Infrastructure Design Report

Project:

Confey Lands LRD, Leixlip

Client:

Leixlip and Newbridge SPV Limited

Doc Ref. CHC-00-XX-RP-C-00001

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Suitability – S4=Planning , S2=Information , A1=Construction

NOTICE

Contents

List of Appendices

List of Figures

List of Tables

1.0 INTRODUCTION

Corrigan Hodnett Consulting Engineers have been appointed in the role of planning stage consultant civil and structural engineers for a proposed development at Confey North, Leixlip, County Kildare. The applicant site lies within the area encompassed by the Confey Lands Masterplan, 13^{th} Dec 2023. The site is identified within the Masterplan as 'R5' and is part of Phase 1a phasing aspect of the overall masterplan lands.

The report has been prepared as part of a diligence process to identify potential planning stage constraints to the development of the subject site and propose ameliorative measures to address these issues where practicable. The report outlines the design strategy to be adopted for the civil/structural elements of the planning application for the scheme. The current iteration of this design proposal has been informed by the Clients criteria and inputs from the various design team members.

The following matters have been reviewed as part of the assessment:

- Storm Water Management and Disposal;
- Foul Water;
- Potable Water;
- Ground Conditions and Soils:

In preparing this report, Corrigan Hodnett Consulting has made reference to the following relevant guidance and design documents:

- Kildare County Development Plan 2023-2029.
- Confey Lands Masterplan, Dec 2023.
- Building Regulations 2010 (Part H).
- Greater Dublin Regional Code of Practice for Drainage Works (DRAFT Version 6).
- Greater Dublin Strategic Drainage Study (GDSDS), 2005.
- The Planning System and Flood Risk Management Guidelines for Planning Authorities, 2009.
- Nature-Based Solutions to the Management of Rainwater and Surface Water Runoff in Urban Areas Best Practice Interim Guidance Document (2021, DHLGH)
- UK SuDS Manual, C753 by CIRIA, 2015.
- Uisce Éireann Code of Practice for Water Infrastructure, 2025.

- Uisce Éireann Code of Practice for Wastewater Infrastructure, 2025.

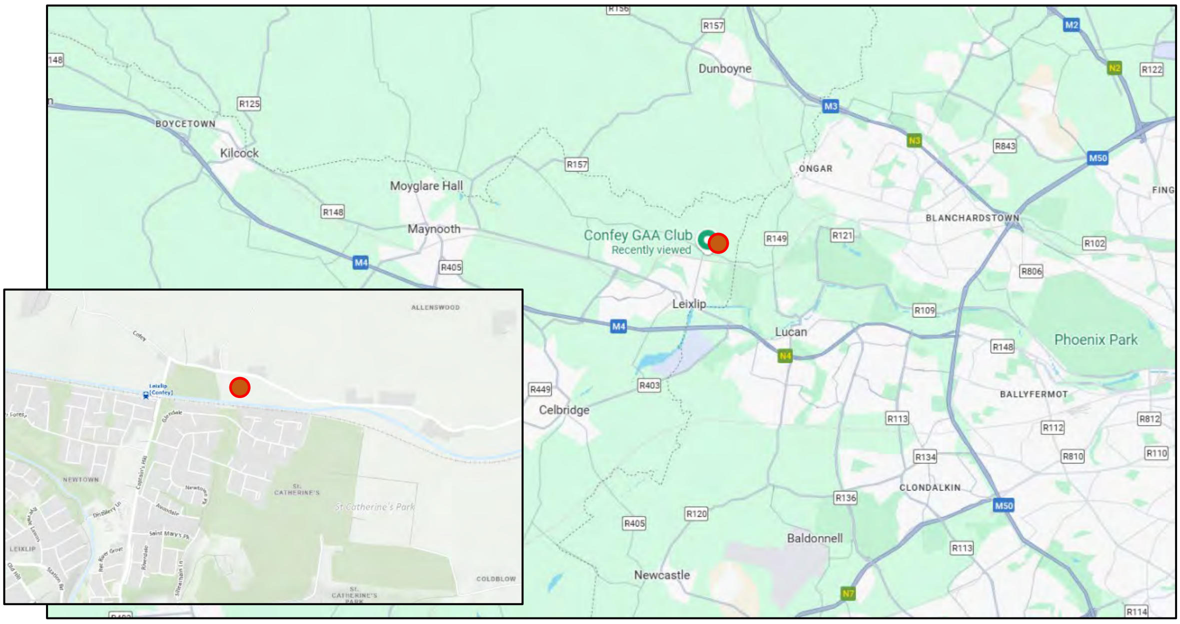
This report should be read in conjunction with the accompanying CHC engineering drawings. Other elements of the application pertaining to architectural, landscaping or M&E elements are covered by the respective members of the design team.

1.1 Site Location

The site is abutting and located to the immediate north of the Royal Canal, and to the immediate east of Confey GAA grounds. The northern boundary is the existing R149 regional road and the eastern boundary is applicant owned lands which are within Character 'R5' in Phase 1b and abutting OPW owned lands further to the east.

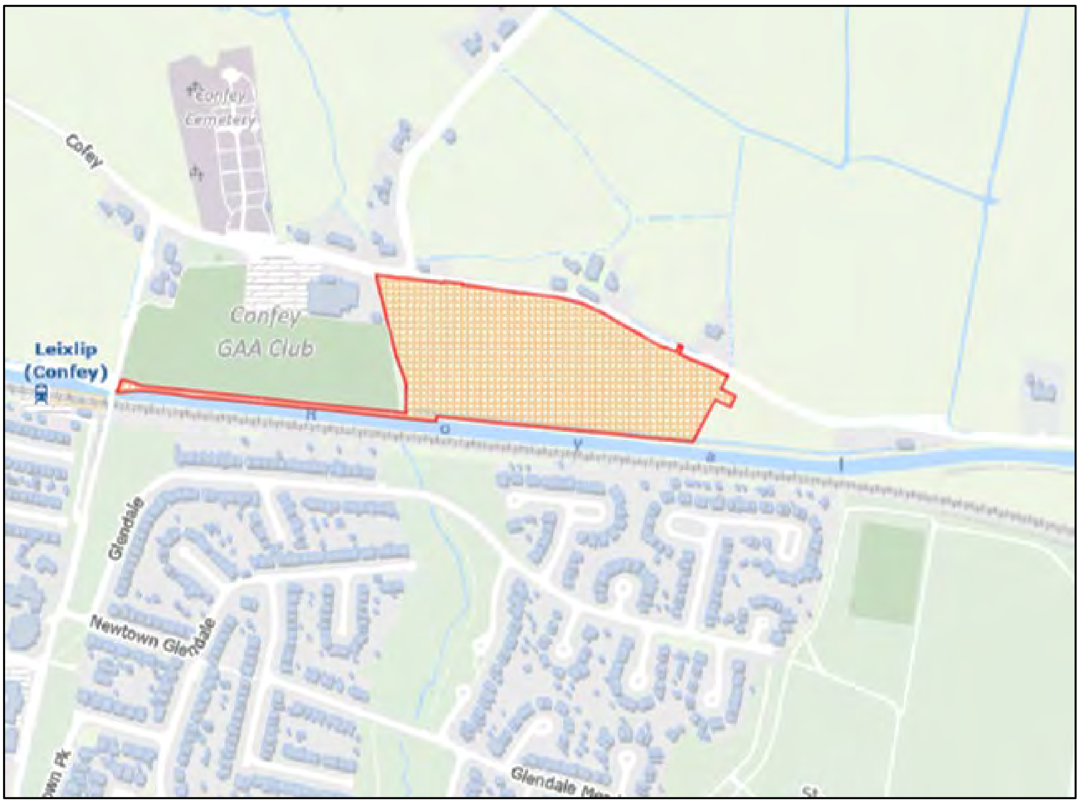
The overall applicant site area (redline boundary) amounts to **4.261 Hectares (42,608 square metres/ 10.53 Acres)** and is inclusive of a section of the Royal Canal tow path which is proposed to be upgraded to facilitate pedestrian and cyclist access from the development site to Leixlip (Confey) train station to the west of the site. *Figure 1-1* and *Figure 1-2* following detail the location of the site in a regional and local context respectively.

Figure 1-1 Site Location; Regional Context[1]



[1] Source – Táilte Éireann

Figure 1-2 Site Location; Local Context[2]



The applicant redline boundary and the existing topographic survey for the scheme are shown on accompanying CHC drawing ref. CHC-00-GR-DR-C-00004 titled '*Applicant site redline boundary and topographical survey*'.

The co-ordinates listed in *Table 1-1* following fall within the site boundary.

Table 1-1 Site Co-ordinates

	X/Easting	Y/Northing
ITM co-ordinates	701250	737100
ING co-ordinates	301321	237074

1.2 Existing Land Use

The entirety of the subject lands are undeveloped and are currently in agricultural use as arable farmland and thus the site is classified as 'Greenfield'.

[2] Indicative Site Location Map

The site is currently accessed directly off the R149 regional road by means of a single agricultural access. There is no public access permitted into the site.

The site falls under the authority of Kildare County Council for planning, road/access and stormwater services purposes. Uisce Éireann are the authority for potable water and wastewater in the area.

1.3 Proposed Development

The proposed development description is as follows;

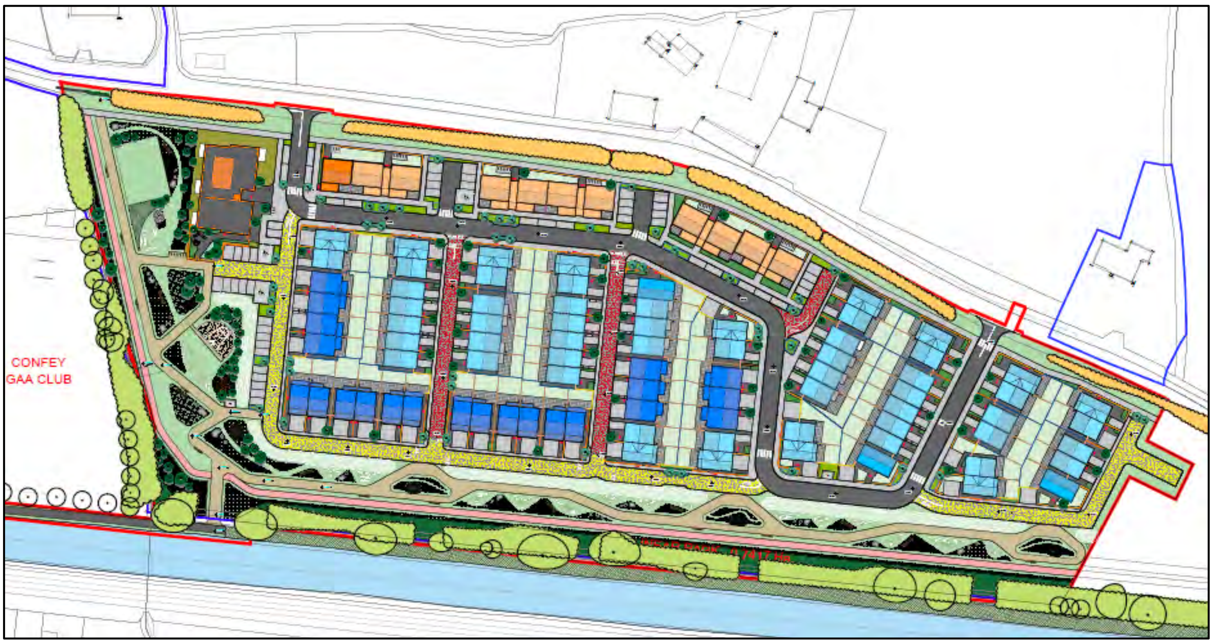
'The proposed development provides a total of 125 residential units, comprising 81 no. houses, 22 no. duplex units and 22 no. apartments. The housing element consists of a mix of semi-detached and terraced dwellings, including 56 no. 3-bedroom houses and 25 no. 4-bedroom houses, ranging in height from 2 to 3 storeys. The development includes 22 no. duplex units within 11 duplex blocks, comprising 11 no. 2-bedroom and 11 no. 3-bedroom duplex homes, arranged over 3 storeys. The apartment element comprises 22 no. units within a single apartment block of up to 5 storeys in height, consisting of 5 no. 1-bedroom apartments and 17 no. 2-bedroom apartments.

Provision of car, cycle and motorbike parking will be provided throughout the development.

Vehicular, pedestrian, and cyclist access points will be provided from the north of the site via R149, with additional pedestrian and cyclist access provided from the south via the Royal Canal Greenway. The development will also provide landscaping, public and communal open spaces and all associated site development works to facilitate the project. These include boundary treatments, plant and waste management areas, and other service provisions.'

Figure 1-3 following details the scheme layout of the proposed development.

Figure 1-3 Proposed Scheme Layout[3]



The scheme architects, Tegós Architects, have prepared detailed studies relating to the architectural and planning aspects of the development site and their documentation should be consulted in this regard for assessment of these aspects of the development. Similarly, the other design team professionals have addressed their respective elements of the scheme under separate cover.

[3] Murphy & Sheanon Site Layout Plan

2.0 LAYOUT, ACCESS AND PARKING

2.1 Development Layout

The proposed scheme layout is primarily informed by the Confey Masterplan. The layout and hierarchy of the internal access roads are all in accordance with the principles set down in section 3.10 of the Masterplan.

The internal roads are compliant with the *Design Manual for Urban Roads and Streets*. A Quality Audit incorporating a Road Safety Audit has been carried out for the scheme and the Problems identified and the Recommendations put forward by the Auditors have been incorporated into the proposals–see Quality Audit conducted by independent auditors Bruton Consulting Engineers and associated completed Feedback Form included under separate cover.

2.2 Current Access Scenario

The site is currently accessed directly off R149 Confey Road in the form of an agricultural access. There is no public access into the site or public right of way through the site.

Figure 2-1 following shows the location of the existing access in context.

Figure 2-1 Existing access plan[4]

[4] Source – Google Maps

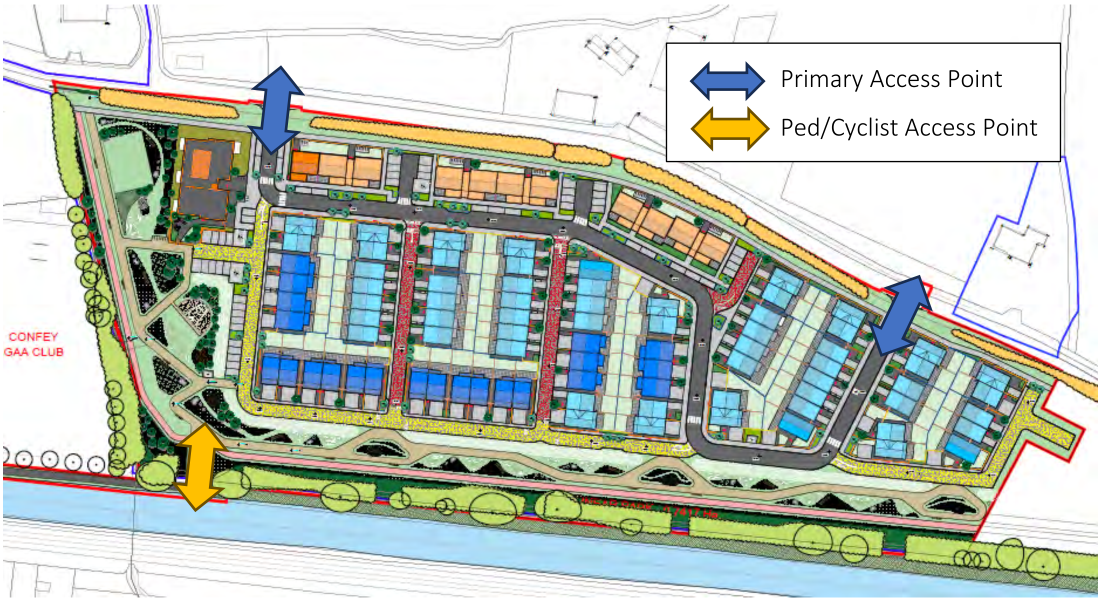
2.3 Proposed Access Scenario

As part of the development a building setback is provided alongside the R149 Confey Road to facilitate future road widening of the R149 in accordance with the Masterplan transport objectives.

There are two vehicular access proposed for the development in accordance with strategies outlined in the Confey Masterplan and the *'Confey Masterplan Strategic Transport and Mobility Report', November 2023* prepared by Arup.

There is a vehicular access proposed to both the eastern and western sides of the site off the R149 Confey Road, the primary access points which facilitate all transport modes. There is pedestrian and cyclist permeability from the site to the canal towpath to the south of the site providing a pedestrian and cyclist link to Leixlip (Confey) Train Station to the west – see *Figure 2-2* following

Figure 2-2 Proposed site access



The primary vehicular access sightlines for the development are demonstrated on drawing *CHC-00-GR-DR-C-00100* titled '*Road Layout, House Levels and Access Sightlines'* and are in accordance with the requirements of the Design Manual for Urban Roads and Streets (DOECLG, DOTTS, 2011). The topographical survey for the scheme has been used in this regard to ensure an accurate assessment. Due to the fact that the existing roadside boundary is being setback along the site frontage adjacent to the two vehicular entrance locations to provide access sightlines for development generated traffic. The sightline requirements are set out in Table 4.2 of DMURS, reproduced in the following table for convenience.

Table 2-1 Stopping Site Distance Standards; Extract from DMURS, Table 4.2

SSD STANDARDS

Design Speed (km/h)	SSD Standard (metres)
10	7
20	14
30	23
40	33
50	45
60	59

Forward Visibility

Design Speed (km/h)	SSD Standard (metres)
10	8
20	15
30	24
40	36
50	49
60	65

Forward Visibility on Bus Routes

Table 4.2: Reduced SSD standards for application within cities towns and villages. Reduced forward visibility increases driver caution and reduces vehicle speeds.

The speed limit on Confey Road is 60kph[5]. In this instance, the required sightline setback distance (‘X’ distance) is 2.4metres and the minimum stopping sight distance (‘Y’ distance) is 65.0m. The accompanying drawings demonstrate that the required sightlines are achievable.

The development line has been setback adjacent to the R149 to facilitate future road upgrades and widening in accordance with the Confey Masterplan with the corridor width reservation to incorporate the required elements (carriageway, footpaths, cyclepaths and verges) as agreed with the Transportation Department of Kildare County Council. A plan of the future scenario post improvement works is shown on accompanying CHC drawing ref. CHC-00-GR-DR-C-00102 titled ‘*Future R149 Road Improvements*’.

Internal road and footpath construction details are all in accordance with the Recommendations for Site Development Works for Housing Areas, (DOELG, 1998) and will comply with any other such specification as required by Kildare County Council.

2.4 Car Parking and Electric Vehicle Charging Infrastructure

The proposed development comprises a total of 125 no. residential units, consisting of 81 no. houses, 22 no. duplex units and 22 no. apartments. For the purposes of car parking assessment, the duplex units are treated as apartments. The proposed car parking provision is summarised in *Table 2-2* following.

[5] While it is noted that the 50kph speed limit may reduce at some stage in the future as the masterplan lands are developed, the higher limit is used for design purposes.

Table 2-2 Schedule of Accommodation and Proposed Car Parking Provision

Unit Type	No. of Units	Parking Arrangement	Proposed Resident Spaces	Proposed Visitor Spaces
Houses	81	All spaces provided in-curtilage	118	–
Duplex units	22	Treated as apartments for parking purposes; spaces provided on-street	22	–
Apartments	22	Resident parking provided in shared/on-street parking areas	18	–
Visitor parking	Applicable to apartment/duplex and general visitor demand	On-street visitor parking, including 2 no. accessible spaces	–	17
Total	125	Residential scheme	158	17

The overall proposed car parking provision is therefore 175 no. spaces, comprising 158 no. resident spaces and 17 no. visitor spaces. Of the visitor spaces, 2 no. spaces are designated accessible parking spaces.

Section 15.7.8 of Chapter 15 of the Kildare County Development Plan identifies car parking standards as maximum standards. For residential development, Table 15.8 identifies a maximum standard of 1 space for houses up to and including 3-bedroom units, and 1 space plus 0.5 visitor spaces for houses of 4 bedrooms or greater. Apartments are subject to a maximum standard of 1.5 spaces per unit plus 1 visitor space per 4 apartments. The Kildare County Development Plan also states that the maximum provision of parking should not be viewed as a target, and that lower rates of parking may be appropriate having regard to location, accessibility, public transport availability and sustainable mobility objectives. In this regard, the subject scheme is located within walking distance of Confey Rail Station, with the furthest residential unit located approximately 700m walking distance from the station. This proximity to existing rail infrastructure provides a strong basis for reduced parking provision, particularly for the duplex and apartment elements of the scheme. *Table 2-3* Following details the required an proposed car parking provision for the scheme.

Table 2-3 Car Parking Standards and Provision

Unit Type	No. of Units	Relevant Maximum Standard	Indicative Maximum Requirement	Proposed Provision
Houses: 4-bedroom	25	1 space plus 0.5 visitor spaces per unit	25 resident spaces plus 12.5 visitor spaces	Included within 118 in-curtilage house spaces
Houses: 2- and 3-bedroom	56	1 space per unit	56 resident spaces	Included within 118 in-curtilage house spaces
Duplex units	22	Treated as apartments: 1.5 spaces per unit plus visitor provision	33 resident spaces plus visitor allowance	22 resident spaces
Apartments	22	1.5 spaces per unit plus 1 visitor space per 4 apartments	33 resident spaces plus 5.5 visitor spaces	18 resident spaces
Visitor parking	44 apartment/duplex units plus general residential visitor demand	1 visitor space per 4 apartments/duplexes, and 0.5 visitor spaces for each 4-bedroom house	Approximately 23.5 visitor spaces	17 visitor spaces, including 2 accessible spaces
Total	125	171 (Maximum provision)	171 (Maximum benchmark only)	175 spaces overall

The proposed quantum of car parking is therefore considered in accordance with the standards identified in the Kildare County Development Plan. This low provision for the houses is justified having regard to the site's proximity to Confey Rail Station, the availability of a realistic public transport alternative for residents, and the Development Plan requirement to balance parking demand against the need to promote sustainable forms of transport, limit traffic congestion and protect the quality of the public realm from the physical impact of parking.

Chapter 15, Table 15.9 of the Kildare County Development Plan, confirms that electric vehicle charging infrastructure requirements are to be provided in accordance with Chapter 5, Objectives TM O117 and TM O118. Objective TM O117 requires a future-proofed approach to the rollout of electric vehicle charging infrastructure and applies the requirements of the EU (Energy Performance of Buildings) Regulations 2021. For new buildings containing one or more dwellings with more than 10 car parking spaces, ducting infrastructure is required for each car parking space to enable the subsequent installation of electric vehicle recharging points. Objective TM O118 further requires that electrical wiring installed for all new residential units includes provision for a double socket home charge point for electric vehicles, with within-curtilage/driveway parking to be provided unless otherwise agreed with the Planning Authority. *Table 2-4* Following details the EV charging and ducting provision proposed for the scheme.

Table 2-4 EV Charging and Ducting Provision

Parking Category	No. of Spaces	EV Charging / Ducting Requirement	Proposed Provision	Compliance Comment
House in-curtilage parking	118	Provision to facilitate home charging for residential units, including double socket home charge point provision in accordance with Objective TM O118.	Each house will be provided with the necessary electrical infrastructure to facilitate domestic EV charging within the curtilage/driveway area.	Complies with the Development Plan requirement for residential EV charging infrastructure.
Duplex resident parking	22	Ducting infrastructure to each space to enable subsequent installation of recharging points, in accordance with Objective TM O117.	Ducting infrastructure will be provided to each duplex parking space to enable future EV charging point installation.	Complies with Objective TM O117 and provides a future-proofed approach.
Apartment resident parking	18	Ducting infrastructure to each space to enable subsequent installation of recharging points, in accordance with Objective TM O117.	Ducting infrastructure will be provided to each apartment parking space to enable future EV charging point installation.	Complies with Objective TM O117 and facilitates future charging provision.
Visitor parking	17	Visitor and shared parking to include EV charging provision where appropriate and to be future-proofed through ducting.	8 no. visitor spaces will be provided with EV charging infrastructure, including the 2 no. accessible spaces. Ducting will be provided to the remaining visitor spaces to facilitate future installation where required.	Provides active EV charging provision for visitor parking, including accessible EV spaces, and future-proofs the remaining spaces.
Total EV-ready / future-proofed parking	175	Ducting infrastructure to enable EV charging infrastructure across residential parking provision.	All spaces will be provided with either active EV charging infrastructure or ducting to facilitate future EV charging installation.	Complies with the Development Plan requirement to provide EV charging infrastructure and ducting for residential development.

The proposed EV strategy therefore provides immediate EV charging capability to 8 no. visitor spaces, including both accessible spaces, while ensuring that all remaining resident and visitor parking spaces are future-proofed through the provision of ducting infrastructure. This approach enables the subsequent installation of EV recharging points in response to resident demand and future uptake of electric vehicles.

2.5 Bicycle Parking

There is no requirement for provision of dedicated cycle spaces within the houses. There is ample space within the curtilage of each dwelling for residential and visitor cycle parking in accordance with Kildare County Development Plan standards. For mid terraced units cycle stores will be provided within curtilage in the front area of the units.

Bicycle parking for the 22no. apartment units is provided at ground floor level in accordance with the DoHLGH document *'Sustainable Residential Development and Compact Settlements Guidelines for Planning Authorities'* at a rate of one space per bedroom plus a visitor allowance of 1 space per two units equating to 39no resident spaces and 11no. visitor spaces. Cycle parking for the duplex units is provided in secure Sheffield stand type accommodation. *Table 2-5* following details the bicycle parking requirements and provision proposed for the scheme.

Table 2-5 Bicycle Parking requirement and provision breakdown

Cycle Parking Spaces	No. of Units	No. of Bedrooms	Visitor Bikes (0.5 per unit)	Bikes on Curtilage	Secure Bike Stands		Total
Apartments	22	39	11	36 in Ground Floor Storage	18	1 spaces per bedroom	
Terraced Houses; (on Curtilage in Front Garden; Secured)	20	60		40		1 spaces per bedroom	
Duplex; Secured Sheffield Stands	22	55	11		66	1 spaces per bedroom	
Houses (on Curtilage in rear Garden)	61	208		208			
Visitor Bike Stands					16		
Total Bike Spaces Required		362	22				384
Total Bike Spaces Provided				**284**	**100**		**384**

2.6 Vehicle Manoeuvring

A vehicle swept path analysis has been undertaken as part of the detailed design for the planning application to demonstrate that the proposal will accommodate public and emergency service vehicles. Details of the vehicle swept paths are shown on accompanying drawings ref. *CHC-00-GR-DR-C-00101* titled '*Vehicle swept path analysis Fire Tender*', *CHC-00-GR-DR-C-00103* titled '*Vehicle swept path analysis Refuse vehicle*' and *CHC-00-GR-DR-C-00104* titled '*Vehicle swept path analysis Private car*'. Note that the Fire Safety Certificate and Disability Access Certificate applications will be made at post-planning stage but the layouts, routes, etc. enabling compliance with The Building Regulations Technical Guidance Documents B and M respectively are designed accordingly at pre-planning stage.

Details of the roads and access proposals for the scheme are shown on the accompanying drawings which are listed in *Table 2-6* following.

Table 2-6 Road and Access Drawings

Road and Access Drawings	
Drawing Reference	**Title**
CHC-00-GR-DR-C-00100	Road Layout, House levels & Access sightlines
CHC-00-GR-DR-C-00101	Vehicle swept path analysis Fire Tender
CHC-00-GR-DR-C-00102	Future R149 Road Improvements
CHC-00-GR-DR-C-00103	Vehicle swept path analysis Refuse vehicle
CHC-00-GR-DR-C-00104	Vehicle swept path analysis Private car
CHC-00-GR-DR-C-00110	Road longitudinal sections
CHC-00-GR-DR-C-00120	Road and Footpath Details – Internal

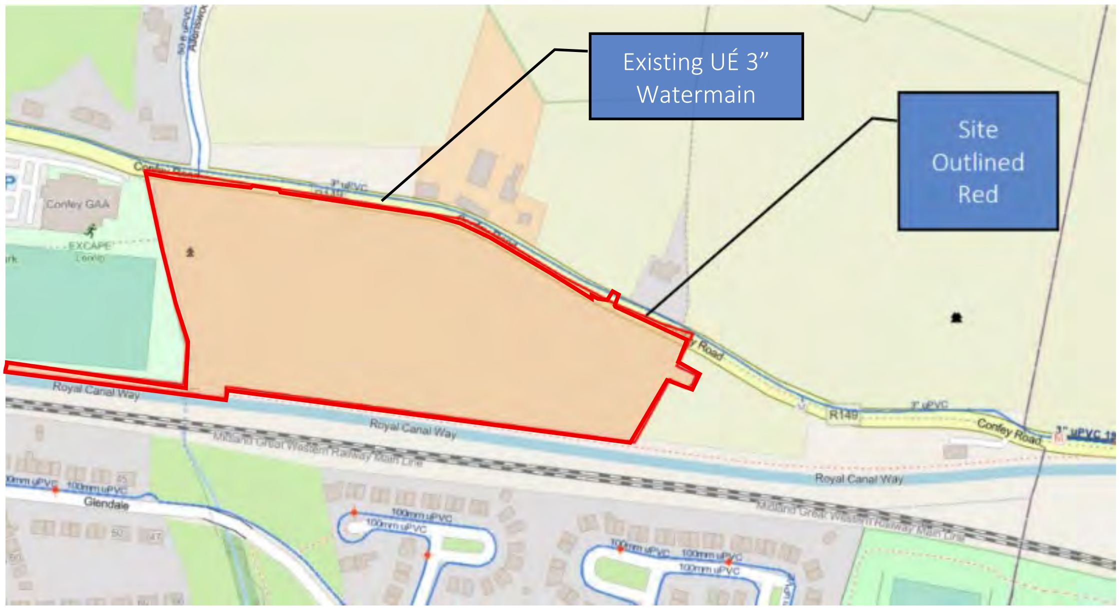
3.0 POTABLE WATER

3.1 Existing Potable Water Infrastructure

There is no existing potable water connection to the site. The Uisce Éireann water services records for the area show a 3" uPVC watermain on the opposite side of regional road R149, Confey Road, adjacent and to the north of the site. There are no records of other watermains within the vicinity of the site.

Figure 3-1 following is an extract from the Uisce Éireann water services records showing the current arrangement with the applicant site outlined red.

Figure 3-1 Extract from water services records mapping - Water



3.2 Development Potable Water Supply

Based on the schedule of accommodation for the development the peak water demand is calculated as follows;

Residential

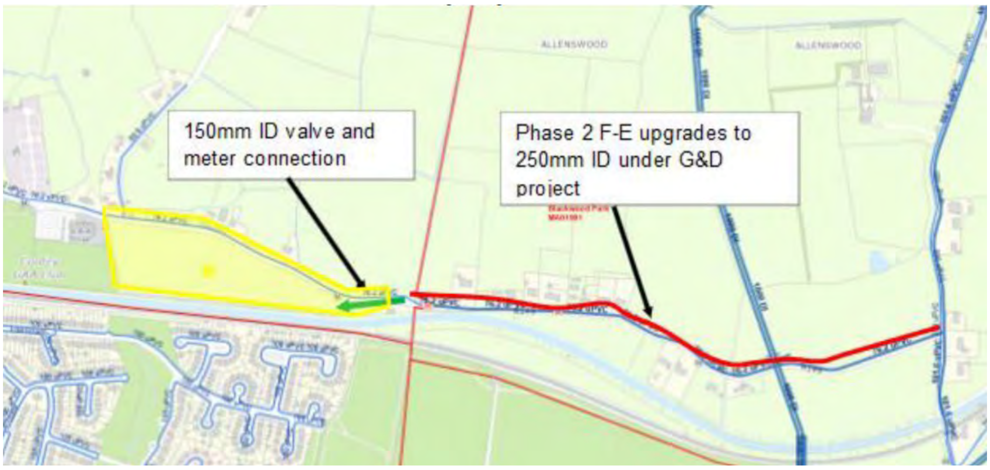
Average Demand =	125units x 2.7persons/unit x 150litres/day/person
	50,625 litres/day = 0.586 litres/second
Peak Demand =	Average Demand x Pf_{DOM}[6]
	0.586 litres/second x 5 = 2.930 litres/second

[6] Pf_{DOM} (Peak domestic factor) = 5 in accordance with UÉ COP for Water Supply

A pre-connection enquiry has been submitted to Uisce Éireann as part of the design process for the scheme Pre-Connection Enquiry Ref Number CDS26003112 dated 29th May 2026.A copy of the Confirmation of Feasibility received is provided at _AppendixB.1_. The feasibility of the water connection has been confirmed by Uisce Éireann subject to necessary network upgrade with the following comments;

- *In order to accommodate the proposed connection, approximately 1.2km of the existing 3'' main must be upgraded to 250mm ID. Uisce Éireann currently has a project on our current investment plan which will provide the necessary upgrade and capacity. This upgrade project (Phase 2 Confey network upgrades) is scheduled to be completed by Q2/2027 (subject to change).*

- *The connection main should be a 150mm ID pipe with a bulk meter and associated telemetry system installed on the line.*



Having regard to the network upgrades required to service the development and the anticipated timeframe detailed in the Confirmation of Feasibility response it is considered that the necessary upgrades will be completed in sufficient time to service the development. Specific details and requirements will be subject to any connection agreement stipulations post planning stage.

It is currently proposed that the development will connect to the upgraded water network at a single location, at the eastern vehicular access point from Confey Road into the development as detailed in the UÉ Confirmation of Feasibility response.

A Statement of Design Acceptance (SoDA) for the internal watermain design, layout and network connection for the scheme has been received from Uisce Éireann under the same reference as the Pre-connection Enquiry feedback, CDS26003112, and is included at _Appendix B.2_. It states;

> *'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, Uisce Éireann has no objection to your proposals.'*

It is however noted that any connection will be subject to a connection agreement which will be contingent on a grant of planing permission for the development.

All water connection proposals and watermains and associated valves, fittings, etc. will be subject to approval by Uisce Éireann and will have to be constructed and installed to the Uisce Éireann publication *'Code of Practice for Water Infrastructure* (Irish Water, 2025), Document UÉ-CDS-5020-03. The distribution network within the buildings will be to the Building Regulations, TGD G – Hygiene (DOEHLG, 2011). Low water usage devices will be required throughout any scheme proposed.

Details of the potable water proposals for the scheme are shown on the accompanying drawings which are listed in *Figure 3-1* following.

Table 3-1 Water Supply Drawings

Water Supply Drawings	
Drawing Reference	Title
CHC-00-GR-DR-C-00300	Watermain Layout
CHC-00-GR-DR-C-00330	Watermain Details. Sheet 1 of 5
CHC-00-GR-DR-C-00331	Watermain Details. Sheet 2 of 5
CHC-00-GR-DR-C-00332	Watermain Details. Sheet 3 of 5
CHC-00-GR-DR-C-00333	Watermain Details. Sheet 4 of 5
CHC-00-GR-DR-C-00334	Watermain Details. Sheet 5 of 5

4.0 WASTEWATER

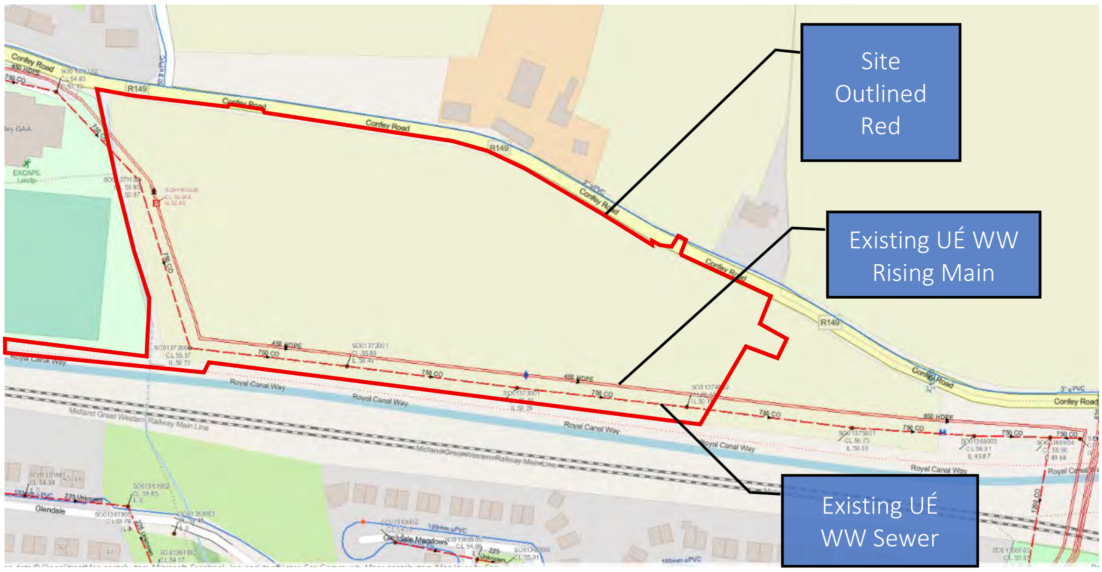
4.1 Existing Wastewater Infrastructure

There are two Uisce Éireann wastewater assets currently traversing the site as follows;

- There is a 450mm diameter wastewater rising main to the south and west of the site running parallel to the site boundaries within the area zoned 'Open Space and Amenity'.
- There is a 750mm diameter wastewater sewer running parallel and to the south/west of the rising main.

Figure 4-1 following is an extract from the Uisce Éireann water services records showing the current wastewater assets within the site.

Figure 4-1 Extract from water services records mapping - Wastewater



4.2 Development Wastewater Disposal

Based on the schedule of accommodation for the development the peak water demand is calculated as follows;

Residential

DWF = 125units x 2.7persons/unit x 150litres/day/person + 10%

55,688 litres/day = 0.645 litres/second

Total Peak Flow[7] = [0.645 x 6] =3.87 litres/second

[7] Design Flow = 6xDWF

A pre-connection enquiry has been submitted to Uisce Éireann as part of the design process for the scheme Pre-Connection Enquiry Ref Number CDS26003112 dated 29th May 2026. A copy of the Confirmation of Feasibility received is included at *Appendix B.1*. The feasibility of the wastewater connection has been confirmed by Uisce Éireann with the following comments;

- *Feasible without infrastructure upgrade by Uisce Éireann.*

It is however noted in the Confirmation of Feasibility that there are existing UÉ assets on the site as follows;

- *As per Uisce Éireann GIS records (please see Section B of this letter), Uisce Éireann assets are present on the site. The Developer must demonstrate that proposed structures and works will not inhibit access for maintenance or endanger structural or functional integrity of the assets during and after the works. For design submissions and queries related to diversion/build near or over, please contact UÉ Diversion Team via email address diversions@water.ie.*

Separation distances for infrastructure and other scheme elements are compliant with UÉ specification requirements. Further details, if necessary, will be developed if required as part of the UÉ Connection Application process subject to a successful grant of planning permission.

It is proposed that the development will discharge the generated wastewater effluent into the existing 750mm diameter wastewater sewer to the south of the site at manhole ref. SO01374002, subject to confirmation by UÉ.

A Statement of Design Acceptance (SoDA) for the internal wastewater design, layout and network connection for the scheme has been received from Uisce Éireann under the same reference as the Pre-connection Enquiry feedback, CDS26003112, and is included at *Appendix B.2*. It states;

> *'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, Uisce Éireann has no objection to your proposals.'*

It is however noted that any connection will be subject to a connection agreement which will be contingent on a grant of planing permission for the development.

All wastewater works for the development are designed to the Uisce Éireann document *'Code of Practice for Wastewater Infrastructure'*, (Irish Water, 2025), Document UÉ-CDS-5030-03.

Details of the wastewater proposals for the scheme are shown on the accompanying drawings which are listed in *Table 4-1* following and the design calculations at *Appendix C.1*.

Table 4-1 Wastewater Drainage Drawings

Wastewater Drainage Drawings	
Drawing Reference	Title
CHC-00-GR-DR-C-00200	Drainage Layout
CHC-00-GR-DR-C-00211	Drainage longitudinal sections – Foul
CH-00-GR-DR-C-00230	Foul and Surface water. Private drainage details
CH-00-GR-DR-C-00250	Wastewater Drainage Details. Sheet 1 of 2
CH-00-GR-DR-C-00251	Wastewater Drainage Details. Sheet 2 of 2

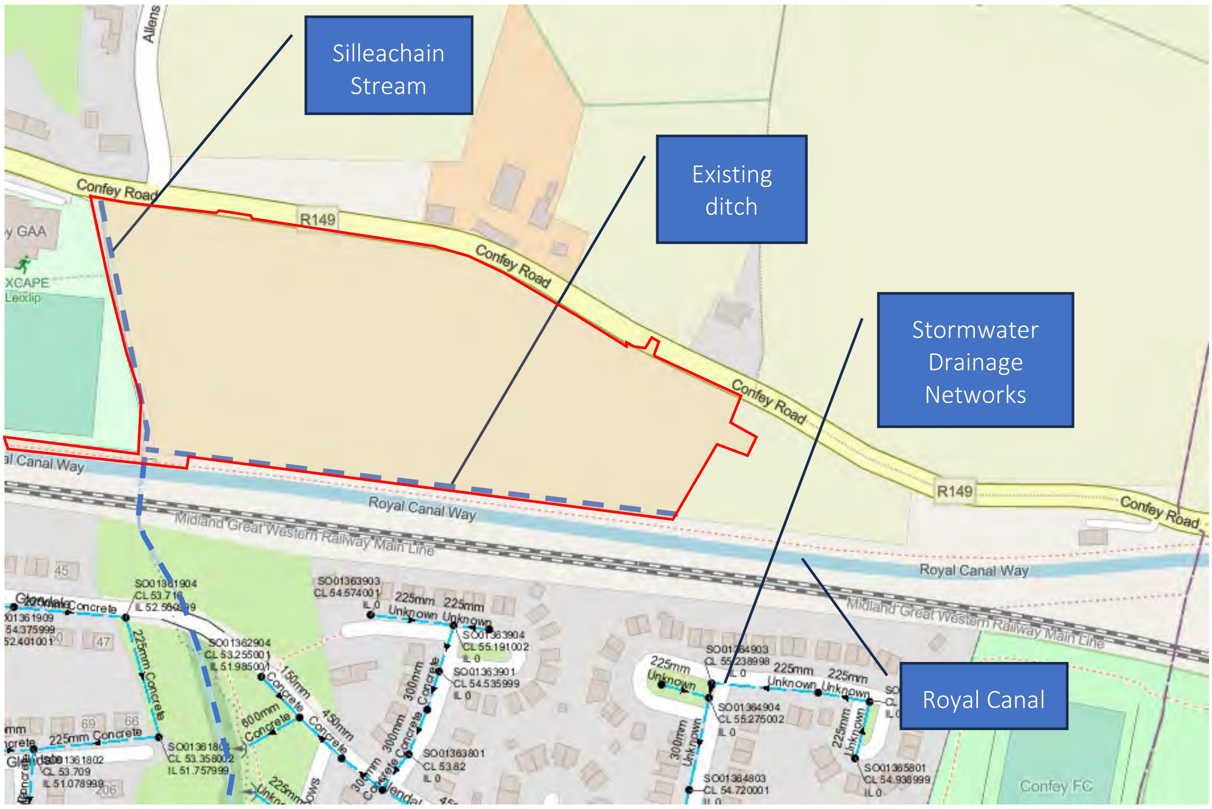
5.0 SURFACE WATER

5.1 Existing Surface Water Infrastructure

There is an existing watercourse (the Silleachain Stream) within the site running along the western boundary which runs beneath the Royal Canal and rail line and joins the River Liffey to the south in Leixlip. On the southern boundary a ditch runs parallel to the Royal Canal to the south and converges with the Silleachain Stream in the southwest corner of the site.

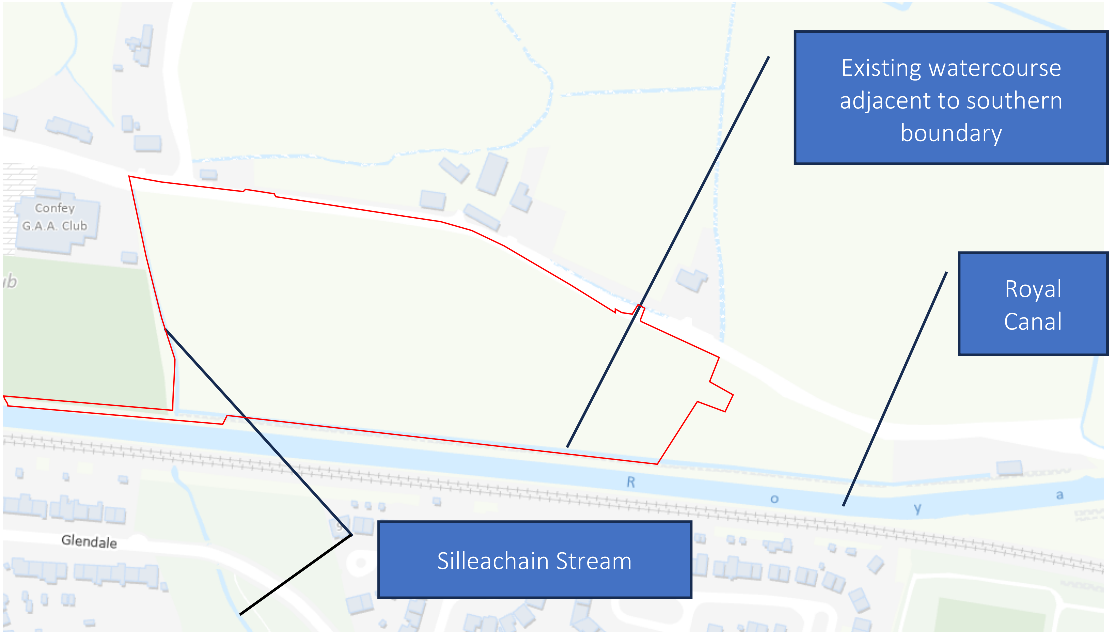
The Silleachain Stream runs in a north to south general direction and outfalls to the River Liffey to the south. There are no identified surface water networks in the vicinity of the site. An extract from the water services records in the area and a map showing the location of the watercourses within the site is shown in *Figure 5-1* and *Figure 5-2* respectively.

Figure 5-1 Extract from water services records - Stormwater



As the records do not indicate any existing surface water assets located within or close to the site. There are no diversions or alterations to existing surface water networks proposed as part of the current development design.

Figure 5-2 Watercourses within the site



The existing site is a greenfield site and does not have any positive drainage network. It is currently farmed as arable farmland with rainfall infiltrating to ground. The soil is predominantly a boulder clay till with minimal infiltration characteristics as was demonstrated by the BRE Digest 365 soakaway testing carried out to inform the surface water drainage design for the scheme.

The infiltration testing carried out indicates that, while infiltration characteristics are poor and would not be considered adequate for concentrated SuDS devices such as soakaways or similar, the infiltration rate is adequate to drain rainwater through the soil in its greenfield state – there is no evidence of wet areas or ponding on a walkover of the site with the lands remaining in good condition despite being worked by heavy farm machinery.

5.2 Development Surface Water Management and Disposal

The Masterplan details that the surface water outfall from the site is at a single point to the Silleachain Stream at the northwest corner of the site. However, on detailed analysis of the site particularly with regard to the fact that the site is relatively flat it is apparent that an single outfall at this location to serve the entire site is not possible. As part of the design process it has been determined that it is necessary to separate the site into five separate surface water drainage catchments and outfall each catchment individually to the watercourse to the south. A specific QBAR value has been calculated for each catchment and each network designed and modelled on that basis. *Figure 5-3* following shows each of the storm catchments numbered A to E.

Figure 5-3 Surface Water Catchments for drainage design purposes

The development site falls within the administrative jurisdiction of Kildare County Council. As such, the *Greater Dublin Strategic Drainage Study (GDSDS)* recommendations are required to be implemented and incorporated into the surface water drainage design solution for the development site. In addition, Section 15.8 of the Kildare CDP applies with specific reference to the *CIRIA SuDS Manual (C753)* and the *Nature-Based Solutions to the Management of Rainwater and Surface Water Runoff in Urban Areas Best Practice Interim Guidance Document (2021, DHLGH)*.

In order to comply with the requirements, any proposed development must ensure that a comprehensive sustainable urban drainage system, SuDS, is incorporated into the development. SuDS requires that post development run-off rates be maintained at equivalent, or lower, levels than pre-development levels. Thus, the development must be able to retain, within its boundaries, storm water volumes from extreme storm events up to a 1 in 100 year storm event, more commonly expressed as a 1.0% AEP (Annual Exceedance Probability). Any new development must have the physical capacity to retain storm water volumes as directed under the Greater Dublin Strategic Drainage Strategy and, if necessary, release these attenuated surface water volumes to an outfall at a controlled flow rate. A further component of the SuDS protocols is to increase the overall water quality of surface water runoff before it enters a natural watercourse or into a public sewer, which ultimately discharges to a water body. This is to ensure the highest possible standard of storm water quality.

In order to future proof new networks, climate change and urban creep considerations must also be incorporated into the surface water management and disposal designs. The relevant factors to be applied in each case are as follows;

- Climate Change +30% factor (increase in rainfall).

- Urban Creep +10% factor (increase in paved contributing areas)[8].

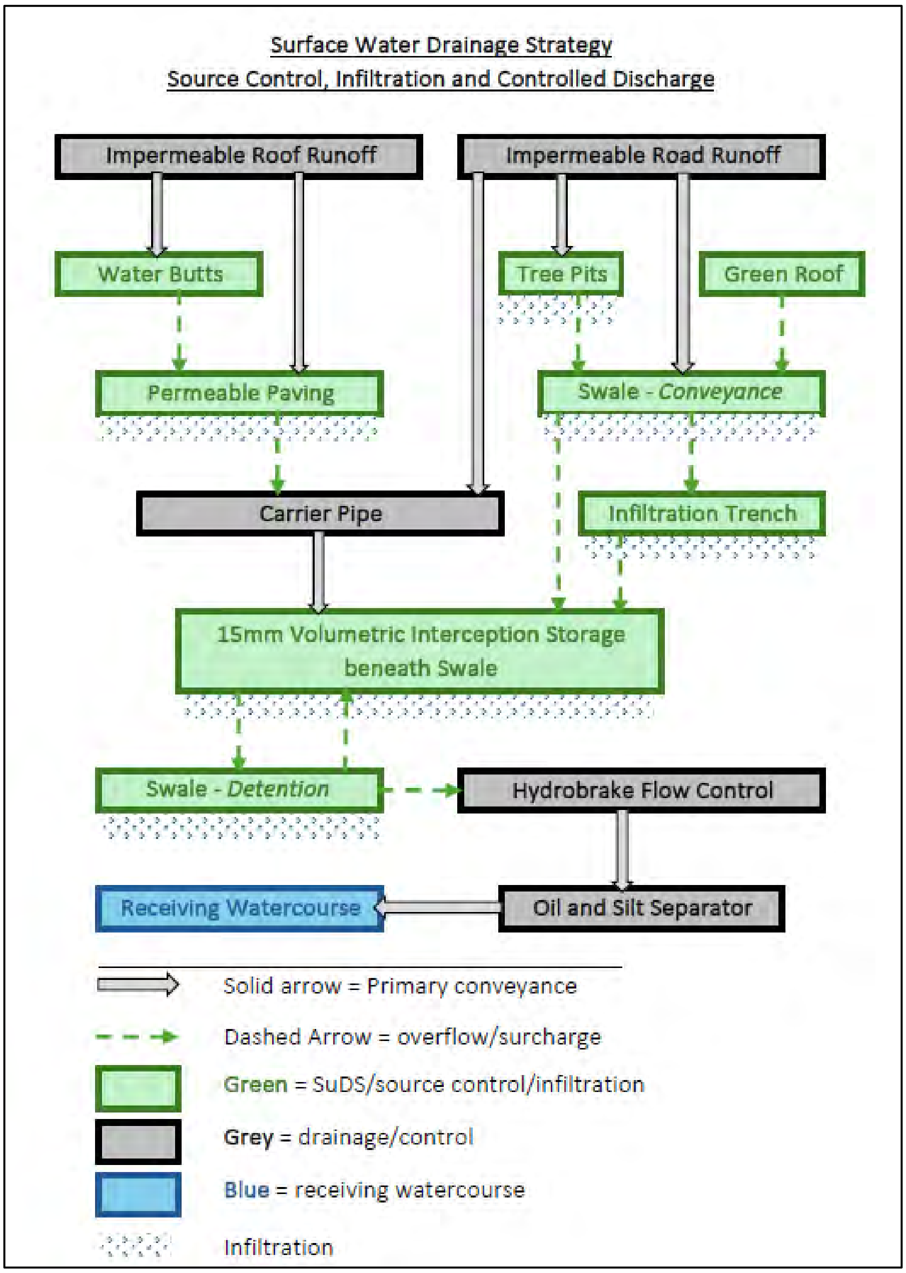
The total positively drained catchment area amounts to 18,120m^2. The 10% Urban Creep factor increases this value to 19,932m^2.

