulation of Utilities (CRU)(https://www.cru.ie/document_group/irish-waters-water-charges-plan-2018/).

You the Customer (including any designers/contractors or other related parties appointed by you) is entirely responsible for the design and construction of all water and/or wastewater infrastructure within the Development which is necessary to facilitate connection(s) from the boundary of the Development to Irish Water's network(s) (the "**Self-Lay Works**"), as reflected in your Design Submission. Acceptance of the Design Submission by Irish Water does not, in any way, render Irish Water liable for any elements of the design and/or construction of the Self-Lay Works.

If you have any further questions, please contact your Irish Water representative:
Name: James O'Sullivan
Phone: 02252269
Email: jameosull@water.ie

Yours sincerely,

Yvonne Harris

Yvonne Harris
Head of Customer Operations

Appendix A

Document Title & Revision

13-125-P220-Proposed Drainage Layout - Sheet 1 of 2
13-125-P221-Proposed Drainage Layout - Sheet 2 of 2

13-125-P224-Proposed Basement Drainage Layout

13-125 Foul Long Sections

13-125-P250-Proposed Water Supply and Road Levels

13-125-P251-Water Supply Details - Sheet 1 of 3

13-125-P252-Water Supply Details - Sheet 2 of 3

13-125-P253-Water Supply Details - Sheet 3 of 3

Additional Comments

The design submission will be subject to further technical review at connection application stage

For further information, visit ***www.water.ie/connections***

Notwithstanding any matters listed above, the Customer (including any appointed designers/contractors, etc.) is entirely responsible for the design and construction of the Self-Lay Works. Acceptance of the Design Submission by Irish Water will not, in any way, render Irish Water liable for any elements of the design and/or construction of the Self-Lay Works.

UK and Ireland Office Locations