There are no underground attenuation tanks proposed as part of the scheme. The scheme prioritises nature based solutions maximising infiltration to ground SuDS devices throughout the development resulting in groundwater recharge, reduced discharge volumes and improved treatment benefits.

A number of Sustainable urban Drainage Systems are available to comply with the required protocols. *Figure 5-4* following shows a diagrammatic representation of the drainage strategy adopted for the development.

[8] Note that the 10% increase for Urban Creep applies to houses, duplexes, apartments, permeable paved areas and roads/paths.

Figure 5-4 Drainage Strategy Diagram/SuDS Management Train



Roof water runoff from the rear of the houses will discharge into rain water butts and overflow into the permeable paved driveway Open Graded Crushed Road (OGCR) sub-base. Roof rainwater from the front of the houses will discharge directly into the permeable paved driveway OGCR sub-base. It will then overflow into the main drainage carrier pipe discharging to the common 15mm volumetric interception storage.

The green roof area will discharge into the infiltration trench/swale and from there into the 15mm volumetric interception storage.

Impermeable road runoff will discharge runoff into bioretention tree pits strategically located at low points on the road and surcharge into the main drainage carrier pipe or swale where the swale is adjacent to the roads. At locations where there are no tree pits at the low points in the road, runoff will be collected by gullies connected to the main drainage carrier pipe. The carrier pipes will drain into the 15mm volumetric interception storage.

The volumetric interception storage will surcharge into the swale for storage purposes in extreme events with limiting discharge ($QBAR_{RURAL}$ discharge rates) through flow control devices in the form of Hydrobrake or similar flow control valves.

The collected surface water will have final discharges to the watercourse to the south of the site through an appropriately sized oil and silt interceptor.

Interception Storage

15mm interception volume storage volume is proposed to be provided for the entirety of the catchment areas within the development including green roof and permeable paved areas. The interception storage required for the entirety of the site amounts to 214.292cu.m. The interception storage proposed to be provided amounts to 220.04cu.m. *Table 5-1* following details the interception storage broken down on a catchment basis.

Table 5-1 Interception storage required and provided on a catchment basis.

Catchment	A	B	C	D	E	Totals
Catchment Area (m^2)	3,430	3,970	4,050	2,950	3,720	18,120
15mm Interception Volume Storage required (m^3)	36.501	47.610	48.532	35.789	45.860	214.292
15mm Interception Volume Storage provided (m^3)	36.800	48.000	52.800	36.000	46.440	220.040

The interception storage is accommodated within the infiltration blanket layer beneath the swale specific to each catchment prior to outfall. It is noted that the permeable paving, green roof, tree pits, swale, and infiltration trenches upstream interception storage will add further storage and infiltration beyond that required. The fact that 15mm interception volume storage is being adopted in lieu of 10mm interception volume storage also means that the 10% Urban Creep factor is already included in the volume proposed to be provided.

Details of the interception storage volume layouts are shown on CHC drawing number *CHC-00-GR-DR-C-00200* titled '*Drainage Layout'*. It is noted that the storage provided is calculated based on the respective upstream catchment IMPermeable area with an 100% paved runoff factor which includes an additional safety factor in itself, although Appendix E2.1.1 of the GDSDS suggests 80%.

It is further noted that the permeable paved car parking areas provide interception storage in their OGCR sub-base material (φ = 0.4) and the road and parking areas adjacent to the swale on the south and west development boundaries similarly provide additional interception through infiltration along with delayed time of entry and treatment. The pipeline beneath the swale takes the form of an infiltration trench with a perforated carrier pipe which also results in additional infiltration for the relevant section of the swale, particularly in catchment Storm A where outfall levels posed a problem due to the flat nature of the site.

Infiltration

It is noted that the BRE Digest 365 Infiltration testing returned failed results. However, this indicates that the slow infiltration rate is not suitable for concentrated infiltration devices as would be the case for soakaways (large drained areas are focused into a small soakaway area). Soils with low infiltration characteristics can still infiltrate meaning that options such as permeable paved areas where the subsoil/paving storage media interface is maximised can provide infiltration benefits. As per the infiltration testing carried out by Ground Investigations Ireland as part of the Site Investigation exercise for the site, the lesser infiltration rate of 2.237×10^{-6} m/s encountered at BRE01 has been adopted for the entirety of the swale area. The aggregate rate of infiltration from the 'failed' tests has been adopted for the remainder of the site, These are the infiltration rates adopted for the drainage analysis for all storm events using the Microdrainage modelling software. A copy of the Site investigation Report is included at *Appendix D.3*.

The modelled network has been simulated for events up to, and including, the 1.0% AEP rainfall event with a 30% allowance for Climate Change and a 10% allowance for Urban Creep. The results of the analysis confirm that the system does not flood in accordance with Appendix E of the GDSDS. Full details are included in *Appendix D.1* to the rear of this report. The current scenario does not include a 30% Climate Change and a 10% Urban Creep allowance whereas the future scenario includes these factors with the contributing sub-catchment areas being manually increased by 10% (for Urban Creep) for the 30% Climate Change and 10% Urban Creep Simulations. The Met Eireann rainfall data is included in *Appendix D.2* to the rear of this report. *Table 5-2* following details the specific drainage characteristics of the site and *Table 5-3* details the calculated Greenfield Runoff for each catchment whereby the positively drained areas ONLY have been used to calculate the QBAR value for each catchment. It is considered that the existing green areas to the west and south of the site will remain unchanged from a runoff perspective and will continue to infiltrate and drain to the existing watercourses to the south and west and south of the site mirroring the existing situation on the ground.

Table 5-2 Site Specific Characteristics

Constants		Data Source
SOIL =	0.30	Based on actual onsite conditions and geotechnical data
SAAR (mm) =	766	Met Eireann Point Rainfall Data
$M_{5\text{-}60}$ (mm) =	16.2	Met Eireann Rainfall Return Period Depths Data[9]
$M_{5\text{-}2day}$ (mm) =	58.9	
Jenkinson's 'R' =	0.2835	eq.[$M_{5\text{-}60}$/$M_{5\text{-}2day}$]
GDSDS E2.2.2 Greenfield Runoff Analysis		
AREA	0.5	sq.km (using 50Ha as site area < 50Ha)
SAAR	942	mm
SOIL	0.30	(SOIL Type 3)
$QBAR_{RURAL}$ = 0.00108 x (50Ha)$^{0.89}$ x SAAR$^{1.17}$ x SOIL$^{2.17}$		
$QBAR_{RURAL}$ for 50Ha site =	101	litres per second

Table 5-3 Catchment Greenfield Runoff Calculations

Catchment Ref.	Storm A	Storm B	Storm C	Storm D	Storm E	Totals
Positively Drained Area (sq.m)	3,430	3,970	4,050	2,950	3,720	18,120
IH 124 method linear scaling factor (Site Area/50Ha)	0.0069	0.0079	0.0081	0.0059	0.0074	
$QBAR_{RURAL}$ (litres/second)	**0.695**	**0.804**	**0.820**	**0.597**	**0.753**	**3.669**
Q_1[10] (litres/second)	0.590	0.683	0.697	0.508	0.640	
Q_{30} (litres/second)	1.459	1.688	1.722	1.255	1.281	
Q_{100} (litres/second)	1.806	2.090	2.132	1.553	1.959	
Adopted Discharge Rate (litres/second)	**0.7**	**0.8**	**0.8**	**0.6**	**0.8**	**3.7**

Limiting Discharge

Collected surface water will be discharged from each individual catchment by means of a simple flow control utilising Hydrobrake flow control mechanisms, the details of which are included in *Appendix D.1*.

Details of the network including online controls, SuDS elements, retention swale storage details and simulation summaries are shown in *Appendix D.1*. The MicroDrainage modelled analysis output and

[9] Refer Appendix E.2 – Met Éireann Return Period Rainfall Depths.

[10] Throttle rates calculated using GDSDS Growth Curve Factors.

calculations confirm that no flooding occurs within the network for any of the analysed storm events modelled as required under Volume 2 of the GDSDS.

For pipe design purposes, the impermeable sub-catchments are considered 100% impermeable in accordance with the GDSDS.

Permeable paving is proposed for surfacing of all privately paved areas, including footpaths around houses and any in-curtilage paved areas. On-street car parking is also to be permeable paving, (Traffic Category 6). In addition to reducing runoff rate and volume, permeable paving also provides a primary level of treatment from runoff from parked cars. The infiltration characteristics of the underlying soils are best optimised by maximising the interface area between the existing soils and proposed sub-base materials. It is noted that the permeable paved areas will result in an increased time of entry for the surface car park areas thereby further improving capacity availability within the system. Details of the permeable paved areas are shown on accompanying CHC drawing number *CHC-00-GR-DR-C-00200* titled '*Drainage Layout'* and *CHC-00-GR-DR-C-00400* titled '*Sustainable Drainage Systems Layout (SuDS)'*. The details of permeable paving included in the Microdrainage simulations have been provided in *Appendix D.1*.

Oil and Silt Interceptor. An interceptor is proposed to be installed on each network prior to discharge. Given the fact that each of the five drainage catchments discharge individually there will be five required for the overall scheme. The inclusion of the permeable pavements, tree pits and infiltration trenches along with the conveyance swale used throughout the development will add treatment value where suspended solids, heavy metals and hydrocarbons become trapped in the sub-base material and are broken down by adsorption and biodegradation. The Simple Index Approach as detailed in Section 26.7.1 of The SuDS Manual confirms that the level of treatment inherent in permeable paving systems has a Total SuDS Mitigation Index in excess of the pollution hazard index for the development type and catchment and runoffs proposed.

Bioretention Tree Pits

Tree pits are located throughout the site to intercept runoff from impermeable public footpaths and roads. As well as providing for an element of interception volume storage they also delay the time of entry and serve a filtration function for runoff which may contain hydrocarbons and suspended solids. A tree pit used for Sustainable Urban Drainage Systems (SuDS) is a designated area within urban landscaping designed to manage stormwater runoff while supporting tree growth. Here are some key characteristics:

- Designated Area: A tree pit is often a below-ground excavation or a specially constructed planter that provides space for tree roots to grow and absorb water.

- **Soil Composition**: The pit typically contains a permeable soil mix that enhances drainage and allows for water infiltration. This may include organic matter and materials that facilitate root health.
- **Water Management**: Tree pits are designed to capture and filter rainwater, helping to reduce surface runoff. They often include features like perforated pipes or gravel layers that promote drainage and slow down the flow of water.
- **Vegetative Layer**: The area is usually supplemented with vegetation (e.g., grasses, shrubs) to further enhance the absorption of stormwater and improve aesthetic value.
- **Infiltration Capability**: The pit allows water to infiltrate into the ground, recharging groundwater supplies and reducing the burden on drainage systems.
- **Biodiversity Support**: These pits can provide habitat for various species, promoting urban biodiversity while also serving as green infrastructure.

<u>Conveyance Swale with infiltration Trench</u>

The conveyance swale is a shallow, broad, and vegetated channel designed to store and convey stormwater runoff while removing pollutants. Runoff from the adjacent road and paved areas are directed into the swale. The inclusion of an infiltration trench beneath the swale adds an underground layer filled with 0.4 Porosity OGCR that allows water to infiltrate to ground.

Some of the benefits are as follows:

- **Stormwater Management:** <u>Slows runoff</u> – The swale reduces the speed of water, allowing sediments and pollutants to settle out. <u>Reduces flooding</u> – By temporarily storing water and allowing gradual infiltration, it helps prevent overwhelming drainage systems during heavy rain.
- **Water Quality Improvement:** <u>Filtration</u> – Vegetation and soil in the swale filter out pollutants, while the infiltration trench provides further treatment as water passes through the gravel and soil layers. <u>Pollutant breakdown</u> – Organic matter and microbes in the soil help break down contaminants.
- **Groundwater Recharge:** <u>Infiltration</u> – The trench allows water to soak into the ground, replenishing local groundwater supplies.
- **Compliance with Regulations:** Sustainable Urban Drainage Systems (SuDS): This approach aligns with best practice guidelines (such as the CIRIA SuDS Manual and the Greater Dublin Strategic Drainage Study) by managing runoff at source, reducing peak flows, and improving water quality.
- **Biodiversity and Amenity:** Habitat creation: Vegetated swales provide habitat for wildlife and can enhance the visual appeal of developments.

- **Climate Resilience:** Adaptation: By managing larger volumes of water and promoting infiltration, these systems help developments adapt to increased rainfall intensity due to climate change.

- **Maintenance**: Regular maintenance of swales includes litter and debris removal, grass cutting, and clearing of inlets, culverts, and outlets from sediment and blockages

Attenuated Discharge

It is proposed to provide a Sustainable Drainage System (SuDS) in accordance with the Greater Dublin Strategic Drainage Study Regional Drainage Policy Volume 2 - New Development (GDSDS-RDP Volume 2). Specific design requirements for SuDS components are established by the Construction Industry Research and Information Association's publication CIRIA C753 - The SuDS Manual (C753).

A SuDS Maintenance Plan is included at *Appendix D.5*. The document sets out the intended operational maintenance strategy for the Sustainable Drainage Systems proposed as part of the development. Its purpose is to identify the SuDS assets forming part of the surface water management network and to define the inspection, maintenance, responsibility and record-keeping requirements necessary to ensure that these assets continue to function effectively throughout the lifetime of the development. The plan demonstrates that appropriate long-term management arrangements can be implemented to preserve the hydraulic, water quality, amenity and biodiversity benefits of the proposed SuDS measures, while also providing guidance for the developer, management company, homeowners, local authority or other maintaining body responsible for their future upkeep.

Table 5-4 following details the contributing areas to be drained and the corresponding breakdown of areas from the contributing area captured by each SuDS type for the development.

Table 5-4 Site Contributing Areas and receiving SuDS

Site Contributing Element	Area (m^2)	Draining To:				
		Infiltration Trench (m^2)	Tree Pits (m^2)	Green Roof (m^2)	Permeable Paving (m^2)	Infiltration Blanket (m^2)
House and Duplex IMPermeable roof area	6,903	0	0	0	6,903	0
Apartment Block A Green Roof areas	379	0	0	379	0	0
Apartment Block A IMPermeable Roof	149	149	0	0	0	0
IMPermeable paved access roads and paths	6,968	0	4,392	0	0	2,576
PERmeable paved Parking Bays and Private Areas	3,722	67	936	0	0	2,719
Total	**18,120**	**216**	**5,328**	**379**	**6,903**	**5,295**

Table 5-5 following details the total area that each SuDS device can potentially cater for interception storage in accordance with Table 24.6 of the CIRIA SuDS Manual. The area calculated in *Table 5-5* for interception storage (20,487sq.m) exceeds the required area outlined in *Table 5-4* (18,120sq.m) therefore the interception requirement for the site is met.

Table 5-5 Provided Interception Storage by SuDS device[11]

SuDS Device	Area of SuDS Device (m^2)	Potential Area (m^2)	Reasoning (Table 24.6 of Ciria The SuDS Manual)
Infiltration Trench	440	440	Areas drained by infiltration trenches can be considered to provide Interception. 10mm interception volume is provided for contributing hardstanding area.
Bioretention Tree Pits	56	56	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.
Green Roof	379	379	Green roof areas are deemed to meet interception requirements for the relevant area.
Permeable Paving	3,722	18,600	Up up to 5 times the permeable paving area can be added as extra contributing area where the infiltration capacity is greater than $1.0x10^{-6}$m/s. Confirmed.
Infiltration Blanket	1,012	1,012	Areas of the site drained to systems that are designed to infiltrate runoff for events greater than a 1 month return period.
Catchment Interception Potential (m^2)		**20,487**	

[11] Interception methods that can be assumed to be compliant for zero runoff from the first 5 mm rainfall for 80% of events during the summer and 50% in winter.

5.3 Greater Dublin Strategic Drainage Study

There are several specific requirements in relation to surface water drainage which must be adhered to as part of any development in areas where the GDSDS is required. Volume 2 of the GDSDS, titled Regional Drainage Policies – Volume 2 New Developments sets out the criteria for new developments. *Table 5-6* following is extract from Volume 2 of the GDSDS which sets out the specific criteria for new developments.

Table 5-6 Extract from GDSDS – Criteria for New Developments

Criteria	Sub-criterion	Return Period (Years)	Design Objective
Criterion 1 River water quality protection	1.1	<1	Interception storage of at least 5mm, and preferably 10mm, of rainfall where runoff to the receiving water can be prevented.
	1.2	<1	Where initial runoff from at least 5mm of rainfall cannot be intercepted, treatment of runoff (treatment volume) is required. Retention pond (if used) to have minimum pool volume equivalent to 15mm rainfall.
Criterion 2 River regime protection	2.1	1	Discharge rate equal to 1 year greenfield site peak runoff rate or 2l/s/ha, whichever is the greater. Site critical duration storm to be used to assess attenuation storage volume.
	2.2	100	Discharge rate equal to 1 in 100 year greenfield site peak runoff rate. Site critical duration storm to be used to assess attenuation storage volume.
Criterion 3 Level of service (flooding) for the site	3.1	30	No flooding on site except where specifically planned flooding is approved. Summer design storm of 15 or 30 minutes are normally critical.
	3.2	100	No internal property flooding. Planned flood routing and temporary flood storage accommodated on site for short high intensity storms. Site critical duration events.

Criteria	Sub-criterion	Return Period (Years)	Design Objective
	3.3	100	No internal property flooding. Floor levels at least 500mm above maximum river level and adjacent onsite storage retention.
	3.4	100	No flooding of adjacent urban areas. Overland flooding managed within the development.
Criterion 4 River flood protection (criterion 4.1, or 4.2 or 4.3 to be applied)	4.1	100	"Long-term" floodwater accommodated on site for development runoff volume which is in excess of the greenfield runoff volume. Temporary flood storage drained by infiltration on a designated flooding area brought into operation by extreme events only. 100 year, 6 hour duration storm to be used for assessment of the additional volume of runoff.
	4.2	100	Infiltration storage provided equal in volume to "long term" storage. Usually designed to operate for all events. 100year, 6 hour duration storm to be used for assessment of the additional volume of runoff
	4.3	100	Maximum discharge rate of QBAR or 2 l/s/ha, whichever is the greater, for all attenuation storage where separate "long term" storage cannot be provided.

5.3.1 Criterion 1 – River Water Quality Protection

The drainage solution proposed for the development contains a range of treatment methods for surface water prior to discharge to ensure river water quality protection. The design complies with Sub-criterion 1.1 as the drainage solution proposed includes minimum interception of 15mm of surface water from the first flush of storm events. The interception storage volume proposed is based on the entire positively drained catchment area including permeable paved areas and the calculations exclude the benefits of delayed time of entry and storage which will be inherent in the receiving SuDS devices. Therefore, the volume provided is in excess of the requirement set down in the GDSDS. The proposals therefore meet the requirements of Criterion 1.1.

As interception storage is to be provided in excess of that required under Sub-Criterion 1.1 of the GDSDS, treatment volume is not required. As such, the extensive permeable paved areas allow for breaking down the pollutants and treating the storm water to a great extent. The proposals therefore meet the requirements of Criterion 1.2.

5.3.2 Criterion 2 – River Regime Protection

The proposed method of disposal of surface water from the site is to the existing watercourse tributary of the Silleachain Stream on the southern site boundary within the applicant's landholding. Due to the nature of the site a total of five separate outfalls (one for each surface water drainage catchment) are required. The outfalls will be a limited discharge outfall in the form of flow control devices. The discharge rate stipulated in Sub-criterion 2.1 requires a limited discharge equivalent to the greenfield site peak runoff rate or 2 l/s/ha, whichever is greater. *Table 5-7* following shows the 2 1/s/ha and the IH124 calculated discharge rates. In several cases the IH124 rates are marginally higher and they have thus been adopted for all catchments for design purposes and therefore the proposals satisfy Criteria 2.1.

Table 5-7 Discharge Rates Comparison

Catchment	Storm A	Storm B	Storm C	Storm D	Storm E
Area (sq.m)	3,430	3,970	4,050	2,950	3,720
2 l/s/Ha Rate	0.686	0.794	0.81	0.59	0.744
IH 124 Rate	0.7	0.8	0.8	0.6	0.8

The surface water network for the development has been modelled and the simulation results confirms that there is no flooding in any of the simulated scenarios, therefore the proposals satisfy Criteria 2.2.

5.3.3 Criterion 3 – Level of Service (Flooding) for the Site

The drainage proposals are shown on the accompanying CHC drawings *CHC-00-GR-DR-C-00200*, *CHC-00-GR-DR-C-00210*, *CHC-00-GR-DR-C-00230 and CHC-00-GR-DR-C-00240*. Calculations for the design of storm drains have been compiled with the MicroDrainage software using the Modified Rational Method in accordance with EN752. Calculations are included for the Storm networks at *Appendix D.1*.

5.3.3.1 Sub-criterion 3.1

The performance of the proposed drainage system in 30-year return period storm events has been analysed. The analyses show that no flooding will occur in 30-year return period storm events. The storm events listed in *Table 5-8* following have been simulated and analysed. Details of the analysed critical events sorted by maximum flood volume are included in *Appendix D.1*. The results shown are the Critical Summary of Results by Maximum Flood Volume (Rank 1) which is the worst-case scenario for each individual pipe. The results confirm that no flooding occurs for any of the modelled storm events and therefore the proposals satisfy the requirements of Criterion 3.1.

Table 5-8 Modelled flood events

Seasonal Return Period	Storm Duration (min)
1 yr Winter + 30% Climate Change 1 yr Summer + 30% Climate Change	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
30 yr Winter + 30% Climate Change 30 yr Summer + 30% Climate Change	
100 yr Winter + 30% Climate Change 100 yr Summer + 30% Climate Change	

5.3.3.2 Sub-criterion 3.2

The performance of the proposed drainage system in 100-year return period storm events has similarly been analysed. The analyses show that no flooding, property or otherwise, is expected in the 100-year return period storm event – refer *Appendix D.1*. Therefore, the proposals satisfy the requirements of Criterion 3.2.

5.3.3.3 Sub-criterion 3.3

The maximum water level in the network will not have an effect on the proposed buildings. The proposed buildings are at least 500mm above the design critical storm water level in their respective network facilities, in accordance with the requirements of Sub-Criterion 3.3. Therefore, the proposals satisfy the requirements of Criterion 3.3.

5.3.4 Sub-criterion 3.4

The performance of the proposed drainage system in the 100-year return period storm events has been analysed. The analyses show that no flooding is expected in the 100-year return period storm event. As such, no off-site overland flow is expected in the 100-year return period storm event. The scheme is designed such that a network system failure would result in surcharged and overspill being directed from within the site onto the green space corridor to the south of the site which would result in infiltration with any excess volumes entering into the Silleachain Stream tributary on the southern site boundary although it is unlikely that volumes would be such that they would reach the watercourse, they would more likely pond and infiltrate.

Therefore, the proposals satisfy the requirements of Criterion 3.4 as no overland/offsite flooding is expected from the proposed drainage system.

5.4 Criterion 4 – River Flood Protection

5.4.1 Sub-criterion 4.1

Permeable paving and interception volume storage is provided throughout the site. There is no flooding within the site for any of the modelled storm events. The modelled flood events confirm that the system does not flood for any event, including the 100year, 6 hour duration storm. Therefore, the proposals satisfy the requirements of Criterion 4.1.

5.4.2 Sub-criterion 4.2

The network has been analysed for flooding events of return period 1, 30 & 100 years and no flooding is generated. The assessment includes an allowance of 30% for Climate Change and a 10% Urban Creep factor Therefore, the proposals satisfy the requirements of Criterion 4.2.

5.4.3 Sub-criterion 4.3

The GDSDS-RDP Volume 2, Appendix E Section E2.4 states that this ensures 'that sufficient stormwater runoff retention is achieved to protect the river during extreme events'. The greenfield runoff rate is applied for all events (rather than a complex flow control device which would result in increased rates for less likely events) and will be achieved through the use of vortex control devices (e.g. Hydrobrake), which reduce the risk of blockage present with other flow control devices. Modelled simulation results for the entire surface water drainage network are included in *Appendix D.1*.

Details of the surface water management and disposal proposals for the scheme are shown on the accompanying drawings which are listed in *Table 5-9* following and the design calculations at *Appendix D.1*.

Table 5-9 Surface Water Management and Disposal Drawings

Surface Water Management and Disposal Drawings	
Drawing Reference	Title
CHC-00-GR-DR-C-00200	Drainage Layout
CHC-00-GR-DR-C-00210	Drainage longitudinal sections – Surface water
CHC-00-GR-DR-C-00230	Foul and Surface water. Private drainage details
CHC-00-GR-DR-C-00240	Surface Water Drainage Details
CHC-00-GR-DR-C-00400	Sustainable Drainage System layout (SuDS)

6.0 RESPONSE TO KILDARE COUNTY COUNCIL S.247 OPINION

As part of the planning process, preplanning consultation feedback has been received from Kildare County Council in correspondence dated 06th February 2026, titled '*Planning & Development Act 2000 (as amended). Notice of LRD Opinion: Large-scale Residential Development*' under PA Reg. ref. LRD2025010. The following section addresses the engineering aspects (namely Drainage, Uisce Éireann and Transportation) of the items raised in the opinion document where appropriate.

6.1 Water Services - SuDS.

1. *A fully SUDS compliant surface water drainage plan is required.*

   RESPONSE

   The surface water management and disposal proposals have been amended further to consultation with Mr Paul Dennis of the Kildare County Council Water Services Department on 15.05.2026. The proposals have been amended to increase the SuDS and overall drainage proposals for the development including removal of underground attenuation facilities. Full details of the amended proposals are provided in Section *5.0* of this report which should be read in conjunction with the associated surface water management and disposal drawings listed in *Table 5-9* and the surface water calculations, model and simulation results provided in *Appendix D.1*.

2. *The proposed surface water drainage system shall be designed in terms of incorporating appropriate Sustainable Drainage Systems (SuDS). The applicant shall comply with the Kildare County Development Sustainable Drainage Systems (SuDS) Guidance Document and incorporate a sequence of SuDS techniques that work together in a Management Train to control the flow, volume and frequency of run-off as well as preventing or treating pollution as water flows through the development. SuDS design shall maximise nature-based solutions and the sustainable drainage systems shall be designed, inspected, and supervised by a qualified engineer who shall certify the works as compliant with regard planning compliance, design and construction. The sustainable drainage systems shall cater for the 1 in 100 year storm event (or as otherwise agreed in writing) and with an allowance of +30% in order to cater for "climate change" and an additional 10% for Urban creep. The Applicant shall ensure that surface water from the development does not discharge to a point where neighbouring developments would be at risk of flooding.*

   RESPONSE

   Details of the SuDS Management Train are outlined in Section *5.0* and *Figure 5-4*. The surface water network model and simulation results included in *Appendix C.1* detail both a Design Year and a 30% Climate Change + 10% Urban Creep scenario with the additional 10% Urban Creep being applied on an area basis to the measured sub-catchment areas.

3. *The proposed Surface Water Drainage and Landscaping layouts/details shall correlate fully with each other as part of any planning application. The applicant is required to show details and sizes of the Sewage, Water and Storm network they are connecting to, and the condition they are in. Surface water and Wastewater drainage systems must discharge to separate pipe networks.*

   RESPONSE

   The Surface Water Drainage and Landscaping layouts are consistent. The surface water discharge from the development is to the watercourse to the south of the site. The wastewater discharge from the development is to the existing wastewater sewer traversing the site. Full details are provided in Sections *4.0* and *5.0* respectively and should be read in conjunction with the appended wastewater and surface water calculations, models and simulations and associated drawings.

4. *Underground attenuation systems are not acceptable. Nature-based SuDS measures are required and attenuation should only be considered as a last resort. Refer to Objective IN 024 of the Kildare County Development Plan 2023-2029. It is the intention of Kildare County Council that the use of underground drainage techniques is to be strictly limited across Kildare as per Objective IN O24. Surface water design to remove the proposed underground Cellular Attenuation System and replace same with a nature based above ground solution such as detention basins.*

   RESPONSE

   The underground attenuation elements of the proposal have been removed. There are no underground attenuation elements proposed as part of the surface water management proposals for the site. Details of the current proposals are provided in Section *5.0* which should be read in conjunction with the associated design calculations and simulation results provided at *Appendix C.1* and the referenced drawings.

5. *The applicant shall submit a dedicated Sustainable Drainage Systems (SuDS) Maintenance Plan for the written approval of the Planning Authority. The plan shall include a schedule of activities providing details and frequency of maintenance tasks required for all SuDS and surface water drainage elements proposed. This maintenance regime shall have planned preventative and response elements and cover all emergency maintenance and repairs.*

   RESPONSE

A SuDS Maintenance Plan has been prepared in accordance with the requirements set out and is included at *Appendix D.4*.

6. *The applicant is required to submit a surface water drainage catchment drawing delineating each proposed individual surface water catchment for the development.*

RESPONSE

The site has been split into five surface water drainage catchments, referenced Catchment A to Catchment E as outlined in *Section 5.0*. Details of the extents of each catchment are shown on accompanying CHC drawing ref. CHC-00-GR-DR-C-00200 titled '*Drainage Layout*'.

7. *All Sustainable Drainage Systems (SuDS) features within areas proposed for Taking in Charge shall be designed and constructed in accordance with Kildare County Council's Sustainable Drainage Systems (SuDS) Taking in Charge Standard Details. All tree pits shall collect runoff via overland flow and not direct discharge to base of tree pit.*

RESPONSE

Noted. All SuDS elements are designed to the Kildare County Council's Sustainable Drainage Systems (SuDS) Taking in Charge Standard Details. Bioretention tree pits shall collect runoff via overland flow and do not direct discharge to base of tree pit. Details of the various elements are shown on the accompanying drawings along with the details included in the Landscape submission under separate cover.

6.2 Uisce Eireann.

Uisce Eireann have reviewed the documents and notes the following:

1. *All Confirmation of Feasibility (COF) letters are usually valid for a period of c. 12 months from date of issuance. After this period, it may be required for the applicant to submit a new PCE in order to obtain an updated COF letter. The applicant is required, under the Large-Scale Residential Development Regulations to submit a valid Confirmation of Feasibility (COF) when lodging their LRD application.*

RESPONSE

An up to date Pre-connection Enquiry Confirmation of Feasibility has been issued from Uisce Éireann under reference CDS26003112 dated 29th May 2026. A copy of the document is included at *Appendix B.1*.

2. *Uisce Eireann does not permit build over its assets. Separation distances from public infrastructure, as per Uisce Eireann's Standards Codes and Practices must be achieved. It is the applicants responsibility to submit a diversion enquiry to Uisce Eireann Diversions Section (diversions@water.ie) prior to construction, where a potential build over of public assets is in question and/or where the applicants proposals cannot achieve separation distances from public infrastructure as per UE Standards & Codes of Practice.*

   RESPONSE

   There are no diversions of Uisce Éireann assets proposed as part of the development. A Statement of Design Acceptance (SoDA) for the internal wastewater design, layout and network connection for the scheme has been received from Uisce Éireann under the same reference as the Pre-connection Enquiry feedback, CDS26003112, and is included at *Appendix B.2* and confirms that the Uisce Éireann Design QA department are satisfied with the current water and wastewater proposals for the site.

3. *Statement of Design Acceptance (SODA) - The applicant is advised that a SODA is recommended to be in place and submitted at full LRD planning application lodgement stage.*

   RESPONSE

   A Statement of Design Acceptance (SoDA) for the internal wastewater design, layout and network connection for the scheme has been received from Uisce Éireann under the same reference as the Pre-connection Enquiry feedback, CDS26003112, and is included at *Appendix B.2*.

6.3 Transportation.

The Transport/Roads Planning Section of the KCC Transport, Mobility and Open Spaces Department has the following comments in relation to the above application.

1. *The applicant to submit road design drawings scale 1:500 for the proposed development detailing the following.*

   a. *The proposed main access points off the R149 for both construction and development traffic. No long straight sections of road >70m as per DMURS.*

      RESPONSE

      Refer accompanying CHC drawings CHC-00-GR-DR-C-00100 titled '*Road Layout, House levels & Access sightlines*' detailing the proposed access locations for the development. Details of the construction stage access for the site is included in the Construction

Management Plan prepared as part of the planing application under separate cover. There are no straight sections of road longer than 70m without traffic calming measured being incorporated – refer above layout plan drawing.

b. *Corner radii and longitudinal gradients to be in accordance with the Design Manual for Urban Roads and Streets DMURS 2019.*

RESPONSE

The corner radii at junctions and road longitudinal sections are all in accordance with DMURS requirements. The radii are annotated on accompanying CHC drawings CHC-00-GR-DR-C-00100 titled '*Road Layout, House levels & Access sightlines*'. The access road longitudinal gradients are detailed on accompanying CHC drawings CHC-00-GR-DR-C-00110 titled '*Road longitudinal sections*' and are compliant with DMURS and TGD Part M requirements.

c. *Vehicular parking to be in keeping with Table 15.8 of Chapter 15 of the Kildare County Development Plan 2023 - 2029.*

RESPONSE

Refer Section *2.4* which details the car parking provision breakdown proposed for the development and demonstrates that the quantum and type is compliant with the Kildare County Development Plan 2023-2029 requirements.

d. *Electric vehicle (EV) charge points for all residential units to be in accordance with Chapter 5 of the Kildare County Development Plan 2023 - 2029.*

RESPONSE

Refer *Section 2.4* which details the EV charging proposed for the development and demonstrates compliance with the Kildare County Development Plan 2023-2029. EV charging points and infrastructure details prepared by Waterman Moylan Consulting Engineers are included under separate cover.

e. *Critical Swept Path Analyses for a 3 axle refuse collection vehicle 9.86 m by 2.50 m in dimension, a private vehicle and a fire tender demonstrating access and egress to and from the site and manoeuvrability on the site.*

RESPONSE

Refer accompanying drawings CHC-00-GR-DR-C-00101, CHC-00-GR-DR-C-00103 and CHC-00-GR-DR-C-00104 titled '*Vehicle swept path analysis Fire Tender*', '*Vehicle swept path analysis Refuse vehicle*' and '*Vehicle swept path analysis Private car*' respectively. The fire tender used in the assessment is a standard Dublin Fire Brigade fire tender. The refuse vehicle used in the assessment conforms to the dimensions stipulated of 9.86m x 2.5m. The private car used to assess the critical parking bays is the Institute of Engineers (ICE) Standard Design Vehicle (SDV). The swept path analysis confirms that the vehicles can access the relevant sections of the development.

f. *The manner in which surface water runoff is collected and disposed of for the application site to comply with SUDS. Storm water runoff attenuation to be located under public open space and not under trafficked area refer to KCC SUDS Guidance Document.*

<u>RESPONSE</u>

There is no underground attenuation proposed beneath any trafficked areas. Refer accompanying drawings ref. CHC-00-GR-DR-C-00200 titled '*Drainage Layout'* and CHC-00-GR-DR-C-00400 titled '*Sustainable Drainage System layout (SuDS)'.*

g. *Surface wearing course for the proposed development to be Stone Mastic Asphalt, SMA 14 surf PMB 65/105-60 des 45mm thick, in compliance with clause 942 of NRA/TII specification. All surface water drainage gullies shall be fitted with suitable locking type covers or gratings.*

<u>RESPONSE</u>

Confirmed. Refer '*Road Buildup*' detail shown on accompanying drawing ref. CHC-00-GR-DR-C-00120 titled *'Road and Footpath Details – Internal'.*

h. *Details of 30 km/h Slow Zones signage and their respective locations in the residential development in accordance with the Department of Transport, Tourism and Sport's (DTTAS) traffic signs advice note TSAN-2016-02.*

<u>RESPONSE</u>

Refer accompanying CHC drawing CHC-00-GR-DR-C-00100 titled '*Road Layout, House levels & Access sightlines*' which details the locations of the gateway signage and details of the signage to be used in each instance in accordance with the DTTAS requirements.

i. *All signage and road markings to be in accordance with the Department of Transport, Tourism and Sport's (DTTAS) Traffic Signs Manual.*

RESPONSE

Noted. Refer accompanying CHC drawing CHC-00-GR-DR-C-00100 titled '*Road Layout, House levels & Access sightlines*' which details the location of signage and roadmarkings which are in accordance with the TSM.

j. *Lines of sight at the proposed vehicular entrance to be in accordance with the Design Manual for Urban Roads and Streets DMURS (2019) where speed limit is 50kph.*

RESPONSE

Details of sightlines at the site entrances and internal junctions are shown on accompanying CHC drawing CHC-00-GR-DR-C-00100 titled '*Road Layout, House levels & Access sightlines*' and are compliant with DMURS requirements.

k. *Permeable paving for the car parking areas if proposed to comply with SUDS.*

RESPONSE

All car parking areas are proposed to be constructed of permeable paving. Details of the build-up are shown on accompanying drawing ref. CHC-00-GR-DR-C-00120 titled *'Road and Footpath Details – Internal'.*

l. *On street parking spaces to be 2.50 metres by 5.00 metres marked in 100mm white lines of a durable material. Disabled parking spaces are to be in accordance with the Irish Wheelchair Association's Best Practice Access Guidelines, clearly marked with 100 mm wide white lines with a durable permanent material and have 1.20-metre-wide accessibility aisles cross hatched in yellow. Disabled parking spaces are also to be marked with a white wheelchair symbol in a durable material.*

RESPONSE

Noted. Car parking delineation for the development is shown on accompanying CHC drawing CHC-00-GR-DR-C-00100 titled '*Road Layout, House levels & Access sightlines*'.

m. *Bicycle parking to be in accordance with Table 15.4 of Chapter 15 of the Kildare County Development Plan 2023 - 2029.*

RESPONSE

Noted. Details of the bicycle parking provision are provided at Section 2.5 which demonstrates that the bicycle parking provided is in accordance with the Kildare County Development Plan 2023-2029 requirements.

n. *Home zones to be a minimum of 4.8m in width with 1.2m footpath access for pedestrians delineated and different pavement finish to be used.*

RESPONSE

Noted. Dimensioned access road and footpath/pedestrian refuge widths are detailed on accompanying CHC drawing CHC-00-GR-DR-C-00100 titled '*Road Layout, House levels & Access sightlines*'. The 1.2m footpath access for shared surfaces and home zone areas are to be constructed with a concrete finish whereas the road surfaces are to be a contrasting Stone Mastic Asphalt finish.

o. *The shared access for pedestrians and cyclists should be a minimum of 3m in width with public lighting provided.*

RESPONSE

Refer Landscaping and Public Lighting proposals included under separate cover for detailed information in this regard.

p. *Landscaping and trees should not impact on sight lines and public lighting and a root management plan to be submitted.*

RESPONSE

Any trees shown within sightline envelopes are bare trunk to a height of 2.1m so do not impact on sightlines as per DMURS. Refer Landscaping proposals included under separate cover for detailed information in this regard.

q. *Parking and set down facilities for the Childcare and Neighbourhood Facilities to be submitted.*

RESPONSE

There are no Childcare and/or Neighbourhood Facilities proposed for the scheme.

2. *The applicant to clarify the extent of home zone provision within the development. The applicant to provide VRU provision (minimum 1.2m width), gateway, signage and road lining entry for the*

proposed home zone areas. Biodiversity linkages from north to south within Home Zone streets should be incorporated.

RESPONSE

Refer accompanying CHC drawing CHC-00-GR-DR-C-00100 titled '*Road Layout, House levels & Access sightlines*' which details the locations of the Home Zone and Shared Surfaces and associated signage and roadmarkings. Private trees are proposed to be located in the front gardens of the properties fronting onto the Home Zone Streets. Refer Landscaping proposals included under separate cover for detailed information in this regard.

3. *The applicant to submit a detailed design and drawings scale 1:500 for the proposed widening works of R149 consisting of a 6.5m wide carriageway with a 1.5m grass verge, 2m wide cycle track and 2m wide footpath at the site frontage. The applicant will be required to construct these road improvements prior to occupation of housing.*

   RESPONSE

   The development line has been setback adjacent to the R149 to facilitate future road upgrades and widening in accordance with the Confey Masterplan with the corridor width reservation to incorporate the required elements (carriageway, footpaths, cyclepaths and verges) as agreed with the Transportation Department of Kildare County Council. A plan of the future scenario post improvement works is shown on acccompanying CHC drawing ref. CHC-00-GR-DR-C-00102 titled '*Future R149 Road Improvements'*. The upgrading of the R149 is not included as part of this LRD application.

4. *The applicant to resubmit a TTA incorporating traffic volumes the Full Master Plan of the proposed development. The submitted TTA only accounts for traffic volumes from phase 1.*

   RESPONSE

   Refer TTA included under separate cover by NRB Consulting Engineers Limited.

5. *The applicant to liaise with Traffic Management Section re any required upgrade works to the traffic signals on Cope Bridge. The applicant to comment on same.*

   RESPONSE

   Refer TTA included under separate cover by NRB Consulting Engineers Limited. It is not anticipated that the traffic signals at Cope Bridge will need to be upgraded and part of the development.

6. *The applicant to provide permeability links to the Royal Canal. The Applicant is requested to provide a drawing and cross section scale 1:500 of pedestrian and cycle linkage between the development and the Royal Canal. Details of permeability links for vulnerable road users into adjoining lands/ development to be submitted where the design should allow for passive surveillance and adequate public lighting. The applicant is requested to provide details of the Filtered Permeability Link, accommodated pedestrians and cyclists, between the development and the Royal Canal. In the detailed solution for permeability, the applicant is requested to consider the following: personal security; legibility; quality of the environment, landscaping, maintenance, lighting, passive surveillance, final position and orientation of houses.*

   RESPONSE

   Refer Landscaping proposals included under separate cover for detailed information on the proposals for the linkage to the Royal canal tow path which facilitates access to Leixlip (Confey) Train Station. The proposals have been developed in consultation with Waterways Ireland.

7. *The applicant is requested to prepare a drawing showing that gradients and horizontal alignments are compliant with relevant design codes such as the DMURS and Cycle Design Manual. The applicant is requested to finalise mutually beneficial details for both the residents and the passing pedestrians and cyclists. Details should include the following: landscaping, public lighting, materials, security and boundary treatment. The applicant is requested ensure the detailed design maximises passive surveillance and promotes active travel.*

   RESPONSE

   Details of the crossfalls and the longitudinal gradients of access roads (and adjacent footpaths) are shown of accompanying CHC drawing CHC-00-GR-DR-C-00100 titled '*Road Layout, House levels & Access sightlines*' and CHC drawing CHC-00-GR-DR-C-00110 titled '*Road longitudinal sections*' respectively. Refer Landscaping proposals included under separate cover in relation to footpaths and cycleways in the landscaped areas.

8. *There is a significant shortfall in car parking and no VRU facilities provided to access the train station at Confey. The proposed VRU access to Confey station along the canal tow path is substandard. The applicant to confirm that they will be upgrading the tow path with hard surfacing, dimensions, public lighting, boundary treatment and permission from Waterways Ireland for same. The Applicant to submit a drawing illustrating same.*

   RESPONSE

   The parking provision proposed for the development is in accordance with the Kildare County Development Plan 2023-2029 requirements. Refer Landscaping proposals included under separate cover in relation to the upgrade works proposed for the canal tow path to facilitate a VRU link to Leixlip (Confey) Train Station.

9. *The applicant to provide a car parking strategy for the proposed management of the car parking spaces for proposed development. The applicant has not detailed how the reduced number of car parking spaces will be allocated for users.*

RESPONSE

The quantum and type of parking proposed for the development is in accordance with Kildare County development Plan 2023-2029 standards – refer Section 2.4. Under the KCDP the maximum quantity of parking spaces permitted for the development is 171no. There are 175no. spaces proposed – refer *Table 2-3 Car Parking Standards and Provision*. It is therefore considered that there is no shortfall in the parking proposal for the development. Parking for the houses is all in-curtilage. Parking for the duplex units, apartment units and visitor parking will be managed by the Management Company appointed for the common areas of the scheme.

10. *Due to the significant shortfall in car parking the applicant to provide loading bays is to serve the proposed development. The applicant to confirm car parking spaces a minimum of 2.5x5.0m in dimension. The applicant to provide a car parking schedule drawing indicating car parking spaces for proposed development and loading bays.*

RESPONSE

Refer response to Item 9. previous.

11. *The applicant to provide details of EV charging car parking spaces and ducting for the at least 20% of the spaces. The applicant is requested to supply ducting infrastructure for all car parking space to enable the subsequent installation of recharging points for electric vehicles, in accordance with TMO117 & TMO118. Where parking associated with units is being supplied on street, dedicated charging points for use by residents are to be provided adjacent to parking spaces. The charging points should operate on metered basis, with access to the charging point being available to residents through a swipe card or PIN number registration facility. The EV Chargers are to be compatible with the Sustainable Energy Authority of Ireland's Triple E Register and should support the use of renewable energy and improve urban air quality.*

RESPONSE

The EV charging provision proposed for the development is detailed in *Section 2.4* and *Table 2-4 EV Charging and Ducting Provision*. The proposals are compliant with the KCDP requirements. Refer Waterman Moylan drawing included under separate cover for the location of the spaces proposed to be provided with EV charging infrastructure and ducting.

12. *The applicant to submit a Mobility Management Plan which is to include:*

    a. *The estimated number of trips for 125 residential units, 81 houses and 44 no. apartments.*

    b. *Full details of all existing public transport links and timetables serving Leixlip and links to commuter rail timetables at Leixlip, Co. Kildare. This is also to list all public transport links to prominent employment centres.*

    c. *Walking and cycling routes in Leixlip.*

    d. *The manner in which future residents of the housing, apartments, and duplexes will be informed of the reduced parking standard and vehicular parking spaces available prior to the occupation of these units.*

    e. *The manner in which the Mobility Management Plan will be made available to future residents.*

    f. *During the lifetime of this Mobility Management Plan, the developer shall submit annual survey results of the modal splits and origin of trips of future residents.*

    RESPONSE

    Refer Mobility Management Plan included under separate cover by NRB Consulting Engineers Limited.

13. *By reducing the number of car parking spaces, the applicant is assuming the residents will avail of public transport. The applicant to therefore provide a public transport study to provide an assessment of public transport capacity on both bus and rail transport to ensure that there is capacity on both modes of transport. The applicant to carry out a public transport study of both rail and bus transport provision for a typical working 7day week over 12hour period, detailing the provision of hourly services and the capacity on each mode of transport.*

    RESPONSE

    Refer response to Item 9 previous. The quantum and type of parking proposed for the development is in accordance with Kildare County development Plan 2023-2029 standards. Refer Mobility Management Plan included under separate cover by NRB Consulting Engineers Limited in relation to existing public transport infrastructure.

14. *The applicant is to submit details and locations on a drawing of appropriate secure bicycle storage for the proposed development in accordance with KCC Development Plan 2023- 2025.*

    RESPONSE

    Refer Section 2.5 in relation to the quantum and type of bicycle parking proposed to be provided in accordance with the Kildare County Development Plan 2023-2029 requirements. Refer Tégos Architecture proposals included under separate cover in relation to the location and details for bicycle storage for the apartment and duplex units.

15. *The Sustainable Urban Drainage Systems (SUDS) features such as swales, drainage blankets, permeable paving in the parking areas are welcomed. The local authority has a preference for a bound stone mastic asphalt in the other traffic areas. The Applicant is required to avoid the use of underground storage tanks that have limited benefits in terms of landscape, ecology and attenuation storage due to silting and maintenance costs.*

    RESPONSE

    All roads and footpaths proposed to be taken in charge will be surfaced with impermeable SMA and concrete respectively. There are no underground storage tanks proposed as part of the surface water drainage solution for the development. The surface water management and disposal proposals have been amended further to consultation with Mr Paul Dennis of the Kildare County Council Water Services Department on 15.05.2026. The proposals have been amended to increase the SuDS and overall drainage proposals for the development including removal of underground attenuation facilities. Full details of the amended proposals are provided in Section *5.0* of this report which should be read in conjunction with the associated surface water management and disposal drawings listed in *Table 5-9* and the surface water calculations, model and simulation results provided in *Appendix D.1*.

16. *The applicant is requested to submit to a Construction Management Plan that is to contain:*

    a. *The duration of the construction phase, including all haul routes to and from the site.*

    b. *Mitigation measures to minimize the effects the proposed development would have on the immediate public road network and existing traffic movements.*

    c. *Wheel wash arrangements and locations for the construction phase.*

    d. *Location of the construction compound, parking, delivery and storage areas during the construction phase. (This is in the interest of the existing residential amenity of properties in the area).*

e. *Scaffolding and hoarding arrangements for the development.*

f. *The manner in which the existing public road and footpath network shall be kept clean.*

g. *A condition and photographic survey of the surround footpath and road network.*

h. *Relevant construction site warning signs shall be in accordance with the Department of Transport, Tourism and Sport (DTTAS) Traffic Signs Manual.*

i. *A Construction Waste Management Plan that is to contain the final destination of each waste stream generated on site.*

RESPONSE

Refer Construction Management Plan for the proposed development under separate cover.

17. *The applicant to carry out a Road Safety Audit by an independent consultant incorporating all RSA recommendations. The RSA is to assess:*

- *The location of the access points to the development.*
- *The internal areas of the proposed development.*
- *The interface with the existing public road / foot path network.*

The applicant is requested to make the necessary changes to the design proposals following the stage 1 and 2 RSA. The applicant is requested to note that if the application is subsequently granted, then the applicant will be required to carry out a stage 3 audit / assessment.

RESPONSE

A Road Safety Audit has been carried out on the scheme by independent auditors and the Recommendations to address the identified issues have been agreed and incorporated into the scheme design. Refer RSA and completed Feedback Form prepared by Bruton Consulting Engineers under separate cover.

18. *The applicant to submit separate public lighting drawings and report including proposed upgrading of lighting on R149 and internal development. The applicant to clarify if public lighting extends along the Royal Canal. The lighting scheme is to be in accordance with KCC Lighting Policy Street Lighting Technical Spec June 2019.*

RESPONSE

Refer public lighting proposals buy Sabre included under separate cover.

19. *The proposed development is adjacent to the railway in Leixlip and therefore requires careful consideration risk analysis in terms of (rail) transportation noise. The proposal may be problematic noise-wise in the future with no feasible way of addressing inborne noise through open windows above the 1st/2nd stories. The applicant is therefore requested to submit an Acoustic Design Statement by a suitably qualified acoustic specialist to ensure the proposed development will not be exposed to noise levels in excess of the Kildare County Third Noise Action Plan Lden threshold of 70 dB (A) and Lnight threshold of 57 dB (A). This statement is to contain the following:*

    a. *A full noise monitoring survey conducted midweek during school-term that is to contain a full set of noise monitoring results over a 5-day period. These results are to include the Time Run Duration, LAeqT (1 hour), LAeqT (15min), LAFmax, LAF10, LAF90, calculated hourly Lden noise levels and measured Lnight noise levels.*

    b. *Calculated Lden and measured Lnight values at the designated open spaces within the application site at a level not less than 1.50 metres above ground level. Calculated Lden and measured Lnight values at the facades of the proposed development at levels not less than 1.50 metres above each floor level so as not to negatively impact on the useability of open space (both public and private) and the ability of future residents to have patio doors / windows open. The statement shall also include noise mitigation measures (including site boundary condition proposals, as deemed required, and the associated estimated noise reduction decibel values in complying with the Kildare County Council Third Noise Action Plan 2019 -2023.*

    c. *The predicted internal noise levels of the proposed residential unit to be in accordance with the recommended indoor ambient noise levels for a dwelling as prescribed under the British Standards BS 8233:2014. This is also to have an assessment with regard to opening windows at night (in summer months) and the impact on internal ambient noise levels. This statement shall also assess the number of LAFmax events from 11.00 pm to 07.00 am having regard to potential sleep disturbance.*

    d. *Glazing and ventilation strategy proposals.*

    e. *Concluding statement having regard to the compliance with the Kildare County Council Third Noise Action Plan 2019- 2023 and the British Standards BS 8233:2014.*

RESPONSE

Refer Acoustic Assessment included under separate cover.

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Appendix A

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Appendix B

B.1 – Uisce Éireann PCE Confirmation of Feasibility ref. CDS26003112

B.2 – Uisce Éireann Statement of Design Acceptance ref. CDS26003112

CONFIRMATION OF FEASIBILITY

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Omni Park Shopping Centre
Santry
Dublin 9
D09TY8K

29 May 2026

Our Ref: CDS26003112 Pre-Connection Enquiry
Lands at, Confey, Leixlip, Co. Kildare

Dear Applicant/Agent,

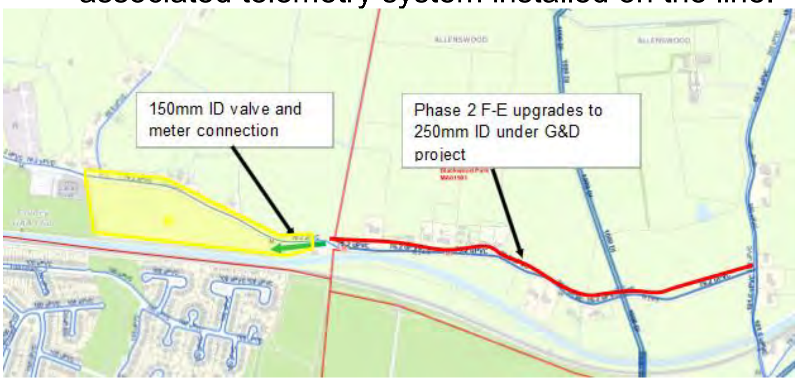
We have completed the review of the Pre-Connection Enquiry.

Uisce Éireann has reviewed the pre-connection enquiry in relation to a Water & Wastewater connection for a Housing Development of 140 unit(s) at Lands at, Confey, Leixlip, Co. Kildare, (the **Development)**.

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

- **Water Connection** - Feasible Subject to upgrades

- In order to accommodate the proposed connection, approximately 1.2km of the existing 3'' main must be upgraded to 250mm ID. Uisce Éireann currently has a project on our current investment plan which will provide the necessary upgrade and capacity. This upgrade project (Phase 2 Confey network upgrades) is scheduled to be completed by Q2/2027 (subject to change)
- The connection main should be a 150mm ID pipe with a bulk meter and associated telemetry system installed on the line.



- **Wastewater Connection** - Feasible without infrastructure upgrade by Uisce Éireann

- As per Uisce Éireann GIS records (please see Section B of this letter), Uisce Éireann assets are present on the site. The Developer must demonstrate that proposed structures and works will not inhibit access for maintenance or endanger structural or functional integrity of the assets during and after the works. For design submissions and queries related to diversion/build near or over, please contact UÉ Diversion Team via email address diversions@water.ie

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

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

Where can you find more information?

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

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

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

Yours sincerely,

Dermot Phelan

Dermot Phelan
Connections and Developer Services

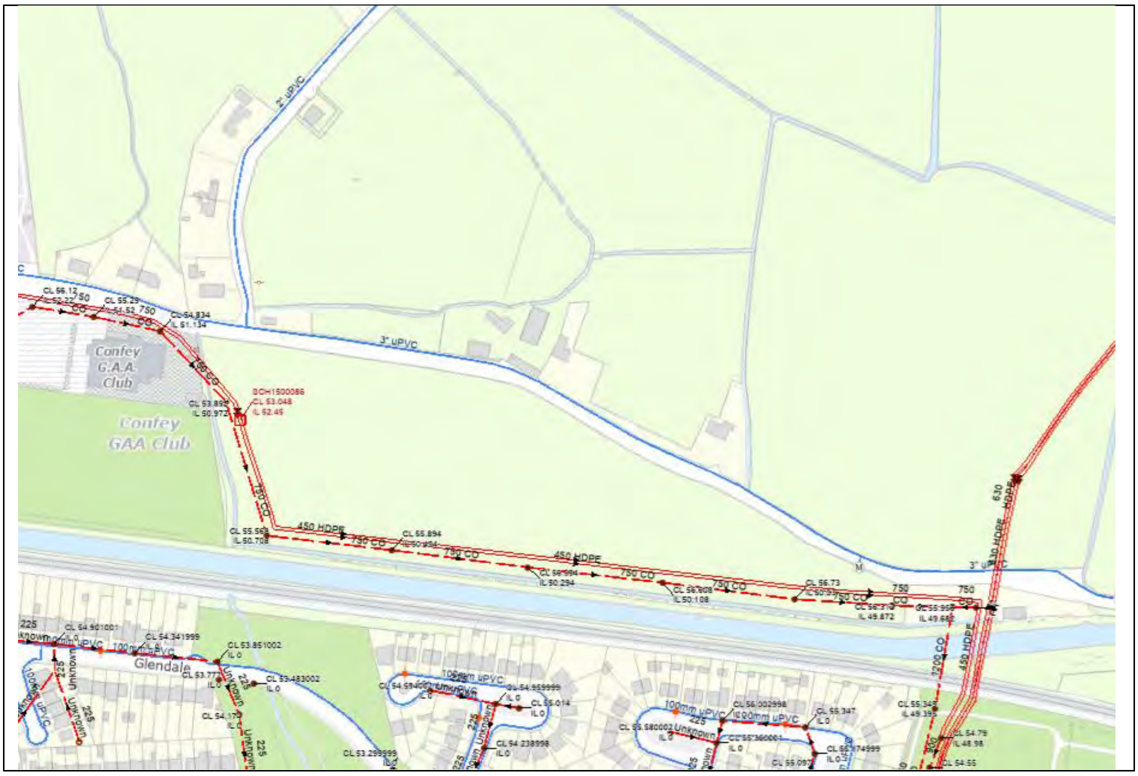
Section A - What is important to know?

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

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

Section B – Details of Uisce Éireann's Network(s)

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



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

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

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

Uisce Éireann
Irish Water

Paul Corrigan
Corrigan Hodnett CE
Balheary Demesne
Balheary Road
Swords
Dublin
K67E5A0

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

Uisce Éireann
PO Box 448
South City
Delivery Office
Cork City

www.water.ie

10 July 2026

Re: Design Submission for Lands at, Confey, Leixlip, Kildare (the "Development") (the "Design Submission") / Connection Reference No: CDS26003112

Dear Paul Corrigan,

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, Uisce Éireann has no objection to your proposals.

This letter does not constitute an offer, in whole or in part, to provide a connection to any Uisce Éireann infrastructure. Before you can connect to our network you must sign a connection agreement with Uisce Éireann. This can be applied for by completing the connection application form at www.water.ie/connections. Uisce Éireann'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 Uisce Éireann's network(s) (the "**Self-Lay Works**"), as reflected in your Design Submission. Acceptance of the Design Submission by Uisce Éireann does not, in any way, render Uisce Éireann liable for any elements of the design and/or construction of the Self-Lay Works.

If you have any further questions, please contact your Uisce Éireann representative:
Name: Antonio Garzón Mielgo
Email: antonio.garzonmielgo@water.ie

Yours sincerely,

Dermot Phelan

Dermot Phelan
Connections and Developer Services

Appendix A

Document Title & Revision

- CHC-00-GR-DR-C-00300-S4-P04_Watermain Layout
- CHC-00-GR-DR-C-00200-S2-P06
- CHC-00-GR-DR-C-00211-S4-P03_Drainage_Longitudinal Sections -Foul

Additional Comments

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

Uisce Éireann cannot guarantee that its Network in any location will have the capacity to deliver a particular flow rate and associated residual pressure to meet the requirements of the relevant Fire Authority, see Section 1.17 of Water Code of Practice.

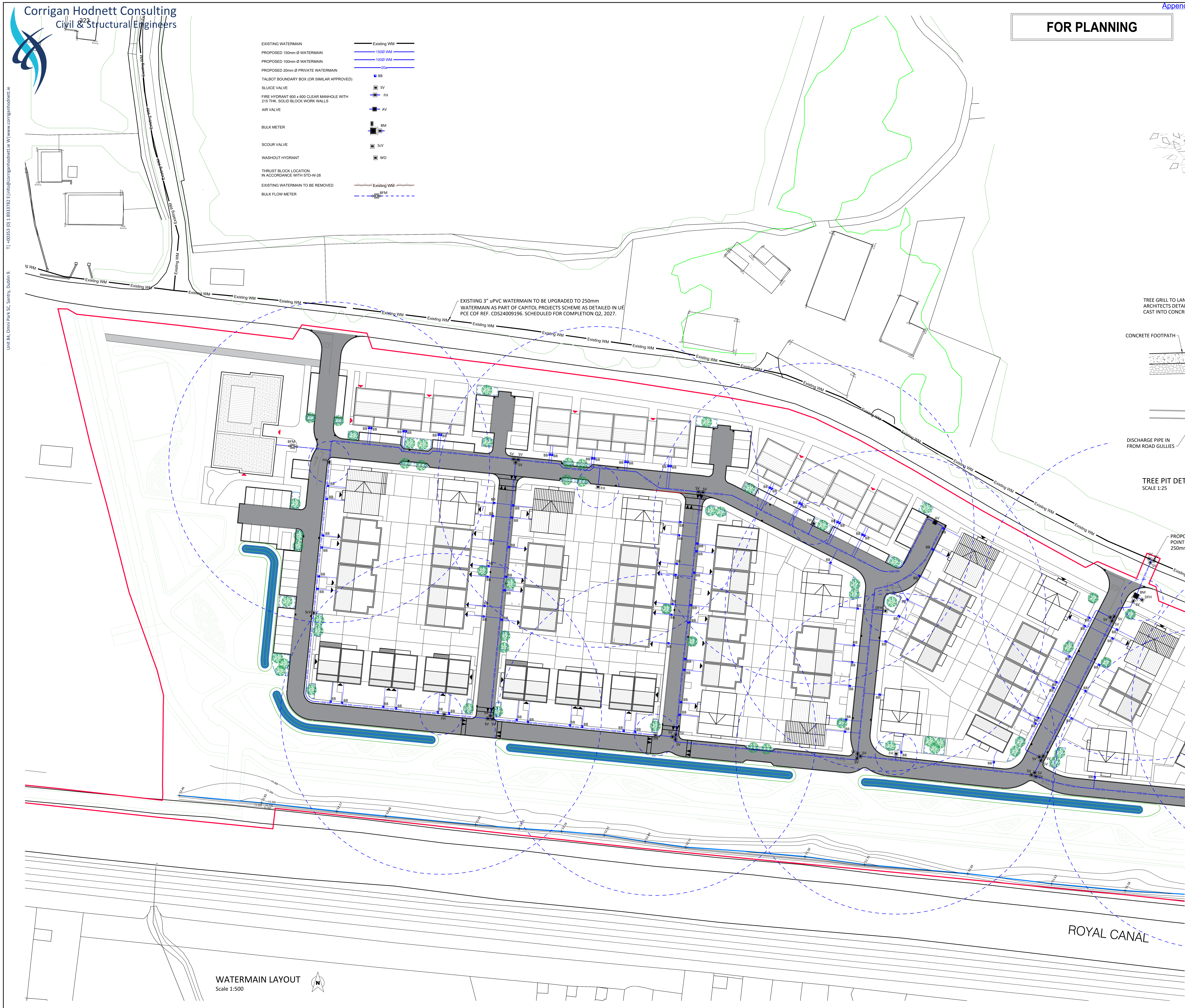
*For further information, visit **www.water.ie/connections***

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 Uisce Éireann will not, in any way, render Uisce Éireann liable for any elements of the design and/or construction of the Self-Lay Works.

Appendix B.2 – Uisce Éireann Statement of Design Acceptance ref. CDS26003112

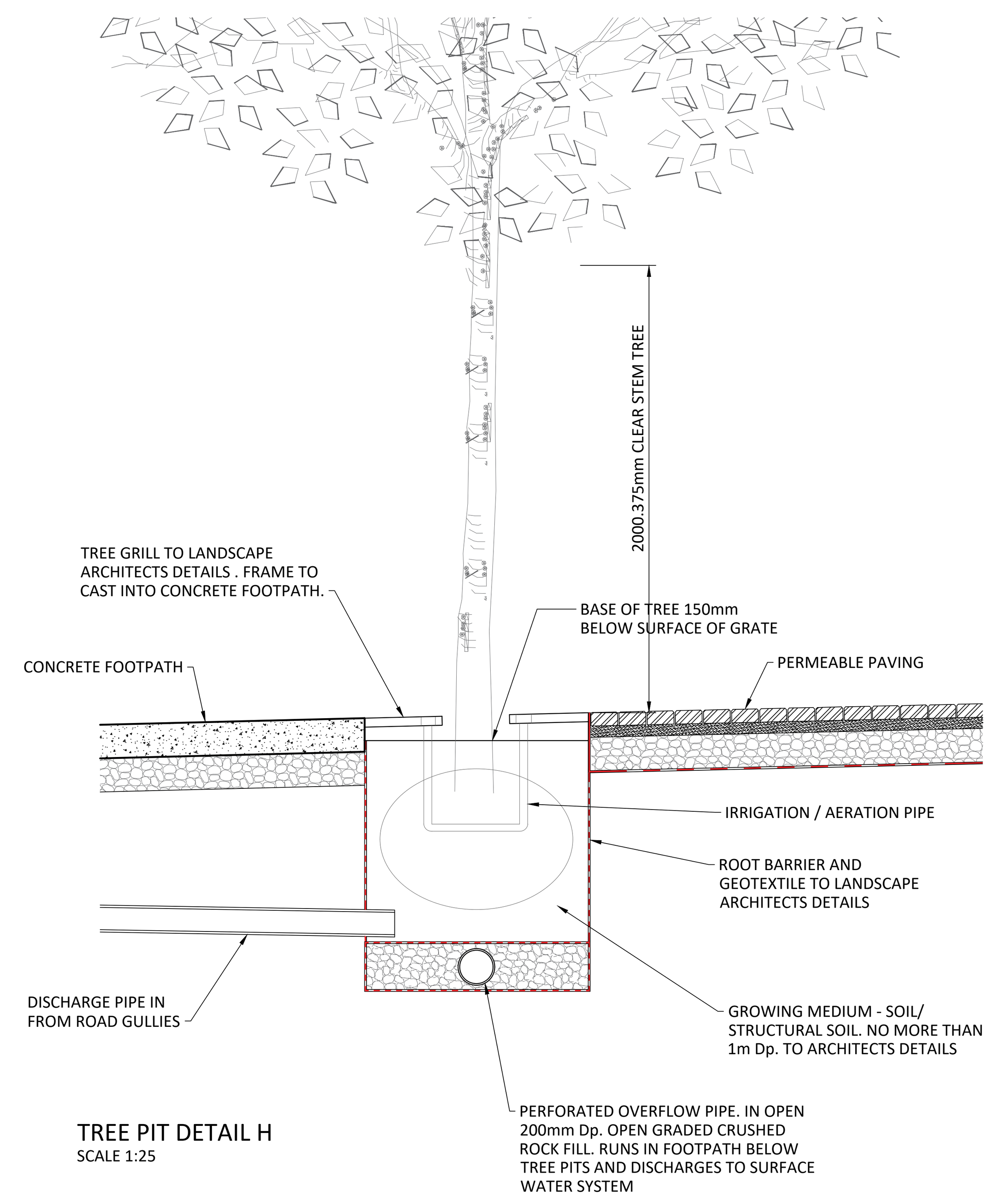
A1

FOR PLANNING



General Notes

1. Do not scale from this drawing. Refer to Architects drawings for all works levels and setting out.
2. This drawing is to be read in conjunction with all other Engineer's and Architect's drawings and specifications. Where discrepancies are observed please notify CHC for clarification.
3. Contractor to check all levels (existing and proposed), setting out and dimensions on site prior to commencement of the works and advise the consultants of any discrepancies.
4. All works to be constructed in accordance with current building control legislation, local authority requirements and good building practice.
5. All Insulation, weathering materials (dpc, dpm, flashings etc), radon barriers and sumps and all sub-floor ducting all to Architect's details.
6. Location of all service pop-ups to be confirmed and set out by the Architect.
7. Refer to Architect's drawings and specifications for fire strategy and all fire protection requirements
8. All materials and products specified must carry CE marking and Declarations of Performance as appropriate.
9. Contractor shall note the recommendations of the site investigation report in respect of all excavation depths, ground water levels and identification of required adequate bearing strata. All foundation formation soft spots or disturbed ground not covered in SI report to be recorded and notified to the Engineer.



TREE PIT DETAIL H
SCALE 1:25

Issue	Suitability	Date	Description	Designed	Drawn	Approved
P04	S4	10.07.2026	Revised to Uisce Eireann comments.	P.C.	N.N.	P.C.
P03	S4	07.07.2026	Issued for Planning.	P.C.	N.N.	P.C.
P02	S4	10.11.2025	Issued for Pre-Planning.	P.C.	N.N.	P.C.
P01	S4	07.10.2025	Issued for Planning.	P.C.	N.N.	P.C.

Suitability: S1=Coordination, S2=Information, S4=Planning, D2=Tender, D3=Compliance, A1=Construction, CR=As Constructed

Project
Confey Lands, Leixlip

Drawing Title
Watermain Layout

CHC
Corrigan Hodnett Consulting

Client
Leixlip and Newbridge SPV Limited

Originator.	Area.	Level.	Type.	Role.	Number.
CHC	- 00	- GR	- DR	- C	-00300

A1

Corrigan Hodnett Consulting
Civil & Structural Engineers
T| +00353 (0) 1 8933782 E| info@corriganhodnett.ie W| www.corriganhodnett.ie
UnRG 84, Omni Park SC, Santry, Dublin 9.

HYDROBRAKE MANHOLE DETAILS					
REF.	Sa7	Sb7	Sc7	Sd5	Se9
Volume (m³)	2.2	1.5	2.0	4.1	2.4
Unit reference	MD-SHE-0037 -5000-0550-5000	MD-SHE-0050 -9000-0550-9000	MD-SHE-0047 -8000-0550-8000	MD-SHE-0041 -6000-0550-6000	MD-SHE-0041 -6000-0550-6000
Design Head (m)	0.550	0.550	0.550	0.550	0.550
Design flow (l/s)	0.5	0.9	0.8	0.6	0.6
Diameter (mm)	37	50	47	41	41
Invert Level (m)	53.659	53.885	53.649	54.023	54.108
Minimum outlet pipe Diameter. (mm) = 75 - Suggested Manhole Diameter (mm) = 1200 Flush-Flo™ Calculated - Objective Minimise upstream storage - Application Surface - Sump Available Yes					

FOR PRE-PLANNING

EXISTING UISCE EIREANN WAYLEAVE
EXISTING FOUL SEWER
STORM SEWER (PUBLIC)
STORM WATER MANHOLES
FOUL SEWER (PUBLIC)
FOUL WATER MANHOLES
PRIVATE FOUL MANHOLE
EXISTING 450mm Ø WASTEWATER RISING MAIN
PLUVIAL CUBE ATTENUATION STORAGE WITH 10mm INTERCEPTION VOLUME STORAGE
TREE PIT
RAIN GARDEN WITH ACCESS JUNCTION
225Ø PERFORATED STORM SEWER
CONVEYANCE SWALE

General Notes

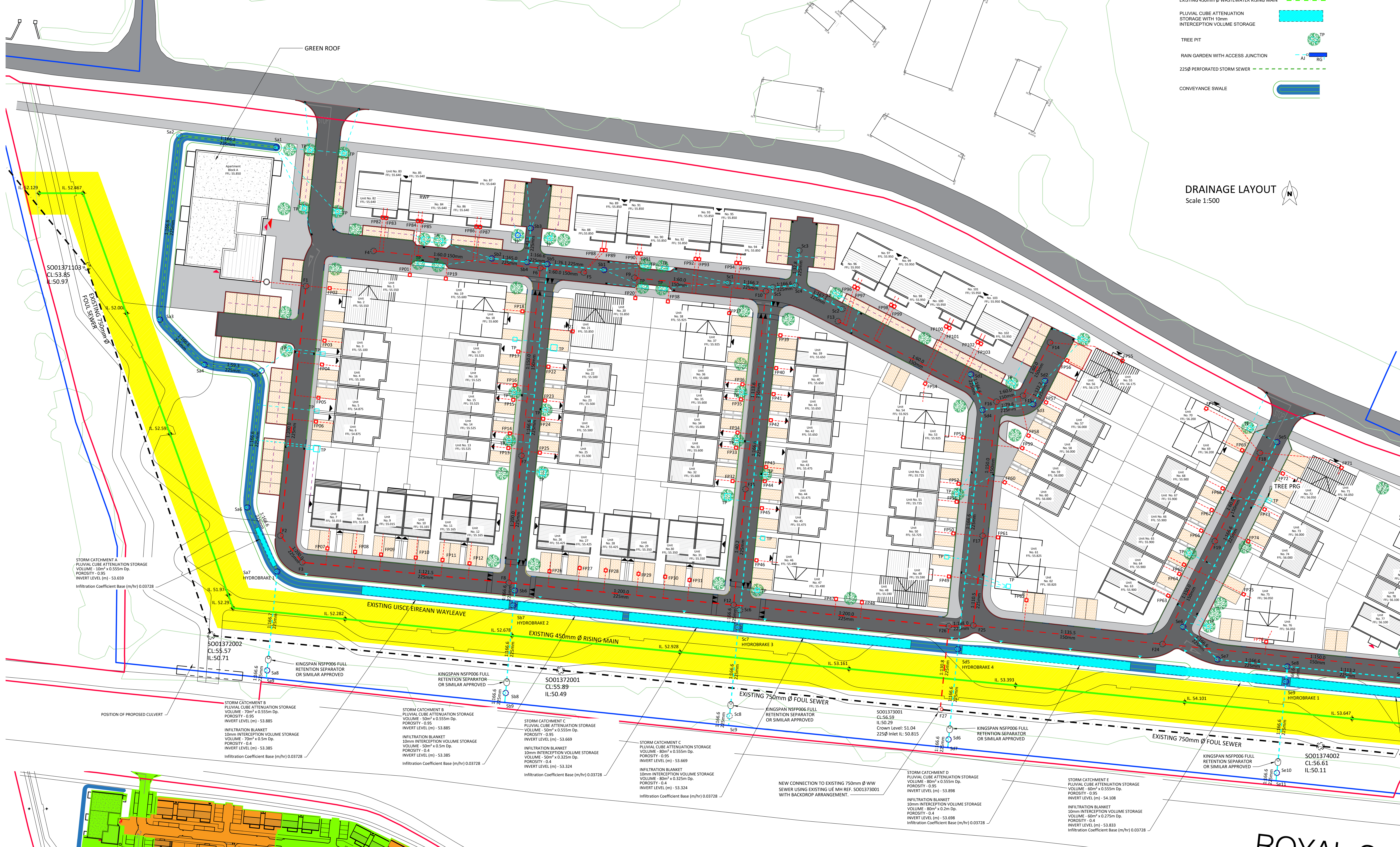
1. Do not scale from this drawing. Refer to ArchRGects drawings for all works levels and setting out.
2. This drawing is to be read in conjunction wRGh all other Engineer's and ArchRGect's drawings and specifications. Where discrepancies are observed please notify CHC for clarification.
3. Contractor to check all levels (existing and proposed), setting out and dimensions on sRGe prior to commencement of the works and advise the consultants of any discrepancies.
4. All works to be constructed in accordance wRGh current building control legislation, local authorRGy requirements and good building practice.
5. All Insulation, weathering materials (dpc, dpm, flashings etc), radon barriers and sumps and all sub-floor ducting all to ArchRGect's details.
6. Location of all service pop-ups to be confirmed and set out by the ArchRGect.
7. Refer to ArchRGect's drawings and specifications for fire strategy and all fire protection requirements
8. All materials and products specified must carry CE marking and Declarations of Performance as appropriate.
9. Contractor shall note the recommendations of the sRGe investigation report in respect of all excavation depths, ground water levels and identification of required adequate bearing strata. All foundation formation soft spots or disturbed ground not covered in SI report to be recorded and notified to the Engineer.

Manhole Name	Cover Level (m)	Pipe Out Invert Level (m)	Pipes In Invert Level (m)
F1	55.311	53.586	
F2	54.794	53.277	53.277
F3	54.845	53.254	53.254
F4	55.469	54.031	
F5	55.705	54.267	
F6	55.689	53.370	53.370
			54.095
F7	55.384	52.998	53.073
F8	55.178	52.847	52.850
			52.847
F9	55.711	54.273	
F10	55.792	53.752	53.752
F11	55.437	53.263	53.338
F12	55.229	52.578	52.580
			52.578
F13	55.663	54.240	
F14	56.040	54.615	
F15	55.947	54.380	54.380
F16	55.928	53.539	53.539
			54.272
F17	55.619	53.252	53.327
F18	55.992	54.039	
F19	55.828	53.648	53.648
F20	55.914	54.189	
F21	56.067	54.133	
F22	55.962	54.026	54.026
			54.026
F23	56.175	53.869	53.869
F24	55.807	53.466	53.466
			53.467
F25	55.626	53.059	53.059
			53.134
F26	55.595	52.322	52.322
			53.017
F27	56.590	OUTFALL	52.171

Manhole Name	Cover Level (m)	Pipe Out Invert Level (m)	Pipes In Invert Level (m)
Sa1	55.450	54.675	55.240
			55.240
			55.277
Sa2	55.335	54.536	54.536
Sa3	55.116	54.273	54.273
Sa4	55.000	54.183	54.183
Sa5	54.730	53.955	53.955
Sa6	54.536	53.760	53.760
Sa16	55.275	54.000	
Sa7	54.500	53.659	53.659
			53.897
Sa8	56.099	53.518	53.518
Sa9	56.474	OUTFALL	53.508
Sb1	55.674	54.549	55.449
Sb2	55.577	54.452	55.198
Sb3	55.722	54.597	55.529
Sb4	55.665	54.401	54.401
Sb5	55.711	54.372	54.372
Sb6	55.176	53.907	53.907
Sb7	55.163	53.885	53.885
Sb8	56.089	53.761	53.760
Sb9	55.000	OUTFALL	53.748
Sc1	55.866	54.741	55.618
Sc2	55.665	54.540	55.497
Sc3	55.843	54.418	
Sc4	55.791	54.166	54.466
Sc5	55.808	54.134	54.677
Sc6	55.199	53.673	53.673
Sc7	55.305	53.649	53.649
Sc8	55.800	53.523	53.523
Sc9	56.019	OUTFALL	53.510
Sd1	55.842	54.417	55.590
Sd2	55.991	54.566	55.770
Sd3	55.941	54.516	54.516
Sd4	55.846	54.364	54.364
Sd5	55.681	54.023	54.023
Sd6	56.259	53.894	53.894
Sd7	56.469	OUTFALL	53.884
Se1	56.068	54.643	
Se2	55.972	54.547	54.547
Se3	56.128	54.417	54.417
Se4	56.161	54.383	54.383
Se5	56.016	54.591	55.764
Se6	55.746	54.297	54.297
Se7	55.853	54.230	54.230
Se8	55.994	54.130	54.130
Se9	56.143	54.108	54.108
Se10	56.419	53.978	53.978
Se11	56.629	OUTFALL	53.968

DRAINAGE LAYOUT

Scale 1:500



CATCHMENTS

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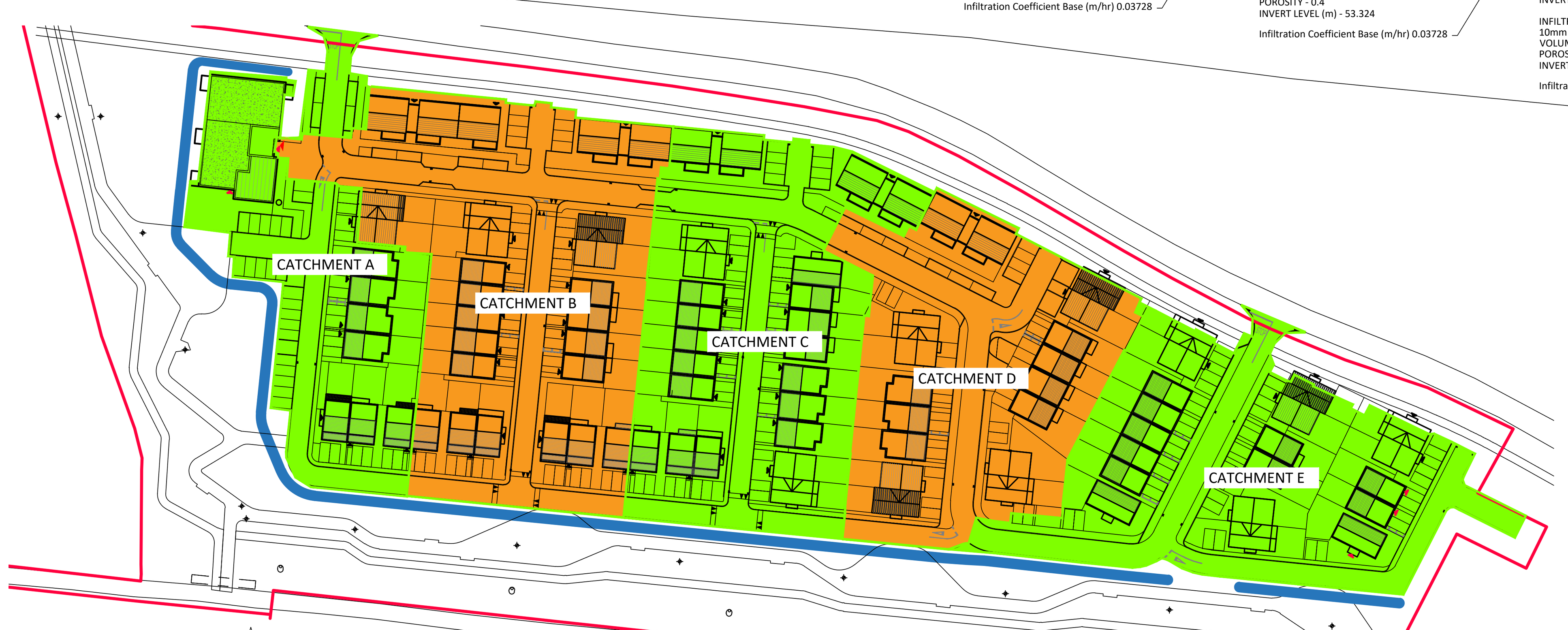

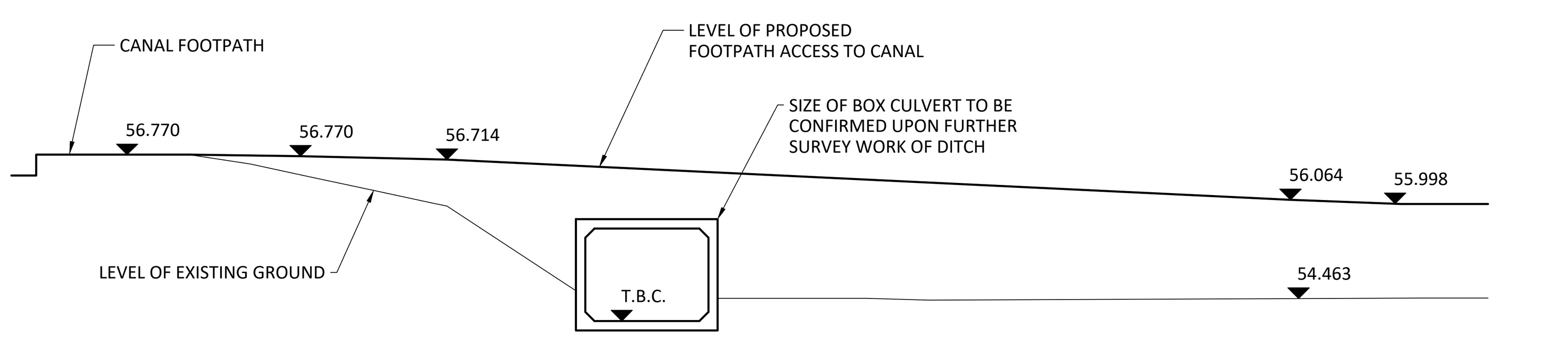

SECTION THROUGH PROPOSED CULVERT

SCALE 1:100

Issue	Suitability	Date	Description	Designed	Drawn	Approved
P06	S2	20.05.2026	Site layout revised.	P.C.	N.N.	P.C.
P01	S4	07.11.2025	Issued for Pre-Planning	P.C.	N.N.	P.C.
P05	S2	03.11.2025	Swale extended.	P.C.	N.N.	P.C.
P04	S2	22.10.2025	Issued for information.	P.C.	N.N.	P.C.
P03	S2	27.02.2025	Wayleave added	P.C.	N.N.	P.C.
P02	S2	24.02.2025	Revised sRGe layout.	P.C.	N.N.	P.C.
P01	S2	11.10.2024	Issued for information.	M.H.	N.N.	M.H.

Suitability: S1=Coordination, S2=Information, S4=Planning, D2=Tender, D3=Compliance, A1=Construction, CR=As Constructed

Project
Confey Lands, Leixlip

Drawing TRGle
Drawing Layout

CHC
Corrigan Hodnett Consulting

Client
Leixlip and Newbridge SPV Limited

Originator.	Area.	Level.	Type.	Role.	Number.
CHC	- 00	- GR	- DR	- C	-00200

A1

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Civil & Structural Engineers

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T| +00353 (0) 1 8933782 E| info@chcce.ie W| www.chcce.ie

General Notes

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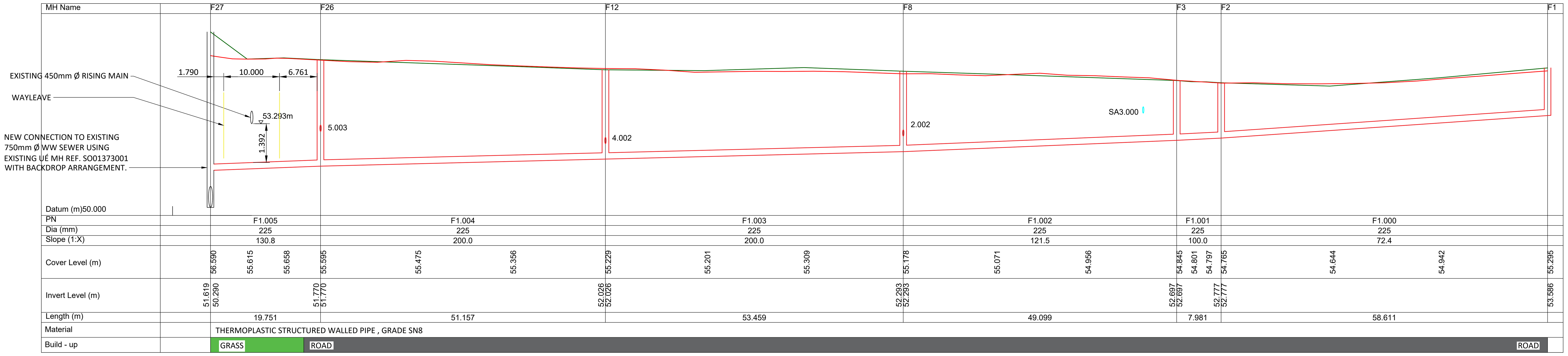
3. Contractor to check all levels (existing and proposed), setting out and dimensions on site prior to commencement of the works and advise the consultants of any discrepancies.
4. All works to be constructed in accordance with current building control legislation, local authority requirements and good building practice.
5. All Insulation, weathering materials (dpc, dpm, flashings etc), radon barriers and sumps and all sub-floor ducting all to Architect's details.
6. Location of all service pop-ups to be confirmed and set out by the Architect.
7. Refer to Architect's drawings and specifications for fire strategy and all fire protection requirements
8. All materials and products specified must carry CE marking and Declarations of Performance as appropriate.
9. Contractor shall note the recommendations of the site investigation report in respect of all excavation depths, ground water levels and identification of required adequate bearing strata. All foundation formation soft spots or disturbed ground not covered in SI report to be recorded and notified to the Engineer.

FOR PLANNING



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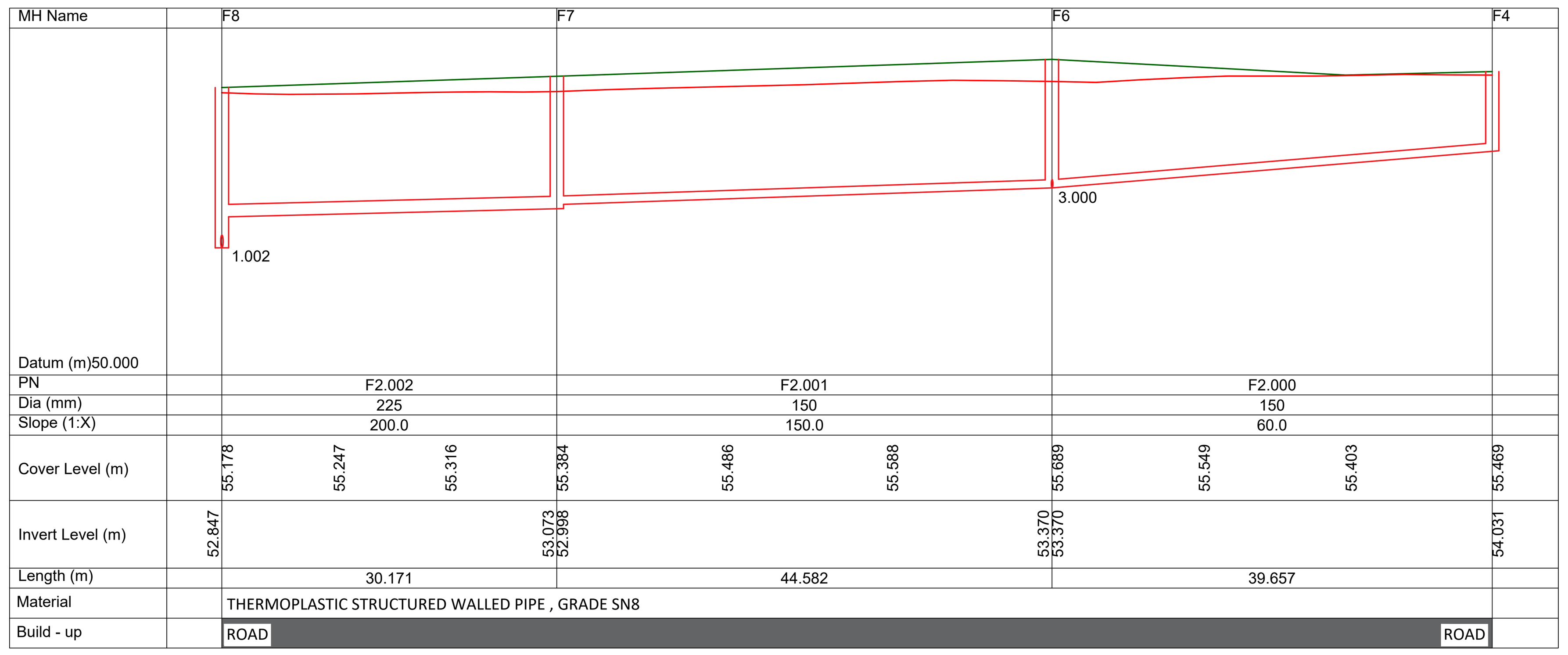
Vertical Scale 1:100



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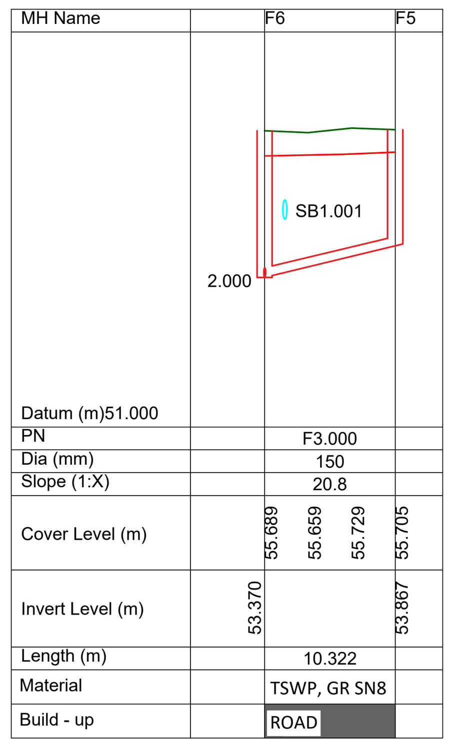
Vertical Scale 1:100



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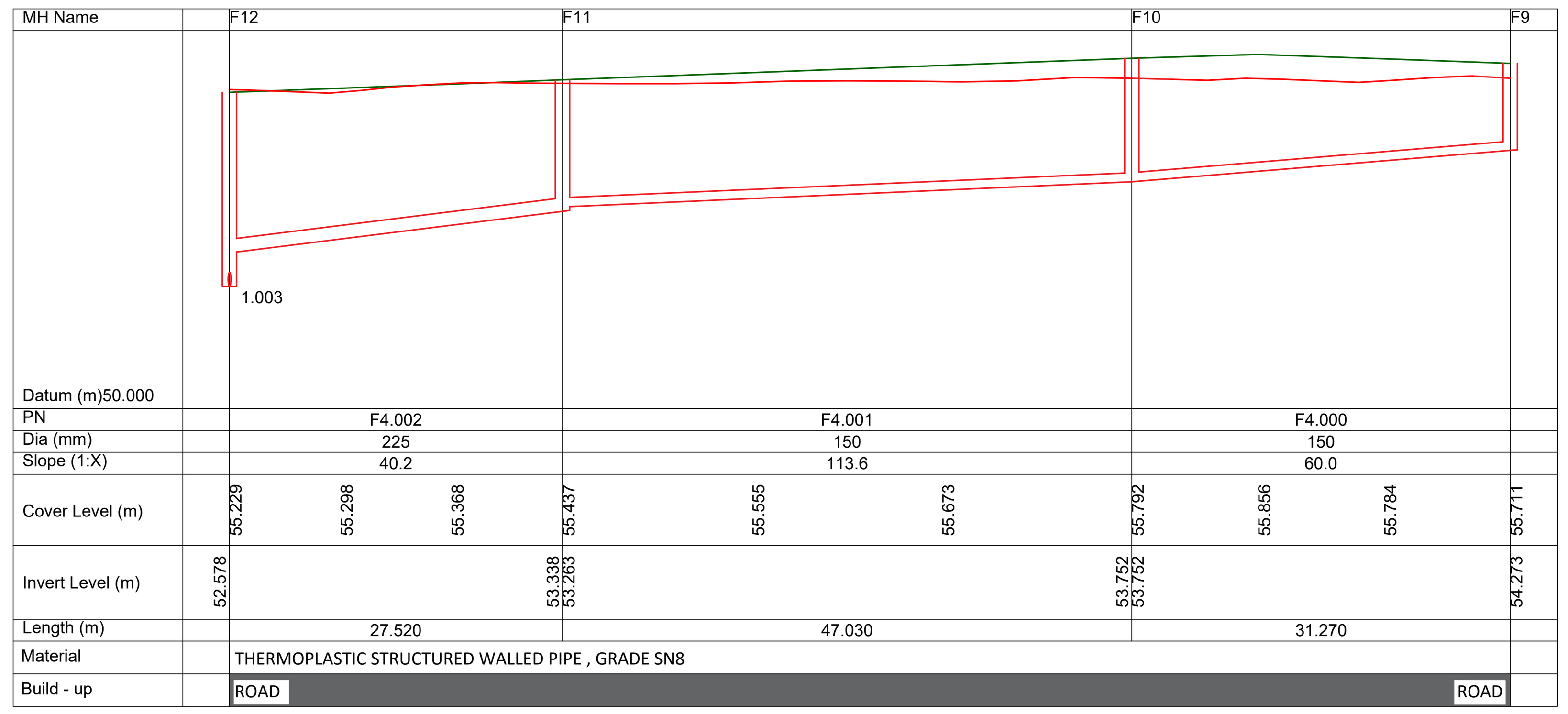

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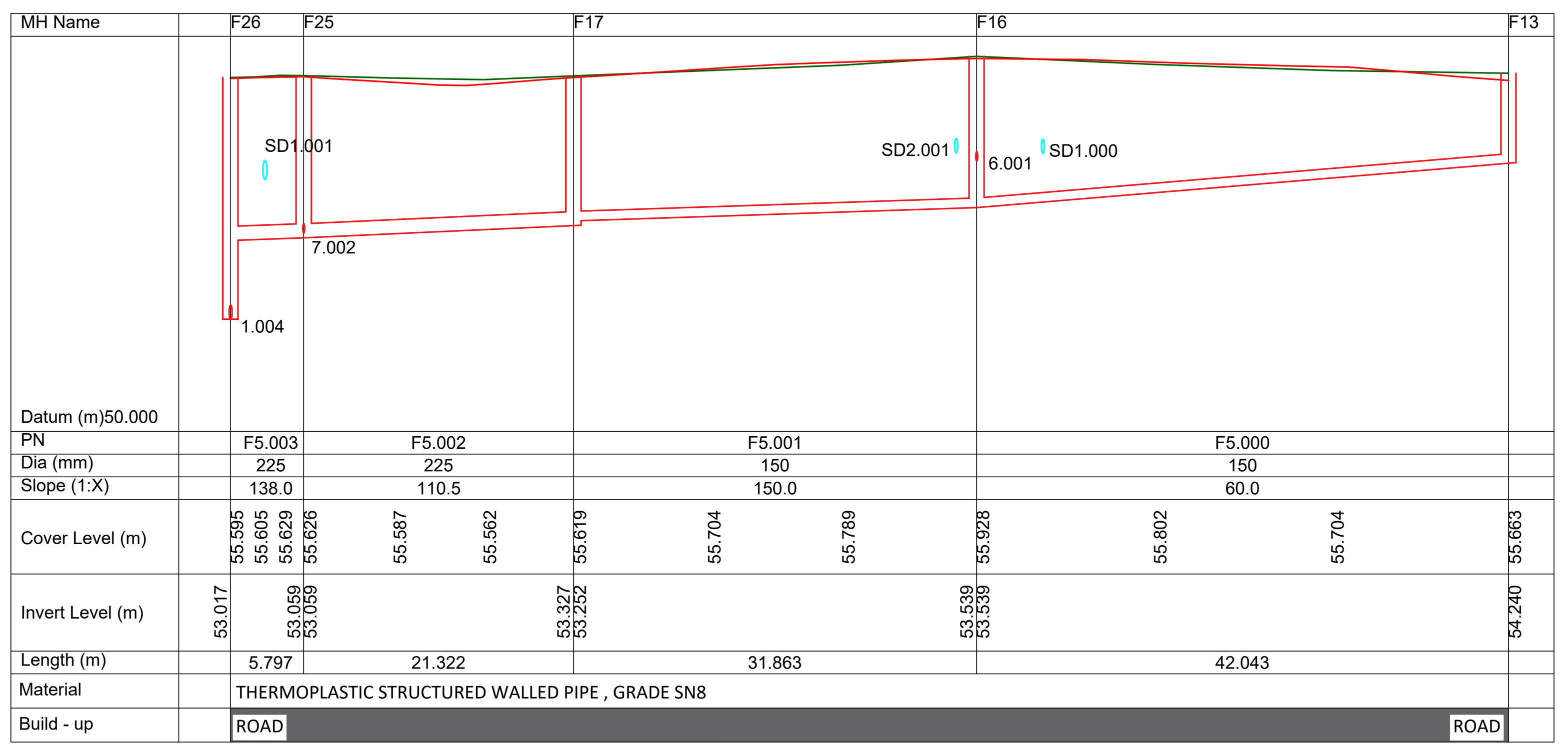

DRAINAGE LONGSECTIONS - FOUL 5
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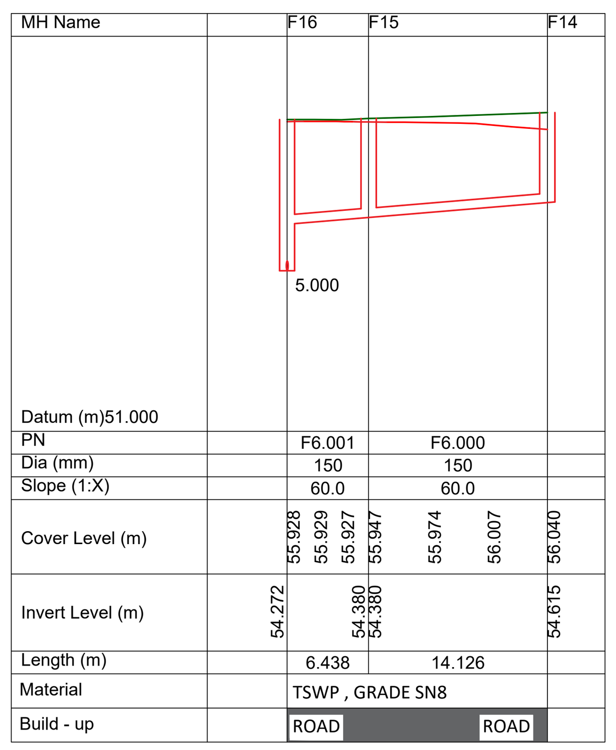

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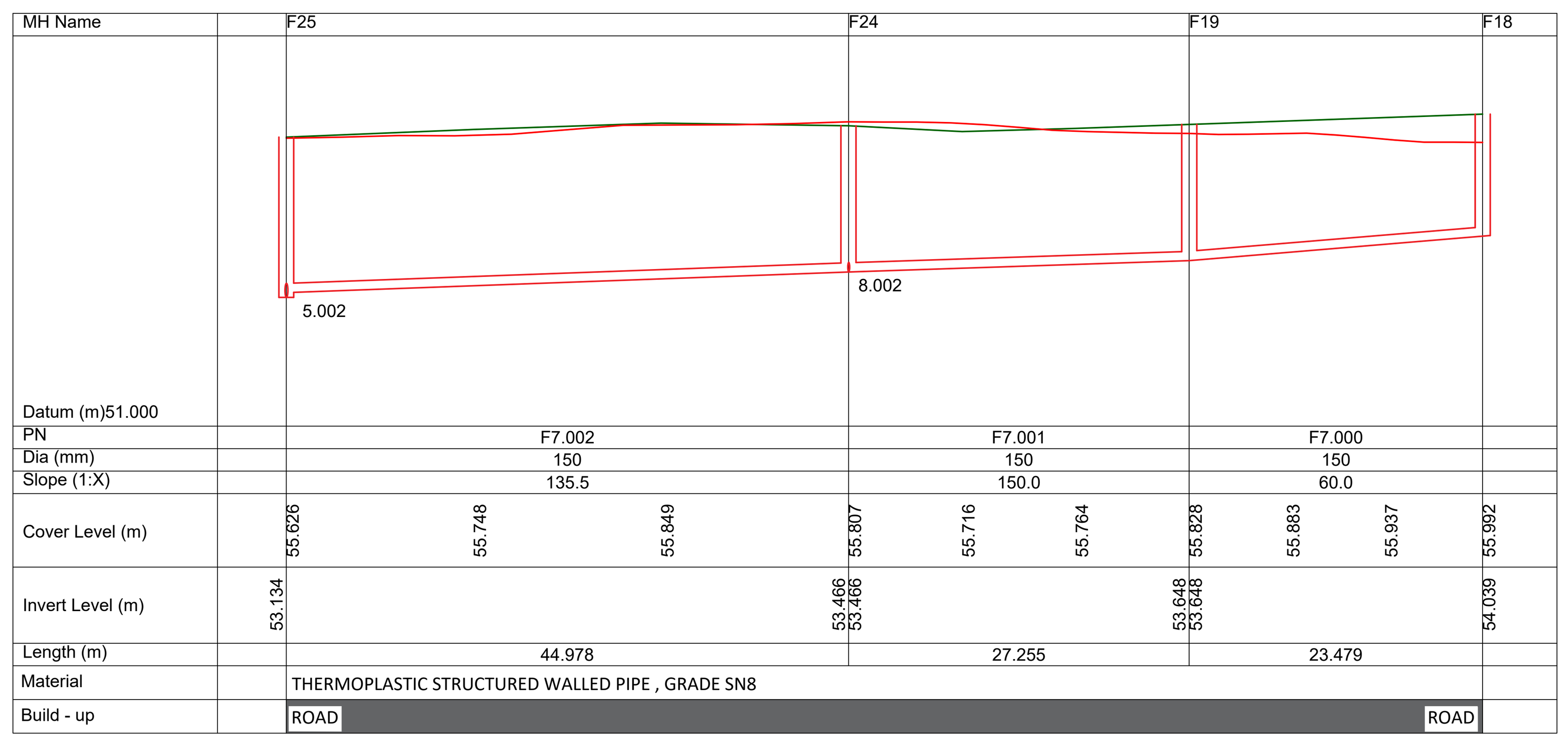
Vertical Scale 1:100



DRAINAGE LONGSECTIONS - FOUL 7
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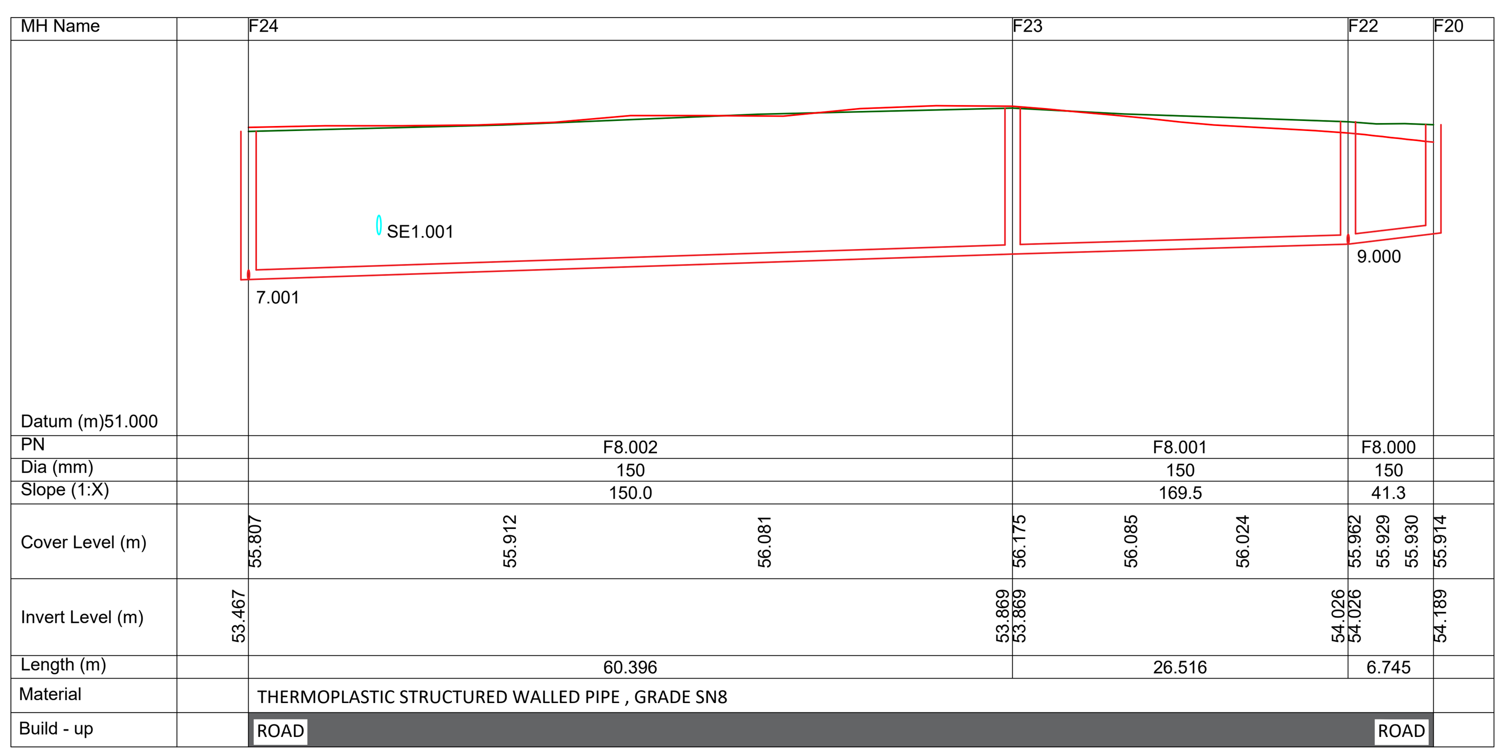
Vertical Scale 1:100



DRAINAGE LONGSECTIONS - FOUL 8
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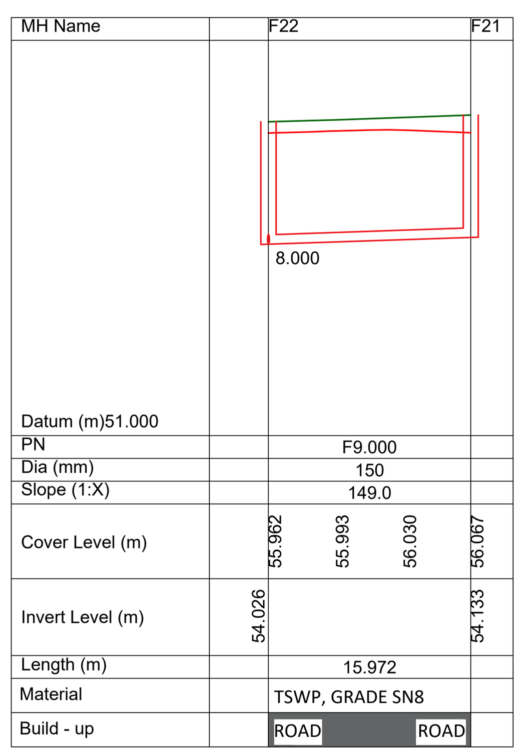
Vertical Scale 1:100



DRAINAGE LONGSECTIONS - FOUL 9
Horizontal Scale 1:500
Vertical Scale 1:100

Issue	Suitability	Date	Description	Designed	Drawn	Approved
P03	S4	10.07.2026	Revised to Usice Eireann Comments	P.C.	N.N.	P.C.
P02	S4	07.07.2026	Issued for Planning.	P.C.	N.N.	P.C.
P01	S4	07.11.2025	Issued for Pre-Planning.	P.C.	N.N.	P.C.

Project
Character Area R5,
Confey Lands, Leixlip.

Drawing Title
Drainage longitudinal sections - Foul

CHC
Corrigan Hodnett Consulting

Client
Leixlip and Newbridge SPV Limited

Originator.	Area.	Level.	Type.	Role.	Number.
CHC	-00	-GR	-DR	-C	-00211

Appendix C

C.1 – Wastewater Design Calculations (Microdrainage)

Corrigan Hodnett Consulting		Page 1
Civil & Structural Engineers Unit 84 Omni Park SC Santry, Dublin 9	Confey R5 Lands Phase 1a Wastewater Network	
Date 01/07/2026 14:12 File CHC-00-XX-CA-C-00014-S2-P01_Confey.MDX	Designed by P.C. Checked by P.C.	
XP Solutions	Network 2020.1.3	

FOUL SEWERAGE DESIGN

Design Criteria for Foul - Main

Pipe Sizes STANDARD Manhole Sizes STANDARD

Industrial Flow (l/s/ha)	0.00	Domestic (l/s/ha)	0.00	Maximum Backdrop Height (m)	4.000
Industrial Peak Flow Factor	0.00	Domestic Peak Flow Factor	6.00	Min Design Depth for Optimisation (m)	1.200
Flow Per Person (l/per/day)	165.00	Add Flow / Climate Change (%)	0	Min Vel for Auto Design only (m/s)	0.75
Persons per House	2.70	Minimum Backdrop Height (m)	0.000	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Network Design Table for Foul - Main

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	Houses	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
F1.000	58.611	0.809	72.4	0.000	27	0.0	0.600	o	225	Pipe/Conduit	
F1.001	7.981	0.080	100.0	0.000	0	0.0	0.600	o	225	Pipe/Conduit	

Network Results Table

PN	US/IL (m)	Σ Area (ha)	Σ Base Flow (l/s)	Σ Hse	Add Flow (l/s)	P.Dep (mm)	P.Vel (m/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
F1.000	53.586	0.000	0.0	27	0.0	18	0.54	1.54	61.2	0.8
F1.001	52.777	0.000	0.0	27	0.0	20	0.49	1.31	52.0	0.8

Network Design Table for Foul - Main

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	Houses	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
F1.002	49.099	0.404	121.5	0.000	6	0.0	0.600	o	225	Pipe/Conduit	
F2.000	39.657	0.661	60.0	0.000	8	0.0	0.600	o	150	Pipe/Conduit	
F3.000	10.322	0.497	20.8	0.000	2	0.0	0.600	o	150	Pipe/Conduit	
F2.001	44.582	0.297	150.0	0.000	10	0.0	0.600	o	150	Pipe/Conduit	
F2.002	30.171	0.151	200.0	0.000	0	0.0	0.600	o	225	Pipe/Conduit	
F1.003	53.459	0.267	200.0	0.000	6	0.0	0.600	o	225	Pipe/Conduit	

Network Results Table

PN	US/IL (m)	Σ Area (ha)	Σ Base Flow (l/s)	Σ Hse	Add Flow (l/s)	P.Dep (mm)	P.Vel (m/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
F1.002	52.697	0.000	0.0	33	0.0	23	0.48	1.18	47.1	1.0
F2.000	54.031	0.000	0.0	8	0.0	11	0.42	1.30	23.0	0.2
F3.000	53.867	0.000	0.0	2	0.0	5	0.39	2.22	39.2	0.1
F2.001	53.370	0.000	0.0	20	0.0	21	0.41	0.82	14.5	0.6
F2.002	52.998	0.000	0.0	20	0.0	20	0.35	0.92	36.6	0.6
F1.003	52.293	0.000	0.0	59	0.0	34	0.48	0.92	36.6	1.8

Network Design Table for Foul - Main

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	Houses	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
F4.000	31.270	0.521	60.0	0.000	9	0.0	0.600	o	150	Pipe/Conduit	
F4.001	47.030	0.414	113.6	0.000	11	0.0	0.600	o	150	Pipe/Conduit	
F4.002	27.520	0.685	40.2	0.000	2	0.0	0.600	o	225	Pipe/Conduit	
F1.004	51.157	0.256	200.0	0.000	2	0.0	0.600	o	225	Pipe/Conduit	
F5.000	42.043	0.701	60.0	0.000	9	0.0	0.600	o	150	Pipe/Conduit	
F6.000	14.126	0.235	60.0	0.000	3	0.0	0.600	o	150	Pipe/Conduit	

Network Results Table

PN	US/IL (m)	Σ Area (ha)	Σ Base Flow (l/s)	Σ Hse	Add Flow (l/s)	P.Dep (mm)	P.Vel (m/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
F4.000	54.273	0.000	0.0	9	0.0	12	0.44	1.30	23.0	0.3
F4.001	53.752	0.000	0.0	20	0.0	20	0.45	0.94	16.6	0.6
F4.002	53.263	0.000	0.0	22	0.0	15	0.63	2.07	82.3	0.7
F1.004	52.026	0.000	0.0	83	0.0	40	0.53	0.92	36.6	2.6
F5.000	54.240	0.000	0.0	9	0.0	12	0.44	1.30	23.0	0.3
F6.000	54.615	0.000	0.0	3	0.0	7	0.31	1.30	23.0	0.1

Network Design Table for Foul - Main

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	Houses	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
F6.001	6.438	0.107	60.0	0.000	1	0.0	0.600	o	150	Pipe/Conduit	
F5.001	31.863	0.212	150.0	0.000	7	0.0	0.600	o	150	Pipe/Conduit	
F5.002	21.322	0.193	110.5	0.000	1	0.0	0.600	o	225	Pipe/Conduit	
F7.000	23.479	0.391	60.0	0.000	9	0.0	0.600	o	150	Pipe/Conduit	
F7.001	27.255	0.182	150.0	0.000	3	0.0	0.600	o	150	Pipe/Conduit	
F8.000	6.745	0.163	41.3	0.000	2	0.0	0.600	o	150	Pipe/Conduit	

Network Results Table

PN	US/IL (m)	Σ Area (ha)	Σ Base Flow (l/s)	Σ Hse	Add Flow (l/s)	P.Dep (mm)	P.Vel (m/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
F6.001	54.380	0.000	0.0	4	0.0	8	0.34	1.30	23.0	0.1
F5.001	53.539	0.000	0.0	20	0.0	21	0.41	0.82	14.5	0.6
F5.002	53.252	0.000	0.0	21	0.0	18	0.43	1.24	49.4	0.6
F7.000	54.039	0.000	0.0	9	0.0	12	0.44	1.30	23.0	0.3
F7.001	53.648	0.000	0.0	12	0.0	17	0.35	0.82	14.5	0.4
F8.000	54.189	0.000	0.0	2	0.0	5	0.30	1.57	27.7	0.1

Network Design Table for Foul - Main

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	Houses	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
F9.000	15.972	0.107	149.0	0.000	15	0.0	0.600	o	150	Pipe/Conduit	
F8.001	26.516	0.156	169.5	0.000	3	0.0	0.600	o	150	Pipe/Conduit	
F8.002	60.396	0.403	150.0	0.000	0	0.0	0.600	o	150	Pipe/Conduit	
F7.002	44.978	0.332	135.5	0.000	0	0.0	0.600	o	150	Pipe/Conduit	
F5.003	5.797	0.042	138.0	0.000	0	0.0	0.600	o	225	Pipe/Conduit	
F1.005	19.751	0.151	130.8	0.000	0	0.0	0.600	o	225	Pipe/Conduit	

Network Results Table

PN	US/IL (m)	Σ Area (ha)	Σ Base Flow (l/s)	Σ Hse	Add Flow (l/s)	P.Dep (mm)	P.Vel (m/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
F9.000	54.133	0.000	0.0	15	0.0	18	0.37	0.82	14.5	0.5
F8.001	54.026	0.000	0.0	20	0.0	22	0.39	0.77	13.6	0.6
F8.002	53.869	0.000	0.0	20	0.0	21	0.41	0.82	14.5	0.6
F7.002	53.466	0.000	0.0	32	0.0	26	0.49	0.86	15.2	1.0
F5.003	53.059	0.000	0.0	53	0.0	29	0.53	1.11	44.2	1.6
F1.005	51.770	0.000	0.0	136	0.0	46	0.72	1.14	45.4	4.2

Manhole Schedules for Foul - Main

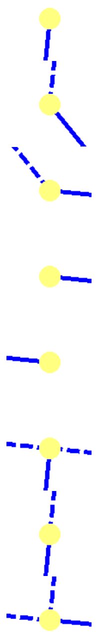
MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	PN	Pipe Out Invert Level (m)	Diameter (mm)	PN	Pipes In Invert Level (m)	Diameter (mm)	Backdrop (mm)
F1	55.295	1.709	Open Manhole	1200	F1.000	53.586	225				
F2	54.765	1.988	Open Manhole	1200	F1.001	52.777	225	F1.000	52.777	225	
F3	54.845	2.147	Open Manhole	1200	F1.002	52.697	225	F1.001	52.697	225	
F4	55.469	1.438	Open Manhole	1200	F2.000	54.031	150				
F5	55.705	1.838	Open Manhole	1200	F3.000	53.867	150				
F6	55.689	2.319	Open Manhole	1200	F2.001	53.370	150	F2.000	53.370	150	
								F3.000	53.370	150	
F7	55.384	2.387	Open Manhole	1200	F2.002	52.998	225	F2.001	53.073	150	
F8	55.178	2.885	Open Manhole	1200	F1.003	52.293	225	F1.002	52.293	225	
								F2.002	52.847	225	554
F9	55.711	1.438	Open Manhole	1200	F4.000	54.273	150				
F10	55.792	2.040	Open Manhole	1200	F4.001	53.752	150	F4.000	53.752	150	
F11	55.437	2.174	Open Manhole	1200	F4.002	53.263	225	F4.001	53.338	150	
F12	55.229	3.203	Open Manhole	1200	F1.004	52.026	225	F1.003	52.026	225	
								F4.002	52.578	225	552
F13	55.663	1.423	Open Manhole	1200	F5.000	54.240	150				
F14	56.040	1.425	Open Manhole	1200	F6.000	54.615	150				
F15	55.947	1.568	Open Manhole	1200	F6.001	54.380	150	F6.000	54.380	150	
F16	55.928	2.389	Open Manhole	1200	F5.001	53.539	150	F5.000	53.539	150	

Manhole Schedules for Foul - Main

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	PN	Pipe Out Invert Level (m)	Diameter (mm)	PN	Pipes In Invert Level (m)	Diameter (mm)	Backdrop (mm)
								F6.001	54.272	150	733
F17	55.619	2.367	Open Manhole	1200	F5.002	53.252	225	F5.001	53.327	150	
F18	55.992	1.953	Open Manhole	1200	F7.000	54.039	150				
F19	55.828	2.180	Open Manhole	1200	F7.001	53.648	150	F7.000	53.648	150	
F20	55.914	1.725	Open Manhole	1200	F8.000	54.189	150				
F21	56.067	1.934	Open Manhole	1200	F9.000	54.133	150				
F22	55.962	1.936	Open Manhole	1200	F8.001	54.026	150	F8.000	54.026	150	
								F9.000	54.026	150	
F23	56.175	2.306	Open Manhole	1200	F8.002	53.869	150	F8.001	53.869	150	
F24	55.807	2.340	Open Manhole	1200	F7.002	53.466	150	F7.001	53.466	150	
								F8.002	53.467	150	
F25	55.626	2.567	Open Manhole	1200	F5.003	53.059	225	F5.002	53.059	225	
								F7.002	53.134	150	1
F26	55.595	3.825	Open Manhole	1200	F1.005	51.770	225	F1.004	51.770	225	
								F5.003	53.017	225	1246
F27	56.590	4.971	Open Manhole	0		OUTFALL		F1.005	51.619	225	

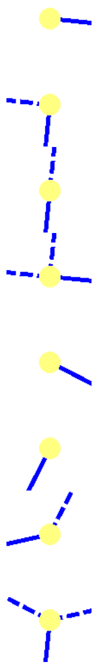
Manhole Schedules for Foul - Main

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
F1	701154.380	737144.000	701154.380	737144.000	Required	
F2	701148.400	737085.695	701148.400	737085.695	Required	
F3	701153.450	737079.514	701153.450	737079.514	Required	
F4	701170.338	737153.114	701170.338	737153.114	Required	
F5	701220.055	737148.011	701220.055	737148.011	Required	
F6	701209.787	737149.065	701209.787	737149.065	Required	
F7	701205.329	737104.707	701205.329	737104.707	Required	
F8	701202.311	737074.687	701202.311	737074.687	Required	



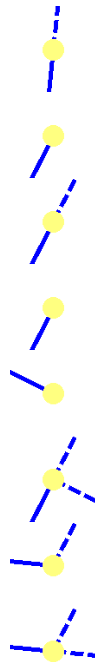
Manhole Schedules for Foul - Main

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
F9	701232.042	737146.782	701232.042	737146.782	Required	
F10	701263.149	737143.590	701263.149	737143.590	Required	
F11	701258.330	737096.807	701258.330	737096.807	Required	
F12	701255.512	737069.432	701255.512	737069.432	Required	
F13	701280.185	737136.511	701280.185	737136.511	Required	
F14	701330.354	737131.479	701330.354	737131.479	Required	
F15	701323.962	737118.883	701323.962	737118.883	Required	
F16	701317.677	737117.487	701317.677	737117.487	Required	



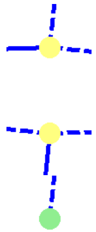
Manhole Schedules for Foul - Main

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
F17	701314.405	737085.792	701314.405	737085.792	Required	
F18	701379.983	737105.410	701379.983	737105.410	Required	
F19	701369.337	737084.483	701369.337	737084.483	Required	
F20	701432.146	737083.841	701432.146	737083.841	Required	
F21	701443.384	737070.702	701443.384	737070.702	Required	
F22	701429.090	737077.829	701429.090	737077.829	Required	
F23	701417.075	737054.191	701417.075	737054.191	Required	
F24	701356.978	737060.190	701356.978	737060.190	Required	



Manhole Schedules for Foul - Main

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
F25	701312.215	737064.583	701312.215	737064.583	Required	
F26	701306.421	737064.403	701306.421	737064.403	Required	
F27	701304.399	737044.756			No Entry	



PIPELINE SCHEDULES for Foul - Main

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
F1.000	o	225	F1	55.295	53.586	1.484	Open Manhole	1200
F1.001	o	225	F2	54.765	52.777	1.763	Open Manhole	1200
F1.002	o	225	F3	54.845	52.697	1.922	Open Manhole	1200
F2.000	o	150	F4	55.469	54.031	1.288	Open Manhole	1200
F3.000	o	150	F5	55.705	53.867	1.688	Open Manhole	1200
F2.001	o	150	F6	55.689	53.370	2.169	Open Manhole	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
F1.000	58.611	72.4	F2	54.765	52.777	1.763	Open Manhole	1200
F1.001	7.981	100.0	F3	54.845	52.697	1.922	Open Manhole	1200
F1.002	49.099	121.5	F8	55.178	52.293	2.660	Open Manhole	1200
F2.000	39.657	60.0	F6	55.689	53.370	2.169	Open Manhole	1200
F3.000	10.322	20.8	F6	55.689	53.370	2.169	Open Manhole	1200
F2.001	44.582	150.0	F7	55.384	53.073	2.162	Open Manhole	1200

PIPELINE SCHEDULES for Foul - Main

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
F2.002	o	225	F7	55.384	52.998	2.162	Open Manhole	1200
F1.003	o	225	F8	55.178	52.293	2.660	Open Manhole	1200
F4.000	o	150	F9	55.711	54.273	1.288	Open Manhole	1200
F4.001	o	150	F10	55.792	53.752	1.890	Open Manhole	1200
F4.002	o	225	F11	55.437	53.263	1.949	Open Manhole	1200
F1.004	o	225	F12	55.229	52.026	2.978	Open Manhole	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
F2.002	30.171	200.0	F8	55.178	52.847	2.106	Open Manhole	1200
F1.003	53.459	200.0	F12	55.229	52.026	2.978	Open Manhole	1200
F4.000	31.270	60.0	F10	55.792	53.752	1.890	Open Manhole	1200
F4.001	47.030	113.6	F11	55.437	53.338	1.949	Open Manhole	1200
F4.002	27.520	40.2	F12	55.229	52.578	2.426	Open Manhole	1200
F1.004	51.157	200.0	F26	55.595	51.770	3.600	Open Manhole	1200

PIPELINE SCHEDULES for Foul - Main

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
F5.000	o	150	F13	55.663	54.240	1.273	Open Manhole	1200
F6.000	o	150	F14	56.040	54.615	1.275	Open Manhole	1200
F6.001	o	150	F15	55.947	54.380	1.418	Open Manhole	1200
F5.001	o	150	F16	55.928	53.539	2.239	Open Manhole	1200
F5.002	o	225	F17	55.619	53.252	2.142	Open Manhole	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
F5.000	42.043	60.0	F16	55.928	53.539	2.239	Open Manhole	1200
F6.000	14.126	60.0	F15	55.947	54.380	1.418	Open Manhole	1200
F6.001	6.438	60.0	F16	55.928	54.272	1.506	Open Manhole	1200
F5.001	31.863	150.0	F17	55.619	53.327	2.142	Open Manhole	1200
F5.002	21.322	110.5	F25	55.626	53.059	2.342	Open Manhole	1200

PIPELINE SCHEDULES for Foul - Main

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
F7.000	o	150	F18	55.992	54.039	1.803	Open Manhole	1200
F7.001	o	150	F19	55.828	53.648	2.030	Open Manhole	1200
F8.000	o	150	F20	55.914	54.189	1.575	Open Manhole	1200
F9.000	o	150	F21	56.067	54.133	1.784	Open Manhole	1200
F8.001	o	150	F22	55.962	54.026	1.786	Open Manhole	1200
F8.002	o	150	F23	56.175	53.869	2.156	Open Manhole	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
F7.000	23.479	60.0	F19	55.828	53.648	2.030	Open Manhole	1200
F7.001	27.255	150.0	F24	55.807	53.466	2.190	Open Manhole	1200
F8.000	6.745	41.3	F22	55.962	54.026	1.786	Open Manhole	1200
F9.000	15.972	149.0	F22	55.962	54.026	1.786	Open Manhole	1200
F8.001	26.516	169.5	F23	56.175	53.869	2.156	Open Manhole	1200
F8.002	60.396	150.0	F24	55.807	53.467	2.190	Open Manhole	1200

PIPELINE SCHEDULES for Foul - Main

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
F7.002	o	150	F24	55.807	53.466	2.190	Open Manhole	1200
F5.003	o	225	F25	55.626	53.059	2.342	Open Manhole	1200
F1.005	o	225	F26	55.595	51.770	3.600	Open Manhole	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
F7.002	44.978	135.5	F25	55.626	53.134	2.342	Open Manhole	1200
F5.003	5.797	138.0	F26	55.595	53.017	2.353	Open Manhole	1200
F1.005	19.751	130.8	F27	56.590	51.619	4.746	Open Manhole	0

Free Flowing Outfall Details for Foul - Main

Outfall Pipe Number	**Outfall Name**	**C. Level (m)**	**I. Level (m)**	**Min I. Level (m)**	**D,L (mm)**	**W (mm)**
F1.005	F27	56.590	51.619	50.815	0	0

Appendix D

D.1 – Microdrainage Network and Model Simulation Results Design Year and Future (30% Climate Change Plus 10% Urban Creep)

D.2 – Met Éireann Return Period Rainfall Depths

D.3 – Ground Investigation Report, July 2025 by Ground Investigations Ireland Ref. 14130-19-24

D.4 – SuDS Maintenance Plan

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm A

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - Scotland and Ireland

Return Period (years)	5	Foul Sewage (l/s/ha)	0.000	Maximum Backdrop Height (m)	1.500
M5-60 (mm)	16.200	Volumetric Runoff Coeff.	0.850	Min Design Depth for Optimisation (m)	0.450
Ratio R	0.275	PIMP (%)	100	Min Vel for Auto Design only (m/s)	1.00
Maximum Rainfall (mm/hr)	150	Add Flow / Climate Change (%)	0	Min Slope for Optimisation (1:X)	500
Maximum Time of Concentration (mins)	30	Minimum Backdrop Height (m)	0.200		

Designed with Level Soffits

Network Design Table for Storm A

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
SA1.000	38.661	0.263	147.0	0.070	4.00	0.0	0.600	o	225	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
SA1.000	62.55	4.60	54.536	0.070	0.0	0.0	0.0	1.08	42.8	13.5

Network Design Table for Storm A

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
SA1.001	15.043	0.090	167.1	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
SA1.002	13.539	0.648	20.9	0.024	0.00	0.0	0.600	o	225	Pipe/Conduit	
SA2.000	25.974	0.153	170.0	0.119	4.00	0.0	0.600	o	225	Pipe/Conduit	
SA2.001	13.211	0.078	170.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
SA2.002	15.558	0.259	60.2	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
SA1.003	32.517	0.108	300.0	0.045	0.00	0.0	0.600	o	300	Pipe/Conduit	
SA1.004	16.705	0.104	161.2	0.011	0.00	0.0	0.600	o	300	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
SA1.001	61.38	4.85	54.273	0.070	0.0	0.0	0.0	1.01	40.1	13.5
SA1.002	61.03	4.93	54.183	0.095	0.0	0.0	0.0	2.88	114.3	17.7
SA2.000	63.36	4.43	54.024	0.119	0.0	0.0	0.0	1.00	39.8	23.2
SA2.001	62.29	4.65	53.871	0.119	0.0	0.0	0.0	1.00	39.8	23.2
SA2.002	61.57	4.81	53.794	0.119	0.0	0.0	0.0	1.69	67.2	23.2
SA1.003	58.47	5.53	53.460	0.259	0.0	0.0	0.0	0.90	63.8	46.5
SA1.004	57.57	5.75	53.352	0.270	0.0	0.0	0.0	1.24	87.3	47.8

Network Design Table for Storm A

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
SA3.000	15.082	0.439	34.4	0.022	4.00	0.0	0.600	o	225	Pipe/Conduit	
SA1.005	23.499	0.078	300.0	0.051	0.00	0.0	0.600	o	300	Pipe/Conduit	
SA1.006	1.751	0.006	300.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	

Network Results Table

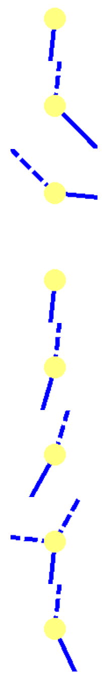
PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
SA3.000	64.99	4.11	53.762	0.022	0.0	0.0	0.0	2.24	89.0	4.3
SA1.005	63.35	4.43	53.248	0.000	0.7	0.0	0.0	0.90	63.8	0.7
SA1.006	63.19	4.47	53.170	0.000	0.7	0.0	0.0	0.90	63.8	0.7

Manhole Schedules for Storm A

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	PN	Pipe Out Invert Level (m)	Pipe Out Diameter (mm)	PN	Pipes In Invert Level (m)	Pipes In Diameter (mm)	Backdrop (mm)
SA1	55.335	0.799	Open Manhole	1200	SA1.000	54.536	225				
SA2	55.116	0.843	Open Manhole	1200	SA1.001	54.273	225	SA1.000	54.273	225	
SA3	55.000	0.817	Open Manhole	1200	SA1.002	54.183	225	SA1.001	54.183	225	
SA4	55.474	1.450	Open Manhole	1200	SA2.000	54.024	225				
SA5	55.414	1.543	Open Manhole	1200	SA2.001	53.871	225	SA2.000	53.871	225	
SA6	55.241	1.447	Open Manhole	1200	SA2.002	53.794	225	SA2.001	53.794	225	
SA7	54.730	1.270	Open Manhole	1200	SA1.003	53.460	300	SA1.002	53.535	225	
								SA2.002	53.535	225	
SA8	54.536	1.185	Open Manhole	1200	SA1.004	53.352	300	SA1.003	53.352	300	
SA9	54.887	1.125	Open Manhole	1200	SA3.000	53.762	225				
SA10	54.500	1.252	Open Manhole	1200	SA1.005	53.248	300	SA1.004	53.248	300	
								SA3.000	53.323	225	
SA11	56.099	2.929	Open Manhole	1200	SA1.006	53.170	300	SA1.005	53.170	300	
SA12	53.508	0.344	Open Manhole	0		OUTFALL		SA1.006	53.164	300	

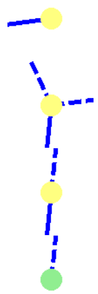
Manhole Schedules for Storm A

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
SA1	701123.846	737175.329	701123.846	737175.329	Required	
SA2	701119.798	737136.881	701119.798	737136.881	Required	
SA3	701130.372	737126.182	701130.372	737126.182	Required	
SA4	701157.722	737176.944	701157.722	737176.944	Required	
SA5	701155.100	737151.103	701155.100	737151.103	Required	
SA6	701151.399	737138.421	701151.399	737138.421	Required	
SA7	701143.842	737124.822	701143.842	737124.822	Required	
SA8	701140.509	737092.476	701140.509	737092.476	Required	



Manhole Schedules for Storm A

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
SA9	701162.512	737079.337	701162.512	737079.337	Required	
SA10	701147.563	737077.334	701147.563	737077.334	Required	
SA11	701145.159	737053.959	701145.159	737053.959	Required	
SA12	701144.980	737052.217			No Entry	



PIPELINE SCHEDULES for Storm A

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
SA1.000	o	225	SA1	55.335	54.536	0.574	Open Manhole	1200
SA1.001	o	225	SA2	55.116	54.273	0.618	Open Manhole	1200
SA1.002	o	225	SA3	55.000	54.183	0.592	Open Manhole	1200
SA2.000	o	225	SA4	55.474	54.024	1.225	Open Manhole	1200
SA2.001	o	225	SA5	55.414	53.871	1.318	Open Manhole	1200
SA2.002	o	225	SA6	55.241	53.794	1.222	Open Manhole	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
SA1.000	38.661	147.0	SA2	55.116	54.273	0.618	Open Manhole	1200
SA1.001	15.043	167.1	SA3	55.000	54.183	0.592	Open Manhole	1200
SA1.002	13.539	20.9	SA7	54.730	53.535	0.970	Open Manhole	1200
SA2.000	25.974	170.0	SA5	55.414	53.871	1.318	Open Manhole	1200
SA2.001	13.211	170.0	SA6	55.241	53.794	1.222	Open Manhole	1200
SA2.002	15.558	60.2	SA7	54.730	53.535	0.970	Open Manhole	1200

PIPELINE SCHEDULES for Storm A

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
SA1.003	o	300	SA7	54.730	53.460	0.970	Open Manhole	1200
SA1.004	o	300	SA8	54.536	53.352	0.885	Open Manhole	1200
SA3.000	o	225	SA9	54.887	53.762	0.900	Open Manhole	1200
SA1.005	o	300	SA10	54.500	53.248	0.952	Open Manhole	1200
SA1.006	o	300	SA11	56.099	53.170	2.629	Open Manhole	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
SA1.003	32.517	300.0	SA8	54.536	53.352	0.885	Open Manhole	1200
SA1.004	16.705	161.2	SA10	54.500	53.248	0.952	Open Manhole	1200
SA3.000	15.082	34.4	SA10	54.500	53.323	0.952	Open Manhole	1200
SA1.005	23.499	300.0	SA11	56.099	53.170	2.629	Open Manhole	1200
SA1.006	1.751	300.0	SA12	53.508	53.164	0.044	Open Manhole	0

Area Summary for Storm A

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	Classification	Default	100	0.015	0.015	0.015
	Classification	Default	100	0.041	0.041	0.055
	Classification	Default	100	0.015	0.015	0.070
1.001	-	-	100	0.000	0.000	0.000
1.002	Classification	Default	100	0.024	0.024	0.024
2.000	Classification	Default	100	0.014	0.014	0.014
	Classification	Default	100	0.015	0.015	0.028
	Classification	Default	100	0.018	0.018	0.047
	Classification	Default	100	0.029	0.029	0.076
	Classification	Default	100	0.007	0.007	0.083
	Classification	Default	100	0.007	0.007	0.090
	Classification	Default	100	0.007	0.007	0.097
	Classification	Default	100	0.007	0.007	0.105
	Classification	Default	100	0.007	0.007	0.112
	Classification	Default	100	0.007	0.007	0.119
2.001	-	-	100	0.000	0.000	0.000
2.002	-	-	100	0.000	0.000	0.000
1.003	Classification	Default	100	0.045	0.045	0.045
1.004	Classification	Default	100	0.011	0.011	0.011
3.000	Classification	Default	100	0.007	0.007	0.007
	Classification	Default	100	0.007	0.007	0.014
	Classification	Default	100	0.007	0.007	0.022
1.005	Classification	Default	100	0.051	0.051	0.051
1.006	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				0.343	0.343	0.343

Network Classifications for Storm A

PN	USMH Name	Pipe Dia (mm)	Min Cover Depth (m)	Max Cover Depth (m)	Pipe Type	MH Dia (mm)	MH Width (mm)	MH Ring Depth (m)	MH Type
SA1.000	SA1	225	0.095	0.618	Unclassified	1200	0	0.574	Unclassified
SA1.001	SA2	225	0.052	0.618	Unclassified	1200	0	0.618	Unclassified
SA1.002	SA3	225	0.404	0.970	Unclassified	1200	0	0.592	Unclassified
SA2.000	SA4	225	1.225	1.404	Unclassified	1200	0	1.225	Unclassified
SA2.001	SA5	225	1.222	1.318	Unclassified	1200	0	1.318	Unclassified
SA2.002	SA6	225	0.970	1.222	Unclassified	1200	0	1.222	Unclassified
SA1.003	SA7	300	0.869	0.970	Unclassified	1200	0	0.970	Unclassified
SA1.004	SA8	300	0.885	1.077	Unclassified	1200	0	0.885	Unclassified
SA3.000	SA9	225	0.900	1.121	Unclassified	1200	0	0.900	Unclassified
SA1.005	SA10	300	0.952	2.629	Unclassified	1200	0	0.952	Unclassified
SA1.006	SA11	300	0.044	2.883	Unclassified	1200	0	2.629	Unclassified

Free Flowing Outfall Details for Storm A

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
SA1.006	SA12	53.508	53.164	0.000	0	0

Simulation Criteria for Storm A

Volumetric Runoff Coeff	0.850	Manhole Headloss Coeff (Global)	0.500	Inlet Coeffiecient	0.800
Areal Reduction Factor	1.000	Foul Sewage per hectare (l/s)	0.000	Flow per Person per Day (l/per/day)	0.000
Hot Start (mins)	0	Additional Flow - % of Total Flow	0.000	Run Time (mins)	60
Hot Start Level (mm)	0	MADD Factor * 10m³/ha Storage	2.000	Output Interval (mins)	1

Number of Input Hydrographs	0	Number of Offline Controls	0	Number of Time/Area Diagrams	1
Number of Online Controls	1	Number of Storage Structures	9	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	M5-60 (mm)	16.200	Cv (Summer)	0.850
Return Period (years)	5	Ratio R	0.275	Cv (Winter)	0.840
Region	Scotland and Ireland	Profile Type	Summer	Storm Duration (mins)	30

Online Controls for Storm A

Hydro-Brake® Optimum Manhole: SA10, DS/PN: SA1.005, Volume (m³): 3.1

Unit Reference	MD-SHE-0045-7000-0500-7000	Sump Available	Yes
Design Head (m)	0.500	Diameter (mm)	45
Design Flow (l/s)	0.7	Invert Level (m)	53.248
Flush-Flo™	Calculated	Minimum Outlet Pipe Diameter (mm)	75
Objective	Minimise upstream storage	Suggested Manhole Diameter (mm)	1200
Application	Surface		

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.500	0.7	Kick-Flo®	0.329	0.6
Flush-Flo™	0.156	0.7	Mean Flow over Head Range	-	0.6

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	0.7	0.600	0.8	1.600	1.2	2.600	1.5	5.000	2.0	7.500	2.4
0.200	0.7	0.800	0.9	1.800	1.2	3.000	1.6	5.500	2.1	8.000	2.5
0.300	0.6	1.000	0.9	2.000	1.3	3.500	1.7	6.000	2.2	8.500	2.6
0.400	0.6	1.200	1.0	2.200	1.4	4.000	1.8	6.500	2.2	9.000	2.6
0.500	0.7	1.400	1.1	2.400	1.4	4.500	1.9	7.000	2.3	9.500	2.7

Storage Structures for Storm A

Infiltration Trench Manhole: SA1, DS/PN: SA1.000

Infiltration Coefficient Base (m/hr)	0.03728	Invert Level (m)	54.035	Cap Volume Depth (m)	0.000
Infiltration Coefficient Side (m/hr)	0.03728	Trench Width (m)	0.6	Cap Infiltration Depth (m)	0.000
Safety Factor	1.0	Trench Length (m)	38.7		
Porosity	0.40	Slope (1:X)	147.0		

Infiltration Trench Manhole: SA2, DS/PN: SA1.001

Infiltration Coefficient Base (m/hr)	0.03728	Invert Level (m)	53.816	Cap Volume Depth (m)	0.000
Infiltration Coefficient Side (m/hr)	0.03728	Trench Width (m)	0.6	Cap Infiltration Depth (m)	0.000
Safety Factor	1.0	Trench Length (m)	15.0		
Porosity	0.40	Slope (1:X)	167.1		

Complex Manhole: SA3, DS/PN: SA1.002

Infiltration Trench

Infiltration Coefficient Base (m/hr)	0.03728	Invert Level (m)	53.700	Cap Volume Depth (m)	0.000
Infiltration Coefficient Side (m/hr)	0.03728	Trench Width (m)	0.6	Cap Infiltration Depth (m)	0.000
Safety Factor	1.0	Trench Length (m)	13.5		
Porosity	0.40	Slope (1:X)	20.9		

Porous Car Park

Infiltration Coefficient Base (m/hr)	0.03728	Porosity	0.40	Slope (1:X)	100.0
Membrane Percolation (mm/hr)	1000	Invert Level (m)	54.350	Depression Storage (mm)	5
Max Percolation (l/s)	36.1	Width (m)	5.0	Evaporation (mm/day)	3
Safety Factor	1.0	Length (m)	26.0	Membrane Depth (mm)	0

Porous Car Park Manhole: SA4, DS/PN: SA2.000

Infiltration Coefficient Base (m/hr)	0.03728	Porosity	0.40	Slope (1:X)	100.0
Membrane Percolation (mm/hr)	1000	Invert Level (m)	54.824	Depression Storage (mm)	5
Max Percolation (l/s)	77.4	Width (m)	5.0	Evaporation (mm/day)	3
Safety Factor	1.0	Length (m)	55.7	Membrane Depth (mm)	0

Infiltration Trench Manhole: SA5, DS/PN: SA2.001

Infiltration Coefficient Base (m/hr)	0.03728	Invert Level (m)	53.898	Cap Volume Depth (m)	0.000
Infiltration Coefficient Side (m/hr)	0.03728	Trench Width (m)	4.0	Cap Infiltration Depth (m)	0.000
Safety Factor	1.0	Trench Length (m)	4.0		
Porosity	0.40	Slope (1:X)	0.0		

Complex Manhole: SA7, DS/PN: SA1.003

Infiltration Trench

Infiltration Coefficient Base (m/hr)	0.03728	Safety Factor	2.0	Invert Level (m)	53.430
Infiltration Coefficient Side (m/hr)	0.03728	Porosity	0.40	Trench Width (m)	0.6

Infiltration Trench

Trench Length (m)	32.5	Cap Volume Depth (m)	0.000
Slope (1:X)	500.0	Cap Infiltration Depth (m)	0.000

Infiltration Trench

Infiltration Coefficient Base (m/hr)	0.03728	Invert Level (m)	53.430	Cap Volume Depth (m)	0.000
Infiltration Coefficient Side (m/hr)	0.03728	Trench Width (m)	2.6	Cap Infiltration Depth (m)	0.000
Safety Factor	2.0	Trench Length (m)	2.6		
Porosity	0.40	Slope (1:X)	0.0		

Porous Car Park

Infiltration Coefficient Base (m/hr)	0.03728	Porosity	0.40	Slope (1:X)	100.0
Membrane Percolation (mm/hr)	1000	Invert Level (m)	53.930	Depression Storage (mm)	5
Max Percolation (l/s)	36.1	Width (m)	5.0	Evaporation (mm/day)	3
Safety Factor	2.0	Length (m)	26.0	Membrane Depth (mm)	0

Complex Manhole: SA8, DS/PN: SA1.004

Infiltration Trench

Infiltration Coefficient Base (m/hr)	0.03728	Invert Level (m)	53.236	Cap Volume Depth (m)	0.000
Infiltration Coefficient Side (m/hr)	0.03728	Trench Width (m)	0.6	Cap Infiltration Depth (m)	0.000
Safety Factor	2.0	Trench Length (m)	16.7		
Porosity	0.40	Slope (1:X)	97.3		

Infiltration Trench

Infiltration Coefficient Base (m/hr)	0.03728	Invert Level (m)	53.236	Cap Volume Depth (m)	0.000
Infiltration Coefficient Side (m/hr)	0.03728	Trench Width (m)	3.0	Cap Infiltration Depth (m)	0.000
Safety Factor	2.0	Trench Length (m)	3.0		
Porosity	0.40	Slope (1:X)	0.0		

Porous Car Park

Infiltration Coefficient Base (m/hr)	0.03728	Porosity	0.40	Slope (1:X)	100.0
Membrane Percolation (mm/hr)	1000	Invert Level (m)	53.736	Depression Storage (mm)	5
Max Percolation (l/s)	29.4	Width (m)	5.0	Evaporation (mm/day)	3
Safety Factor	2.0	Length (m)	21.2	Membrane Depth (mm)	0

Porous Car Park Manhole: SA9, DS/PN: SA3.000

Infiltration Coefficient Base (m/hr)	0.03728	Porosity	0.40	Slope (1:X)	100.0
Membrane Percolation (mm/hr)	1000	Invert Level (m)	54.237	Depression Storage (mm)	5
Max Percolation (l/s)	29.4	Width (m)	5.0	Evaporation (mm/day)	3
Safety Factor	1.0	Length (m)	21.2	Membrane Depth (mm)	0

Complex Manhole: SA10, DS/PN: SA1.005

Infiltration Blanket

Infiltration Coefficient Base (m/hr)	0.03728	Porosity	0.40	Diameter/Width (m)	4.0
Safety Factor	2.0	Invert Level (m)	52.648	Length (m)	40.0

Infiltration Blanket

Cap Volume Depth (m) 0.575

Tank or Pond

Invert Level (m) 54.115

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	40.0	0.375	160.0

Manhole Headloss for Storm A

PN	US/MH Name	US/MH Headloss
SA1.000	SA1	0.500
SA1.001	SA2	0.500
SA1.002	SA3	0.500
SA2.000	SA4	0.500
SA2.001	SA5	0.500
SA2.002	SA6	0.500
SA1.003	SA7	0.500
SA1.004	SA8	0.500
SA3.000	SA9	0.500
SA1.005	SA10	0.500
SA1.006	SA11	0.500

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

Simulation Criteria

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

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 1
Number of Online Controls 1 Number of Storage Structures 9 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR M5-60 (mm) 16.400 Cv (Summer) 0.750
Region Scotland and Ireland Ratio R 0.275 Cv (Winter) 0.840

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

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years)	1, 30, 100
Climate Change (%)	0, 0, 0

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

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status

PN	US/MH Name	Level Exceeded

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)
SA1.000	SA1	120 Winter	100	+0%					54.567	-0.194	0.000	0.05		136
SA1.001	SA2	240 Winter	100	+0%					54.296	-0.202	0.000	0.02		129
SA1.002	SA3	30 Summer	100	+0%					54.225	-0.183	0.000	0.07		117
SA2.000	SA4	15 Winter	100	+0%	100/15 Summer				54.275	0.026	0.000	1.07		4
SA2.001	SA5	480 Winter	100	+0%	100/15 Winter				54.155	0.059	0.000	0.16		153
SA2.002	SA6	480 Winter	100	+0%	100/120 Winter				54.152	0.134	0.000	0.09		
SA1.003	SA7	480 Winter	100	+0%	30/120 Winter				54.149	0.389	0.000	0.13		181
SA1.004	SA8	480 Winter	100	+0%	30/120 Summer				54.147	0.496	0.000	0.11		201
SA3.000	SA9	480 Winter	100	+0%	100/120 Winter				54.147	0.160	0.000	0.01		184
SA1.005	SA10	480 Winter	100	+0%	30/60 Winter				54.147	0.599	0.000	0.02		
SA1.006	SA11	480 Winter	100	+0%					53.198	-0.272	0.000	0.02		

PN	US/MH Name	Pipe Flow (l/s)	Status	Level Exceeded
SA1.000	SA1	1.9	OK	
SA1.001	SA2	0.8	OK	
SA1.002	SA3	7.4	OK	
SA2.000	SA4	39.4	SURCHARGED	
SA2.001	SA5	5.4	SURCHARGED	
SA2.002	SA6	5.4	SURCHARGED	
SA1.003	SA7	7.7	SURCHARGED	

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

PN	US/MH Name	Pipe Flow (l/s)	Status	Level Exceeded
SA1.004	SA8	7.9	SURCHARGED	
SA3.000	SA9	1.0	SURCHARGED	
SA1.005	SA10	0.9	SURCHARGED	
SA1.006	SA11	0.9	OK	

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm B

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - Scotland and Ireland

Return Period (years)	5	Foul Sewage (l/s/ha)	0.000	Maximum Backdrop Height (m)	1.500
M5-60 (mm)	16.200	Volumetric Runoff Coeff.	0.850	Min Design Depth for Optimisation (m)	0.450
Ratio R	0.275	PIMP (%)	100	Min Vel for Auto Design only (m/s)	1.00
Maximum Rainfall (mm/hr)	150	Add Flow / Climate Change (%)	0	Min Slope for Optimisation (1:X)	500
Maximum Time of Concentration (mins)	30	Minimum Backdrop Height (m)	0.200		

Designed with Level Soffits

Network Design Table for Storm B

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
SB1.000	8.417	0.051	165.0	0.088	4.00	0.0	0.600	o	225	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
SB1.000	64.86	4.14	54.452	0.088	0.0	0.0	0.0	1.02	40.4	17.5

Network Design Table for Storm B

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
SB2.000	8.052	0.196	41.1	0.018	4.00	0.0	0.600	o	225	Pipe/Conduit	
SB1.001	4.803	0.029	166.6	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
SB3.000	13.472	0.177	76.1	0.049	4.00	0.0	0.600	o	225	Pipe/Conduit	
SB1.002	77.543	0.465	166.6	0.217	0.00	0.0	0.600	o	300	Pipe/Conduit	
SB1.003	3.522	0.018	200.0	0.026	0.00	0.0	0.600	o	300	Pipe/Conduit	
SB1.004	20.799	0.069	300.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
SB2.000	65.24	4.07	54.597	0.018	0.0	0.0	0.0	2.05	81.4	3.6
SB1.001	64.45	4.22	54.401	0.106	0.0	0.0	0.0	1.01	40.2	20.9
SB3.000	64.80	4.15	54.549	0.049	0.0	0.0	0.0	1.50	59.7	9.7
SB1.002	59.48	5.28	54.297	0.371	0.0	0.0	0.0	1.22	85.9	67.8
SB1.003	59.26	5.33	53.832	0.397	0.0	0.0	0.0	1.11	78.3	72.3
SB1.004	63.60	4.38	53.814	0.000	0.8	0.0	0.0	0.90	63.8	0.8

Network Design Table for Storm B

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
SB1.005	2.081	0.007	299.9	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
SB1.005	63.41	4.42	53.745	0.000	0.8	0.0	0.0	0.90	63.8	0.8

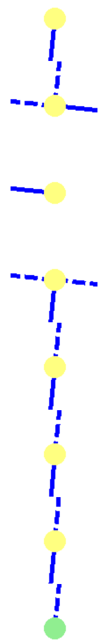
Manhole Schedules for Storm B

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	PN	Pipe Out Invert Level (m)	Diameter (mm)	PN	Pipes In Invert Level (m)	Diameter (mm)	Backdrop (mm)
SB1	55.577	1.125	Open Manhole	1200	SB1.000	54.452	225				
SB2	55.722	1.125	Open Manhole	1200	SB2.000	54.597	225				
SB3	55.665	1.264	Open Manhole	1200	SB1.001	54.401	225	SB1.000	54.401	225	
								SB2.000	54.401	225	
SB4	55.674	1.125	Open Manhole	1200	SB3.000	54.549	225				
SB5	55.711	1.414	Open Manhole	1200	SB1.002	54.297	300	SB1.001	54.372	225	
								SB3.000	54.372	225	
SB6	55.176	1.344	Open Manhole	1200	SB1.003	53.832	300	SB1.002	53.832	300	
SB7	55.163	1.349	Open Manhole	1200	SB1.004	53.814	300	SB1.003	53.814	300	
SB8	56.089	2.344	Open Manhole	1200	SB1.005	53.745	300	SB1.004	53.745	300	
SB9	55.000	1.262	Open Manhole	0		OUTFALL		SB1.005	53.738	300	

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
SB1	701198.334	737151.346	701198.334	737151.346	Required	

Manhole Schedules for Storm B

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
SB2	701207.529	737158.496	701207.529	737158.496	Required	
SB3	701206.707	737150.487	701206.707	737150.487	Required	
SB4	701224.887	737148.621	701224.887	737148.621	Required	
SB5	701211.485	737149.996	701211.485	737149.996	Required	
SB6	701203.775	737072.838	701203.775	737072.838	Required	
SB7	701203.425	737069.333	701203.425	737069.333	Required	
SB8	701201.586	737048.616	701201.586	737048.616	Required	
SB9	701201.379	737046.545			No Entry	



PIPELINE SCHEDULES for Storm B

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
SB1.000	o	225	SB1	55.577	54.452	0.900	Open Manhole	1200
SB2.000	o	225	SB2	55.722	54.597	0.900	Open Manhole	1200
SB1.001	o	225	SB3	55.665	54.401	1.039	Open Manhole	1200
SB3.000	o	225	SB4	55.674	54.549	0.900	Open Manhole	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
SB1.000	8.417	165.0	SB3	55.665	54.401	1.039	Open Manhole	1200
SB2.000	8.052	41.1	SB3	55.665	54.401	1.039	Open Manhole	1200
SB1.001	4.803	166.6	SB5	55.711	54.372	1.114	Open Manhole	1200
SB3.000	13.472	76.1	SB5	55.711	54.372	1.114	Open Manhole	1200

PIPELINE SCHEDULES for Storm B

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
SB1.002	o	300	SB5	55.711	54.297	1.114	Open Manhole	1200
SB1.003	o	300	SB6	55.176	53.832	1.044	Open Manhole	1200
SB1.004	o	300	SB7	55.163	53.814	1.049	Open Manhole	1200
SB1.005	o	300	SB8	56.089	53.745	2.044	Open Manhole	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
SB1.002	77.543	166.6	SB6	55.176	53.832	1.044	Open Manhole	1200
SB1.003	3.522	200.0	SB7	55.163	53.814	1.049	Open Manhole	1200
SB1.004	20.799	300.0	SB8	56.089	53.745	2.044	Open Manhole	1200
SB1.005	2.081	299.9	SB9	55.000	53.738	0.962	Open Manhole	0

Area Summary for Storm B

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	Classification	Default	100	0.023	0.023	0.023
	Classification	Default	100	0.033	0.033	0.056
	Classification	Default	100	0.010	0.010	0.066
	Classification	Default	100	0.012	0.012	0.078
	Classification	Default	100	0.010	0.010	0.088
2.000	Classification	Default	100	0.018	0.018	0.018
1.001	-	-	100	0.000	0.000	0.000
3.000	Classification	Default	100	0.013	0.013	0.013
	Classification	Default	100	0.013	0.013	0.027
	Classification	Default	100	0.013	0.013	0.039
	Classification	Default	100	0.010	0.010	0.049
1.002	Classification	Default	100	0.016	0.016	0.016
	Classification	Default	100	0.016	0.016	0.031
	Classification	Default	100	0.011	0.011	0.043
	Classification	Default	100	0.013	0.013	0.055
	Classification	Default	100	0.019	0.019	0.075
	Classification	Default	100	0.012	0.012	0.086
	Classification	Default	100	0.007	0.007	0.093
	Classification	Default	100	0.007	0.007	0.100
	Classification	Default	100	0.006	0.006	0.106
	Classification	Default	100	0.006	0.006	0.113
	Classification	Default	100	0.006	0.006	0.119
	Classification	Default	100	0.006	0.006	0.125
	Classification	Default	100	0.006	0.006	0.132
	Classification	Default	100	0.007	0.007	0.139
	Classification	Default	100	0.007	0.007	0.146

Area Summary for Storm B

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
	Classification	Default	100	0.007	0.007	0.153
	Classification	Default	100	0.007	0.007	0.161
	Classification	Default	100	0.007	0.007	0.168
	Classification	Default	100	0.007	0.007	0.175
	Classification	Default	100	0.007	0.007	0.182
	Classification	Default	100	0.007	0.007	0.189
	Classification	Default	100	0.007	0.007	0.196
	Classification	Default	100	0.007	0.007	0.203
	Classification	Default	100	0.007	0.007	0.210
	Classification	Default	100	0.007	0.007	0.217
1.003	Classification	Default	100	0.026	0.026	0.026
1.004	-	-	100	0.000	0.000	0.000
1.005	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				0.397	0.397	0.397

Network Classifications for Storm B

PN	USMH Name	Pipe Dia (mm)	Min Cover Depth (m)	Max Cover Depth (m)	Pipe Type	MH Dia (mm)	MH Width (mm)	MH Ring Depth (m)	MH Type
SB1.000	SB1	225	0.900	1.077	Unclassified	1200	0	0.900	Unclassified
SB2.000	SB2	225	0.900	1.039	Unclassified	1200	0	0.900	Unclassified
SB1.001	SB3	225	1.021	1.114	Unclassified	1200	0	1.039	Unclassified
SB3.000	SB4	225	0.900	1.114	Unclassified	1200	0	0.900	Unclassified
SB1.002	SB5	300	1.044	1.114	Unclassified	1200	0	1.114	Unclassified
SB1.003	SB6	300	1.044	1.147	Unclassified	1200	0	1.044	Unclassified
SB1.004	SB7	300	1.010	2.044	Unclassified	1200	0	1.049	Unclassified
SB1.005	SB8	300	0.962	2.272	Unclassified	1200	0	2.044	Unclassified

Free Flowing Outfall Details for Storm B

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
SB1.005	SB9	55.000	53.738	0.000	0	0

Simulation Criteria for Storm B

Volumetric Runoff Coeff	0.850	Manhole Headloss Coeff (Global)	0.500	Inlet Coeffiecient	0.800
Areal Reduction Factor	1.000	Foul Sewage per hectare (l/s)	0.000	Flow per Person per Day (l/per/day)	0.000
Hot Start (mins)	0	Additional Flow - % of Total Flow	0.000	Run Time (mins)	60
Hot Start Level (mm)	0	MADD Factor * 10m³/ha Storage	2.000	Output Interval (mins)	1

Number of Input Hydrographs	0	Number of Offline Controls	0	Number of Time/Area Diagrams	0
Number of Online Controls	1	Number of Storage Structures	6	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	M5-60 (mm)	16.200	Cv (Summer)	0.850
Return Period (years)	5	Ratio R	0.275	Cv (Winter)	0.840
Region	Scotland and Ireland	Profile Type	Summer	Storm Duration (mins)	30

Online Controls for Storm B

Hydro-Brake® Optimum Manhole: SB7, DS/PN: SB1.004, Volume (m³): 1.7

Unit Reference	MD-SHE-0044-8000-0790-8000	Sump Available	Yes
Design Head (m)	0.790	Diameter (mm)	44
Design Flow (l/s)	0.8	Invert Level (m)	53.814
Flush-Flo™	Calculated	Minimum Outlet Pipe Diameter (mm)	75
Objective	Minimise upstream storage	Suggested Manhole Diameter (mm)	1200
Application	Surface		

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.790	0.8	Kick-Flo®	0.389	0.6
Flush-Flo™	0.193	0.7	Mean Flow over Head Range	-	0.7

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	0.7	0.600	0.7	1.600	1.1	2.600	1.4	5.000	1.8	7.500	2.2
0.200	0.7	0.800	0.8	1.800	1.2	3.000	1.5	5.500	1.9	8.000	2.3
0.300	0.7	1.000	0.9	2.000	1.2	3.500	1.6	6.000	2.0	8.500	2.4
0.400	0.6	1.200	1.0	2.200	1.3	4.000	1.7	6.500	2.1	9.000	2.4
0.500	0.7	1.400	1.0	2.400	1.3	4.500	1.8	7.000	2.1	9.500	2.5

Storage Structures for Storm B

Complex Manhole: SB1, DS/PN: SB1.000

Porous Car Park

Infiltration Coefficient Base (m/hr)	0.03728	Porosity	0.40	Slope (1:X)	100.0
Membrane Percolation (mm/hr)	1000	Invert Level (m)	54.427	Depression Storage (mm)	5
Max Percolation (l/s)	38.4	Width (m)	2.4	Evaporation (mm/day)	3
Safety Factor	1.0	Length (m)	57.6	Membrane Depth (mm)	0

Infiltration Trench

Infiltration Coefficient Base (m/hr)	0.03728	Invert Level (m)	53.927	Cap Volume Depth (m)	0.000
Infiltration Coefficient Side (m/hr)	0.03728	Trench Width (m)	3.0	Cap Infiltration Depth (m)	0.000
Safety Factor	1.0	Trench Length (m)	3.0		
Porosity	0.40	Slope (1:X)	0.0		

Complex Manhole: SB2, DS/PN: SB2.000

Porous Car Park

Infiltration Coefficient Base (m/hr)	0.03728	Max Percolation (l/s)	28.9	Porosity	0.40
Membrane Percolation (mm/hr)	1000	Safety Factor	1.0	Invert Level (m)	55.072

Porous Car Park

Width (m)	5.0	Slope (1:X)	100.0	Evaporation (mm/day)	3
Length (m)	20.8	Depression Storage (mm)	5	Membrane Depth (mm)	0

Infiltration Trench

Infiltration Coefficient Base (m/hr)	0.03728	Invert Level (m)	54.572	Cap Volume Depth (m)	0.000
Infiltration Coefficient Side (m/hr)	0.03728	Trench Width (m)	2.1	Cap Infiltration Depth (m)	0.000
Safety Factor	1.0	Trench Length (m)	2.1		
Porosity	0.40	Slope (1:X)	0.0		

Infiltration Trench Manhole: SB4, DS/PN: SB3.000

Infiltration Coefficient Base (m/hr)	0.03728	Invert Level (m)	54.524	Cap Volume Depth (m)	0.000
Infiltration Coefficient Side (m/hr)	0.03728	Trench Width (m)	3.0	Cap Infiltration Depth (m)	0.000
Safety Factor	1.0	Trench Length (m)	3.0		
Porosity	0.40	Slope (1:X)	0.0		

Porous Car Park Manhole: SB5, DS/PN: SB1.002

Infiltration Coefficient Base (m/hr)	0.03728	Porosity	0.40	Slope (1:X)	100.0
Membrane Percolation (mm/hr)	1000	Invert Level (m)	55.061	Depression Storage (mm)	5
Max Percolation (l/s)	113.3	Width (m)	5.0	Evaporation (mm/day)	3
Safety Factor	2.0	Length (m)	81.6	Membrane Depth (mm)	0

Complex Manhole: SB6, DS/PN: SB1.003

Porous Car Park

Infiltration Coefficient Base (m/hr)	0.03728	Porosity	0.40	Slope (1:X)	100.0
Membrane Percolation (mm/hr)	1000	Invert Level (m)	54.026	Depression Storage (mm)	5
Max Percolation (l/s)	63.4	Width (m)	5.5	Evaporation (mm/day)	3
Safety Factor	2.0	Length (m)	41.5	Membrane Depth (mm)	0

Infiltration Trench

Infiltration Coefficient Base (m/hr)	0.03728	Invert Level (m)	54.176	Cap Volume Depth (m)	0.000
Infiltration Coefficient Side (m/hr)	0.03728	Trench Width (m)	2.1	Cap Infiltration Depth (m)	0.000
Safety Factor	2.0	Trench Length (m)	2.1		
Porosity	0.40	Slope (1:X)	0.0		

Complex Manhole: SB7, DS/PN: SB1.004

Infiltration Blanket

Infiltration Coefficient Base (m/hr)	0.03728	Invert Level (m)	53.210	Cap Volume Depth (m)	0.600
Safety Factor	2.0	Diameter/Width (m)	4.0		
Porosity	0.40	Length (m)	50.0		

Tank or Pond

Invert Level (m) 54.688

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	50.0	0.375	200.0

Manhole Headloss for Storm B

PN	US/MH Name	US/MH Headloss
SB1.000	SB1	0.500
SB2.000	SB2	0.500
SB1.001	SB3	0.500
SB3.000	SB4	0.500
SB1.002	SB5	0.500
SB1.003	SB6	0.500
SB1.004	SB7	0.500
SB1.005	SB8	0.500

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

Simulation Criteria

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

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 1 Number of Storage Structures 6 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR M5-60 (mm) 16.400 Cv (Summer) 0.750
Region Scotland and Ireland Ratio R 0.275 Cv (Winter) 0.840

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

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years) 1, 30, 100
Climate Change (%) 0, 0, 0

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

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status

PN	US/MH Name	Level Exceeded

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)
SB1.000	SB1	480 Winter	100	+0%	100/15 Summer				54.777	0.100	0.000	0.12		176
SB2.000	SB2	480 Winter	100	+0%					54.772	-0.050	0.000	0.01		149
SB1.001	SB3	480 Winter	100	+0%	30/480 Winter				54.777	0.151	0.000	0.15		
SB3.000	SB4	480 Winter	100	+0%	100/360 Winter				54.779	0.005	0.000	0.04		162
SB1.002	SB5	480 Winter	100	+0%	30/360 Winter				54.778	0.181	0.000	0.19		221
SB1.003	SB6	480 Winter	100	+0%	30/15 Summer				54.773	0.641	0.000	0.29		264
SB1.004	SB7	480 Winter	100	+0%	30/30 Winter				54.772	0.658	0.000	0.02		
SB1.005	SB8	480 Winter	100	+0%					53.772	-0.272	0.000	0.02		

PN	US/MH Name	Pipe Flow (l/s)	Status	Level Exceeded
SB1.000	SB1	3.7	SURCHARGED	
SB2.000	SB2	0.6	OK	
SB1.001	SB3	4.2	SURCHARGED	
SB3.000	SB4	2.2	SURCHARGED	
SB1.002	SB5	15.5	SURCHARGED	
SB1.003	SB6	14.3	SURCHARGED	
SB1.004	SB7	0.9	SURCHARGED	
SB1.005	SB8	0.9	OK	

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm C

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - Scotland and Ireland

Return Period (years)	5	Foul Sewage (l/s/ha)	0.000	Maximum Backdrop Height (m)	1.500
M5-60 (mm)	16.200	Volumetric Runoff Coeff.	0.850	Min Design Depth for Optimisation (m)	1.200
Ratio R	0.275	PIMP (%)	100	Min Vel for Auto Design only (m/s)	1.00
Maximum Rainfall (mm/hr)	150	Add Flow / Climate Change (%)	0	Min Slope for Optimisation (1:X)	500
Maximum Time of Concentration (mins)	30	Minimum Backdrop Height (m)	0.200		

Designed with Level Soffits

Network Design Table for Storm C

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
SC1.000	10.670	0.064	166.7	0.052	4.00	0.0	0.600	o	225	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
SC1.000	64.66	4.18	54.741	0.052	0.0	0.0	0.0	1.01	40.1	10.3

Network Design Table for Storm C

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
SC2.000	8.277	0.252	32.8	0.018	4.00	0.0	0.600	o	225	Pipe/Conduit	
SC3.000	12.369	0.074	167.1	0.067	4.00	0.0	0.600	o	225	Pipe/Conduit	
SC2.001	5.354	0.032	166.6	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
SC1.001	76.706	0.384	200.0	0.226	0.00	0.0	0.600	o	300	Pipe/Conduit	
SC1.002	4.073	0.020	200.0	0.043	0.00	0.0	0.600	o	300	Pipe/Conduit	
SC1.003	21.070	0.088	240.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
SC2.000	65.27	4.06	54.418	0.018	0.0	0.0	0.0	2.29	91.1	3.6
SC3.000	64.51	4.20	54.540	0.067	0.0	0.0	0.0	1.01	40.1	13.2
SC2.001	64.06	4.29	54.166	0.085	0.0	0.0	0.0	1.01	40.2	16.6
SC1.001	58.79	5.45	54.059	0.362	0.0	0.0	0.0	1.11	78.3	65.3
SC1.002	58.54	5.51	53.675	0.405	0.0	0.0	0.0	1.11	78.3	72.8
SC1.003	63.78	4.35	53.655	0.000	0.8	0.0	0.0	1.01	71.4	0.8

Network Design Table for Storm C

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
SC1.004	2.105	0.009	240.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
SC1.004	63.61	4.38	53.567	0.000	0.8	0.0	0.0	1.01	71.4	0.8

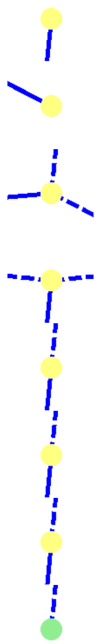
Manhole Schedules for Storm C

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	PN	Pipe Out Invert Level (m)	Diameter (mm)	PN	Pipes In Invert Level (m)	Diameter (mm)	Backdrop (mm)
SC1	55.866	1.125	Open Manhole	1200	SC1.000	54.741	225				
SC2	55.843	1.425	Open Manhole	1200	SC2.000	54.418	225				
SC3	55.665	1.125	Open Manhole	1200	SC3.000	54.540	225				
SC4	55.791	1.625	Open Manhole	1200	SC2.001	54.166	225	SC2.000	54.166	225	
								SC3.000	54.466	225	300
SC5	55.808	1.749	Open Manhole	1200	SC1.001	54.059	300	SC1.000	54.677	225	543
								SC2.001	54.134	225	
SC6	55.199	1.524	Open Manhole	1200	SC1.002	53.675	300	SC1.001	53.675	300	
SC7	55.305	1.650	Open Manhole	1200	SC1.003	53.655	300	SC1.002	53.655	300	
SC8	55.800	2.233	Open Manhole	1200	SC1.004	53.567	300	SC1.003	53.567	300	
SC9	56.019	2.461	Open Manhole	0		OUTFALL		SC1.004	53.558	300	

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
SC1	701254.274	737145.605	701254.274	737145.605	Required	

Manhole Schedules for Storm C

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
SC2	701271.067	737153.219	701271.067	737153.219	Required	
SC3	701281.253	737139.389	701281.253	737139.389	Required	
SC4	701270.222	737144.986	701270.222	737144.986	Required	
SC5	701264.889	737144.515	701264.889	737144.515	Required	
SC6	701257.046	737068.212	701257.046	737068.212	Required	
SC7	701256.629	737064.160	701256.629	737064.160	Required	
SC8	701254.558	737043.192	701254.558	737043.192	Required	
SC9	701254.351	737041.097			No Entry	



PIPELINE SCHEDULES for Storm C

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
SC1.000	o	225	SC1	55.866	54.741	0.900	Open Manhole	1200
SC2.000	o	225	SC2	55.843	54.418	1.200	Open Manhole	1200
SC3.000	o	225	SC3	55.665	54.540	0.900	Open Manhole	1200
SC2.001	o	225	SC4	55.791	54.166	1.400	Open Manhole	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
SC1.000	10.670	166.7	SC5	55.808	54.677	0.906	Open Manhole	1200
SC2.000	8.277	32.8	SC4	55.791	54.166	1.400	Open Manhole	1200
SC3.000	12.369	167.1	SC4	55.791	54.466	1.100	Open Manhole	1200
SC2.001	5.354	166.6	SC5	55.808	54.134	1.449	Open Manhole	1200

PIPELINE SCHEDULES for Storm C

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
SC1.001	o	300	SC5	55.808	54.059	1.449	Open Manhole	1200
SC1.002	o	300	SC6	55.199	53.675	1.224	Open Manhole	1200
SC1.003	o	300	SC7	55.305	53.655	1.350	Open Manhole	1200
SC1.004	o	300	SC8	55.800	53.567	1.933	Open Manhole	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
SC1.001	76.706	200.0	SC6	55.199	53.675	1.224	Open Manhole	1200
SC1.002	4.073	200.0	SC7	55.305	53.655	1.350	Open Manhole	1200
SC1.003	21.070	240.0	SC8	55.800	53.567	1.933	Open Manhole	1200
SC1.004	2.105	240.0	SC9	56.019	53.558	2.161	Open Manhole	0

Area Summary for Storm C

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	Classification	Default	100	0.015	0.015	0.015
	Classification	Default	100	0.014	0.014	0.030
	Classification	Default	100	0.010	0.010	0.039
	Classification	Default	100	0.013	0.013	0.052
2.000	Classification	Default	100	0.018	0.018	0.018
3.000	Classification	Default	100	0.016	0.016	0.016
	Classification	Default	100	0.010	0.010	0.026
	Classification	Default	100	0.012	0.012	0.038
	Classification	Default	100	0.028	0.028	0.067
2.001	-	-	100	0.000	0.000	0.000
1.001	Classification	Default	100	0.040	0.040	0.040
	Classification	Default	100	0.018	0.018	0.058
	Classification	Default	100	0.015	0.015	0.073
	Classification	Default	100	0.011	0.011	0.085
	Classification	Default	100	0.009	0.009	0.094
	Classification	Default	100	0.007	0.007	0.100
	Classification	Default	100	0.007	0.007	0.107
	Classification	Default	100	0.006	0.006	0.114
	Classification	Default	100	0.006	0.006	0.120
	Classification	Default	100	0.006	0.006	0.126
	Classification	Default	100	0.006	0.006	0.133
	Classification	Default	100	0.006	0.006	0.139
	Classification	Default	100	0.007	0.007	0.146
	Classification	Default	100	0.007	0.007	0.153
	Classification	Default	100	0.007	0.007	0.160
	Classification	Default	100	0.007	0.007	0.167

Area Summary for Storm C

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
	Classification	Default	100	0.007	0.007	0.174
	Classification	Default	100	0.007	0.007	0.182
	Classification	Default	100	0.007	0.007	0.189
	Classification	Default	100	0.007	0.007	0.196
	Classification	Default	100	0.007	0.007	0.203
	Classification	Default	100	0.007	0.007	0.210
	Classification	Default	100	0.007	0.007	0.217
	Classification	Default	100	0.008	0.008	0.226
1.002	Classification	Default	100	0.027	0.027	0.027
	Classification	Default	100	0.016	0.016	0.043
1.003	-	-	100	0.000	0.000	0.000
1.004	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				0.405	0.405	0.405

Network Classifications for Storm C

PN	USMH Name	Pipe Dia (mm)	Min Cover Depth (m)	Max Cover Depth (m)	Pipe Type	MH Dia (mm)	MH Width (mm)	MH Ring Depth (m)	MH Type
SC1.000	SC1	225	0.857	0.919	Unclassified	1200	0	0.900	Unclassified
SC2.000	SC2	225	1.200	1.400	Unclassified	1200	0	1.200	Unclassified
SC3.000	SC3	225	0.900	1.100	Unclassified	1200	0	0.900	Unclassified
SC2.001	SC4	225	1.364	1.449	Unclassified	1200	0	1.400	Unclassified
SC1.001	SC5	300	1.224	1.449	Unclassified	1200	0	1.449	Unclassified
SC1.002	SC6	300	1.224	1.355	Unclassified	1200	0	1.224	Unclassified
SC1.003	SC7	300	1.350	1.933	Unclassified	1200	0	1.350	Unclassified
SC1.004	SC8	300	1.933	2.161	Unclassified	1200	0	1.933	Unclassified

Free Flowing Outfall Details for Storm C

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
SC1.004	SC9	56.019	53.558	0.000	0	0

Simulation Criteria for Storm C

Volumetric Runoff Coeff	0.850	Manhole Headloss Coeff (Global)	0.500	Inlet Coeffiecient	0.800
Areal Reduction Factor	1.000	Foul Sewage per hectare (l/s)	0.000	Flow per Person per Day (l/per/day)	0.000
Hot Start (mins)	0	Additional Flow - % of Total Flow	0.000	Run Time (mins)	60
Hot Start Level (mm)	0	MADD Factor * 10m³/ha Storage	2.000	Output Interval (mins)	1

Number of Input Hydrographs	0	Number of Offline Controls	0	Number of Time/Area Diagrams	0
Number of Online Controls	1	Number of Storage Structures	4	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	M5-60 (mm)	16.200	Cv (Summer)	0.850
Return Period (years)	5	Ratio R	0.275	Cv (Winter)	0.840
Region	Scotland and Ireland	Profile Type	Summer	Storm Duration (mins)	30

Online Controls for Storm C

Hydro-Brake® Optimum Manhole: SC7, DS/PN: SC1.003, Volume (m³): 2.1

Unit Reference	MD-SHE-0041-8000-1077-8000	Sump Available	Yes
Design Head (m)	1.077	Diameter (mm)	41
Design Flow (l/s)	0.8	Invert Level (m)	53.655
Flush-Flo™	Calculated	Minimum Outlet Pipe Diameter (mm)	75
Objective	Minimise upstream storage	Suggested Manhole Diameter (mm)	1200
Application	Surface		

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.077	0.8	Kick-Flo®	0.364	0.5
Flush-Flo™	0.180	0.6	Mean Flow over Head Range	-	0.6

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	0.6	0.600	0.6	1.600	1.0	2.600	1.2	5.000	1.6	7.500	1.9
0.200	0.6	0.800	0.7	1.800	1.0	3.000	1.3	5.500	1.7	8.000	2.0
0.300	0.6	1.000	0.8	2.000	1.1	3.500	1.4	6.000	1.7	8.500	2.0
0.400	0.5	1.200	0.8	2.200	1.1	4.000	1.4	6.500	1.8	9.000	2.1
0.500	0.6	1.400	0.9	2.400	1.1	4.500	1.5	7.000	1.9	9.500	2.1

Storage Structures for Storm C

Porous Car Park Manhole: SC2, DS/PN: SC2.000

Infiltration Coefficient Base (m/hr)	0.03728	Porosity	0.40	Slope (1:X)	100.0
Membrane Percolation (mm/hr)	1000	Invert Level (m)	55.193	Depression Storage (mm)	5
Max Percolation (l/s)	28.9	Width (m)	5.0	Evaporation (mm/day)	3
Safety Factor	2.0	Length (m)	20.8	Membrane Depth (mm)	0

Complex Manhole: SC3, DS/PN: SC3.000

Infiltration Trench

Infiltration Coefficient Base (m/hr)	0.03728	Invert Level (m)	54.515	Cap Volume Depth (m)	0.000
Infiltration Coefficient Side (m/hr)	0.03728	Trench Width (m)	2.1	Cap Infiltration Depth (m)	0.000
Safety Factor	2.0	Trench Length (m)	2.1		
Porosity	0.40	Slope (1:X)	0.0		

Porous Car Park

Infiltration Coefficient Base (m/hr)	0.03728	Porosity	0.40	Slope (1:X)	100.0
Membrane Percolation (mm/hr)	1000	Invert Level (m)	55.015	Depression Storage (mm)	5
Max Percolation (l/s)	18.7	Width (m)	2.4	Evaporation (mm/day)	3
Safety Factor	2.0	Length (m)	28.0	Membrane Depth (mm)	0

Complex Manhole: SC6, DS/PN: SC1.002

Infiltration Trench

Infiltration Coefficient Base (m/hr)	0.03728	Invert Level (m)	53.598	Cap Volume Depth (m)	0.000
Infiltration Coefficient Side (m/hr)	0.03728	Trench Width (m)	2.6	Cap Infiltration Depth (m)	0.000
Safety Factor	2.0	Trench Length (m)	2.6		
Porosity	0.40	Slope (1:X)	0.0		

Porous Car Park

Infiltration Coefficient Base (m/hr)	0.03728	Porosity	0.40	Slope (1:X)	100.0
Membrane Percolation (mm/hr)	1000	Invert Level (m)	54.098	Depression Storage (mm)	5
Max Percolation (l/s)	178.8	Width (m)	5.0	Evaporation (mm/day)	3
Safety Factor	2.0	Length (m)	128.7	Membrane Depth (mm)	0

Complex Manhole: SC7, DS/PN: SC1.003

Infiltration Blanket

Infiltration Coefficient Base (m/hr)	0.03728	Invert Level (m)	53.024	Cap Volume Depth (m)	0.550
Safety Factor	2.0	Diameter/Width (m)	4.0		
Porosity	0.40	Length (m)	60.0		

Tank or Pond

Invert Level (m) 54.930

Depth (m)	**Area (m²)**	**Depth (m)**	**Area (m²)**
0.000	60.0	0.375	240.0

Manhole Headloss for Storm C

PN	**US/MH Name**	**US/MH Headloss**
SC1.000	SC1	0.500
SC2.000	SC2	0.500
SC3.000	SC3	0.500
SC2.001	SC4	0.500
SC1.001	SC5	0.500
SC1.002	SC6	0.500
SC1.003	SC7	0.500
SC1.004	SC8	0.500

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

Simulation Criteria

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

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 1 Number of Storage Structures 4 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR M5-60 (mm) 16.400 Cv (Summer) 0.750
Region Scotland and Ireland Ratio R 0.275 Cv (Winter) 0.840

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

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years)	1, 30, 100
Climate Change (%)	0, 0, 0

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

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status

PN	US/MH Name	Level Exceeded

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)
SC1.000	SC1	600 Winter	100	+0%					54.916	-0.050	0.000	0.06		
SC2.000	SC2	600 Winter	100	+0%	30/240 Winter				54.916	0.273	0.000	0.01		262
SC3.000	SC3	600 Winter	100	+0%	100/15 Summer				54.917	0.152	0.000	0.08		234
SC2.001	SC4	600 Winter	100	+0%	30/15 Summer				54.916	0.525	0.000	0.10		
SC1.001	SC5	600 Winter	100	+0%	30/15 Summer				54.915	0.556	0.000	0.17		
SC1.002	SC6	600 Winter	100	+0%	30/15 Summer				54.908	0.933	0.000	0.27		275
SC1.003	SC7	480 Winter	100	+0%	30/30 Winter				54.930	0.975	0.000	0.01		
SC1.004	SC8	600 Winter	100	+0%					53.594	-0.274	0.000	0.02		

PN	US/MH Name	Pipe Flow (l/s)	Status	Level Exceeded
SC1.000	SC1	2.0	OK	
SC2.000	SC2	0.7	SURCHARGED	
SC3.000	SC3	2.6	SURCHARGED	
SC2.001	SC4	3.1	SURCHARGED	
SC1.001	SC5	13.0	SURCHARGED	
SC1.002	SC6	13.0	FLOOD RISK	
SC1.003	SC7	0.9	SURCHARGED	
SC1.004	SC8	0.9	OK	

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm D

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - Scotland and Ireland

Return Period (years)	5	Foul Sewage (l/s/ha)	0.000	Maximum Backdrop Height (m)	1.500
M5-60 (mm)	16.200	Volumetric Runoff Coeff.	0.850	Min Design Depth for Optimisation (m)	1.200
Ratio R	0.275	PIMP (%)	100	Min Vel for Auto Design only (m/s)	1.00
Maximum Rainfall (mm/hr)	150	Add Flow / Climate Change (%)	0	Min Slope for Optimisation (1:X)	500
Maximum Time of Concentration (mins)	30	Minimum Backdrop Height (m)	0.200		

Designed with Level Soffits

Network Design Table for Storm D

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
SD1.000	8.841	0.053	166.8	0.044	4.00	0.0	0.600	o	225	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
SD1.000	64.82	4.15	54.417	0.044	0.0	0.0	0.0	1.01	40.1	8.8

Network Design Table for Storm D

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
SD2.000	6.204	0.051	121.6	0.050	4.00	0.0	0.600	o	225	Pipe/Conduit	
SD2.001	12.067	0.151	79.9	0.014	0.00	0.0	0.600	o	225	Pipe/Conduit	
SD1.001	56.812	0.227	250.0	0.167	0.00	0.0	0.600	o	300	Pipe/Conduit	
SD1.002	21.486	0.086	250.0	0.020	0.00	0.0	0.600	o	300	Pipe/Conduit	
SD1.003	1.649	0.007	250.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
SD2.000	65.13	4.09	54.566	0.050	0.0	0.0	0.0	1.18	47.1	10.0
SD2.001	64.41	4.22	54.515	0.064	0.0	0.0	0.0	1.46	58.2	12.6
SD1.001	59.90	5.18	54.289	0.275	0.0	0.0	0.0	0.99	70.0	50.6
SD1.002	63.71	4.36	54.062	0.000	0.6	0.0	0.0	0.99	70.0	0.6
SD1.003	63.57	4.39	53.976	0.000	0.6	0.0	0.0	0.99	70.0	0.6

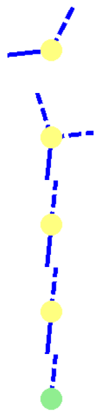
Manhole Schedules for Storm D

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	Pipe Out PN	Pipe Out Invert Level (m)	Pipe Out Diameter (mm)	Pipes In PN	Pipes In Invert Level (m)	Pipes In Diameter (mm)	Backdrop (mm)
SD1	55.842	1.425	Open Manhole	1200	SD1.000	54.417	225				
SD2	55.991	1.425	Open Manhole	1200	SD2.000	54.566	225				
SD3	55.941	1.426	Open Manhole	1200	SD2.001	54.515	225	SD2.000	54.515	225	
SD4	55.846	1.557	Open Manhole	1200	SD1.001	54.289	300	SD1.000	54.364	225	
								SD2.001	54.364	225	
SD5	55.681	1.619	Open Manhole	1200	SD1.002	54.062	300	SD1.001	54.062	300	
SD6	56.259	2.283	Open Manhole	1200	SD1.003	53.976	300	SD1.002	53.976	300	
SD7	56.469	2.500	Open Manhole	0		OUTFALL		SD1.003	53.969	300	

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
SD1	701311.716	737123.932	701311.716	737123.932	Required	
SD2	701329.204	737122.405	701329.204	737122.405	Required	

Manhole Schedules for Storm D

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
SD3	701326.397	737116.872	701326.397	737116.872	Required	
SD4	701314.407	737115.510	701314.407	737115.510	Required	
SD5	701308.572	737058.999	701308.572	737058.999	Required	
SD6	701306.365	737037.626	701306.365	737037.626	Required	
SD7	701306.196	737035.986			No Entry	



PIPELINE SCHEDULES for Storm D

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
SD1.000	o	225	SD1	55.842	54.417	1.200	Open Manhole	1200
SD2.000	o	225	SD2	55.991	54.566	1.200	Open Manhole	1200
SD2.001	o	225	SD3	55.941	54.515	1.201	Open Manhole	1200
SD1.001	o	300	SD4	55.846	54.289	1.257	Open Manhole	1200
SD1.002	o	300	SD5	55.681	54.062	1.319	Open Manhole	1200
SD1.003	o	300	SD6	56.259	53.976	1.983	Open Manhole	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
SD1.000	8.841	166.8	SD4	55.846	54.364	1.257	Open Manhole	1200
SD2.000	6.204	121.6	SD3	55.941	54.515	1.201	Open Manhole	1200
SD2.001	12.067	79.9	SD4	55.846	54.364	1.257	Open Manhole	1200
SD1.001	56.812	250.0	SD5	55.681	54.062	1.319	Open Manhole	1200
SD1.002	21.486	250.0	SD6	56.259	53.976	1.983	Open Manhole	1200
SD1.003	1.649	250.0	SD7	56.469	53.969	2.200	Open Manhole	0

Area Summary for Storm D

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	Classification	Default	100	0.022	0.022	0.022
	Classification	Default	100	0.013	0.013	0.035
	Classification	Default	100	0.010	0.010	0.044
2.000	Classification	Default	100	0.036	0.036	0.036
	Classification	Default	100	0.007	0.007	0.043
	Classification	Default	100	0.007	0.007	0.050
2.001	Classification	Default	100	0.007	0.007	0.007
	Classification	Default	100	0.007	0.007	0.014
1.001	Classification	Default	100	0.061	0.061	0.061
	Classification	Default	100	0.029	0.029	0.090
	Classification	Default	100	0.007	0.007	0.097
	Classification	Default	100	0.007	0.007	0.104
	Classification	Default	100	0.007	0.007	0.111
	Classification	Default	100	0.007	0.007	0.118
	Classification	Default	100	0.007	0.007	0.124
	Classification	Default	100	0.007	0.007	0.131
	Classification	Default	100	0.007	0.007	0.139
	Classification	Default	100	0.007	0.007	0.146
	Classification	Default	100	0.007	0.007	0.153
	Classification	Default	100	0.007	0.007	0.161
	Classification	Default	100	0.007	0.007	0.167
1.002	Classification	Default	100	0.020	0.020	0.020
1.003	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				0.295	0.295	0.295

Network Classifications for Storm D

PN	USMH Name	Pipe Dia (mm)	Min Cover Depth (m)	Max Cover Depth (m)	Pipe Type	MH Dia (mm)	MH Width (mm)	MH Ring Depth (m)	MH Type
SD1.000	SD1	225	1.200	1.274	Unclassified	1200	0	1.200	Unclassified
SD2.000	SD2	225	1.200	1.205	Unclassified	1200	0	1.200	Unclassified
SD2.001	SD3	225	1.201	1.259	Unclassified	1200	0	1.201	Unclassified
SD1.001	SD4	300	1.118	1.319	Unclassified	1200	0	1.257	Unclassified
SD1.002	SD5	300	1.263	1.983	Unclassified	1200	0	1.319	Unclassified
SD1.003	SD6	300	1.983	2.200	Unclassified	1200	0	1.983	Unclassified

Free Flowing Outfall Details for Storm D

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
SD1.003	SD7	56.469	53.969	0.000	0	0

Simulation Criteria for Storm D

Volumetric Runoff Coeff	0.850	Manhole Headloss Coeff (Global)	0.500	Inlet Coeffiecient	0.800
Areal Reduction Factor	1.000	Foul Sewage per hectare (l/s)	0.000	Flow per Person per Day (l/per/day)	0.000
Hot Start (mins)	0	Additional Flow - % of Total Flow	0.000	Run Time (mins)	60
Hot Start Level (mm)	0	MADD Factor * 10m³/ha Storage	2.000	Output Interval (mins)	1

Number of Input Hydrographs	0	Number of Offline Controls	0	Number of Time/Area Diagrams	0
Number of Online Controls	1	Number of Storage Structures	3	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	M5-60 (mm)	16.200	Cv (Summer)	0.850
Return Period (years)	5	Ratio R	0.275	Cv (Winter)	0.840
Region	Scotland and Ireland	Profile Type	Summer	Storm Duration (mins)	30

Online Controls for Storm D

Hydro-Brake® Optimum Manhole: SD5, DS/PN: SD1.002, Volume (m³): 5.8

Unit Reference	MD-SHE-0035-6000-1103-6000	Sump Available	Yes
Design Head (m)	1.103	Diameter (mm)	35
Design Flow (l/s)	0.6	Invert Level (m)	54.062
Flush-Flo™	Calculated	Minimum Outlet Pipe Diameter (mm)	75
Objective	Minimise upstream storage	Suggested Manhole Diameter (mm)	1200
Application	Surface		

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.103	0.6	Kick-Flo®	0.309	0.3
Flush-Flo™	0.155	0.4	Mean Flow over Head Range	-	0.4

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	0.4	0.600	0.5	1.600	0.7	2.600	0.9	5.000	1.2	7.500	1.4
0.200	0.4	0.800	0.5	1.800	0.7	3.000	0.9	5.500	1.2	8.000	1.5
0.300	0.4	1.000	0.6	2.000	0.8	3.500	1.0	6.000	1.3	8.500	1.5
0.400	0.4	1.200	0.6	2.200	0.8	4.000	1.1	6.500	1.3	9.000	1.5
0.500	0.4	1.400	0.7	2.400	0.8	4.500	1.1	7.000	1.4	9.500	1.6

Storage Structures for Storm D

Porous Car Park Manhole: SD3, DS/PN: SD2.001

Infiltration Coefficient Base (m/hr)	0.03728	Porosity	0.40	Slope (1:X)	100.0
Membrane Percolation (mm/hr)	1000	Invert Level (m)	55.291	Depression Storage (mm)	5
Max Percolation (l/s)	158.8	Width (m)	5.0	Evaporation (mm/day)	3
Safety Factor	2.0	Length (m)	114.3	Membrane Depth (mm)	0

Complex Manhole: SD4, DS/PN: SD1.001

Infiltration Trench

Infiltration Coefficient Base (m/hr)	0.03728	Invert Level (m)	54.696	Cap Volume Depth (m)	0.000
Infiltration Coefficient Side (m/hr)	0.03728	Trench Width (m)	1.5	Cap Infiltration Depth (m)	0.000
Safety Factor	2.0	Trench Length (m)	1.5		
Porosity	0.40	Slope (1:X)	0.0		

Porous Car Park

Infiltration Coefficient Base (m/hr)	0.03728	Porosity	0.40	Slope (1:X)	100.0
Membrane Percolation (mm/hr)	1000	Invert Level (m)	55.196	Depression Storage (mm)	5
Max Percolation (l/s)	28.8	Width (m)	2.4	Evaporation (mm/day)	3
Safety Factor	2.0	Length (m)	43.2	Membrane Depth (mm)	0

Complex Manhole: SD5, DS/PN: SD1.002

Infiltration Blanket

Infiltration Coefficient Base (m/hr)	0.03728	Invert Level (m)	53.573	Cap Volume Depth (m)	0.375
Safety Factor	2.0	Diameter/Width (m)	4.0		
Porosity	0.40	Length (m)	60.0		

Infiltration Trench

Infiltration Coefficient Base (m/hr)	0.03728	Invert Level (m)	54.531	Cap Volume Depth (m)	0.000
Infiltration Coefficient Side (m/hr)	0.03728	Trench Width (m)	3.0	Cap Infiltration Depth (m)	0.000
Safety Factor	2.0	Trench Length (m)	3.0		
Porosity	0.40	Slope (1:X)	0.0		

Porous Car Park

Infiltration Coefficient Base (m/hr)	0.03728	Porosity	0.40	Slope (1:X)	100.0
Membrane Percolation (mm/hr)	1000	Invert Level (m)	55.031	Depression Storage (mm)	5
Max Percolation (l/s)	451.8	Width (m)	4.0	Evaporation (mm/day)	3
Safety Factor	2.0	Length (m)	406.6	Membrane Depth (mm)	0

Tank or Pond

Invert Level (m) 55.306

Tank or Pond

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	60.0	0.375	240.0

Manhole Headloss for Storm D

PN	US/MH Name	US/MH Headloss
SD1.000	SD1	0.500
SD2.000	SD2	0.500
SD2.001	SD3	0.500
SD1.001	SD4	0.500
SD1.002	SD5	0.500
SD1.003	SD6	0.500

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

Simulation Criteria

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

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 1 Number of Storage Structures 3 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR M5-60 (mm) 16.400 Cv (Summer) 0.750
Region Scotland and Ireland Ratio R 0.275 Cv (Winter) 0.840

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

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years) 1, 30, 100
Climate Change (%) 0, 0, 0

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status

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

PN	US/MH Name	Level Exceeded

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)
SD1.000	SD1	480 Winter	100	+0%	30/60 Winter				55.451	0.809	0.000	0.06		
SD2.000	SD2	480 Winter	100	+0%	30/60 Winter				55.452	0.661	0.000	0.07		
SD2.001	SD3	480 Winter	100	+0%	30/60 Winter				55.451	0.711	0.000	0.06		160
SD1.001	SD4	480 Winter	100	+0%	30/60 Summer				55.451	0.862	0.000	0.16		228
SD1.002	SD5	480 Winter	100	+0%	30/60 Summer				55.446	1.084	0.000	0.01		446
SD1.003	SD6	480 Winter	100	+0%					54.002	-0.274	0.000	0.01		

PN	US/MH Name	Pipe Flow (l/s)	Status	Level Exceeded
SD1.000	SD1	1.9	SURCHARGED	
SD2.000	SD2	2.2	SURCHARGED	
SD2.001	SD3	2.7	SURCHARGED	
SD1.001	SD4	10.8	SURCHARGED	
SD1.002	SD5	0.7	FLOOD RISK	
SD1.003	SD6	0.7	OK	

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm E

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - Scotland and Ireland

Return Period (years)	5	Foul Sewage (l/s/ha)	0.000	Maximum Backdrop Height (m)	1.500
M5-60 (mm)	16.200	Volumetric Runoff Coeff.	0.850	Min Design Depth for Optimisation (m)	1.200
Ratio R	0.275	PIMP (%)	100	Min Vel for Auto Design only (m/s)	1.00
Maximum Rainfall (mm/hr)	150	Add Flow / Climate Change (%)	0	Min Slope for Optimisation (1:X)	500
Maximum Time of Concentration (mins)	30	Minimum Backdrop Height (m)	0.200		

Designed with Level Soffits

Network Design Table for Storm E

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
SE1.000	49.008	0.294	166.6	0.199	4.00	0.0	0.600	o	225	Pipe/Conduit	🔒

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
SE1.000	61.56	4.81	54.591	0.199	0.0	0.0	0.0	1.01	40.2	37.5

Network Design Table for Storm E

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
SE1.001	11.211	0.067	166.6	0.042	0.00	0.0	0.600	o	300	Pipe/Conduit	
SE1.002	16.605	0.100	166.1	0.007	0.00	0.0	0.600	o	300	Pipe/Conduit	
SE2.000	13.733	0.096	142.9	0.011	4.00	0.0	0.600	o	225	Pipe/Conduit	
SE2.001	21.601	0.130	166.6	0.066	0.00	0.0	0.600	o	225	Pipe/Conduit	
SE2.002	5.734	0.034	166.6	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
SE2.003	28.617	0.253	113.2	0.008	0.00	0.0	0.600	o	225	Pipe/Conduit	
SE1.003	3.575	0.021	166.6	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
SE1.004	1.936	0.065	29.8	0.040	0.00	0.0	0.600	o	300	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
SE1.001	60.86	4.96	54.222	0.240	0.0	0.0	0.0	1.22	85.9	44.9
SE1.002	59.87	5.19	54.155	0.247	0.0	0.0	0.0	1.22	86.0	45.3
SE2.000	64.49	4.21	54.643	0.011	0.0	0.0	0.0	1.09	43.4	2.1
SE2.001	62.71	4.57	54.547	0.077	0.0	0.0	0.0	1.01	40.2	14.8
SE2.002	62.25	4.66	54.417	0.077	0.0	0.0	0.0	1.01	40.2	14.8
SE2.003	60.48	5.05	54.383	0.085	0.0	0.0	0.0	1.23	48.8	15.8
SE1.003	59.66	5.24	54.055	0.332	0.0	0.0	0.0	1.22	85.9	60.8
SE1.004	65.53	4.01	54.033	0.000	0.8	0.0	0.0	2.89	204.4	0.8

Network Design Table for Storm E

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
SE1.005	19.762	0.079	250.2	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
SE1.006	1.772	0.007	250.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	

Network Results Table

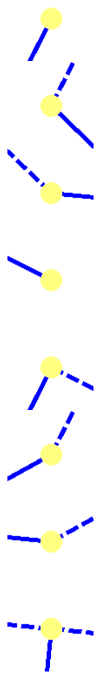
PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
SE1.005	63.80	4.34	53.213	0.000	0.8	0.0	0.0	0.99	69.9	0.8
SE1.006	63.65	4.37	53.134	0.000	0.8	0.0	0.0	0.99	70.0	0.8

Manhole Schedules for Storm E

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	PN	Pipe Out Invert Level (m)	Diameter (mm)	PN	Pipes In Invert Level (m)	Diameter (mm)	Backdrop (mm)
SE1	56.016	1.425	Open Manhole	1200	SE1.000	54.591	225				
SE2	55.746	1.524	Open Manhole	1200	SE1.001	54.222	300	SE1.000	54.297	225	
SE3	55.853	1.699	Open Manhole	1200	SE1.002	54.155	300	SE1.001	54.155	300	
SE4	56.068	1.425	Open Manhole	1200	SE2.000	54.643	225				
SE5	55.972	1.425	Open Manhole	1200	SE2.001	54.547	225	SE2.000	54.547	225	
SE6	56.128	1.711	Open Manhole	1200	SE2.002	54.417	225	SE2.001	54.417	225	
SE7	56.161	1.779	Open Manhole	1200	SE2.003	54.383	225	SE2.002	54.383	225	
SE8	55.994	1.939	Open Manhole	1200	SE1.003	54.055	300	SE1.002	54.055	300	
								SE2.003	54.130	225	
SE9	56.143	2.110	Open Manhole	1200	SE1.004	54.033	300	SE1.003	54.033	300	
SE10	56.200	2.987	Open Manhole	1200	SE1.005	53.213	300	SE1.004	53.968	300	755
SE11	56.419	3.285	Open Manhole	1200	SE1.006	53.134	300	SE1.005	53.134	300	
SE12	56.629	3.502	Open Manhole	0		OUTFALL		SE1.006	53.127	300	

Manhole Schedules for Storm E

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
SE1	701384.100	737107.933	701384.100	737107.933	Required	
SE2	701361.878	737064.253	701361.878	737064.253	Required	
SE3	701370.003	737056.528	701370.003	737056.528	Required	
SE4	701442.096	737067.924	701442.096	737067.924	Required	
SE5	701429.810	737074.060	701429.810	737074.060	Required	
SE6	701420.023	737054.803	701420.023	737054.803	Required	
SE7	701415.001	737052.036	701415.001	737052.036	Required	
SE8	701386.526	737054.879	701386.526	737054.879	Required	



Manhole Schedules for Storm E

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
SE9	701386.171	737051.322	701386.171	737051.322	Required	
SE10	701385.978	737049.395	701385.978	737049.395	Required	
SE11	701384.015	737029.732	701384.015	737029.732	Required	
SE12	701383.839	737027.968			No Entry	

PIPELINE SCHEDULES for Storm E

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
SE1.000	o	225	SE1	56.016	54.591	1.200	Open Manhole	1200
SE1.001	o	300	SE2	55.746	54.222	1.224	Open Manhole	1200
SE1.002	o	300	SE3	55.853	54.155	1.399	Open Manhole	1200
SE2.000	o	225	SE4	56.068	54.643	1.200	Open Manhole	1200
SE2.001	o	225	SE5	55.972	54.547	1.200	Open Manhole	1200
SE2.002	o	225	SE6	56.128	54.417	1.486	Open Manhole	1200
SE2.003	o	225	SE7	56.161	54.383	1.554	Open Manhole	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
SE1.000	49.008	166.6	SE2	55.746	54.297	1.224	Open Manhole	1200
SE1.001	11.211	166.6	SE3	55.853	54.155	1.399	Open Manhole	1200
SE1.002	16.605	166.1	SE8	55.994	54.055	1.639	Open Manhole	1200
SE2.000	13.733	142.9	SE5	55.972	54.547	1.200	Open Manhole	1200
SE2.001	21.601	166.6	SE6	56.128	54.417	1.486	Open Manhole	1200
SE2.002	5.734	166.6	SE7	56.161	54.383	1.554	Open Manhole	1200
SE2.003	28.617	113.2	SE8	55.994	54.130	1.639	Open Manhole	1200

PIPELINE SCHEDULES for Storm E

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
SE1.003	o	300	SE8	55.994	54.055	1.639	Open Manhole	1200
SE1.004	o	300	SE9	56.143	54.033	1.810	Open Manhole	1200
SE1.005	o	300	SE10	56.200	53.213	2.687	Open Manhole	1200
SE1.006	o	300	SE11	56.419	53.134	2.985	Open Manhole	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
SE1.003	3.575	166.6	SE9	56.143	54.033	1.810	Open Manhole	1200
SE1.004	1.936	29.8	SE10	56.200	53.968	1.932	Open Manhole	1200
SE1.005	19.762	250.2	SE11	56.419	53.134	2.985	Open Manhole	1200
SE1.006	1.772	250.0	SE12	56.629	53.127	3.202	Open Manhole	0

Area Summary for Storm E

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	Classification	Default	100	0.102	0.102	0.102
	Classification	Default	100	0.007	0.007	0.109
	Classification	Default	100	0.007	0.007	0.116
	Classification	Default	100	0.006	0.006	0.122
	Classification	Default	100	0.006	0.006	0.129
	Classification	Default	100	0.006	0.006	0.135
	Classification	Default	100	0.006	0.006	0.141
	Classification	Default	100	0.006	0.006	0.148
	Classification	Default	100	0.008	0.008	0.156
	Classification	Default	100	0.007	0.007	0.163
	Classification	Default	100	0.007	0.007	0.170
	Classification	Default	100	0.007	0.007	0.177
	Classification	Default	100	0.007	0.007	0.184
	Classification	Default	100	0.007	0.007	0.191
	Classification	Default	100	0.007	0.007	0.199
1.001	Classification	Default	100	0.042	0.042	0.042
1.002	Classification	Default	100	0.007	0.007	0.007
2.000	Classification	Default	100	0.011	0.011	0.011
2.001	Classification	Default	100	0.040	0.040	0.040
	Classification	Default	100	0.007	0.007	0.046
	Classification	Default	100	0.007	0.007	0.053
	Classification	Default	100	0.006	0.006	0.060
	Classification	Default	100	0.006	0.006	0.066
2.002	-	-	100	0.000	0.000	0.000
2.003	Classification	Default	100	0.008	0.008	0.008
1.003	-	-	100	0.000	0.000	0.000

Area Summary for Storm E

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.004	Classification	Default	100	0.040	0.040	0.040
1.005	-	-	100	0.000	0.000	0.000
1.006	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				0.372	0.372	0.372

Network Classifications for Storm E

PN	USMH Name	Pipe Dia (mm)	Min Cover Depth (m)	Max Cover Depth (m)	Pipe Type	MH Dia (mm)	MH Width (mm)	MH Ring Depth (m)	MH Type
SE1.000	SE1	225	1.185	1.224	Unclassified	1200	0	1.200	Unclassified
SE1.001	SE2	300	1.224	1.399	Unclassified	1200	0	1.224	Unclassified
SE1.002	SE3	300	1.399	1.639	Unclassified	1200	0	1.399	Unclassified
SE2.000	SE4	225	1.200	1.200	Unclassified	1200	0	1.200	Unclassified
SE2.001	SE5	225	1.200	1.486	Unclassified	1200	0	1.200	Unclassified
SE2.002	SE6	225	1.486	1.554	Unclassified	1200	0	1.486	Unclassified
SE2.003	SE7	225	1.554	1.639	Unclassified	1200	0	1.554	Unclassified
SE1.003	SE8	300	1.617	1.810	Unclassified	1200	0	1.639	Unclassified
SE1.004	SE9	300	1.810	1.932	Unclassified	1200	0	1.810	Unclassified
SE1.005	SE10	300	2.484	2.985	Unclassified	1200	0	2.687	Unclassified
SE1.006	SE11	300	2.985	3.202	Unclassified	1200	0	2.985	Unclassified

Free Flowing Outfall Details for Storm E

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
SE1.006	SE12	56.629	53.127	0.000	0	0

Simulation Criteria for Storm E

Volumetric Runoff Coeff	0.850	Manhole Headloss Coeff (Global)	0.500	Inlet Coeffiecient	0.800
Areal Reduction Factor	1.000	Foul Sewage per hectare (l/s)	0.000	Flow per Person per Day (l/per/day)	0.000
Hot Start (mins)	0	Additional Flow - % of Total Flow	0.000	Run Time (mins)	60
Hot Start Level (mm)	0	MADD Factor * 10m³/ha Storage	2.000	Output Interval (mins)	1

Number of Input Hydrographs	0	Number of Offline Controls	0	Number of Time/Area Diagrams	0
Number of Online Controls	1	Number of Storage Structures	6	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	M5-60 (mm)	16.200	Cv (Summer)	0.850
Return Period (years)	5	Ratio R	0.275	Cv (Winter)	0.840
Region	Scotland and Ireland	Profile Type	Summer	Storm Duration (mins)	30

Online Controls for Storm E

Hydro-Brake® Optimum Manhole: SE9, DS/PN: SE1.004, Volume (m³): 2.6

Unit Reference	MD-SHE-0045-8000-0724-8000	Sump Available	Yes
Design Head (m)	0.724	Diameter (mm)	45
Design Flow (l/s)	0.8	Invert Level (m)	54.033
Flush-Flo™	Calculated	Minimum Outlet Pipe Diameter (mm)	75
Objective	Minimise upstream storage	Suggested Manhole Diameter (mm)	1200
Application	Surface		

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.724	0.8	Kick-Flo®	0.398	0.6
Flush-Flo™	0.197	0.7	Mean Flow over Head Range	-	0.7

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	0.7	0.600	0.7	1.600	1.1	2.600	1.4	5.000	1.9	7.500	2.3
0.200	0.7	0.800	0.8	1.800	1.2	3.000	1.5	5.500	2.0	8.000	2.4
0.300	0.7	1.000	0.9	2.000	1.3	3.500	1.6	6.000	2.1	8.500	2.5
0.400	0.6	1.200	1.0	2.200	1.3	4.000	1.7	6.500	2.2	9.000	2.5
0.500	0.7	1.400	1.1	2.400	1.4	4.500	1.8	7.000	2.2	9.500	2.6

Storage Structures for Storm E

Complex Manhole: SE2, DS/PN: SE1.001

Porous Car Park

Infiltration Coefficient Base (m/hr)	0.03728	Porosity	0.40	Slope (1:X)	0.0
Membrane Percolation (mm/hr)	1000	Invert Level (m)	55.096	Depression Storage (mm)	5
Max Percolation (l/s)	127.5	Width (m)	5.0	Evaporation (mm/day)	3
Safety Factor	1.0	Length (m)	91.8	Membrane Depth (mm)	0

Infiltration Trench

Infiltration Coefficient Base (m/hr)	0.03728	Invert Level (m)	55.096	Cap Volume Depth (m)	0.000
Infiltration Coefficient Side (m/hr)	0.03728	Trench Width (m)	3.0	Cap Infiltration Depth (m)	0.000
Safety Factor	1.0	Trench Length (m)	3.0		
Porosity	0.40	Slope (1:X)	0.0		

Complex Manhole: SE3, DS/PN: SE1.002

Infiltration Blanket

Infiltration Coefficient Base (m/hr)	0.03728	Porosity	0.40	Diameter/Width (m)	4.0
Safety Factor	1.0	Invert Level (m)	53.480	Length (m)	43.0

Infiltration Blanket

Cap Volume Depth (m) 0.675

Tank or Pond

Invert Level (m) 55.478

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	43.0	0.375	172.0

Infiltration Trench Manhole: SE5, DS/PN: SE2.001

Infiltration Coefficient Base (m/hr)	0.03728	Invert Level (m)	54.822	Cap Volume Depth (m)	0.000
Infiltration Coefficient Side (m/hr)	0.03728	Trench Width (m)	2.1	Cap Infiltration Depth (m)	0.000
Safety Factor	1.0	Trench Length (m)	2.1		
Porosity	0.40	Slope (1:X)	0.0		

Porous Car Park Manhole: SE6, DS/PN: SE2.002

Infiltration Coefficient Base (m/hr)	0.03728	Porosity	0.40	Slope (1:X)	100.0
Membrane Percolation (mm/hr)	1000	Invert Level (m)	55.478	Depression Storage (mm)	5
Max Percolation (l/s)	35.1	Width (m)	5.0	Evaporation (mm/day)	3
Safety Factor	1.0	Length (m)	25.3	Membrane Depth (mm)	0

Porous Car Park Manhole: SE8, DS/PN: SE1.003

Infiltration Coefficient Base (m/hr)	0.03728	Porosity	0.40	Slope (1:X)	100.0
Membrane Percolation (mm/hr)	1000	Invert Level (m)	55.344	Depression Storage (mm)	5
Max Percolation (l/s)	107.5	Width (m)	5.0	Evaporation (mm/day)	3
Safety Factor	1.0	Length (m)	77.4	Membrane Depth (mm)	0

Complex Manhole: SE9, DS/PN: SE1.004

Infiltration Blanket

Infiltration Coefficient Base (m/hr)	0.03728	Invert Level (m)	53.358	Cap Volume Depth (m)	0.675
Safety Factor	1.0	Diameter/Width (m)	4.0		
Porosity	0.40	Length (m)	43.0		

Tank or Pond

Invert Level (m) 55.768

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	43.0	0.375	172.0

Manhole Headloss for Storm E

PN	US/MH Name	US/MH Headloss
SE1.000	SE1	0.500
SE1.001	SE2	0.500
SE1.002	SE3	0.500
SE2.000	SE4	0.500
SE2.001	SE5	0.500
SE2.002	SE6	0.500
SE2.003	SE7	0.500
SE1.003	SE8	0.500
SE1.004	SE9	0.500
SE1.005	SE10	0.500
SE1.006	SE11	0.500

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

Simulation Criteria

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

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 1 Number of Storage Structures 6 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR M5-60 (mm) 16.400 Cv (Summer) 0.750
Region Scotland and Ireland Ratio R 0.275 Cv (Winter) 0.840

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

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years) 1, 30, 100
Climate Change (%) 0, 0, 0

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status

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

PN	US/MH Name	Level Exceeded

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)
SE1.000	SE1	15 Winter	100	+0%	30/15 Summer				55.281	0.465	0.000	1.55		
SE1.001	SE2	360 Winter	100	+0%	100/15 Summer				54.874	0.352	0.000	0.21		89
SE1.002	SE3	360 Winter	100	+0%	100/120 Winter				54.872	0.417	0.000	0.16		329
SE2.000	SE4	360 Winter	100	+0%	100/360 Winter				54.875	0.007	0.000	0.02		
SE2.001	SE5	360 Winter	100	+0%	100/180 Winter				54.875	0.103	0.000	0.12		67
SE2.002	SE6	360 Winter	100	+0%	100/180 Winter				54.873	0.231	0.000	0.14		84
SE2.003	SE7	360 Winter	100	+0%	100/180 Winter				54.873	0.265	0.000	0.11		
SE1.003	SE8	360 Winter	100	+0%	100/120 Winter				54.870	0.516	0.000	0.32		106
SE1.004	SE9	360 Winter	100	+0%	100/120 Winter				54.870	0.537	0.000	0.01		337
SE1.005	SE10	360 Winter	100	+0%					53.233	-0.280	0.000	0.01		
SE1.006	SE11	360 Winter	100	+0%					53.161	-0.273	0.000	0.02		

PN	US/MH Name	Pipe Flow (l/s)	Status	Level Exceeded
SE1.000	SE1	59.5	SURCHARGED	
SE1.001	SE2	13.5	SURCHARGED	
SE1.002	SE3	11.7	SURCHARGED	
SE2.000	SE4	0.6	SURCHARGED	
SE2.001	SE5	4.3	SURCHARGED	
SE2.002	SE6	4.3	SURCHARGED	
SE2.003	SE7	4.8	SURCHARGED	

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

PN	US/MH Name	Pipe Flow (l/s)	Status	Level Exceeded
SE1.003	SE8	16.2	SURCHARGED	
SE1.004	SE9	0.9	SURCHARGED	
SE1.005	SE10	0.9	OK	
SE1.006	SE11	0.9	OK	

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm A

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - Scotland and Ireland

Return Period (years)	5	Foul Sewage (l/s/ha)	0.000	Maximum Backdrop Height (m)	1.500
M5-60 (mm)	16.200	Volumetric Runoff Coeff.	0.850	Min Design Depth for Optimisation (m)	0.450
Ratio R	0.275	PIMP (%)	100	Min Vel for Auto Design only (m/s)	1.00
Maximum Rainfall (mm/hr)	150	Add Flow / Climate Change (%)	0	Min Slope for Optimisation (1:X)	500
Maximum Time of Concentration (mins)	30	Minimum Backdrop Height (m)	0.200		

Designed with Level Soffits

Network Design Table for Storm A

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
SA1.000	38.661	0.263	147.0	0.077	4.00	0.0	0.600	o	225	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
SA1.000	62.55	4.60	54.536	0.077	0.0	0.0	0.0	1.08	42.8	14.8

Network Design Table for Storm A

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
SA1.001	15.043	0.090	167.1	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
SA1.002	13.539	0.648	20.9	0.026	0.00	0.0	0.600	o	225	Pipe/Conduit	
SA2.000	25.974	0.153	169.8	0.131	4.00	0.0	0.600	o	225	Pipe/Conduit	
SA2.001	13.211	0.078	170.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
SA2.002	15.558	0.259	60.2	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
SA1.003	32.517	0.108	301.1	0.050	0.00	0.0	0.600	o	300	Pipe/Conduit	
SA1.004	16.705	0.104	160.6	0.012	0.00	0.0	0.600	o	300	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
SA1.001	61.38	4.85	54.273	0.077	0.0	0.0	0.0	1.01	40.1	14.8
SA1.002	61.03	4.93	54.183	0.103	0.0	0.0	0.0	2.88	114.3	19.3
SA2.000	63.36	4.43	54.024	0.131	0.0	0.0	0.0	1.00	39.8	25.5
SA2.001	62.29	4.65	53.871	0.131	0.0	0.0	0.0	1.00	39.8	25.5
SA2.002	61.57	4.81	53.794	0.131	0.0	0.0	0.0	1.69	67.2	25.5
SA1.003	58.46	5.53	53.460	0.284	0.0	0.0	0.0	0.90	63.7	51.0
SA1.004	57.57	5.75	53.352	0.296	0.0	0.0	0.0	1.24	87.5	52.3

Network Design Table for Storm A

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
SA3.000	15.082	0.439	34.4	0.024	4.00	0.0	0.600	o	225	Pipe/Conduit	
SA1.005	23.499	0.078	301.3	0.056	0.00	0.0	0.600	o	300	Pipe/Conduit	
SA1.006	1.751	0.006	300.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	

Network Results Table

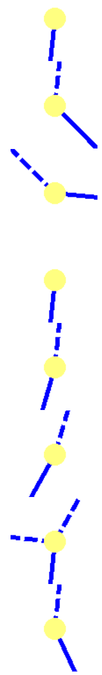
PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
SA3.000	64.99	4.11	53.762	0.024	0.0	0.0	0.0	2.24	89.0	4.8
SA1.005	63.35	4.43	53.248	0.000	0.7	0.0	0.0	0.90	63.7	0.7
SA1.006	63.19	4.47	53.170	0.000	0.7	0.0	0.0	0.90	63.8	0.7

Manhole Schedules for Storm A

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	Pipe Out PN	Pipe Out Invert Level (m)	Pipe Out Diameter (mm)	Pipes In PN	Pipes In Invert Level (m)	Pipes In Diameter (mm)	Backdrop (mm)
SA1	55.535	0.999	Open Manhole	1200	SA1.000	54.536	225				
SA2	55.116	0.843	Open Manhole	1200	SA1.001	54.273	225	SA1.000	54.273	225	
SA3	55.000	0.817	Open Manhole	1200	SA1.002	54.183	225	SA1.001	54.183	225	
SA4	55.474	1.450	Open Manhole	1200	SA2.000	54.024	225				
SA5	55.414	1.543	Open Manhole	1200	SA2.001	53.871	225	SA2.000	53.871	225	
SA6	55.241	1.447	Open Manhole	1200	SA2.002	53.794	225	SA2.001	53.794	225	
SA7	54.730	1.270	Open Manhole	1200	SA1.003	53.460	300	SA1.002	53.535	225	
								SA2.002	53.535	225	
SA8	54.536	1.184	Open Manhole	1200	SA1.004	53.352	300	SA1.003	53.352	300	
SA9	54.887	1.125	Open Manhole	1200	SA3.000	53.762	225				
SA10	54.500	1.252	Open Manhole	1200	SA1.005	53.248	300	SA1.004	53.248	300	
								SA3.000	53.323	225	
SA11	56.099	2.929	Open Manhole	1200	SA1.006	53.170	300	SA1.005	53.170	300	
SA12	53.508	0.344	Open Manhole	0		OUTFALL		SA1.006	53.164	300	

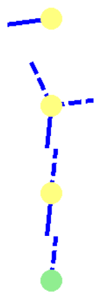
Manhole Schedules for Storm A

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
SA1	701123.846	737175.329	701123.846	737175.329	Required	
SA2	701119.798	737136.881	701119.798	737136.881	Required	
SA3	701130.372	737126.182	701130.372	737126.182	Required	
SA4	701157.722	737176.944	701157.722	737176.944	Required	
SA5	701155.100	737151.103	701155.100	737151.103	Required	
SA6	701151.399	737138.421	701151.399	737138.421	Required	
SA7	701143.842	737124.822	701143.842	737124.822	Required	
SA8	701140.509	737092.476	701140.509	737092.476	Required	



Manhole Schedules for Storm A

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
SA9	701162.512	737079.337	701162.512	737079.337	Required	
SA10	701147.563	737077.334	701147.563	737077.334	Required	
SA11	701145.159	737053.959	701145.159	737053.959	Required	
SA12	701144.980	737052.217			No Entry	



PIPELINE SCHEDULES for Storm A

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
SA1.000	o	225	SA1	55.535	54.536	0.774	Open Manhole	1200
SA1.001	o	225	SA2	55.116	54.273	0.618	Open Manhole	1200
SA1.002	o	225	SA3	55.000	54.183	0.592	Open Manhole	1200
SA2.000	o	225	SA4	55.474	54.024	1.225	Open Manhole	1200
SA2.001	o	225	SA5	55.414	53.871	1.318	Open Manhole	1200
SA2.002	o	225	SA6	55.241	53.794	1.222	Open Manhole	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
SA1.000	38.661	147.0	SA2	55.116	54.273	0.618	Open Manhole	1200
SA1.001	15.043	167.1	SA3	55.000	54.183	0.592	Open Manhole	1200
SA1.002	13.539	20.9	SA7	54.730	53.535	0.970	Open Manhole	1200
SA2.000	25.974	169.8	SA5	55.414	53.871	1.318	Open Manhole	1200
SA2.001	13.211	170.0	SA6	55.241	53.794	1.222	Open Manhole	1200
SA2.002	15.558	60.2	SA7	54.730	53.535	0.970	Open Manhole	1200

PIPELINE SCHEDULES for Storm A

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
SA1.003	o	300	SA7	54.730	53.460	0.970	Open Manhole	1200
SA1.004	o	300	SA8	54.536	53.352	0.884	Open Manhole	1200
SA3.000	o	225	SA9	54.887	53.762	0.900	Open Manhole	1200
SA1.005	o	300	SA10	54.500	53.248	0.952	Open Manhole	1200
SA1.006	o	300	SA11	56.099	53.170	2.629	Open Manhole	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
SA1.003	32.517	301.1	SA8	54.536	53.352	0.884	Open Manhole	1200
SA1.004	16.705	160.6	SA10	54.500	53.248	0.952	Open Manhole	1200
SA3.000	15.082	34.4	SA10	54.500	53.323	0.952	Open Manhole	1200
SA1.005	23.499	301.3	SA11	56.099	53.170	2.629	Open Manhole	1200
SA1.006	1.751	300.0	SA12	53.508	53.164	0.044	Open Manhole	0

Area Summary for Storm A

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	-	-	100	0.077	0.077	0.077
1.001	-	-	100	0.000	0.000	0.000
1.002	-	-	100	0.026	0.026	0.026
2.000	-	-	100	0.131	0.131	0.131
2.001	-	-	100	0.000	0.000	0.000
2.002	-	-	100	0.000	0.000	0.000
1.003	-	-	100	0.050	0.050	0.050
1.004	-	-	100	0.012	0.012	0.012
3.000	-	-	100	0.024	0.024	0.024
1.005	-	-	100	0.056	0.056	0.056
1.006	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				0.376	0.376	0.376

Network Classifications for Storm A

PN	USMH Name	Pipe Dia (mm)	Min Cover Depth (m)	Max Cover Depth (m)	Pipe Type	MH Dia (mm)	MH Width (mm)	MH Ring Depth (m)	MH Type
SA1.000	SA1	225	0.095	0.774	Unclassified	1200	0	0.774	Unclassified
SA1.001	SA2	225	0.052	0.618	Unclassified	1200	0	0.618	Unclassified
SA1.002	SA3	225	0.404	0.970	Unclassified	1200	0	0.592	Unclassified
SA2.000	SA4	225	1.225	1.404	Unclassified	1200	0	1.225	Unclassified
SA2.001	SA5	225	1.222	1.318	Unclassified	1200	0	1.318	Unclassified
SA2.002	SA6	225	0.970	1.222	Unclassified	1200	0	1.222	Unclassified
SA1.003	SA7	300	0.869	0.970	Unclassified	1200	0	0.970	Unclassified
SA1.004	SA8	300	0.884	1.077	Unclassified	1200	0	0.884	Unclassified
SA3.000	SA9	225	0.900	1.121	Unclassified	1200	0	0.900	Unclassified
SA1.005	SA10	300	0.952	2.629	Unclassified	1200	0	0.952	Unclassified
SA1.006	SA11	300	0.044	2.883	Unclassified	1200	0	2.629	Unclassified

Free Flowing Outfall Details for Storm A

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
SA1.006	SA12	53.508	53.164	0.000	0	0

Simulation Criteria for Storm A

Volumetric Runoff Coeff	0.850	Manhole Headloss Coeff (Global)	0.500	Inlet Coeffiecient	0.800
Areal Reduction Factor	1.000	Foul Sewage per hectare (l/s)	0.000	Flow per Person per Day (l/per/day)	0.000
Hot Start (mins)	0	Additional Flow - % of Total Flow	0.000	Run Time (mins)	60
Hot Start Level (mm)	0	MADD Factor * 10m³/ha Storage	2.000	Output Interval (mins)	1

Number of Input Hydrographs	0	Number of Offline Controls	0	Number of Time/Area Diagrams	1
Number of Online Controls	1	Number of Storage Structures	9	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	M5-60 (mm)	16.200	Cv (Summer)	0.850
Return Period (years)	5	Ratio R	0.275	Cv (Winter)	0.840
Region	Scotland and Ireland	Profile Type	Summer	Storm Duration (mins)	30

Online Controls for Storm A

Hydro-Brake® Optimum Manhole: SA10, DS/PN: SA1.005, Volume (m³): 3.1

Unit Reference	MD-SHE-0045-7000-0500-7000	Sump Available	Yes
Design Head (m)	0.500	Diameter (mm)	45
Design Flow (l/s)	0.7	Invert Level (m)	53.248
Flush-Flo™	Calculated	Minimum Outlet Pipe Diameter (mm)	75
Objective	Minimise upstream storage	Suggested Manhole Diameter (mm)	1200
Application	Surface		

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.500	0.7	Kick-Flo®	0.329	0.6
Flush-Flo™	0.156	0.7	Mean Flow over Head Range	-	0.6

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	0.7	0.600	0.8	1.600	1.2	2.600	1.5	5.000	2.0	7.500	2.4
0.200	0.7	0.800	0.9	1.800	1.2	3.000	1.6	5.500	2.1	8.000	2.5
0.300	0.6	1.000	0.9	2.000	1.3	3.500	1.7	6.000	2.2	8.500	2.6
0.400	0.6	1.200	1.0	2.200	1.4	4.000	1.8	6.500	2.2	9.000	2.6
0.500	0.7	1.400	1.1	2.400	1.4	4.500	1.9	7.000	2.3	9.500	2.7

Storage Structures for Storm A

Infiltration Trench Manhole: SA1, DS/PN: SA1.000

Infiltration Coefficient Base (m/hr)	0.03728	Invert Level (m)	54.035	Cap Volume Depth (m)	0.000
Infiltration Coefficient Side (m/hr)	0.03728	Trench Width (m)	0.6	Cap Infiltration Depth (m)	0.000
Safety Factor	1.0	Trench Length (m)	38.7		
Porosity	0.40	Slope (1:X)	147.0		

Infiltration Trench Manhole: SA2, DS/PN: SA1.001

Infiltration Coefficient Base (m/hr)	0.03728	Invert Level (m)	53.816	Cap Volume Depth (m)	0.000
Infiltration Coefficient Side (m/hr)	0.03728	Trench Width (m)	0.6	Cap Infiltration Depth (m)	0.000
Safety Factor	1.0	Trench Length (m)	15.0		
Porosity	0.40	Slope (1:X)	167.1		

Complex Manhole: SA3, DS/PN: SA1.002

Infiltration Trench

Infiltration Coefficient Base (m/hr)	0.03728	Invert Level (m)	53.700	Cap Volume Depth (m)	0.000
Infiltration Coefficient Side (m/hr)	0.03728	Trench Width (m)	0.6	Cap Infiltration Depth (m)	0.000
Safety Factor	1.0	Trench Length (m)	13.5		
Porosity	0.40	Slope (1:X)	20.9		

Porous Car Park

Infiltration Coefficient Base (m/hr)	0.03728	Porosity	0.40	Slope (1:X)	100.0
Membrane Percolation (mm/hr)	1000	Invert Level (m)	54.350	Depression Storage (mm)	5
Max Percolation (l/s)	36.1	Width (m)	5.0	Evaporation (mm/day)	3
Safety Factor	1.0	Length (m)	26.0	Membrane Depth (mm)	0

Porous Car Park Manhole: SA4, DS/PN: SA2.000

Infiltration Coefficient Base (m/hr)	0.03728	Porosity	0.40	Slope (1:X)	100.0
Membrane Percolation (mm/hr)	1000	Invert Level (m)	54.824	Depression Storage (mm)	5
Max Percolation (l/s)	77.4	Width (m)	5.0	Evaporation (mm/day)	3
Safety Factor	1.0	Length (m)	55.7	Membrane Depth (mm)	0

Infiltration Trench Manhole: SA5, DS/PN: SA2.001

Infiltration Coefficient Base (m/hr)	0.03728	Invert Level (m)	53.898	Cap Volume Depth (m)	0.000
Infiltration Coefficient Side (m/hr)	0.03728	Trench Width (m)	4.0	Cap Infiltration Depth (m)	0.000
Safety Factor	1.0	Trench Length (m)	4.0		
Porosity	0.40	Slope (1:X)	0.0		

Complex Manhole: SA7, DS/PN: SA1.003

Infiltration Trench

Infiltration Coefficient Base (m/hr)	0.03728	Safety Factor	2.0	Invert Level (m)	53.430
Infiltration Coefficient Side (m/hr)	0.03728	Porosity	0.40	Trench Width (m)	0.6

Infiltration Trench

Trench Length (m)	32.5	Cap Volume Depth (m)	0.000
Slope (1:X)	500.0	Cap Infiltration Depth (m)	0.000

Infiltration Trench

Infiltration Coefficient Base (m/hr)	0.03728	Invert Level (m)	53.430	Cap Volume Depth (m)	0.000
Infiltration Coefficient Side (m/hr)	0.03728	Trench Width (m)	2.6	Cap Infiltration Depth (m)	0.000
Safety Factor	2.0	Trench Length (m)	2.6		
Porosity	0.40	Slope (1:X)	0.0		

Porous Car Park

Infiltration Coefficient Base (m/hr)	0.03728	Porosity	0.40	Slope (1:X)	100.0
Membrane Percolation (mm/hr)	1000	Invert Level (m)	53.930	Depression Storage (mm)	5
Max Percolation (l/s)	36.1	Width (m)	5.0	Evaporation (mm/day)	3
Safety Factor	2.0	Length (m)	26.0	Membrane Depth (mm)	0

Complex Manhole: SA8, DS/PN: SA1.004

Infiltration Trench

Infiltration Coefficient Base (m/hr)	0.03728	Invert Level (m)	53.236	Cap Volume Depth (m)	0.000
Infiltration Coefficient Side (m/hr)	0.03728	Trench Width (m)	0.6	Cap Infiltration Depth (m)	0.000
Safety Factor	2.0	Trench Length (m)	16.7		
Porosity	0.40	Slope (1:X)	97.3		

Infiltration Trench

Infiltration Coefficient Base (m/hr)	0.03728	Invert Level (m)	53.236	Cap Volume Depth (m)	0.000
Infiltration Coefficient Side (m/hr)	0.03728	Trench Width (m)	3.0	Cap Infiltration Depth (m)	0.000
Safety Factor	2.0	Trench Length (m)	3.0		
Porosity	0.40	Slope (1:X)	0.0		

Porous Car Park

Infiltration Coefficient Base (m/hr)	0.03728	Porosity	0.40	Slope (1:X)	100.0
Membrane Percolation (mm/hr)	1000	Invert Level (m)	53.736	Depression Storage (mm)	5
Max Percolation (l/s)	29.4	Width (m)	5.0	Evaporation (mm/day)	3
Safety Factor	2.0	Length (m)	21.2	Membrane Depth (mm)	0

Porous Car Park Manhole: SA9, DS/PN: SA3.000

Infiltration Coefficient Base (m/hr)	0.03728	Porosity	0.40	Slope (1:X)	100.0
Membrane Percolation (mm/hr)	1000	Invert Level (m)	54.237	Depression Storage (mm)	5
Max Percolation (l/s)	29.4	Width (m)	5.0	Evaporation (mm/day)	3
Safety Factor	1.0	Length (m)	21.2	Membrane Depth (mm)	0

Complex Manhole: SA10, DS/PN: SA1.005

Infiltration Blanket

Infiltration Coefficient Base (m/hr)	0.03728	Porosity	0.40	Diameter/Width (m)	4.0
Safety Factor	2.0	Invert Level (m)	52.648	Length (m)	40.0

Infiltration Blanket

Cap Volume Depth (m) 0.575

Tank or Pond

Invert Level (m) 54.115

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	40.0	0.375	160.0

Manhole Headloss for Storm A

PN	US/MH Name	US/MH Headloss
SA1.000	SA1	0.500
SA1.001	SA2	0.500
SA1.002	SA3	0.500
SA2.000	SA4	0.500
SA2.001	SA5	0.500
SA2.002	SA6	0.500
SA1.003	SA7	0.500
SA1.004	SA8	0.500
SA3.000	SA9	0.500
SA1.005	SA10	0.500
SA1.006	SA11	0.500

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

Simulation Criteria

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

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 1
Number of Online Controls 1 Number of Storage Structures 9 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR M5-60 (mm) 16.400 Cv (Summer) 0.750
Region Scotland and Ireland Ratio R 0.275 Cv (Winter) 0.840

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

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years)	1, 30, 100
Climate Change (%)	30, 30, 30

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

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status

PN	US/MH Name	Level Exceeded

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)
SA1.000	SA1	120 Winter	100	+30%					54.578	-0.183	0.000	0.08		146
SA1.001	SA2	480 Winter	100	+30%					54.359	-0.139	0.000	0.03		200
SA1.002	SA3	480 Winter	100	+30%					54.359	-0.049	0.000	0.02		234
SA2.000	SA4	15 Winter	100	+30%	30/15 Summer				54.519	0.270	0.000	1.47		4
SA2.001	SA5	480 Winter	100	+30%	30/15 Summer				54.366	0.269	0.000	0.20		292
SA2.002	SA6	480 Winter	100	+30%	30/60 Winter				54.362	0.344	0.000	0.11		
SA1.003	SA7	480 Winter	100	+30%	30/30 Winter				54.358	0.598	0.000	0.15		259
SA1.004	SA8	480 Winter	100	+30%	30/30 Winter				54.356	0.704	0.000	0.12		324
SA3.000	SA9	480 Winter	100	+30%	30/60 Winter				54.354	0.367	0.000	0.02		123
SA1.005	SA10	480 Winter	100	+30%	1/360 Winter				54.355	0.807	0.000	0.02		
SA1.006	SA11	480 Winter	100	+30%					53.198	-0.271	0.000	0.02		

PN	US/MH Name	Pipe Flow (l/s)	Status	Level Exceeded
SA1.000	SA1	3.2	OK	
SA1.001	SA2	1.2	OK	
SA1.002	SA3	2.3	OK	
SA2.000	SA4	53.9	SURCHARGED	
SA2.001	SA5	6.8	SURCHARGED	
SA2.002	SA6	6.5	SURCHARGED	
SA1.003	SA7	8.7	SURCHARGED	

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

PN	US/MH Name	Pipe Flow (l/s)	Status	Level Exceeded
SA1.004	SA8	8.7	FLOOD RISK	
SA3.000	SA9	1.3	SURCHARGED	
SA1.005	SA10	1.0	FLOOD RISK	
SA1.006	SA11	1.0	OK	

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm B

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - Scotland and Ireland

Return Period (years)	5	Foul Sewage (l/s/ha)	0.000	Maximum Backdrop Height (m)	1.500
M5-60 (mm)	16.200	Volumetric Runoff Coeff.	0.850	Min Design Depth for Optimisation (m)	0.450
Ratio R	0.275	PIMP (%)	100	Min Vel for Auto Design only (m/s)	1.00
Maximum Rainfall (mm/hr)	150	Add Flow / Climate Change (%)	0	Min Slope for Optimisation (1:X)	500
Maximum Time of Concentration (mins)	30	Minimum Backdrop Height (m)	0.200		

Designed with Level Soffits

Network Design Table for Storm B

« - Indicates pipe capacity < flow

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)

Network Design Table for Storm B

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
SB1.000	8.417	0.051	165.0	0.097	4.00	0.0	0.600	o	225	Pipe/Conduit	
SB2.000	8.052	0.196	41.1	0.020	4.00	0.0	0.600	o	225	Pipe/Conduit	
SB1.001	4.803	0.029	165.6	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
SB3.000	13.472	0.177	76.1	0.054	4.00	0.0	0.600	o	225	Pipe/Conduit	
SB1.002	77.543	0.465	166.8	0.239	0.00	0.0	0.600	o	300	Pipe/Conduit	
SB1.003	3.522	0.018	195.7	0.029	0.00	0.0	0.600	o	300	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
SB1.000	64.86	4.14	54.452	0.097	0.0	0.0	0.0	1.01	40.4	19.3
SB2.000	65.24	4.07	54.597	0.020	0.0	0.0	0.0	2.05	81.4	4.0
SB1.001	64.45	4.22	54.401	0.117	0.0	0.0	0.0	1.01	40.3	23.1
SB3.000	64.80	4.15	54.549	0.054	0.0	0.0	0.0	1.50	59.7	10.7
SB1.002	59.48	5.28	54.297	0.410	0.0	0.0	0.0	1.21	85.9	74.8
SB1.003	59.26	5.33	53.832	0.439	0.0	0.0	0.0	1.12	79.2«	79.8

Network Design Table for Storm B

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
SB1.004	20.799	0.069	300.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
SB1.005	2.081	0.007	299.9	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
SB1.004	63.60	4.38	53.814	0.000	0.8	0.0	0.0	0.90	63.8	0.8
SB1.005	63.41	4.42	53.745	0.000	0.8	0.0	0.0	0.90	63.8	0.8

Manhole Schedules for Storm B

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	PN	Pipe Out Invert Level (m)	Diameter (mm)	PN	Pipes In Invert Level (m)	Diameter (mm)	Backdrop (mm)
SB1	55.577	1.125	Open Manhole	1200	SB1.000	54.452	225				
SB2	55.722	1.125	Open Manhole	1200	SB2.000	54.597	225				
SB3	55.665	1.264	Open Manhole	1200	SB1.001	54.401	225	SB1.000	54.401	225	
								SB2.000	54.401	225	
SB4	55.674	1.125	Open Manhole	1200	SB3.000	54.549	225				
SB5	55.711	1.414	Open Manhole	1200	SB1.002	54.297	300	SB1.001	54.372	225	
								SB3.000	54.372	225	
SB6	55.176	1.344	Open Manhole	1200	SB1.003	53.832	300	SB1.002	53.832	300	
SB7	55.163	1.349	Open Manhole	1200	SB1.004	53.814	300	SB1.003	53.814	300	
SB8	56.089	2.344	Open Manhole	1200	SB1.005	53.745	300	SB1.004	53.745	300	
SB9	55.000	1.262	Open Manhole	0		OUTFALL		SB1.005	53.738	300	

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
SB1	701198.334	737151.346	701198.334	737151.346	Required	

Manhole Schedules for Storm B

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
SB2	701207.529	737158.496	701207.529	737158.496	Required	
SB3	701206.707	737150.487	701206.707	737150.487	Required	
SB4	701224.887	737148.621	701224.887	737148.621	Required	
SB5	701211.485	737149.996	701211.485	737149.996	Required	
SB6	701203.775	737072.838	701203.775	737072.838	Required	
SB7	701203.425	737069.333	701203.425	737069.333	Required	
SB8	701201.586	737048.616	701201.586	737048.616	Required	
SB9	701201.379	737046.545			No Entry	

PIPELINE SCHEDULES for Storm B

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
SB1.000	o	225	SB1	55.577	54.452	0.900	Open Manhole	1200
SB2.000	o	225	SB2	55.722	54.597	0.900	Open Manhole	1200
SB1.001	o	225	SB3	55.665	54.401	1.039	Open Manhole	1200
SB3.000	o	225	SB4	55.674	54.549	0.900	Open Manhole	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
SB1.000	8.417	165.0	SB3	55.665	54.401	1.039	Open Manhole	1200
SB2.000	8.052	41.1	SB3	55.665	54.401	1.039	Open Manhole	1200
SB1.001	4.803	165.6	SB5	55.711	54.372	1.114	Open Manhole	1200
SB3.000	13.472	76.1	SB5	55.711	54.372	1.114	Open Manhole	1200

PIPELINE SCHEDULES for Storm B

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
SB1.002	o	300	SB5	55.711	54.297	1.114	Open Manhole	1200
SB1.003	o	300	SB6	55.176	53.832	1.044	Open Manhole	1200
SB1.004	o	300	SB7	55.163	53.814	1.049	Open Manhole	1200
SB1.005	o	300	SB8	56.089	53.745	2.044	Open Manhole	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
SB1.002	77.543	166.8	SB6	55.176	53.832	1.044	Open Manhole	1200
SB1.003	3.522	195.7	SB7	55.163	53.814	1.049	Open Manhole	1200
SB1.004	20.799	300.0	SB8	56.089	53.745	2.044	Open Manhole	1200
SB1.005	2.081	299.9	SB9	55.000	53.738	0.962	Open Manhole	0

Area Summary for Storm B

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	-	-	100	0.097	0.097	0.097
2.000	-	-	100	0.020	0.020	0.020
1.001	-	-	100	0.000	0.000	0.000
3.000	-	-	100	0.054	0.054	0.054
1.002	-	-	100	0.239	0.239	0.239
1.003	-	-	100	0.029	0.029	0.029
1.004	-	-	100	0.000	0.000	0.000
1.005	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				0.439	0.439	0.439

Network Classifications for Storm B

PN	USMH Name	Pipe Dia (mm)	Min Cover Depth (m)	Max Cover Depth (m)	Pipe Type	MH Dia (mm)	MH Width (mm)	MH Ring Depth (m)	MH Type
SB1.000	SB1	225	0.900	1.077	Unclassified	1200	0	0.900	Unclassified
SB2.000	SB2	225	0.900	1.039	Unclassified	1200	0	0.900	Unclassified
SB1.001	SB3	225	1.021	1.114	Unclassified	1200	0	1.039	Unclassified
SB3.000	SB4	225	0.900	1.114	Unclassified	1200	0	0.900	Unclassified
SB1.002	SB5	300	1.044	1.114	Unclassified	1200	0	1.114	Unclassified
SB1.003	SB6	300	1.044	1.147	Unclassified	1200	0	1.044	Unclassified
SB1.004	SB7	300	1.010	2.044	Unclassified	1200	0	1.049	Unclassified
SB1.005	SB8	300	0.962	2.272	Unclassified	1200	0	2.044	Unclassified

Free Flowing Outfall Details for Storm B

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
SB1.005	SB9	55.000	53.738	0.000	0	0

Simulation Criteria for Storm B

Volumetric Runoff Coeff	0.850	Manhole Headloss Coeff (Global)	0.500	Inlet Coeffiecient	0.800
Areal Reduction Factor	1.000	Foul Sewage per hectare (l/s)	0.000	Flow per Person per Day (l/per/day)	0.000
Hot Start (mins)	0	Additional Flow - % of Total Flow	0.000	Run Time (mins)	60
Hot Start Level (mm)	0	MADD Factor * 10m³/ha Storage	2.000	Output Interval (mins)	1

Number of Input Hydrographs	0	Number of Offline Controls	0	Number of Time/Area Diagrams	0
Number of Online Controls	1	Number of Storage Structures	6	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	M5-60 (mm)	16.200	Cv (Summer)	0.850
Return Period (years)	5	Ratio R	0.275	Cv (Winter)	0.840
Region	Scotland and Ireland	Profile Type	Summer	Storm Duration (mins)	30

Online Controls for Storm B

Hydro-Brake® Optimum Manhole: SB7, DS/PN: SB1.004, Volume (m³): 1.7

Unit Reference	MD-SHE-0044-8000-0790-8000	Sump Available	Yes
Design Head (m)	0.790	Diameter (mm)	44
Design Flow (l/s)	0.8	Invert Level (m)	53.814
Flush-Flo™	Calculated	Minimum Outlet Pipe Diameter (mm)	75
Objective	Minimise upstream storage	Suggested Manhole Diameter (mm)	1200
Application	Surface		

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.790	0.8	Kick-Flo®	0.389	0.6
Flush-Flo™	0.193	0.7	Mean Flow over Head Range	-	0.7

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	0.7	0.600	0.7	1.600	1.1	2.600	1.4	5.000	1.8	7.500	2.2
0.200	0.7	0.800	0.8	1.800	1.2	3.000	1.5	5.500	1.9	8.000	2.3
0.300	0.7	1.000	0.9	2.000	1.2	3.500	1.6	6.000	2.0	8.500	2.4
0.400	0.6	1.200	1.0	2.200	1.3	4.000	1.7	6.500	2.1	9.000	2.4
0.500	0.7	1.400	1.0	2.400	1.3	4.500	1.8	7.000	2.1	9.500	2.5

Storage Structures for Storm B

Complex Manhole: SB1, DS/PN: SB1.000

Porous Car Park

Infiltration Coefficient Base (m/hr)	0.03728	Porosity	0.40	Slope (1:X)	100.0
Membrane Percolation (mm/hr)	1000	Invert Level (m)	54.427	Depression Storage (mm)	5
Max Percolation (l/s)	38.4	Width (m)	2.4	Evaporation (mm/day)	3
Safety Factor	1.0	Length (m)	57.6	Membrane Depth (mm)	0

Infiltration Trench

Infiltration Coefficient Base (m/hr)	0.03728	Invert Level (m)	53.927	Cap Volume Depth (m)	0.000
Infiltration Coefficient Side (m/hr)	0.03728	Trench Width (m)	3.0	Cap Infiltration Depth (m)	0.000
Safety Factor	1.0	Trench Length (m)	3.0		
Porosity	0.40	Slope (1:X)	0.0		

Complex Manhole: SB2, DS/PN: SB2.000

Porous Car Park

Infiltration Coefficient Base (m/hr)	0.03728	Max Percolation (l/s)	28.9	Porosity	0.40
Membrane Percolation (mm/hr)	1000	Safety Factor	1.0	Invert Level (m)	55.072

Porous Car Park

Width (m)	5.0	Slope (1:X)	100.0	Evaporation (mm/day)	3
Length (m)	20.8	Depression Storage (mm)	5	Membrane Depth (mm)	0

Infiltration Trench

Infiltration Coefficient Base (m/hr)	0.03728	Invert Level (m)	54.572	Cap Volume Depth (m)	0.000
Infiltration Coefficient Side (m/hr)	0.03728	Trench Width (m)	2.1	Cap Infiltration Depth (m)	0.000
Safety Factor	1.0	Trench Length (m)	2.1		
Porosity	0.40	Slope (1:X)	0.0		

Infiltration Trench Manhole: SB4, DS/PN: SB3.000

Infiltration Coefficient Base (m/hr)	0.03728	Invert Level (m)	54.524	Cap Volume Depth (m)	0.000
Infiltration Coefficient Side (m/hr)	0.03728	Trench Width (m)	3.0	Cap Infiltration Depth (m)	0.000
Safety Factor	1.0	Trench Length (m)	3.0		
Porosity	0.40	Slope (1:X)	0.0		

Porous Car Park Manhole: SB5, DS/PN: SB1.002

Infiltration Coefficient Base (m/hr)	0.03728	Porosity	0.40	Slope (1:X)	100.0
Membrane Percolation (mm/hr)	1000	Invert Level (m)	55.061	Depression Storage (mm)	5
Max Percolation (l/s)	113.3	Width (m)	5.0	Evaporation (mm/day)	3
Safety Factor	2.0	Length (m)	81.6	Membrane Depth (mm)	0

Complex Manhole: SB6, DS/PN: SB1.003

Porous Car Park

Infiltration Coefficient Base (m/hr)	0.03728	Porosity	0.40	Slope (1:X)	100.0
Membrane Percolation (mm/hr)	1000	Invert Level (m)	54.026	Depression Storage (mm)	5
Max Percolation (l/s)	63.4	Width (m)	5.5	Evaporation (mm/day)	3
Safety Factor	2.0	Length (m)	41.5	Membrane Depth (mm)	0

Infiltration Trench

Infiltration Coefficient Base (m/hr)	0.03728	Invert Level (m)	54.176	Cap Volume Depth (m)	0.000
Infiltration Coefficient Side (m/hr)	0.03728	Trench Width (m)	2.1	Cap Infiltration Depth (m)	0.000
Safety Factor	2.0	Trench Length (m)	2.1		
Porosity	0.40	Slope (1:X)	0.0		

Complex Manhole: SB7, DS/PN: SB1.004

Infiltration Blanket

Infiltration Coefficient Base (m/hr)	0.03728	Invert Level (m)	53.210	Cap Volume Depth (m)	0.600
Safety Factor	2.0	Diameter/Width (m)	4.0		
Porosity	0.40	Length (m)	50.0		

Tank or Pond

Invert Level (m) 54.688

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	50.0	0.375	200.0

Manhole Headloss for Storm B

PN	US/MH Name	US/MH Headloss
SB1.000	SB1	0.500
SB2.000	SB2	0.500
SB1.001	SB3	0.500
SB3.000	SB4	0.500
SB1.002	SB5	0.500
SB1.003	SB6	0.500
SB1.004	SB7	0.500
SB1.005	SB8	0.500

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

Simulation Criteria

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

Number of Input Hydrographs	0	Number of Offline Controls	0	Number of Time/Area Diagrams	0
Number of Online Controls	1	Number of Storage Structures	6	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model		FSR M5-60 (mm)	16.400	Cv (Summer)	0.750
Region	Scotland and Ireland	Ratio R	0.275	Cv (Winter)	0.840

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

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years)	1, 30, 100
Climate Change (%)	30, 30, 30

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

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status

PN	US/MH Name	Level Exceeded

Appendix D.1 – Microdrainage Network and Model Simulation Results Design Year and Future (30% Climate Change Plus 10% Urban Creep)

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)
SB1.000	SB1	600 Winter	100	+30%	30/15 Summer				55.012	0.335	0.000	0.12		269
SB2.000	SB2	600 Winter	100	+30%	30/240 Winter				55.010	0.188	0.000	0.01		277
SB1.001	SB3	600 Winter	100	+30%	30/15 Summer				55.013	0.387	0.000	0.14		
SB3.000	SB4	600 Winter	100	+30%	30/15 Winter				55.016	0.242	0.000	0.04		298
SB1.002	SB5	600 Winter	100	+30%	30/15 Summer				55.015	0.418	0.000	0.19		409
SB1.003	SB6	600 Winter	100	+30%	1/120 Winter				55.009	0.877	0.000	0.25		400
SB1.004	SB7	600 Winter	100	+30%	1/120 Winter				55.009	0.895	0.000	0.02		
SB1.005	SB8	600 Winter	100	+30%					53.773	-0.271	0.000	0.02		

PN	US/MH Name	Pipe Flow (l/s)	Status	Level Exceeded
SB1.000	SB1	3.7	SURCHARGED	
SB2.000	SB2	0.7	SURCHARGED	
SB1.001	SB3	4.2	SURCHARGED	
SB3.000	SB4	2.3	SURCHARGED	
SB1.002	SB5	15.3	SURCHARGED	
SB1.003	SB6	12.5	FLOOD RISK	
SB1.004	SB7	1.0	FLOOD RISK	
SB1.005	SB8	1.0	OK	

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm C

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - Scotland and Ireland

Return Period (years)	5	Foul Sewage (l/s/ha)	0.000	Maximum Backdrop Height (m)	1.500
M5-60 (mm)	16.200	Volumetric Runoff Coeff.	0.850	Min Design Depth for Optimisation (m)	1.200
Ratio R	0.275	PIMP (%)	100	Min Vel for Auto Design only (m/s)	1.00
Maximum Rainfall (mm/hr)	150	Add Flow / Climate Change (%)	0	Min Slope for Optimisation (1:X)	500
Maximum Time of Concentration (mins)	30	Minimum Backdrop Height (m)	0.200		

Designed with Level Soffits

Network Design Table for Storm C

« - Indicates pipe capacity < flow

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)

Network Design Table for Storm C

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
SC1.000	10.670	0.064	166.7	0.057	4.00	0.0	0.600	o	225	Pipe/Conduit	
SC2.000	8.277	0.252	32.8	0.020	4.00	0.0	0.600	o	225	Pipe/Conduit	
SC3.000	12.369	0.074	167.1	0.074	4.00	0.0	0.600	o	225	Pipe/Conduit	
SC2.001	5.354	0.032	166.6	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
SC1.001	76.706	0.384	199.8	0.249	0.00	0.0	0.600	o	300	Pipe/Conduit	
SC1.002	4.073	0.020	203.7	0.047	0.00	0.0	0.600	o	300	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
SC1.000	64.66	4.18	54.741	0.057	0.0	0.0	0.0	1.01	40.1	11.3
SC2.000	65.27	4.06	54.418	0.020	0.0	0.0	0.0	2.29	91.1	4.0
SC3.000	64.51	4.20	54.540	0.074	0.0	0.0	0.0	1.01	40.1	14.7
SC2.001	64.06	4.29	54.166	0.094	0.0	0.0	0.0	1.01	40.2	18.5
SC1.001	58.79	5.45	54.059	0.400	0.0	0.0	0.0	1.11	78.4	72.2
SC1.002	58.54	5.51	53.675	0.447	0.0	0.0	0.0	1.10	77.6«	80.3

Network Design Table for Storm C

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
SC1.003	21.070	0.088	240.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
SC1.004	2.105	0.009	240.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
SC1.003	63.78	4.35	53.655	0.000	0.8	0.0	0.0	1.01	71.4	0.8
SC1.004	63.61	4.38	53.567	0.000	0.8	0.0	0.0	1.01	71.4	0.8

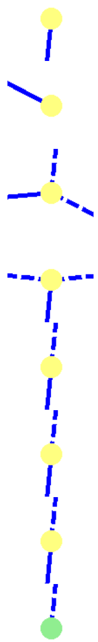
Manhole Schedules for Storm C

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	PN	Pipe Out Invert Level (m)	Diameter (mm)	PN	Pipes In Invert Level (m)	Diameter (mm)	Backdrop (mm)
SC1	55.866	1.125	Open Manhole	1200	SC1.000	54.741	225				
SC2	55.843	1.425	Open Manhole	1200	SC2.000	54.418	225				
SC3	55.665	1.125	Open Manhole	1200	SC3.000	54.540	225				
SC4	55.791	1.625	Open Manhole	1200	SC2.001	54.166	225	SC2.000	54.166	225	
								SC3.000	54.466	225	300
SC5	55.808	1.749	Open Manhole	1200	SC1.001	54.059	300	SC1.000	54.677	225	543
								SC2.001	54.134	225	
SC6	55.199	1.524	Open Manhole	1200	SC1.002	53.675	300	SC1.001	53.675	300	
SC7	55.305	1.650	Open Manhole	1200	SC1.003	53.655	300	SC1.002	53.655	300	
SC8	55.800	2.233	Open Manhole	1200	SC1.004	53.567	300	SC1.003	53.567	300	
SC9	56.019	2.461	Open Manhole	0		OUTFALL		SC1.004	53.558	300	

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
SC1	701254.274	737145.605	701254.274	737145.605	Required	

Manhole Schedules for Storm C

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
SC2	701271.067	737153.219	701271.067	737153.219	Required	
SC3	701281.253	737139.389	701281.253	737139.389	Required	
SC4	701270.222	737144.986	701270.222	737144.986	Required	
SC5	701264.889	737144.515	701264.889	737144.515	Required	
SC6	701257.046	737068.212	701257.046	737068.212	Required	
SC7	701256.629	737064.160	701256.629	737064.160	Required	
SC8	701254.558	737043.192	701254.558	737043.192	Required	
SC9	701254.351	737041.097			No Entry	



PIPELINE SCHEDULES for Storm C

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
SC1.000	o	225	SC1	55.866	54.741	0.900	Open Manhole	1200
SC2.000	o	225	SC2	55.843	54.418	1.200	Open Manhole	1200
SC3.000	o	225	SC3	55.665	54.540	0.900	Open Manhole	1200
SC2.001	o	225	SC4	55.791	54.166	1.400	Open Manhole	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
SC1.000	10.670	166.7	SC5	55.808	54.677	0.906	Open Manhole	1200
SC2.000	8.277	32.8	SC4	55.791	54.166	1.400	Open Manhole	1200
SC3.000	12.369	167.1	SC4	55.791	54.466	1.100	Open Manhole	1200
SC2.001	5.354	166.6	SC5	55.808	54.134	1.449	Open Manhole	1200

PIPELINE SCHEDULES for Storm C

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
SC1.001	o	300	SC5	55.808	54.059	1.449	Open Manhole	1200
SC1.002	o	300	SC6	55.199	53.675	1.224	Open Manhole	1200
SC1.003	o	300	SC7	55.305	53.655	1.350	Open Manhole	1200
SC1.004	o	300	SC8	55.800	53.567	1.933	Open Manhole	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
SC1.001	76.706	199.8	SC6	55.199	53.675	1.224	Open Manhole	1200
SC1.002	4.073	203.7	SC7	55.305	53.655	1.350	Open Manhole	1200
SC1.003	21.070	240.0	SC8	55.800	53.567	1.933	Open Manhole	1200
SC1.004	2.105	240.0	SC9	56.019	53.558	2.161	Open Manhole	0

Area Summary for Storm C

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	-	-	100	0.057	0.057	0.057
2.000	-	-	100	0.020	0.020	0.020
3.000	-	-	100	0.074	0.074	0.074
2.001	-	-	100	0.000	0.000	0.000
1.001	-	-	100	0.249	0.249	0.249
1.002	-	-	100	0.047	0.047	0.047
1.003	-	-	100	0.000	0.000	0.000
1.004	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				0.447	0.447	0.447

Network Classifications for Storm C

PN	USMH Name	Pipe Dia (mm)	Min Cover Depth (m)	Max Cover Depth (m)	Pipe Type	MH Dia (mm)	MH Width (mm)	MH Ring Depth (m)	MH Type
SC1.000	SC1	225	0.857	0.919	Unclassified	1200	0	0.900	Unclassified
SC2.000	SC2	225	1.200	1.400	Unclassified	1200	0	1.200	Unclassified
SC3.000	SC3	225	0.900	1.100	Unclassified	1200	0	0.900	Unclassified
SC2.001	SC4	225	1.364	1.449	Unclassified	1200	0	1.400	Unclassified
SC1.001	SC5	300	1.224	1.449	Unclassified	1200	0	1.449	Unclassified
SC1.002	SC6	300	1.224	1.355	Unclassified	1200	0	1.224	Unclassified
SC1.003	SC7	300	1.350	1.933	Unclassified	1200	0	1.350	Unclassified
SC1.004	SC8	300	1.933	2.161	Unclassified	1200	0	1.933	Unclassified

Free Flowing Outfall Details for Storm C

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
SC1.004	SC9	56.019	53.558	0.000	0	0

Simulation Criteria for Storm C

Volumetric Runoff Coeff	0.850	Manhole Headloss Coeff (Global)	0.500	Inlet Coeffiecient	0.800
Areal Reduction Factor	1.000	Foul Sewage per hectare (l/s)	0.000	Flow per Person per Day (l/per/day)	0.000
Hot Start (mins)	0	Additional Flow - % of Total Flow	0.000	Run Time (mins)	60
Hot Start Level (mm)	0	MADD Factor * 10m³/ha Storage	2.000	Output Interval (mins)	1

Number of Input Hydrographs	0	Number of Offline Controls	0	Number of Time/Area Diagrams	0
Number of Online Controls	1	Number of Storage Structures	4	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	M5-60 (mm)	16.200	Cv (Summer)	0.850
Return Period (years)	5	Ratio R	0.275	Cv (Winter)	0.840
Region	Scotland and Ireland	Profile Type	Summer	Storm Duration (mins)	30

Online Controls for Storm C

Hydro-Brake® Optimum Manhole: SC7, DS/PN: SC1.003, Volume (m³): 2.1

Unit Reference	MD-SHE-0041-8000-1077-8000	Sump Available	Yes
Design Head (m)	1.077	Diameter (mm)	41
Design Flow (l/s)	0.8	Invert Level (m)	53.655
Flush-Flo™	Calculated	Minimum Outlet Pipe Diameter (mm)	75
Objective	Minimise upstream storage	Suggested Manhole Diameter (mm)	1200
Application	Surface		

Control Points	**Head (m)**	**Flow (l/s)**	**Control Points**	**Head (m)**	**Flow (l/s)**
Design Point (Calculated)	1.077	0.8	Kick-Flo®	0.364	0.5
Flush-Flo™	0.180	0.6	Mean Flow over Head Range	-	0.6

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

Depth (m)	**Flow (l/s)**	**Depth (m)**	**Flow (l/s)**	**Depth (m)**	**Flow (l/s)**	**Depth (m)**	**Flow (l/s)**	**Depth (m)**	**Flow (l/s)**	**Depth (m)**	**Flow (l/s)**
0.100	0.6	0.600	0.6	1.600	1.0	2.600	1.2	5.000	1.6	7.500	1.9
0.200	0.6	0.800	0.7	1.800	1.0	3.000	1.3	5.500	1.7	8.000	2.0
0.300	0.6	1.000	0.8	2.000	1.1	3.500	1.4	6.000	1.7	8.500	2.0
0.400	0.5	1.200	0.8	2.200	1.1	4.000	1.4	6.500	1.8	9.000	2.1
0.500	0.6	1.400	0.9	2.400	1.1	4.500	1.5	7.000	1.9	9.500	2.1

Storage Structures for Storm C

Porous Car Park Manhole: SC2, DS/PN: SC2.000

Infiltration Coefficient Base (m/hr)	0.03728	Porosity	0.40	Slope (1:X)	100.0
Membrane Percolation (mm/hr)	1000	Invert Level (m)	55.193	Depression Storage (mm)	5
Max Percolation (l/s)	28.9	Width (m)	5.0	Evaporation (mm/day)	3
Safety Factor	2.0	Length (m)	20.8	Membrane Depth (mm)	0

Complex Manhole: SC3, DS/PN: SC3.000

Infiltration Trench

Infiltration Coefficient Base (m/hr)	0.03728	Invert Level (m)	54.515	Cap Volume Depth (m)	0.000
Infiltration Coefficient Side (m/hr)	0.03728	Trench Width (m)	2.1	Cap Infiltration Depth (m)	0.000
Safety Factor	2.0	Trench Length (m)	2.1		
Porosity	0.40	Slope (1:X)	0.0		

Porous Car Park

Infiltration Coefficient Base (m/hr)	0.03728	Porosity	0.40	Slope (1:X)	100.0
Membrane Percolation (mm/hr)	1000	Invert Level (m)	55.015	Depression Storage (mm)	5
Max Percolation (l/s)	18.7	Width (m)	2.4	Evaporation (mm/day)	3
Safety Factor	2.0	Length (m)	28.0	Membrane Depth (mm)	0

Complex Manhole: SC6, DS/PN: SC1.002

Infiltration Trench

Infiltration Coefficient Base (m/hr)	0.03728	Invert Level (m)	53.598	Cap Volume Depth (m)	0.000
Infiltration Coefficient Side (m/hr)	0.03728	Trench Width (m)	2.6	Cap Infiltration Depth (m)	0.000
Safety Factor	2.0	Trench Length (m)	2.6		
Porosity	0.40	Slope (1:X)	0.0		

Porous Car Park

Infiltration Coefficient Base (m/hr)	0.03728	Porosity	0.40	Slope (1:X)	100.0
Membrane Percolation (mm/hr)	1000	Invert Level (m)	54.098	Depression Storage (mm)	5
Max Percolation (l/s)	178.8	Width (m)	5.0	Evaporation (mm/day)	3
Safety Factor	2.0	Length (m)	128.7	Membrane Depth (mm)	0

Complex Manhole: SC7, DS/PN: SC1.003

Infiltration Blanket

Infiltration Coefficient Base (m/hr)	0.03728	Invert Level (m)	53.024	Cap Volume Depth (m)	0.550
Safety Factor	2.0	Diameter/Width (m)	4.0		
Porosity	0.40	Length (m)	60.0		

Tank or Pond

Invert Level (m) 54.930

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	60.0	0.375	240.0

Manhole Headloss for Storm C

PN	US/MH Name	US/MH Headloss
SC1.000	SC1	0.500
SC2.000	SC2	0.500
SC3.000	SC3	0.500
SC2.001	SC4	0.500
SC1.001	SC5	0.500
SC1.002	SC6	0.500
SC1.003	SC7	0.500
SC1.004	SC8	0.500

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

Simulation Criteria

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

Number of Input Hydrographs	0	Number of Offline Controls	0	Number of Time/Area Diagrams	0
Number of Online Controls	1	Number of Storage Structures	4	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model		FSR M5-60 (mm)	16.400	Cv (Summer)	0.750
Region	Scotland and Ireland	Ratio R	0.275	Cv (Winter)	0.840

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

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years)	1, 30, 100
Climate Change (%)	30, 30, 30

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

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status

PN	US/MH Name	Level Exceeded

Appendix D.1 – Microdrainage Network and Model Simulation Results Design Year and Future (30% Climate Change Plus 10% Urban Creep)

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)
SC1.000	SC1	15 Winter	100	+30%	30/360 Winter				55.276	0.310	0.000	0.62		
SC2.000	SC2	15 Winter	100	+30%	30/15 Summer				55.234	0.591	0.000	0.12		5
SC3.000	SC3	15 Winter	100	+30%	30/15 Summer				55.256	0.491	0.000	1.09		4
SC2.001	SC4	15 Winter	100	+30%	1/480 Winter				55.231	0.840	0.000	1.53		
SC1.001	SC5	15 Winter	100	+30%	1/360 Winter				55.224	0.865	0.000	1.59		
SC1.002	SC6	720 Winter	100	+30%	1/120 Winter				55.153	1.178	0.000	0.24		444
SC1.003	SC7	720 Winter	100	+30%	1/120 Winter				55.152	1.197	0.000	0.01		
SC1.004	SC8	720 Winter	100	+30%					53.594	-0.273	0.000	0.02		

PN	US/MH Name	Pipe Flow (l/s)	Status	Level Exceeded
SC1.000	SC1	21.1	SURCHARGED	
SC2.000	SC2	8.3	SURCHARGED	
SC3.000	SC3	37.6	SURCHARGED	
SC2.001	SC4	45.6	SURCHARGED	
SC1.001	SC5	119.6	SURCHARGED	
SC1.002	SC6	11.8	FLOOD RISK	
SC1.003	SC7	0.9	FLOOD RISK	
SC1.004	SC8	0.9	OK	

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm D

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - Scotland and Ireland

Return Period (years)	5	Foul Sewage (l/s/ha)	0.000	Maximum Backdrop Height (m)	1.500
M5-60 (mm)	16.200	Volumetric Runoff Coeff.	0.850	Min Design Depth for Optimisation (m)	1.200
Ratio R	0.275	PIMP (%)	100	Min Vel for Auto Design only (m/s)	1.00
Maximum Rainfall (mm/hr)	150	Add Flow / Climate Change (%)	0	Min Slope for Optimisation (1:X)	500
Maximum Time of Concentration (mins)	30	Minimum Backdrop Height (m)	0.200		

Designed with Level Soffits

Network Design Table for Storm D

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
SD1.000	8.841	0.053	166.8	0.048	4.00	0.0	0.600	o	225	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
SD1.000	64.82	4.15	54.417	0.048	0.0	0.0	0.0	1.01	40.1	9.5

Network Design Table for Storm D

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
SD2.000	6.204	0.051	121.6	0.055	4.00	0.0	0.600	o	225	Pipe/Conduit	
SD2.001	12.067	0.151	79.9	0.015	0.00	0.0	0.600	o	225	Pipe/Conduit	
SD1.001	56.812	0.227	250.3	0.184	0.00	0.0	0.600	o	300	Pipe/Conduit	
SD1.002	21.486	0.086	249.8	0.022	0.00	0.0	0.600	o	300	Pipe/Conduit	
SD1.003	1.649	0.007	250.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
SD2.000	65.13	4.09	54.566	0.055	0.0	0.0	0.0	1.18	47.1	11.0
SD2.001	64.41	4.22	54.515	0.070	0.0	0.0	0.0	1.46	58.2	13.8
SD1.001	59.90	5.18	54.289	0.302	0.0	0.0	0.0	0.99	69.9	55.5
SD1.002	63.71	4.36	54.062	0.000	0.6	0.0	0.0	0.99	70.0	0.6
SD1.003	63.57	4.39	53.976	0.000	0.6	0.0	0.0	0.99	70.0	0.6

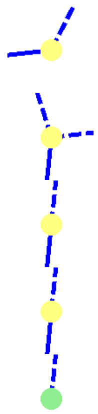
Manhole Schedules for Storm D

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	PN	Pipe Out Invert Level (m)	Diameter (mm)	PN	Pipes In Invert Level (m)	Diameter (mm)	Backdrop (mm)
SD1	55.842	1.425	Open Manhole	1200	SD1.000	54.417	225				
SD2	55.991	1.425	Open Manhole	1200	SD2.000	54.566	225				
SD3	55.941	1.426	Open Manhole	1200	SD2.001	54.515	225	SD2.000	54.515	225	
SD4	55.846	1.557	Open Manhole	1200	SD1.001	54.289	300	SD1.000	54.364	225	
								SD2.001	54.364	225	
SD5	55.681	1.619	Open Manhole	1200	SD1.002	54.062	300	SD1.001	54.062	300	
SD6	56.259	2.283	Open Manhole	1200	SD1.003	53.976	300	SD1.002	53.976	300	
SD7	56.469	2.500	Open Manhole	0		OUTFALL		SD1.003	53.969	300	

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
SD1	701311.716	737123.932	701311.716	737123.932	Required	
SD2	701329.204	737122.405	701329.204	737122.405	Required	

Manhole Schedules for Storm D

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
SD3	701326.397	737116.872	701326.397	737116.872	Required	
SD4	701314.407	737115.510	701314.407	737115.510	Required	
SD5	701308.572	737058.999	701308.572	737058.999	Required	
SD6	701306.365	737037.626	701306.365	737037.626	Required	
SD7	701306.196	737035.986			No Entry	



PIPELINE SCHEDULES for Storm D

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
SD1.000	o	225	SD1	55.842	54.417	1.200	Open Manhole	1200
SD2.000	o	225	SD2	55.991	54.566	1.200	Open Manhole	1200
SD2.001	o	225	SD3	55.941	54.515	1.201	Open Manhole	1200
SD1.001	o	300	SD4	55.846	54.289	1.257	Open Manhole	1200
SD1.002	o	300	SD5	55.681	54.062	1.319	Open Manhole	1200
SD1.003	o	300	SD6	56.259	53.976	1.983	Open Manhole	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
SD1.000	8.841	166.8	SD4	55.846	54.364	1.257	Open Manhole	1200
SD2.000	6.204	121.6	SD3	55.941	54.515	1.201	Open Manhole	1200
SD2.001	12.067	79.9	SD4	55.846	54.364	1.257	Open Manhole	1200
SD1.001	56.812	250.3	SD5	55.681	54.062	1.319	Open Manhole	1200
SD1.002	21.486	249.8	SD6	56.259	53.976	1.983	Open Manhole	1200
SD1.003	1.649	250.0	SD7	56.469	53.969	2.200	Open Manhole	0

Area Summary for Storm D

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	-	-	100	0.048	0.048	0.048
2.000	-	-	100	0.055	0.055	0.055
2.001	-	-	100	0.015	0.015	0.015
1.001	-	-	100	0.184	0.184	0.184
1.002	-	-	100	0.022	0.022	0.022
1.003	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				0.324	0.324	0.324

Network Classifications for Storm D

PN	USMH Name	Pipe Dia (mm)	Min Cover Depth (m)	Max Cover Depth (m)	Pipe Type	MH Dia (mm)	MH Width (mm)	MH Ring Depth (m)	MH Type
SD1.000	SD1	225	1.200	1.274	Unclassified	1200	0	1.200	Unclassified
SD2.000	SD2	225	1.200	1.205	Unclassified	1200	0	1.200	Unclassified
SD2.001	SD3	225	1.201	1.259	Unclassified	1200	0	1.201	Unclassified
SD1.001	SD4	300	1.118	1.319	Unclassified	1200	0	1.257	Unclassified
SD1.002	SD5	300	1.263	1.983	Unclassified	1200	0	1.319	Unclassified
SD1.003	SD6	300	1.983	2.200	Unclassified	1200	0	1.983	Unclassified

Free Flowing Outfall Details for Storm D

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
SD1.003	SD7	56.469	53.969	0.000	0	0

Simulation Criteria for Storm D

Volumetric Runoff Coeff	0.850	Manhole Headloss Coeff (Global)	0.500	Inlet Coeffiecient	0.800
Areal Reduction Factor	1.000	Foul Sewage per hectare (l/s)	0.000	Flow per Person per Day (l/per/day)	0.000
Hot Start (mins)	0	Additional Flow - % of Total Flow	0.000	Run Time (mins)	60
Hot Start Level (mm)	0	MADD Factor * 10m³/ha Storage	2.000	Output Interval (mins)	1

Number of Input Hydrographs	0	Number of Offline Controls	0	Number of Time/Area Diagrams	0
Number of Online Controls	1	Number of Storage Structures	3	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	M5-60 (mm)	16.200	Cv (Summer)	0.850
Return Period (years)	5	Ratio R	0.275	Cv (Winter)	0.840
Region	Scotland and Ireland	Profile Type	Summer	Storm Duration (mins)	30

Online Controls for Storm D

Hydro-Brake® Optimum Manhole: SD5, DS/PN: SD1.002, Volume (m^3): 5.8

Unit Reference	MD-SHE-0035-6000-1103-6000	Sump Available	Yes
Design Head (m)	1.103	Diameter (mm)	35
Design Flow (l/s)	0.6	Invert Level (m)	54.062
Flush-Flo™	Calculated	Minimum Outlet Pipe Diameter (mm)	75
Objective	Minimise upstream storage	Suggested Manhole Diameter (mm)	1200
Application	Surface		

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.103	0.6	Kick-Flo®	0.309	0.3
Flush-Flo™	0.155	0.4	Mean Flow over Head Range	-	0.4

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	0.4	0.600	0.5	1.600	0.7	2.600	0.9	5.000	1.2	7.500	1.4
0.200	0.4	0.800	0.5	1.800	0.7	3.000	0.9	5.500	1.2	8.000	1.5
0.300	0.4	1.000	0.6	2.000	0.8	3.500	1.0	6.000	1.3	8.500	1.5
0.400	0.4	1.200	0.6	2.200	0.8	4.000	1.1	6.500	1.3	9.000	1.5
0.500	0.4	1.400	0.7	2.400	0.8	4.500	1.1	7.000	1.4	9.500	1.6

Storage Structures for Storm D

Porous Car Park Manhole: SD3, DS/PN: SD2.001

Infiltration Coefficient Base (m/hr)	0.03728	Porosity	0.40	Slope (1:X)	100.0
Membrane Percolation (mm/hr)	1000	Invert Level (m)	55.291	Depression Storage (mm)	5
Max Percolation (l/s)	158.8	Width (m)	5.0	Evaporation (mm/day)	3
Safety Factor	2.0	Length (m)	114.3	Membrane Depth (mm)	0

Complex Manhole: SD4, DS/PN: SD1.001

Infiltration Trench

Infiltration Coefficient Base (m/hr)	0.03728	Invert Level (m)	54.696	Cap Volume Depth (m)	0.000
Infiltration Coefficient Side (m/hr)	0.03728	Trench Width (m)	1.5	Cap Infiltration Depth (m)	0.000
Safety Factor	2.0	Trench Length (m)	1.5		
Porosity	0.40	Slope (1:X)	0.0		

Porous Car Park

Infiltration Coefficient Base (m/hr)	0.03728	Porosity	0.40	Slope (1:X)	100.0
Membrane Percolation (mm/hr)	1000	Invert Level (m)	55.196	Depression Storage (mm)	5
Max Percolation (l/s)	28.8	Width (m)	2.4	Evaporation (mm/day)	3
Safety Factor	2.0	Length (m)	43.2	Membrane Depth (mm)	0

Complex Manhole: SD5, DS/PN: SD1.002

Infiltration Blanket

Infiltration Coefficient Base (m/hr)	0.03728	Invert Level (m)	53.573	Cap Volume Depth (m)	0.375
Safety Factor	2.0	Diameter/Width (m)	4.0		
Porosity	0.40	Length (m)	60.0		

Infiltration Trench

Infiltration Coefficient Base (m/hr)	0.03728	Invert Level (m)	54.531	Cap Volume Depth (m)	0.000
Infiltration Coefficient Side (m/hr)	0.03728	Trench Width (m)	3.0	Cap Infiltration Depth (m)	0.000
Safety Factor	2.0	Trench Length (m)	3.0		
Porosity	0.40	Slope (1:X)	0.0		

Porous Car Park

Infiltration Coefficient Base (m/hr)	0.03728	Porosity	0.40	Slope (1:X)	100.0
Membrane Percolation (mm/hr)	1000	Invert Level (m)	55.031	Depression Storage (mm)	5
Max Percolation (l/s)	451.8	Width (m)	4.0	Evaporation (mm/day)	3
Safety Factor	2.0	Length (m)	406.6	Membrane Depth (mm)	0

Tank or Pond

Invert Level (m) 55.306

Tank or Pond

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	60.0	0.375	240.0

Manhole Headloss for Storm D

PN	US/MH Name	US/MH Headloss
SD1.000	SD1	0.500
SD2.000	SD2	0.500
SD2.001	SD3	0.500
SD1.001	SD4	0.500
SD1.002	SD5	0.500
SD1.003	SD6	0.500

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

Simulation Criteria

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

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 1 Number of Storage Structures 3 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR M5-60 (mm) 16.400 Cv (Summer) 0.750
Region Scotland and Ireland Ratio R 0.275 Cv (Winter) 0.840

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

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years) 1, 30, 100
Climate Change (%) 30, 30, 30

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status

Appendix D.1 – Microdrainage Network and Model Simulation Results Design Year and Future (30% Climate Change Plus 10% Urban Creep)

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

PN	US/MH Name	Level Exceeded

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)
SD1.000	SD1	600 Winter	100	+30%	1/360 Winter				55.603	0.961	0.000	0.07		
SD2.000	SD2	600 Winter	100	+30%	1/600 Winter				55.603	0.812	0.000	0.08		
SD2.001	SD3	600 Winter	100	+30%	1/480 Winter				55.602	0.862	0.000	0.05		241
SD1.001	SD4	600 Winter	100	+30%	1/360 Winter				55.602	1.013	0.000	0.17		315
SD1.002	SD5	600 Winter	100	+30%	1/180 Winter				55.597	1.235	0.000	0.01		417
SD1.003	SD6	600 Winter	100	+30%					54.002	-0.274	0.000	0.01		

PN	US/MH Name	Pipe Flow (l/s)	Status	Level Exceeded
SD1.000	SD1	2.4	FLOOD RISK	
SD2.000	SD2	2.7	SURCHARGED	
SD2.001	SD3	2.6	SURCHARGED	
SD1.001	SD4	11.6	FLOOD RISK	
SD1.002	SD5	0.7	FLOOD RISK	
SD1.003	SD6	0.7	OK	

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm E

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - Scotland and Ireland

Return Period (years)	5	Foul Sewage (l/s/ha)	0.000	Maximum Backdrop Height (m)	1.500
M5-60 (mm)	16.200	Volumetric Runoff Coeff.	0.850	Min Design Depth for Optimisation (m)	1.200
Ratio R	0.275	PIMP (%)	100	Min Vel for Auto Design only (m/s)	1.00
Maximum Rainfall (mm/hr)	150	Add Flow / Climate Change (%)	0	Min Slope for Optimisation (1:X)	500
Maximum Time of Concentration (mins)	30	Minimum Backdrop Height (m)	0.200		

Designed with Level Soffits

Network Design Table for Storm E

« - Indicates pipe capacity < flow

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)

Network Design Table for Storm E

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
SE1.000	49.008	0.294	166.7	0.219	4.00	0.0	0.600	o	225	Pipe/Conduit	
SE1.001	11.211	0.067	167.3	0.046	0.00	0.0	0.600	o	300	Pipe/Conduit	
SE1.002	16.605	0.100	166.1	0.008	0.00	0.0	0.600	o	300	Pipe/Conduit	
SE2.000	13.733	0.096	143.1	0.012	4.00	0.0	0.600	o	225	Pipe/Conduit	
SE2.001	21.601	0.130	166.2	0.073	0.00	0.0	0.600	o	225	Pipe/Conduit	
SE2.002	5.734	0.034	166.6	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
SE2.003	28.617	0.253	113.1	0.009	0.00	0.0	0.600	o	225	Pipe/Conduit	
SE1.003	3.575	0.021	166.6	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
SE1.000	61.56	4.81	54.591	0.219	0.0	0.0	0.0	1.01	40.2«	41.4
SE1.001	60.86	4.96	54.222	0.265	0.0	0.0	0.0	1.21	85.7	49.5
SE1.002	59.87	5.19	54.155	0.273	0.0	0.0	0.0	1.22	86.0	50.2
SE2.000	64.49	4.21	54.643	0.012	0.0	0.0	0.0	1.09	43.4	2.4
SE2.001	62.71	4.57	54.547	0.085	0.0	0.0	0.0	1.01	40.2	16.4
SE2.002	62.25	4.66	54.417	0.085	0.0	0.0	0.0	1.01	40.2	16.4
SE2.003	60.48	5.05	54.383	0.094	0.0	0.0	0.0	1.23	48.8	17.5
SE1.003	59.66	5.24	54.055	0.367	0.0	0.0	0.0	1.22	85.9	67.2

Network Design Table for Storm E

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
SE1.004	1.936	0.065	29.8	0.044	0.00	0.0	0.600	o	300	Pipe/Conduit	
SE1.005	19.762	0.079	250.2	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
SE1.006	1.772	0.007	250.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	

Network Results Table

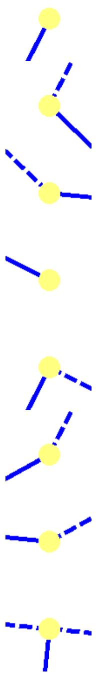
PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
SE1.004	65.53	4.01	54.033	0.000	0.8	0.0	0.0	2.89	204.4	0.8
SE1.005	63.80	4.34	53.213	0.000	0.8	0.0	0.0	0.99	69.9	0.8
SE1.006	63.65	4.37	53.134	0.000	0.8	0.0	0.0	0.99	70.0	0.8

Manhole Schedules for Storm E

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	PN	Pipe Out Invert Level (m)	Diameter (mm)	PN	Pipes In Invert Level (m)	Diameter (mm)	Backdrop (mm)
SE1	56.016	1.425	Open Manhole	1200	SE1.000	54.591	225				
SE2	55.746	1.524	Open Manhole	1200	SE1.001	54.222	300	SE1.000	54.297	225	
SE3	55.853	1.698	Open Manhole	1200	SE1.002	54.155	300	SE1.001	54.155	300	
SE4	56.068	1.425	Open Manhole	1200	SE2.000	54.643	225				
SE5	55.972	1.425	Open Manhole	1200	SE2.001	54.547	225	SE2.000	54.547	225	
SE6	56.128	1.711	Open Manhole	1200	SE2.002	54.417	225	SE2.001	54.417	225	
SE7	56.161	1.779	Open Manhole	1200	SE2.003	54.383	225	SE2.002	54.383	225	
SE8	55.994	1.939	Open Manhole	1200	SE1.003	54.055	300	SE1.002	54.055	300	
								SE2.003	54.130	225	
SE9	56.143	2.110	Open Manhole	1200	SE1.004	54.033	300	SE1.003	54.033	300	
SE10	56.200	2.987	Open Manhole	1200	SE1.005	53.213	300	SE1.004	53.968	300	755
SE11	56.419	3.285	Open Manhole	1200	SE1.006	53.134	300	SE1.005	53.134	300	
SE12	56.629	3.502	Open Manhole	0		OUTFALL		SE1.006	53.127	300	

Manhole Schedules for Storm E

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
SE1	701384.100	737107.933	701384.100	737107.933	Required	
SE2	701361.878	737064.253	701361.878	737064.253	Required	
SE3	701370.003	737056.528	701370.003	737056.528	Required	
SE4	701442.096	737067.924	701442.096	737067.924	Required	
SE5	701429.810	737074.060	701429.810	737074.060	Required	
SE6	701420.023	737054.803	701420.023	737054.803	Required	
SE7	701415.001	737052.036	701415.001	737052.036	Required	
SE8	701386.526	737054.879	701386.526	737054.879	Required	



Manhole Schedules for Storm E

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
SE9	701386.171	737051.322	701386.171	737051.322	Required	
SE10	701385.978	737049.395	701385.978	737049.395	Required	
SE11	701384.015	737029.732	701384.015	737029.732	Required	
SE12	701383.839	737027.968			No Entry	

PIPELINE SCHEDULES for Storm E

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
SE1.000	o	225	SE1	56.016	54.591	1.200	Open Manhole	1200
SE1.001	o	300	SE2	55.746	54.222	1.224	Open Manhole	1200
SE1.002	o	300	SE3	55.853	54.155	1.398	Open Manhole	1200
SE2.000	o	225	SE4	56.068	54.643	1.200	Open Manhole	1200
SE2.001	o	225	SE5	55.972	54.547	1.200	Open Manhole	1200
SE2.002	o	225	SE6	56.128	54.417	1.486	Open Manhole	1200
SE2.003	o	225	SE7	56.161	54.383	1.553	Open Manhole	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
SE1.000	49.008	166.7	SE2	55.746	54.297	1.224	Open Manhole	1200
SE1.001	11.211	167.3	SE3	55.853	54.155	1.398	Open Manhole	1200
SE1.002	16.605	166.1	SE8	55.994	54.055	1.639	Open Manhole	1200
SE2.000	13.733	143.1	SE5	55.972	54.547	1.200	Open Manhole	1200
SE2.001	21.601	166.2	SE6	56.128	54.417	1.486	Open Manhole	1200
SE2.002	5.734	166.6	SE7	56.161	54.383	1.554	Open Manhole	1200
SE2.003	28.617	113.1	SE8	55.994	54.130	1.639	Open Manhole	1200

PIPELINE SCHEDULES for Storm E

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
SE1.003	o	300	SE8	55.994	54.055	1.639	Open Manhole	1200
SE1.004	o	300	SE9	56.143	54.033	1.810	Open Manhole	1200
SE1.005	o	300	SE10	56.200	53.213	2.687	Open Manhole	1200
SE1.006	o	300	SE11	56.419	53.134	2.985	Open Manhole	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
SE1.003	3.575	166.6	SE9	56.143	54.033	1.810	Open Manhole	1200
SE1.004	1.936	29.8	SE10	56.200	53.968	1.932	Open Manhole	1200
SE1.005	19.762	250.2	SE11	56.419	53.134	2.985	Open Manhole	1200
SE1.006	1.772	250.0	SE12	56.629	53.127	3.202	Open Manhole	0

Area Summary for Storm E

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	-	-	100	0.219	0.219	0.219
1.001	-	-	100	0.046	0.046	0.046
1.002	-	-	100	0.008	0.008	0.008
2.000	-	-	100	0.012	0.012	0.012
2.001	-	-	100	0.073	0.073	0.073
2.002	-	-	100	0.000	0.000	0.000
2.003	-	-	100	0.009	0.009	0.009
1.003	-	-	100	0.000	0.000	0.000
1.004	-	-	100	0.044	0.044	0.044
1.005	-	-	100	0.000	0.000	0.000
1.006	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				0.411	0.411	0.411

Network Classifications for Storm E

PN	USMH Name	Pipe Dia (mm)	Min Cover Depth (m)	Max Cover Depth (m)	Pipe Type	MH Dia (mm)	MH Width (mm)	MH Ring Depth (m)	MH Type
SE1.000	SE1	225	1.185	1.224	Unclassified	1200	0	1.200	Unclassified
SE1.001	SE2	300	1.224	1.398	Unclassified	1200	0	1.224	Unclassified
SE1.002	SE3	300	1.398	1.639	Unclassified	1200	0	1.398	Unclassified
SE2.000	SE4	225	1.200	1.200	Unclassified	1200	0	1.200	Unclassified
SE2.001	SE5	225	1.200	1.486	Unclassified	1200	0	1.200	Unclassified
SE2.002	SE6	225	1.486	1.554	Unclassified	1200	0	1.486	Unclassified
SE2.003	SE7	225	1.553	1.639	Unclassified	1200	0	1.553	Unclassified
SE1.003	SE8	300	1.617	1.810	Unclassified	1200	0	1.639	Unclassified
SE1.004	SE9	300	1.810	1.932	Unclassified	1200	0	1.810	Unclassified
SE1.005	SE10	300	2.484	2.985	Unclassified	1200	0	2.687	Unclassified
SE1.006	SE11	300	2.985	3.202	Unclassified	1200	0	2.985	Unclassified

Free Flowing Outfall Details for Storm E

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
SE1.006	SE12	56.629	53.127	0.000	0	0

Simulation Criteria for Storm E

Volumetric Runoff Coeff	0.850	Manhole Headloss Coeff (Global)	0.500	Inlet Coeffiecient	0.800
Areal Reduction Factor	1.000	Foul Sewage per hectare (l/s)	0.000	Flow per Person per Day (l/per/day)	0.000
Hot Start (mins)	0	Additional Flow - % of Total Flow	0.000	Run Time (mins)	60
Hot Start Level (mm)	0	MADD Factor * 10m³/ha Storage	2.000	Output Interval (mins)	1

Number of Input Hydrographs	0	Number of Offline Controls	0	Number of Time/Area Diagrams	0
Number of Online Controls	1	Number of Storage Structures	6	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	M5-60 (mm)	16.200	Cv (Summer)	0.850
Return Period (years)	5	Ratio R	0.275	Cv (Winter)	0.840
Region	Scotland and Ireland	Profile Type	Summer	Storm Duration (mins)	30

Online Controls for Storm E

Hydro-Brake® Optimum Manhole: SE9, DS/PN: SE1.004, Volume (m³): 2.6

Unit Reference	MD-SHE-0045-8000-0724-8000	Sump Available	Yes
Design Head (m)	0.724	Diameter (mm)	45
Design Flow (l/s)	0.8	Invert Level (m)	54.033
Flush-Flo™	Calculated	Minimum Outlet Pipe Diameter (mm)	75
Objective	Minimise upstream storage	Suggested Manhole Diameter (mm)	1200
Application	Surface		

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.724	0.8	Kick-Flo®	0.398	0.6
Flush-Flo™	0.197	0.7	Mean Flow over Head Range	-	0.7

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	0.7	0.600	0.7	1.600	1.1	2.600	1.4	5.000	1.9	7.500	2.3
0.200	0.7	0.800	0.8	1.800	1.2	3.000	1.5	5.500	2.0	8.000	2.4
0.300	0.7	1.000	0.9	2.000	1.3	3.500	1.6	6.000	2.1	8.500	2.5
0.400	0.6	1.200	1.0	2.200	1.3	4.000	1.7	6.500	2.2	9.000	2.5
0.500	0.7	1.400	1.1	2.400	1.4	4.500	1.8	7.000	2.2	9.500	2.6

Storage Structures for Storm E

Complex Manhole: SE2, DS/PN: SE1.001

Porous Car Park

Infiltration Coefficient Base (m/hr)	0.03728	Porosity	0.40	Slope (1:X)	0.0
Membrane Percolation (mm/hr)	1000	Invert Level (m)	55.096	Depression Storage (mm)	5
Max Percolation (l/s)	127.5	Width (m)	5.0	Evaporation (mm/day)	3
Safety Factor	1.0	Length (m)	91.8	Membrane Depth (mm)	0

Infiltration Trench

Infiltration Coefficient Base (m/hr)	0.03728	Invert Level (m)	55.096	Cap Volume Depth (m)	0.000
Infiltration Coefficient Side (m/hr)	0.03728	Trench Width (m)	3.0	Cap Infiltration Depth (m)	0.000
Safety Factor	1.0	Trench Length (m)	3.0		
Porosity	0.40	Slope (1:X)	0.0		

Complex Manhole: SE3, DS/PN: SE1.002

Infiltration Blanket

Infiltration Coefficient Base (m/hr)	0.03728	Porosity	0.40	Diameter/Width (m)	4.0
Safety Factor	1.0	Invert Level (m)	53.480	Length (m)	43.0

Infiltration Blanket

Cap Volume Depth (m) 0.675

Tank or Pond

Invert Level (m) 55.478

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	43.0	0.375	172.0

Infiltration Trench Manhole: SE5, DS/PN: SE2.001

Infiltration Coefficient Base (m/hr)	0.03728	Invert Level (m)	54.822	Cap Volume Depth (m)	0.000
Infiltration Coefficient Side (m/hr)	0.03728	Trench Width (m)	2.1	Cap Infiltration Depth (m)	0.000
Safety Factor	1.0	Trench Length (m)	2.1		
Porosity	0.40	Slope (1:X)	0.0		

Porous Car Park Manhole: SE6, DS/PN: SE2.002

Infiltration Coefficient Base (m/hr)	0.03728	Porosity	0.40	Slope (1:X)	100.0
Membrane Percolation (mm/hr)	1000	Invert Level (m)	55.478	Depression Storage (mm)	5
Max Percolation (l/s)	35.1	Width (m)	5.0	Evaporation (mm/day)	3
Safety Factor	1.0	Length (m)	25.3	Membrane Depth (mm)	0

Porous Car Park Manhole: SE8, DS/PN: SE1.003

Infiltration Coefficient Base (m/hr)	0.03728	Porosity	0.40	Slope (1:X)	100.0
Membrane Percolation (mm/hr)	1000	Invert Level (m)	55.344	Depression Storage (mm)	5
Max Percolation (l/s)	107.5	Width (m)	5.0	Evaporation (mm/day)	3
Safety Factor	1.0	Length (m)	77.4	Membrane Depth (mm)	0

Complex Manhole: SE9, DS/PN: SE1.004

Infiltration Blanket

Infiltration Coefficient Base (m/hr)	0.03728	Invert Level (m)	53.358	Cap Volume Depth (m)	0.675
Safety Factor	1.0	Diameter/Width (m)	4.0		
Porosity	0.40	Length (m)	43.0		

Tank or Pond

Invert Level (m) 55.768

Depth (m)	**Area (m²)**	**Depth (m)**	**Area (m²)**
0.000	43.0	0.375	172.0

Manhole Headloss for Storm E

PN	US/MH Name	US/MH Headloss
SE1.000	SE1	0.500
SE1.001	SE2	0.500
SE1.002	SE3	0.500
SE2.000	SE4	0.500
SE2.001	SE5	0.500
SE2.002	SE6	0.500
SE2.003	SE7	0.500
SE1.003	SE8	0.500
SE1.004	SE9	0.500
SE1.005	SE10	0.500
SE1.006	SE11	0.500

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

Simulation Criteria

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

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 1 Number of Storage Structures 6 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR M5-60 (mm) 16.400 Cv (Summer) 0.750
Region Scotland and Ireland Ratio R 0.275 Cv (Winter) 0.840

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

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years) 1, 30, 100
Climate Change (%) 30, 30, 30

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status

Appendix D.1 – Microdrainage Network and Model Simulation Results Design Year and Future (30% Climate Change Plus 10% Urban Creep)

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

PN	US/MH Name	Level Exceeded

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)
SE1.000	SE1	15 Winter	100	+30%	30/15 Summer				55.921	1.105	0.000	2.08		
SE1.001	SE2	360 Winter	100	+30%	30/15 Summer				55.283	0.761	0.000	0.30		90
SE1.002	SE3	360 Winter	100	+30%	30/120 Summer				55.308	0.853	0.000	0.25		411
SE2.000	SE4	360 Winter	100	+30%	30/120 Winter				55.318	0.450	0.000	0.02		
SE2.001	SE5	360 Winter	100	+30%	30/120 Winter				55.318	0.546	0.000	0.17		152
SE2.002	SE6	360 Winter	100	+30%	30/120 Winter				55.328	0.686	0.000	0.21		168
SE2.003	SE7	360 Winter	100	+30%	30/120 Winter				55.334	0.726	0.000	0.15		
SE1.003	SE8	360 Winter	100	+30%	30/120 Summer				55.336	0.981	0.000	0.49		199
SE1.004	SE9	360 Winter	100	+30%	30/120 Summer				55.342	1.009	0.000	0.02		425
SE1.005	SE10	360 Winter	100	+30%					53.237	-0.276	0.000	0.02		
SE1.006	SE11	360 Winter	100	+30%					53.162	-0.272	0.000	0.02		

PN	US/MH Name	Pipe Flow (l/s)	Status	Level Exceeded
SE1.000	SE1	79.9	FLOOD RISK	
SE1.001	SE2	19.4	SURCHARGED	
SE1.002	SE3	18.2	SURCHARGED	
SE2.000	SE4	0.9	SURCHARGED	
SE2.001	SE5	6.2	SURCHARGED	
SE2.002	SE6	6.2	SURCHARGED	
SE2.003	SE7	6.9	SURCHARGED	

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

PN	US/MH Name	Pipe Flow (l/s)	Status	Level Exceeded
SE1.003	SE8	25.1	SURCHARGED	
SE1.004	SE9	1.0	SURCHARGED	
SE1.005	SE10	1.0	OK	
SE1.006	SE11	1.0	OK	

Met Eireann
Return Period Rainfall Depths for sliding Durations
Irish Grid: Easting: 301331, Northing: 237084,

	Interval		Years													
DURATION	6months,	1year,	2,	3,	4,	5,	10,	20,	30,	50,	75,	100,	150,	200,	250,	500,
5 mins	2.4,	3.4,	4.0,	4.9,	5.6,	6.1,	7.7,	9.6,	10.8,	12.6,	14.3,	15.5,	17.5,	19.1,	20.4,	N/A ,
10 mins	3.3,	4.8,	5.6,	6.9,	7.8,	8.4,	10.7,	13.3,	15.1,	17.6,	19.9,	21.6,	24.4,	26.6,	28.4,	N/A ,
15 mins	3.9,	5.6,	6.6,	8.1,	9.1,	9.9,	12.6,	15.7,	17.8,	20.7,	23.4,	25.5,	28.7,	31.3,	33.4,	N/A ,
30 mins	5.1,	7.4,	8.6,	10.4,	11.7,	12.7,	16.0,	19.7,	22.2,	25.8,	29.0,	31.5,	35.3,	38.4,	40.9,	N/A ,
1 hours	6.8,	9.6,	11.1,	13.4,	15.0,	16.2,	20.3,	24.8,	27.9,	32.1,	36.0,	38.9,	43.5,	47.1,	50.0,	N/A ,
2 hours	8.9,	12.5,	14.4,	17.3,	19.3,	20.8,	25.7,	31.2,	34.9,	40.0,	44.6,	48.1,	53.6,	57.8,	61.3,	N/A ,
3 hours	10.5,	14.6,	16.8,	20.1,	22.3,	24.0,	29.5,	35.7,	39.8,	45.5,	50.6,	54.5,	60.5,	65.1,	69.0,	N/A ,
4 hours	11.8,	16.3,	18.7,	22.3,	24.7,	26.5,	32.5,	39.3,	43.7,	49.8,	55.3,	59.5,	65.9,	70.9,	75.0,	N/A ,
6 hours	13.9,	19.1,	21.8,	25.8,	28.5,	30.6,	37.4,	44.9,	49.8,	56.7,	62.7,	67.4,	74.5,	80.0,	84.5,	N/A ,
9 hours	16.4,	22.3,	25.4,	30.0,	33.0,	35.4,	42.9,	51.4,	56.8,	64.4,	71.1,	76.3,	84.1,	90.1,	95.1,	N/A ,
12 hours	18.4,	24.9,	28.3,	33.3,	36.6,	39.2,	47.4,	56.5,	62.4,	70.6,	77.8,	83.3,	91.7,	98.1,	103.5,	N/A ,
18 hours	21.6,	29.0,	32.9,	38.6,	42.3,	45.2,	54.4,	64.6,	71.2,	80.3,	88.2,	94.3,	103.5,	110.6,	116.5,	N/A ,
24 hours	24.3,	32.4,	36.7,	42.8,	46.9,	50.1,	60.1,	71.0,	78.1,	87.9,	96.4,	103.0,	112.9,	120.5,	126.7,	148.1,
2 days	30.5,	39.7,	44.3,	51.1,	55.5,	58.9,	69.5,	81.0,	88.4,	98.4,	107.1,	113.7,	123.6,	131.1,	137.3,	158.3,
3 days	35.5,	45.5,	50.5,	57.8,	62.5,	66.1,	77.3,	89.3,	96.9,	107.2,	116.1,	122.8,	132.9,	140.6,	146.8,	167.9,
4 days	39.9,	50.6,	56.0,	63.6,	68.6,	72.3,	84.0,	96.5,	104.4,	115.0,	124.1,	131.0,	141.3,	149.0,	155.3,	176.7,
6 days	47.6,	59.5,	65.4,	73.8,	79.2,	83.2,	95.8,	109.0,	117.3,	128.5,	138.0,	145.2,	155.8,	163.8,	170.3,	192.1,
8 days	54.5,	67.4,	73.8,	82.7,	88.4,	92.8,	106.0,	120.0,	128.6,	140.3,	150.2,	157.5,	168.5,	176.8,	183.5,	205.8,
10 days	60.8,	74.6,	81.4,	90.8,	96.9,	101.4,	115.3,	129.8,	138.9,	150.9,	161.1,	168.7,	180.0,	188.5,	195.3,	218.1,
12 days	66.8,	81.4,	88.5,	98.4,	104.7,	109.4,	123.9,	139.0,	148.3,	160.7,	171.2,	179.1,	190.6,	199.3,	206.3,	229.5,
16 days	77.8,	93.8,	101.5,	112.3,	119.1,	124.1,	139.7,	155.7,	165.5,	178.6,	189.6,	197.8,	209.9,	218.9,	226.2,	250.2,
20 days	88.0,	105.3,	113.5,	125.0,	132.2,	137.6,	154.0,	170.8,	181.2,	194.9,	206.3,	214.8,	227.4,	236.7,	244.2,	268.9,
25 days	100.1,	118.7,	127.5,	139.8,	147.5,	153.2,	170.6,	188.3,	199.2,	213.5,	225.5,	234.3,	247.4,	257.0,	264.8,	290.3,

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

Appendix D.2 – Met Éireann Return Period Rainfall Depths

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Ground Investigations Ireland

Confey Leixlip

Corrigan Hodnett Consulting Ltd

Ground Investigation Report

July 2025

GROUND INVESTIGATIONS IRELAND
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A	Final	C Ess	M Sutton	M Sutton	Dublin	10 July 2025

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

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APPENDICES

1.0 Preamble

On the instructions of Corrigan Hodnett Consulting Engineers, a site investigation was carried out by Ground Investigations Ireland Ltd., between October and November 2024 at the site of the proposed Residential Development in Confey, Leixlip.

2.0 Overview

2.1. Background

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

2.2. Purpose and Scope

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

- Visit project site to observe existing conditions
- Carry out 7 No. Trial Pits to a maximum depth of 3.10m BGL
- Carry out 7 No. Plate Bearing Tests to determine CBR value
- Carry out 8 No. Soakaways to determine a soil infiltration value to BRE digest 365
- Carry out 3 No. Window Sample Boreholes to a maximum depth of 1.90m BGL
- Carry out 20 No. Dynamic Probes to determine soil strength/density characteristics
- Geotechnical & Environmental Laboratory testing
- Report with recommendations

3.0 Subsurface Exploration

3.1. General

During the ground investigation a programme of intrusive investigation specified by the Consulting Engineer was undertaken to determine the sub surface conditions at the proposed site. Regular sampling and in-situ testing was undertaken in the exploratory holes to facilitate the geotechnical descriptions and to enable laboratory testing to be carried out on the soil samples recovered during excavation and drilling.
The procedures used in this site investigation are in accordance with Eurocode 7 Part 2: Ground Investigation and testing (ISEN 1997 – 2:2007) and B.S. 5930:2015.

3.2. Trial Pits

The trial pits were excavated using a JCB 3CX excavator at the locations shown in the exploratory hole location plan in Appendix 1. The locations were checked using a CAT scan to minimise the potential for encountering services during the excavation. The trial pits were sampled, logged and photographed by a Geotechnical Engineer/Engineering Geologist prior to backfilling with arisings. Notes were made of any services, inclusions, pit stability, groundwater encountered and the characteristics of the strata encountered and are presented on the trial pit logs which are provided in Appendix 2 of this Report.

3.3. Soakaway Testing

The soakaway testing was carried out in selected trial pits at the locations shown in the exploratory hole location plan in Appendix 1. These pits were carefully excavated and filled with water to assess the infiltration characteristics of the proposed site. The pits were allowed to drain and the drop in water level was recorded over time as required by BRE Digest 365. The pits were logged prior to completing the soakaway test and were backfilled with arising's upon completion. The soakaway test results are provided in Appendix 3 of this Report.

3.4. Percussion Boreholes

The percussion boreholes were carried out at the locations shown in the location plan in Appendix 1 using a Tecopsa SPT Tec 10 percussion drilling rig. The percussion sampling consists of a 1m long steel tube with a cutting edge and an internal plastic liner which is mechanically driven into the ground utilising a 63.5kg weight falling a height of 760mm. Upon completion of the 1m sample, the tube is withdrawn and the plastic liner removed and sealed for logging and sub sampling by a Geotechnical Engineer/Engineering Geologist. The tube is replaced in the borehole and a subsequent 1m sample can be recovered. Occasionally outer casing or a reduced diameter tube is utilised to enable the window sample to progress in difficult drilling conditions. Geotechnical or environmental soil samples can be recovered from each of the liners following logging.

Standard Penetration Tests were carried out in the boreholes. The results of these tests, together with the depths at which the tests were taken are shown on the accompanying borehole records. The test consists of a thick wall sampler tube, 50mm external diameter, being driven into the soil by a weight of 63.5kg and with a free drop of 760mm. For gravels and glacial till the driving shoe was replaced by a solid 60º cone. The Standard Penetration Test number referred to as the 'N' value is the number of blows required to drive the tube 300mm, after an initial penetration of 150mm. The number gives a guide to the consistency of the soil and can also be used to estimate the relative strength/density at the depth of the test and also to estimate the bearing capacity and compressibility of the soil. The percussion borehole records are provided in Appendix 4 of this Report.

3.5. Dynamic Probing (DPH)

The dynamic probe tests (DPH) were carried out at the locations shown in the location plan in Appendix 1 in accordance with B.S. 1377: Part 9 1990. The test consists of mechanically driving a cone with a 50kg weight in 100mm intervals and monitoring the number of blows required. An equivalent Standard Penetration Test (SPT) ‘N’ value may be calculated by dividing the total number of blows over a 300mm drive length by 1.5. The dynamic probe logs are provided in Appendix 5 of this Report.

3.6. Surveying

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

3.7. In-situ Plate Bearing Test

The plate bearing tests were carried out using a 305mm or 450mm diameter plate at the locations shown on the site plan in Appendix 1. The plate was loaded in increments using a hydraulic jack and an excavator to provide a reaction and the displacement was monitored in accordance with BS1377 Part 9 using independently mounted digital strain gauges. The constrained modulus and equivalent CBR are calculated in accordance with HD29/75 and are provided on the test reports in Appendix 6 of this Report.

3.8. Laboratory Testing

Samples were selected from the exploratory holes for a range of geotechnical and environmental testing to assist in the classification of soils and to provide information for the proposed design.
Environmental & Chemical testing as required by the specification, including the Rilta Suite, pH, and sulphate testing was carried out by Element Materials Technology Laboratory in the UK. The Rilta suite testing includes both Solid Waste and Leachate Waste Acceptance Criteria.
Geotechnical testing consisting of moisture content, Atterberg limits, Particle Size Distribution (PSD), and hydrometer tests were carried out in NMTL’s Geotechnical Laboratory in Carlow.
The results of the laboratory testing are included in Appendix 7 of this Report.

4.0 Ground Conditions

4.1. General

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

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

- Topsoil
- Cohesive Deposits

TOPSOIL: Topsoil was encountered in all the exploratory holes and was present to a maximum depth of 0.40m BGL.

COHESIVE DEPOSITS: Cohesive deposits were encountered beneath the Topsoil and were described typically as *brown slightly sandy slightly gravelly silty CLAY with low cobble content* overlying a *greyish brown sandy slightly gravelly silty CLAY with medium cobble content and low boulder content* overlying *dark grey to black slightly sandy gravelly silty CLAY with medium cobble content and low boulder content*. The secondary sand and gravel constituents varied across the site and with depth. The strength of the cohesive deposits typically increased with depth and was firm to stiff or stiff below 1.60m BGL in the majority of the exploratory holes. These deposits had low, medium, or high cobble and boulder content, where noted on the exploratory hole logs.

4.2. In-situ Strength Testing

The correlated DPH blow counts indicate that the overburden deposits are generally soft or soft to firm to a depth of 0.50m to 1.00m BGL, and become firm to stiff or stiff with depth.

4.3. Groundwater

Groundwater strikes are noted on the exploratory hole logs where they occurred and where possible drilling was suspended for twenty minutes to allow the subsequent rise in groundwater to be recorded. We would point out that these exploratory holes did not remain open for sufficiently long periods of time to establish the hydrogeological regime and groundwater levels would be expected to vary with the tide, time of year, rainfall, nearby construction and other factors.

4.4. Laboratory Testing

4.4.1. Geotechnical Laboratory Testing

The geotechnical testing carried out on soil samples recovered generally confirm the descriptions on the logs with the primary constituent of the cohesive deposits found to be a CLAY of low to intermediate plasticity. The Particle Size Distribution tests confirm that generally the cohesive deposits are well-graded with percentages of sands generally ranging between 12% and 20%, and percentages of gravel ranging between 27% and 55% generally, with fines contents of 24% to 50%.

4.4.2. Chemical Laboratory Testing

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

4.4.3. Environmental Laboratory Testing

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

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

As part of the suite a leachate is generated from the solid sample which is analysed for antimony, arsenic, barium, cadmium, chromium, copper, lead, mercury, molybdenum, nickel, selenium, zinc, chloride, fluoride, soluble sulphate, sulphide, phenols, dissolved organic carbon (DOC) and total dissolved solids (TDS).

While the laboratory report provides a comparison with the waste acceptance criteria limits it does not provide a waste classification of the material sampled nor does it comment on any potentially hazardous properties of the materials tested. The possibility for contamination, not revealed by the testing undertaken should be borne in mind particularly where Made Ground deposits are present or the previous site use or location indicate a risk of environmental variation. The waste classification report is included under the cover of a separate report by Ground Investigations Ireland.

The results from the completed laboratory testing are included in Appendix 7 of this report.

5.0 Recommendations & Conclusions

5.1. General

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

5.2. Foundations

At the location of the proposed structure an allowable bearing capacity of 125 kN/m^2 is recommended for conventional strip or pad foundations on the stiff cohesive deposits at the depths outlined in the table below. The possibility for variation in the depth of the made ground in the vicinity of these foundations should be considered and foundation inspections should be carried out. Any soft spots encountered at the proposed foundation depths should be excavated and replaced with lean mix concrete.

	Allowable Bearing Capacities (ABC) kN/m^2						
Dynamic Probe	**ABC**	**Depth**	**Comment**	**Dynamic Probe**	**ABC**	**Depth**	**Comment**
No.	**kN/m^2**	**m BGL**		**No.**	**kN/m^2**	**m BGL**	
DP01	125	0.80	**Cohesive**	**DP11**	125	0.50	**Cohesive**
DP02	125	1.30	**Cohesive**	**DP12**	125	1.80	**Cohesive**
DP03	125	2.40	**Cohesive**	**DP13**	125	0.60	**Cohesive**
DP04	125	0.60	**Cohesive**	**DP14**	125	0.80	**Cohesive**
DP05	125	0.60	**Cohesive**	**DP15**	125	1.60	**Cohesive**
DP06	125	0.80	**Cohesive**	**DP16**	125	0.60	**Cohesive**
DP07	125	0.60	**Cohesive**	**DP17**	125	0.60	**Cohesive**
DP08	125	0.80	**Cohesive**	**DP18**	125	0.60	**Cohesive**
DP09	125	0.60	**Cohesive**	**DP19**	125	1.60	**Cohesive**
DP10	125	0.60	**Cohesive**	**DP20**	125	2.10	**Cohesive**

In any part of the site, should part of the foundation be on rock we would recommend that all the foundations of the unit in question be lowered to the competent rock stratum to avoid differential settlement.

A ground bearing floor slab is recommended to be based on the firm to stiff cohesive deposits with an appropriate depth of compacted hardcore specified by the consulting engineer and in accordance with the limits and guidelines in SR21:2014 +A1:2016 and/or NRA SRW CL808 Type E granular stone fill.

The pH and sulphate testing completed on samples recovered from the exploratory holes indicates the pH results are near neutral and the sulphate results are low, when compared to the guideline values from BRE Special Digest 1:2005. No special precautions are required for concrete foundations to prevent sulphate attack. The samples tested were below the limits of DS1 in the BRE Special Digest 1:2005.

5.3. External Pavements

The proposed pavements are recommended to be designed in accordance with the CBR test results included in the Appendices of this Report. The low CBR test results indicate that a capping layer or a sufficient depth of crushed stone fill may be required. Plate bearing tests are recommended at the time of construction to verify the design assumptions for the proposed pavement make up and to verify adequate compaction has been achieved.

The use of a geogrid and separation membrane may improve the performance of the proposed pavement and enable a more economical pavement design to be achieved, a specialist supplier is recommended to advise of the required strength, depth and type of geotextile for the proposed design.

5.4. Excavations

Short term temporary excavations in the cohesive deposits will remain stable for a limited time only and will require to be appropriately battered or the sides supported if the excavation is below 1.25m BGL or is required to permit man entry.

Excavations in the soft Cohesive Deposits will require to be appropriately battered or the sides supported due to the low strength of these deposits.

The groundwater and stability noted on the trial pit logs should be consulted when determining the most appropriate construction methods for excavations.

Any waste material to be removed off site should be disposed of to a suitably licenced landfill.

The environmental testing completed during the ground investigation is reported under the cover of a separate GII Waste Classification/Subsoil Assessment Report.

5.5. Soakaway Design

Infiltration rates of f=2.237 x 10^{-6} m/s and 3.655 x 10^{-6} m/s respectively were calculated for the soakaway locations BRE01 and BRE05. At the locations of BRE02, BRE03, BRE04, BRE06, BRE07, and BRE08 the water level dropped too slowly to allow calculation of ‘f’ the soil infiltration rate. These locations are therefore not recommended as suitable for soakaway design and construction.

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

APPENDIX 1 - Site Location Plan

Borehole
Soakaway Test
Trial Pit with CBR Plate Test
Dynamic Probe
Site Boundary
Site Location

Client:

Waterman Moylan
Engineering Consultants

Project Code:
14130-09-24

Project Title:
Confey Leixlip

Drawing Title:
Figure 1 Site Location Plan

GROUND INVESTIGATIONS IRELAND
Geotechnical & Environmental

Ground Investigations Ireland Ltd.
Catherinstown House,
Hazelhatch Road,
Newcastle, Co. Dublin
www.gii.ie 01-6015175/5176

0 15 30 45 60 75 m

Drawn By:	Date:
CE	25/10/2024

APPENDIX 2 – Trial Pit Records

Ground Investigations Ireland Ltd www.gii.ie	Site: Confey Leixlip	Trial Pit Number: TP01

Machine : JCB 3CX Method : Trial Pit	Dimensions: 3.30m x 0.60m x 3.10m (L x W x D)	Ground Level (mOD): 55.63	Client: Corrigan Hodnett	Job Number: 14130-09-24
	Location: 701404.8 E 737072.9 N	Dates: 22/10/2024	Engineer: Corrigan Hodnett	Sheet: 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.40)	Brown slightly sandy slightly gravelly TOPSOIL.		
0.50	B1			55.23	0.40	Soft to firm brown slightly sandy slightly gravelly CLAY with low subangular to subrounded cobble content. Gravel is subangular to subrounded fine to coarse.		
1.00	B2				(0.80)			
				54.43	1.20	Stiff greyish brown sandy slightly gravelly CLAY with low subangular to subrounded cobble and boulder content. Gravel is subangular to subrounded fine to coarse.		
2.00	B3				(1.10)			
				53.33	2.30	Stiff dark grey to black slightly sandy gravelly CLAY with medium suborunded cobble content and low boulder content. Gravel is subangular to subrounded fine to coarse.		
3.00	B4				(0.80)			
				52.53	3.10	OBSTRUCTION: Possible bedrock or boulders.		
						Complete at 3.10m		

Plan

Remarks

No groundwater encountered.
Trial Pit sidewalls stable.
Trial Pit carried out to 3.10m BGL. Obstructed due to possible bedrock or boulders.
Trial Pit backfilled upon completion.

Scale (approx)	Logged By	Figure No.
1:25	CE	14130-09-24.TP01

Ground Investigations Ireland Ltd www.gii.ie	Site: Confey Leixlip	Trial Pit Number: TP02
Machine : JCB 3CX **Method :** Trial Pit	**Dimensions:** 3.20m x 0.60m x 2.40m (L x W x D)	**Ground Level (mOD):** 55.61
Client: Corrigan Hodnett	**Job Number:** 14130-09-24	
Location: 701346.7 E 737097.5 N	**Dates:** 22/10/2024	**Engineer:** Corrigan Hodnett
Sheet: 1/1		

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.35)	Brown slightly sandy slightly gravelly TOPSOIL.		
				55.26	0.35 (0.15)	Firm brown slightly sandy slightly gravelly CLAY with low subrounded cobble content. Gravel is subangular to subrounded fine to coarse.		
0.50	B1			55.11	0.50 (0.30)	Stiff brown slightly sandy slightly gravelly CLAY with low subrounded cobble content. Gravel is subangular to subrounded fine to coarse.		
1.00	B2			54.81	0.80 (0.80)	Stiff brown slightly sandy slightly gravelly CLAY with medium subrounded cobble content and low boulder content. Gravel is subangular to subrounded fine to coarse.		
				54.01	1.60 (0.50)	Firm greyish brown sandy slightly gravelly CLAY with low subangular to subrounded cobble content. Gravel is subangular to subrounded fine to coarse. (Damp).		
2.00	B3			53.51	2.10 (0.30)	Stiff greyish brown to grey sandy slightly gravelly CLAY with medium subangular to subrounded cobble and boulder content. Gravel is subangular to subrounded fine to coarse. (Damp).		
			slow(1) at 2.40m.	53.21	2.40	OBSTRUCTION: Possible bedrock or boulders.		∇1
						Complete at 2.40m		

Plan

Remarks

Groundwater encountered at 2.40m BGL.
Trial Pit sidewalls stable.
Trial Pit carried out to 2.40m BGL. Obstructed due to possible bedrock or boulders.
Trial Pit backfilled upon completion.

Scale (approx)	Logged By	Figure No.
1:25	CE	14130-09-24.TP02

Ground Investigations Ireland Ltd www.gii.ie				Site: Confey Leixlip	Trial Pit Number: **TP03**
Machine : JCB 3CX **Method :** Trial Pit	**Dimensions** 3.20m x 0.60m x 3.00m (L x W x D)		**Ground Level (mOD)** 55.37	**Client** Corrigan Hodnett	**Job Number** 14130-09-24
	Location 701288.6 E 737065.9 N		**Dates** 23/10/2024	**Engineer** Corrigan Hodnett	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.40)	Brown slightly sandy slightly gravelly TOPSOIL.		
0.50	B1			54.97	0.40 (0.50)	Firm to stiff light brown slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to coarse.		
1.00	B2			54.47	0.90 (0.50)	Stiff brown slightly sandy slightly gravelly CLAY with low subrounded cobble content. Gravel is subangular to subrounded fine to coarse.		
				53.97	1.40 (0.40)	Firm brown slightly sandy slightly gravelly CLAY with low subrounded cobble content. Gravel is subangular to subrounded fine to coarse.		
2.00	B3			53.57	1.80 (0.60)	Stiff greyish brown slightly sandy gravelly CLAY with medium subangular to subrounded cobble content and low boulder content. Gravel is angular to subrounded fine to coarse.		
				52.97	2.40 (0.60)	Stiff dark grey to black slightly sandy slightly gravelly CLAY with medium subangular cobble content and low boulder content. Gravel is angular to subrounded fine to coarse.		
3.00	B4			52.37	3.00	OBSTRUCTION: Possible bedrock or boulders.		
						Complete at 3.00m		

Plan

Remarks

No groundwater encountered.
Trial Pit sidewalls stable.
Trial Pit carried out to 3.10m BGL. Obstructed due to possible bedrock or boulders.
Trial Pit backfilled upon completion.

Scale (approx)	Logged By	Figure No.
1:25	CE	14130-09-24.TP03

Ground Investigations Ireland Ltd
www.gii.ie

Site	Trial Pit Number
Confey Leixlip	TP04

Machine	Method	Dimensions	Ground Level (mOD)	Client	Job Number
JCB 3CX	Trial Pit	3.50m x 0.60m x 2.60m (L x W x D)	55.32	Corrigan Hodnett	14130-09-24

Location	Dates	Engineer	Sheet
701263.1 E 737140.1 N	23/10/2024	Corrigan Hodnett	1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.40)	Brown slightly sandy slightly gravelly TOPSOIL.		
0.50	B1			54.92	0.40 (0.30)	Soft to firm brown slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to coarse.		
1.00	B2			54.62	0.70 (0.50)	Stiff brown slightly sandy gravelly CLAY with low subrounded cobble content. Gravel is subangular to subrounded fine to coarse.		
				54.12	1.20 (0.40)	Firm to stiff brown to greyish brown sandy slightly gravelly CLAY with low subangular to subrounded cobble and boulder content. Gravel is subangular to subrounded fine to coarse.		
				53.72	1.60 (0.20)	Firm greyish brown mottled grey slightly sandy slightly gravelly CLAY with medium subangular to subrounded cobble and low boulder content. Gravel is angular to subrounded fine to coarse. (Damp).		
				53.52	1.80 (0.40)	Stiff greyish brown mottled grey slightly sandy slightly gravelly CLAY with medium subangular to subrounded cobble and low boulder content. Gravel is angular to subrounded fine to coarse. (Damp).		
				53.12	2.20 (0.40)	Stiff dark grey to black slightly sandy gravelly CLAY with medium subangular to subrounded cobble content and low boulder content. Gravel is angular to subrounded fine to coarse.		
				52.72	2.60	OBSTRUCTION: Possible bedrock or boulders.		
						Complete at 2.60m		

Plan

Remarks

No groundwater encountered.
Trial Pit sidewalls stable.
Trial Pit carried out to 2.60m BGL. Obstructed due to possible bedrock or boulders.
Trial Pit backfilled upon completion.

Scale (approx)	Logged By	Figure No.
1:25	CE	14130-09-24.TP04

Ground Investigations Ireland Ltd www.gii.ie			Site: Confey Leixlip	Trial Pit Number: TP05
Machine : JCB 3CX Method : Trial Pit	Dimensions: 3.30m x 0.60m x 2.10m (L x W x D)	Ground Level (mOD): 54.90	Client: Corrigan Hodnett	Job Number: 14130-09-24
	Location: 701170.8 E 737078.1 N	Dates: 23/10/2024	Engineer: Corrigan Hodnett	Sheet: 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.35)	Brown slightly sandy slightly gravelly TOPSOIL.		
				54.55	0.35			
0.50	B1				(0.25)	Soft to firm brown slightly sandy slightly gravelly CLAY with low subrounded cobble content. Gravel is subangular to subrounded fine to coarse.		
				54.30	0.60			
					(0.20)	Firm to stiff brown slightly sandy slightly gravelly CLAY with low subrounded cobble content. Gravel is subangular to subrounded fine to coarse.		
				54.10	0.80			
1.00	B2				(0.90)	Stiff brown sandy slightly gravelly CLAY with low subrounded cobble and boulder content. Gravel is subangular to subrounded fine to coarse.		
				53.20	1.70			
2.00	B3				(0.40)	Stiff brown to greyish brown slightly sandy gravelly CLAY with medium subangular to subrounded cobble content and low boulder content. Gravel is angular to subrounded fine to coarse.		
				52.80	2.10	OBSTRUCTION: Possible bedrock or boulders.		
						Complete at 2.10m		

Plan

Remarks

No groundwater encountered.
Trial Pit sidewalls stable.
Trial Pit carried out to 2.10m BGL. Obstructed due to possible bedrock or boulders.
Trial Pit backfilled upon completion.

Scale (approx)	Logged By	Figure No.
1:25	CE	14130-09-24.TP05

Ground Investigations Ireland Ltd www.gii.ie			Site: Confey Leixlip	Trial Pit Number: **TP06**
Machine : JCB 3CX **Method :** Trial Pit	**Dimensions** 3.40m x 0.60m x 2.20m (L x W x D)	**Ground Level (mOD)** 54.96	**Client** Corrigan Hodnett	**Job Number** 14130-09-24
	Location 701163.3 E 737111.4 N	**Dates** 23/10/2024	**Engineer** Corrigan Hodnett	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.40)	Brown slightly sandy slightly gravelly TOPSOIL.		
0.50	B1			54.56	0.40 (0.40)	Firm to stiff brown slightly sandy slightly gravelly CLAY with low subrounded cobble content. Gravel is subangular to subrounded fine to coarse.		
1.00	B2			54.16	0.80 (0.80)	Stiff brown to greyish brown slightly sandy gravelly CLAY with low subangular to subrounded cobble and boulder content. Gravel is angular to subrounded fine to coarse.		
				53.36	1.60 (0.60)	Stiff greyish brown slightly sandy gravelly CLAY with medium subangular to subrounded cobble content and low boulder content. Gravel is angular to subrounded fine to coarse.		
				52.76	2.20	OBSTRUCTION: Possible bedrock or boulders.		
						Complete at 2.20m		

Plan

Remarks

No groundwater encountered.
Trial Pit sidewalls stable.
Trial Pit carried out to 2.20m BGL. Obstructed due to possible bedrock or boulders.
Trial Pit backfilled upon completion.

Scale (approx)	Logged By	Figure No.
1:25	CE	14130-09-24.TP06

Ground Investigations Ireland Ltd www.gii.ie			Site: Confey Leixlip	Trial Pit Number: TP07
Machine : JCB 3CX Method : Trial Pit	Dimensions: 3.40m x 0.60m x 2.80m (L x W x D)	Ground Level (mOD): 55.30	Client: Corrigan Hodnett	Job Number: 14130-09-24
	Location: 701166.5 E 737150 N	Dates: 23/10/2024	Engineer: Corrigan Hodnett	Sheet: 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.35)	Brown slightly sandy slightly gravelly TOPSOIL.		
0.50	B1			54.95	0.35 (0.25)	Soft to firm brown slightly sandy slightly gravelly CLAY with low subrounded cobble content. Gravel is subangular to subrounded fine to coarse.		
				54.70	0.60 (0.30)	Stiff brown slightly sandy slightly gravelly CLAY with low subrounded cobble content. Gravel is subangular to subrounded fine to coarse.		
1.00	B2			54.40	0.90 (0.50)	Stiff brown slightly sandy slightly gravelly CLAY with low subangular to subrounded cobble and boulder content. Gravel is subangular to subrounded fine to coarse.		
				53.90	1.40 (0.40)	Firm to stiff brown slightly sandy slightly gravelly CLAY with low subangular to subrounded cobble and boulder content. Gravel is subangular to subrounded fine to coarse.		
2.00	B3			53.50	1.80 (1.00)	Stiff brown to greyish brown slightly sandy gravelly CLAY with low subangular to subrounded cobble and boulder content. Gravel is angular to subrounded fine to coarse.		
				52.50	2.80	OBSTRUCTION: Possible bedrock or boulders.		
						Complete at 2.80m		

Plan

Remarks

No groundwater encountered.
Trial Pit sidewalls stable.
Trial Pit carried out to 2.80m BGL. Obstructed due to possible bedrock or boulders.
Trial Pit backfilled upon completion.

Scale (approx)	Logged By	Figure No.
1:25	CE	14130-09-24.TP07

Ground Investigations Ireland Ltd www.gii.ie	Site: Confey Leixlip	Trial Pit Number: BRE01
Machine : JCB 3CX **Method :** Trial Pit	**Client:** Corrigan Hodnett	**Job Number:** 14130-09-24
Dimensions: 1.90m x 0.40m x 1.60m (L x W x D)	**Ground Level (mOD):** 55.83	
Location: 701386.8 E 737048.9 N	**Dates:** 22/10/2024	
Engineer: Corrigan Hodnett		**Sheet:** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.40)	Brown slightly sandy slightly gravelly TOPSOIL.		
				55.43	0.40	Firm brown slightly sandy slightly gravelly CLAY with low subrounded cobble and boulder content. Gravel is subangular to subrounded fine to coarse.		
					(0.50)			
				54.93	0.90	Stiff brown slightly sandy gravelly CLAY with medium subangular to subrounded cobble content and low boulder content. Gravel is subangular to subrounded fine to coarse.		
					(0.70)			
				54.23	1.60	Complete at 1.60m		

Plan

Remarks

No groundwater encountered.
Trial Pit sidewalls collapsing slightly in the topsoil.
Trial Pit carried out to 1.60m BGL. Soakaway test carried out in trial pit upon completion.
Trial Pit backfilled upon completion of soakaway test.

Scale (approx)	Logged By	Figure No.
1:25	CE	14130-09-24.BRE01

Ground Investigations Ireland Ltd www.gii.ie	Site: Confey Leixlip	Trial Pit Number: BRE02

Machine : JCB 3CX Method : Trial Pit	Dimensions: 2.00m x 0.40m x 1.70m (L x W x D)	Ground Level (mOD): 55.55	Client: Corrigan Hodnett	Job Number: 14130-09-24
	Location: 701366.2 E 737080.4 N	Dates: 22/10/2024	Engineer: Corrigan Hodnett	Sheet: 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.35)	Brown slightly sandy slightly gravelly TOPSOIL.		
				55.20	0.35 (0.45)	Firm light brown slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to coarse.		
				54.75	0.80 (0.50)	Stiff brown slightly sandy slightly gravelly CLAY with low subangular to subrounded cobble and boulder content. Gravel is subangular to subrounded fine to coarse.		
				54.25	1.30 (0.40)	Firm to stiff greyish brown slightly sandy gravelly CLAY with low subangular to subrounded cobble content. Gravel is subangular to subrounded fine to coarse.		
				53.85	1.70	Complete at 1.70m		

Plan

Remarks

No groundwater encountered.
Trial Pit sidewalls stable.
Trial Pit carried out to 1.70m BGL. Soakaway test carried out in trial pit upon completion.
Trial Pit backfilled upon completion of soakaway test.

Scale (approx)	Logged By	Figure No.
1:25	CE	14130-09-24.BRE02

Ground Investigations Ireland Ltd www.gii.ie		Site: Confey Leixlip	Trial Pit Number: BRE03
Machine : JCB 3CX Method : Trial Pit	Dimensions: 2.00m x 0.40m x 1.80m (L x W x D)	Ground Level (mOD): 55.57	Client: Corrigan Hodnett	Job Number: 14130-09-24
	Location: 701285.9 E 737118.1 N	Dates: 22/10/2024	Engineer: Corrigan Hodnett	Sheet: 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.40)	Brown slightly sandy slightly gravelly TOPSOIL.		
				55.17	0.40 (0.60)	Firm to stiff brown slightly sandy slightly gravelly CLAY with low subrounded cobble and boulder content. Gravel is subangular to subrounded fine to coarse.		
				54.57	1.00 (0.80)	Firm to stiff greyish brown slightly sandy gravelly CLAY with low subangular to subrounded cobble content. Gravel is subangular to subrounded fine to coarse.		
				53.77	1.80	Complete at 1.80m		

Plan

Remarks

No groundwater encountered.
Trial Pit sidewalls stable.
Trial Pit carried out to 1.80m BGL. Soakaway test carried out in trial pit upon completion.
Trial Pit backfilled upon completion of soakaway test.

Scale (approx)	Logged By	Figure No.
1:25	CE	14130-09-24.BRE03

Ground Investigations Ireland Ltd www.gii.ie			Site: Confey Leixlip	Trial Pit Number: **BRE04**
Machine : JCB 3CX **Method :** Trial Pit	**Dimensions** 1.80m x 0.40m x 1.80m (L x W x D)	**Ground Level (mOD)** 55.22	**Client** Corrigan Hodnett	**Job Number** 14130-09-24
	Location 701232.8 E 737117.1 N	**Dates** 22/10/2024	**Engineer** Corrigan Hodnett	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.35)	Brown slightly sandy slightly gravelly TOPSOIL.		
				54.87	0.35 (0.55)	Soft to firm brown slightly sandy slightly gravelly CLAY with low subrounded cobble content. Gravel is subangular to subrounded fine to coarse.		
				54.32	0.90 (0.90)	Stiff brown to greyish brown sandy slightly gravelly CLAY with low subangular to subrounded cobble content. Gravel is subangular to subrounded fine to coarse.		
				53.42	1.80	Complete at 1.80m		

Plan

Remarks

No groundwater encountered.
Trial Pit sidewalls collapsing slightly in the topsoil.
Trial Pit carried out to 1.80m BGL. Soakaway test carried out in trial pit upon completion.
Trial Pit backfilled upon completion of soakaway test.

Scale (approx)	Logged By	Figure No.
1:25	CE	14130-09-24.BRE04

Ground Investigations Ireland Ltd www.gii.ie		Site: Confey Leixlip	Trial Pit Number: BRE05
Machine : JCB 3CX Method : Trial Pit	Dimensions: 2.00m x 0.40m x 1.60m (L x W x D)	Ground Level (mOD): 54.88	Client: Corrigan Hodnett	Job Number: 14130-09-24
	Location: 701191.3 E 737070.1 N	Dates: 23/10/2024	Engineer: Corrigan Hodnett	Sheet: 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.35)	Brown slightly sandy slightly gravelly TOPSOIL.		
				54.53	0.35 (0.25)	Soft to firm brown slightly sandy slightly gravelly CLAY with low subrounded cobble content. Gravel is subangular to subrounded fine to coarse.		
				54.28	0.60 (0.40)	Stiff brown slightly sandy slightly gravelly CLAY with low subrounded cobble content. Gravel is subangular to subrounded fine to coarse.		
				53.88	1.00 (0.60)	Stiff greyish brown slightly sandy gravelly CLAY with medium subangular to subrounded cobble content and low boulder content. Gravel is angular to subrounded fine to coarse.		
				53.28	1.60	Complete at 1.60m		

Plan

Remarks

No groundwater encountered.
Trial Pit sidewalls stable.
Trial Pit carried out to 1.60m BGL. Soakaway test carried out in trial pit upon completion.
Trial Pit backfilled upon completion of soakaway test.

Scale (approx)	Logged By	Figure No.
1:25	CE	14130-09-24.BRE05

Ground Investigations Ireland Ltd www.gii.ie	Site: Confey Leixlip	Trial Pit Number: BRE06

Machine : JCB 3CX Method : Trial Pit	Dimensions: 2.30m x 0.40m x 1.80m (L x W x D)	Ground Level (mOD): 55.05	Client: Corrigan Hodnett	Job Number: 14130-09-24
	Location: 701183.5 E 737115.1 N	Dates: 23/10/2024	Engineer: Corrigan Hodnett	Sheet: 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.40)	Brown slightly sandy slightly gravelly TOPSOIL.		
				54.65	0.40 (0.60)	Stiff brown slightly sandy slightly gravelly CLAY with low subrounded cobble content. Gravel is subangular to subrounded fine to coarse.		
				54.05	1.00 (0.80)	Stiff brown to greyish brown slightly sandy gravelly CLAY with low subangular to subrounded cobble content. Gravel is subangular to subrounded fine to coarse.		
				53.25	1.80	Complete at 1.80m		

Plan

Remarks

No groundwater encountered.
Trial Pit sidewalls collapsing slightly in the topsoil.
Trial Pit carried out to 1.80m BGL. Soakaway test carried out in trial pit upon completion.
Trial Pit backfilled upon completion of soakaway test.

Scale (approx)	Logged By	Figure No.
1:25	CE	14130-09-24.BRE06

Ground Investigations Ireland Ltd www.gii.ie		Site: Confey Leixlip	Trial Pit Number: BRE07
Machine : JCB 3CX Method : Trial Pit	Dimensions: 2.30m x 0.40m x 1.40m (L x W x D)	Ground Level (mOD): 54.41	Client: Corrigan Hodnett	Job Number: 14130-09-24
	Location: 701137 E 737082.8 N	Dates: 23/10/2024	Engineer: Corrigan Hodnett	Sheet: 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.30)	Brown slightly sandy slightly gravelly TOPSOIL.		
				54.11	0.30 (0.60)	Soft to firm brown slightly sandy slightly gravelly CLAY with low subrounded cobble and boulder content. Gravel is subangular to subrounded fine to coarse.		
				53.51	0.90 (0.50)	Firm to stiff brown mottled greyish brown slightly sandy slightly gravelly CLAY with low subangular cobble and boulder content. Gravel is angular to subrounded fine to coarse.		
				53.01	1.40	Complete at 1.40m		

Plan

Remarks

No groundwater encountered.
Trial Pit sidewalls collapsing slightly in the topsoil.
Trial Pit carried out to 1.40m BGL. Soakaway test carried out in trial pit upon completion.
Trial Pit backfilled upon completion of soakaway test.

Scale (approx)	Logged By	Figure No.
1:25	CE	14130-09-24.BRE07

Ground Investigations Ireland Ltd www.gii.ie			Site Confey Leixlip	Trial Pit Number **BRE08**
Machine : JCB 3CX **Method :** Trial Pit	**Dimensions** 2.10m x 0.40m x 1.80m (L x W x D)	**Ground Level (mOD)** 54.42	**Client** Corrigan Hodnett	**Job Number** 14130-09-24
	Location 701136.4 E 737127 N	**Dates** 23/10/2024	**Engineer** Corrigan Hodnett	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.35)	Brown slightly sandy slightly gravelly TOPSOIL.		
				54.07	0.35			
					(0.55)	Stiff light brown slightly sandy slightly gravelly CLAY with low subrounded cobble content. Gravel is subangular to subrounded fine to coarse.		
				53.52	0.90			
					(0.90)	Firm to stiff brown to greyish brown slightly sandy gravelly CLAY with medium subangular to subrounded cobble content and low boulder content. Gravel is angular to subrounded fine to coarse.		
				52.62	1.80	Complete at 1.80m		

Plan

Remarks

No groundwater encountered.
Trial Pit sidewalls collapsing slightly in the topsoil.
Trial Pit carried out to 1.80m BGL. Soakaway test carried out in trial pit upon completion.
Trial Pit backfilled upon completion of soakaway test.

Scale (approx)	Logged By	Figure No.
1:25	CE	14130-09-24.BRE08

Confey Leixlip – Trial Pit Photographs

TP01

TP01

Confey Leixlip – Trial Pit Photographs

TP01

TP02

Confey Leixlip – Trial Pit Photographs

TP02

TP02

Confey Leixlip – Trial Pit Photographs

TP03

TP03

Confey Leixlip – Trial Pit Photographs

TP03

TP04

Confey Leixlip – Trial Pit Photographs

TP04

TP04

Confey Leixlip – Trial Pit Photographs

TP05

TP05

Confey Leixlip – Trial Pit Photographs

TP05

TP06

Confey Leixlip – Trial Pit Photographs

TP06

TP06

Confey Leixlip – Trial Pit Photographs

TP07

TP07

Confey Leixlip – Trial Pit Photographs

TP07

Confey Leixlip – Soakaway Pit Photographs

BRE01

BRE01

Confey Leixlip – Soakaway Pit Photographs

BRE01

BRE02

Confey Leixlip – Soakaway Pit Photographs

BRE02

BRE02

Confey Leixlip – Soakaway Pit Photographs

BRE03

BRE03

Confey Leixlip – Soakaway Pit Photographs

BRE03

BRE04

Confey Leixlip – Soakaway Pit Photographs

BRE04

BRE04

Confey Leixlip – Soakaway Pit Photographs

BRE05

BRE05

Confey Leixlip – Soakaway Pit Photographs

BRE05

BRE06

Confey Leixlip – Soakaway Pit Photographs

BRE06

BRE06

Confey Leixlip – Soakaway Pit Photographs

BRE07

BRE07

Confey Leixlip – Soakaway Pit Photographs

BRE07

BRE08

Confey Leixlip – Soakaway Pit Photographs

BRE08

BRE08

APPENDIX 3 – Soakaway Testing Records

GROUND INVESTIGATIONS IRELAND
Geotechnical & Environmental

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Newcastle,
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D22 YD52

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Web: www.gii.ie

BRE01

Soakaway Test to BRE Digest 365
Trial Pit Dimensions: 1.90m x 0.40m x 1.60m (L x W x D)

Date	Time	Water level (m bgl)
22/10/2024	0	-0.430
22/10/2024	5	-0.450
22/10/2024	12	-0.450
22/10/2024	53	-0.530
22/10/2024	139	-0.650
22/10/2024	295	-0.750
22/10/2024	392	-0.810

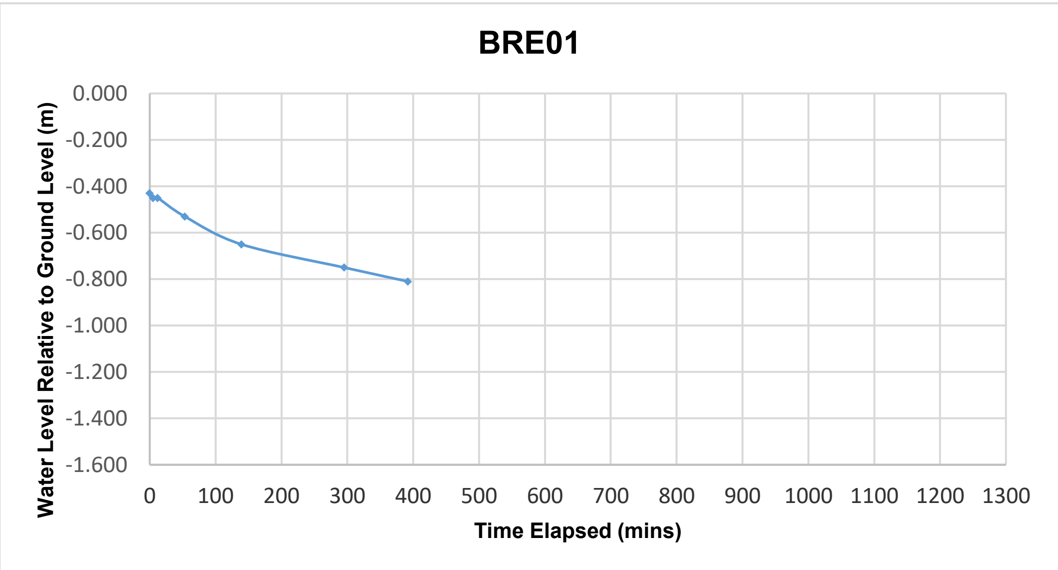
Start depth	Depth of Pit	Diff	75% full	25%full
0.43	**1.600**	**1.170**	**0.7225**	**1.3075**

Length of pit (m)	Width of pit (m)	75-25Ht (m)	Vp75-25 (m3)
1.900	0.400	0.585	0.44

Tp75-25 (from graph) (s) **57600**

50% Eff Depth	ap50 (m2)
0.585	3.451

f = 2.237E-06 m/s



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Web: www.gii.ie

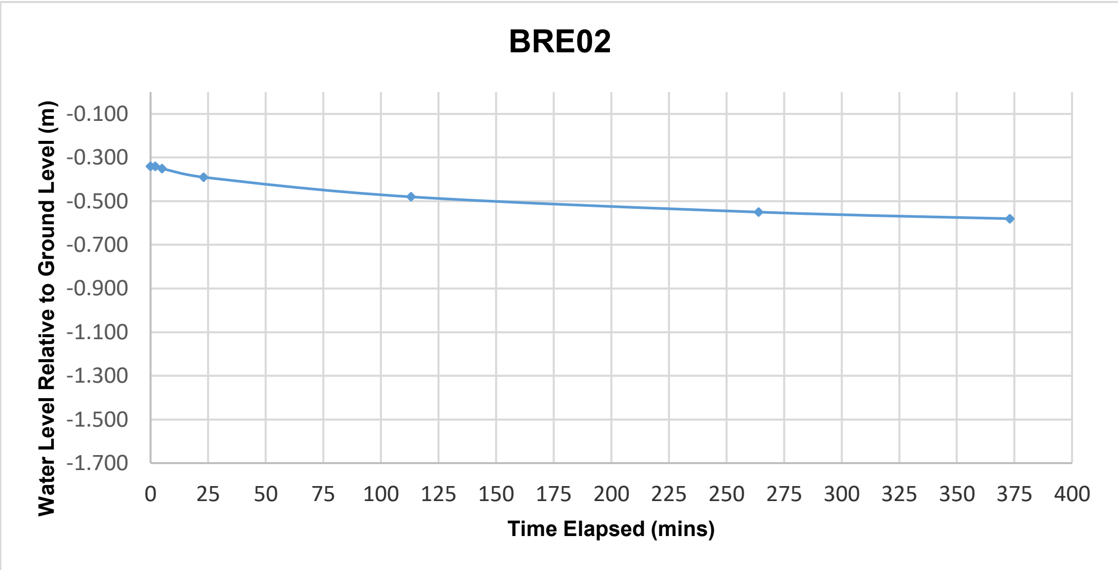
BRE02

Soakaway Test to BRE Digest 365
Trial Pit Dimensions: 2.00m x 0.40m x 1.70m (L x W x D)

Date	Time	Water level (m bgl)
22/10/2024	0	-0.340
22/10/2024	2	-0.340
22/10/2024	5	-0.350
22/10/2024	23	-0.390
22/10/2024	113	-0.480
22/10/2024	264	-0.550
22/10/2024	373	-0.580

***Soakaway failed - Pit backfilled**

Start depth	Depth of Pit	Diff	75% full	25%full
0.34	1.700	1.360	0.68	1.36



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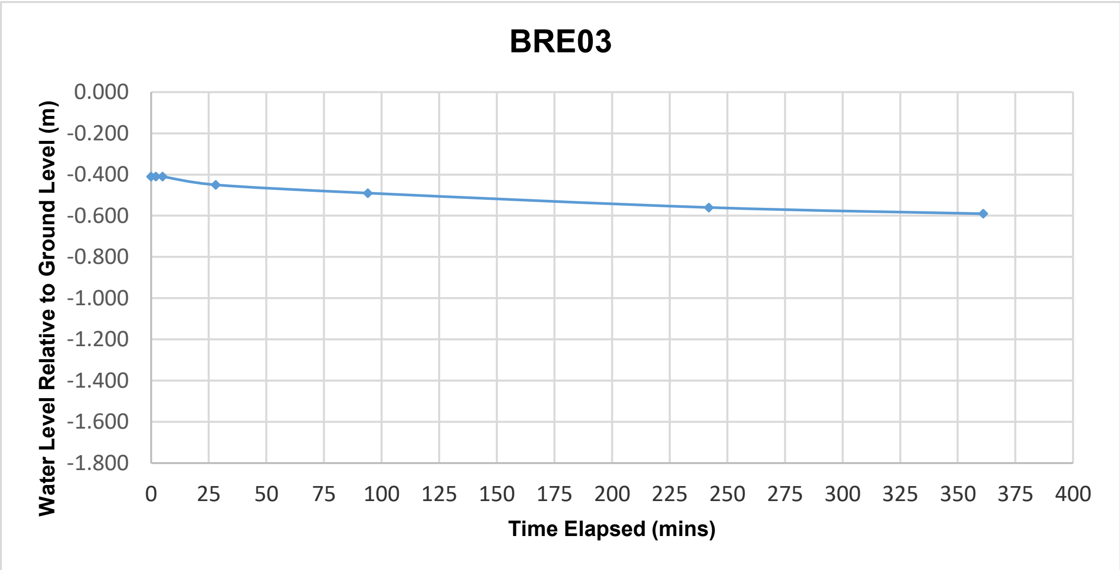
BRE03

Soakaway Test to BRE Digest 365
Trial Pit Dimensions: 2.00m x 0.40m x 1.80m (L x W x D)

Date	Time	Water level (m bgl)
22/10/2024	0	-0.410
22/10/2024	2	-0.410
22/10/2024	5	-0.410
22/10/2024	28	-0.450
22/10/2024	94	-0.490
22/10/2024	242	-0.560
22/10/2024	361	-0.590

***Soakaway failed - Pit backfilled**

Start depth	Depth of Pit	Diff	75% full	25%full
0.41	1.800	1.390	0.7575	1.4525



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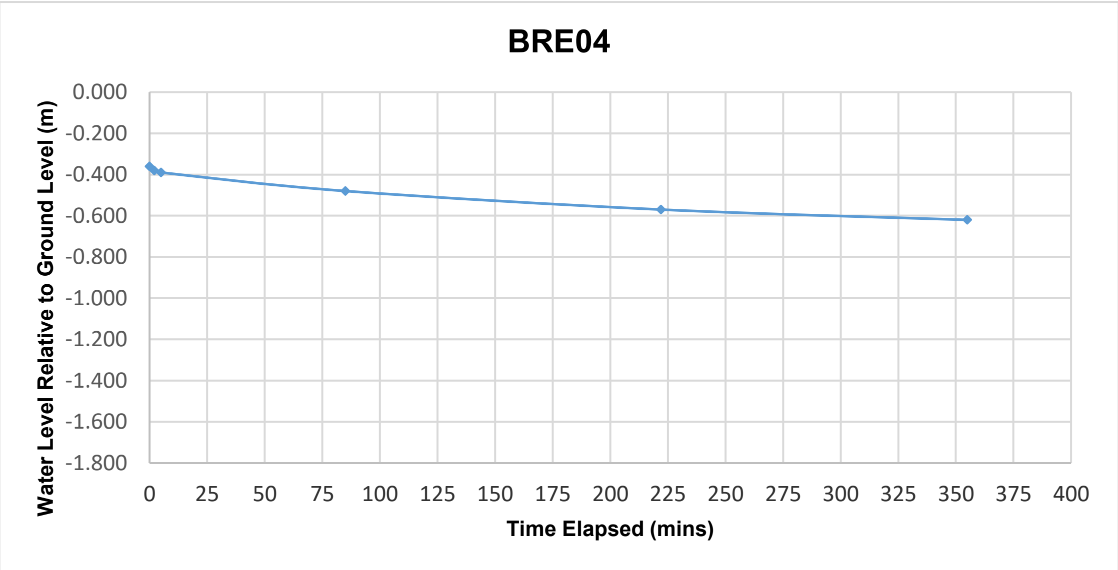
BRE04

Soakaway Test to BRE Digest 365
Trial Pit Dimensions: 1.80m x 0.40m x 1.80m (L x W x D)

Date	Time	Water level (m bgl)
22/10/2024	0	-0.360
22/10/2024	2	-0.380
22/10/2024	5	-0.390
22/10/2024	85	-0.480
22/10/2024	222	-0.570
22/10/2024	355	-0.620

***Soakaway failed - Pit backfilled**

Start depth	Depth of Pit	Diff	75% full	25%full
0.36	1.800	1.440	0.72	1.44



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BRE05

Soakaway Test to BRE Digest 365
Trial Pit Dimensions: 2.00m x 0.40m x 1.60m (L x W x D)

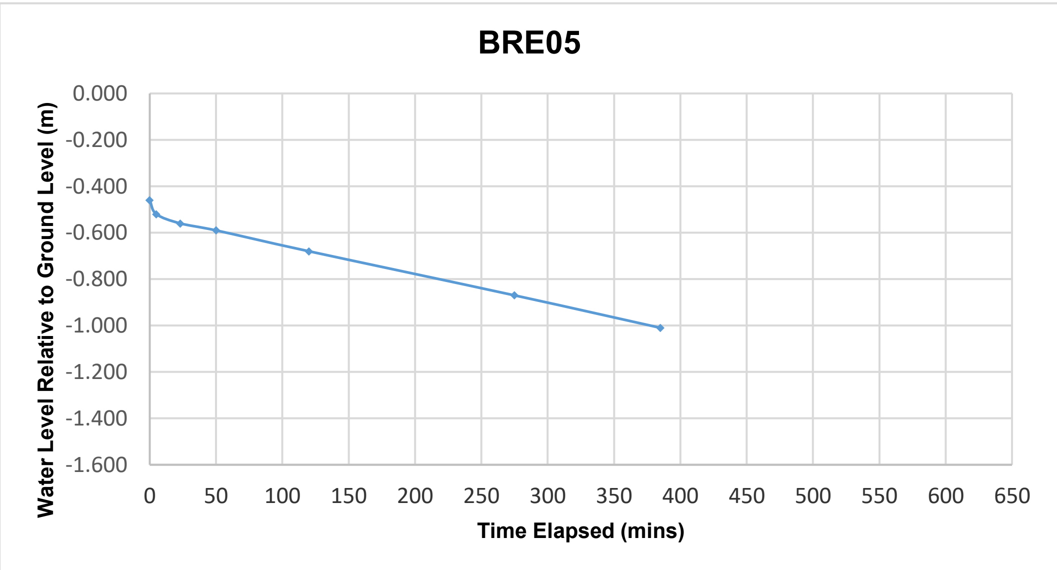
Date	Time	Water level (m bgl)
23/10/2024	0	-0.460
23/10/2024	5	-0.520
23/10/2024	23	-0.560
23/10/2024	50	-0.590
23/10/2024	120	-0.680
23/10/2024	275	-0.870
23/10/2024	385	-1.010

Start depth	Depth of Pit	Diff	75% full	25%full
0.46	**1.600**	**1.140**	**0.745**	**1.315**

Length of pit (m)	Width of pit (m)	75-25Ht (m)	Vp75-25 (m3)
2.000	0.400	0.570	0.46

Tp75-25 (from graph) (s)	**35280**	50% Eff Depth	ap50 (m2)
		0.570	3.536

f = 3.655E-06 m/s



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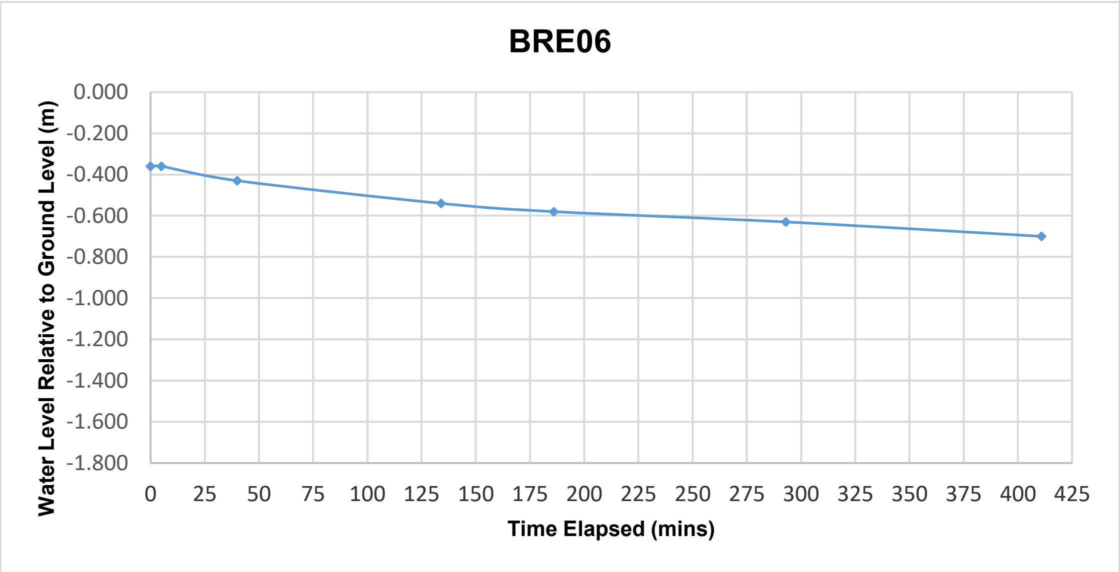
BRE06

Soakaway Test to BRE Digest 365
Trial Pit Dimensions: 2.30m x 0.40m x 1.80m (L x W x D)

Date	Time	Water level (m bgl)
23/10/2024	0	-0.360
23/10/2024	5	-0.360
23/10/2024	40	-0.430
23/10/2024	134	-0.540
23/10/2024	186	-0.580
23/10/2024	293	-0.630
23/10/2024	411	-0.700

***Soakaway failed - Pit backfilled**

Start depth	Depth of Pit	Diff	75% full	25%full
0.36	1.800	1.440	0.72	1.44



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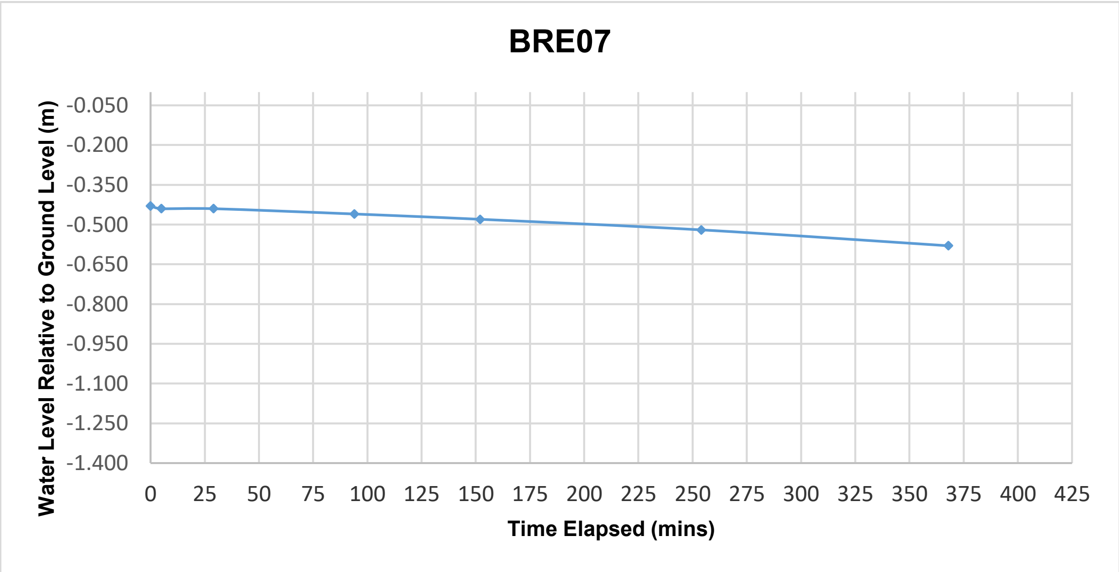
BRE07

Soakaway Test to BRE Digest 365
Trial Pit Dimensions: 2.30m x 0.40m x 1.40m (L x W x D)

Date	Time	Water level (m bgl)
23/10/2024	0	-0.430
23/10/2024	5	-0.440
23/10/2024	29	-0.440
23/10/2024	94	-0.460
23/10/2024	152	-0.480
23/10/2024	254	-0.520
23/10/2024	368	-0.580

***Soakaway failed - Pit backfilled**

Start depth	Depth of Pit	Diff	75% full	25%full
0.44	1.400	0.960	0.68	1.16



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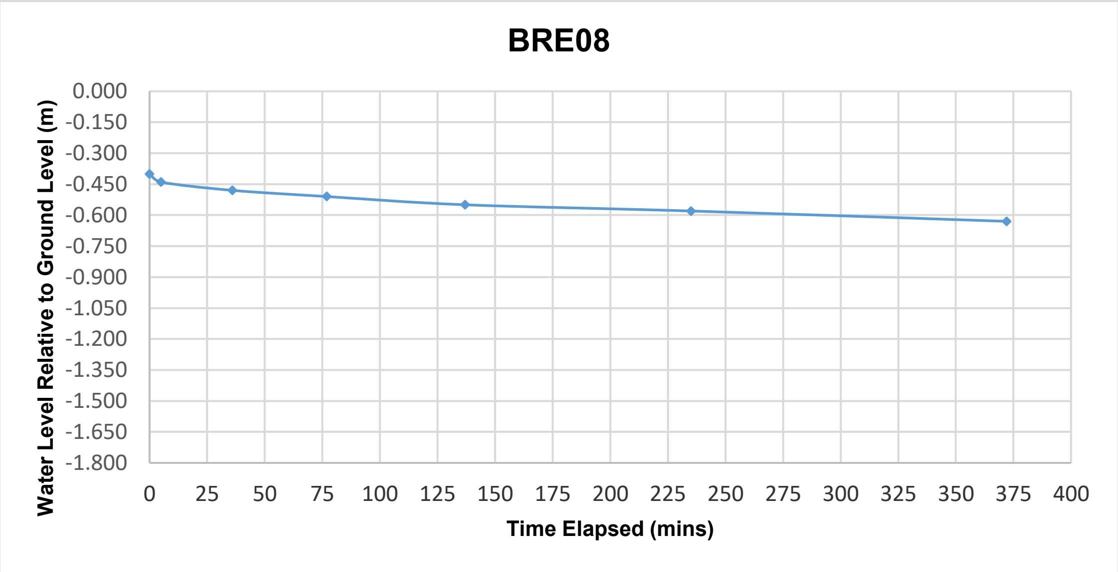
BRE08

Soakaway Test to BRE Digest 365
Trial Pit Dimensions: 2.10m x 0.40m x 1.80m (L x W x D)

Date	Time	Water level (m bgl)
23/10/2024	0	-0.400
23/10/2024	5	-0.440
23/10/2024	36	-0.480
23/10/2024	77	-0.510
23/10/2024	137	-0.550
23/10/2024	235	-0.580
23/10/2024	372	-0.630

***Soakaway failed - Pit backfilled**

Start depth	Depth of Pit	Diff	75% full	25%full
0.40	1.800	1.400	0.75	1.45



APPENDIX 4 – Percussion Borehole Records

Ground Investigations Ireland Ltd www.gii.ie	Site: Confey Leixlip	Number: **BH01**

Machine : Tec 10 Method : Drive-in Windowless Sampler	Dimensions: 88mm to 1.00m 68mm to 1.90m	Ground Level (mOD): 55.88	Client: Corrigan Hodnett	Job Number: 14130-09-24
	Location: 701408.1 E 737055.3 N	Dates: 01/03/2025	Engineer: Corrigan Hodnett	Sheet: 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.20)	TOPSOIL with frequent rootlets and fragments of red brick.		
0.20-0.46	B			55.68	0.20 (0.26)	MADE GROUND: Brown slightly sandy slighly gravelly silty Clay with frequent rootlets and fragments of red brick.		
0.46-1.30	B			55.42	0.46 (0.84)	Brown mottled grey slightly sandy gravelly silty CLAY with occasional rootlets. Gravel is angular to subrounded fine to medium.		
1.00-1.40	SPT(C) 50/250		6,10/18,22,10					
1.30-1.41	B			54.58	1.30 (0.10)	Dense dark grey clayey gravelly coarse SAND. Gravel is subangular to subrounded fine to medium.		
1.41-1.90	B			54.48	1.40 (0.50)	Very stiff brown mottled grey slightly sandy gravelly silty CLAY. Gravel is angular to subrounded fine to medium.		
				53.98	1.90	Complete at 1.90m		

Remarks	Scale (approx)	Logged By
Lightweight percussive techniques carried out to 1.90m BGL. No groundwater encountered. Recovery from GL to 1.00m BGL is 100%. Recovery from 1.00m BGL to 1.90m BGL is 100%.	1:25	EM
	Figure No. 14130-09-24.BH01	

Ground Investigations Ireland Ltd www.gii.ie			Site: Confey Leixlip	Number: BH02
Machine : Tec 10 Method : Drive-in Windowless Sampler	Dimensions: 88mm to 1.00m, 68mm to 1.90m	Ground Level (mOD): 55.32	Client: Corrigan Hodnett	Job Number: 14130-09-24
	Location: 701280.3 E 737087.9 N	Dates: 01/06/2025	Engineer: Corrigan Hodnett	Sheet: 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
				55.12	(0.20) 0.20	TOPSOIL with rootlets.		
0.20-1.54	B					Brown mottled grey sandy gravelly silty CLAY. Gravel is angular to subrounded fine to coarse.		
					(1.34)			
1.00-1.45	SPT(C) N=22		5,12/6,3,7,6					
1.54-1.65	B			53.78	1.54	Stiff greyish brown slightly sandy slightly gravelly silty CLAY. Gravel is subangular to subrounded fine to medium.		
				53.67	1.65 (0.25)			
1.90-2.05	SPT(C) 50/0		25,25/50	53.42	1.90	Stiff dark brownish grey slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded fine to coarse.		
						Complete at 1.90m		

Remarks
Lightweight percussive techniques carried out to 1.90m BGL.
No groundwater encountered.
Recovery from GL to 1.00m BGL is 93%
Recovery from 1.00m BGL 1.90m BGL is 79%

Scale (approx)	Logged By
1:50	EM

Figure No. 14130-09-24.BH02

Ground Investigations Ireland Ltd
www.gii.ie

Machine : Tec 10 **Method :** Drive-in Windowless Sampler	**Dimensions** 88mm to 1.00m 68mm to 1.70m	**Ground Level (mOD)** 55.18	**Site** Confey Leixlip **Client** Corrigan Hodnett	**Number** **BH03** **Job Number** 14130-09-24
	Location 701183.2 E 737129.7 N	**Dates** 04/12/2024	**Engineer** Corrigan Hodnett	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.20)	TOPSOIL with frequent rootlets.		
0.20-0.80	B			54.98	0.20	Brown slightly sandy slightly gravelly silty CLAY. Gravel is angular to subrounded fine to medium.		
					(0.60)			
0.80-1.45	B			54.38	0.80	Stiff greyish brown sandy gravelly silty CLAY. Gravel is angular to subrounded fine to medium.		
1.00-1.45	SPT(C) N=43		7,14/17,12,6,8		(0.65)			
1.45-1.61	B			53.73	1.45	Dense greyish brown very clayey sandy angular to subrounded fine to medium GRAVEL.		
					(0.25)			
1.70-1.85	SPT(C) 50/0		25,25/50	53.48	1.70	Complete at 1.70m		

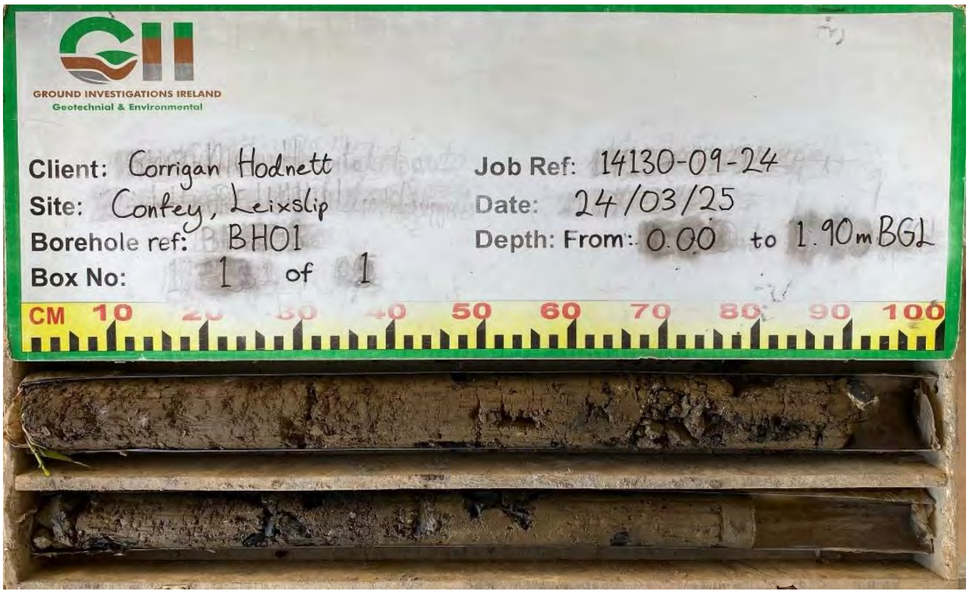
Remarks
Lightweight percussive techniques carried out to 1.70m BGL.
No groundwater encountered.
Recovery from GL to 1.00m BGL is 95%.
Recovery from 1.00m BGL to 1.70m BGL is 87%.

Scale (approx)	Logged By
1:25	EM

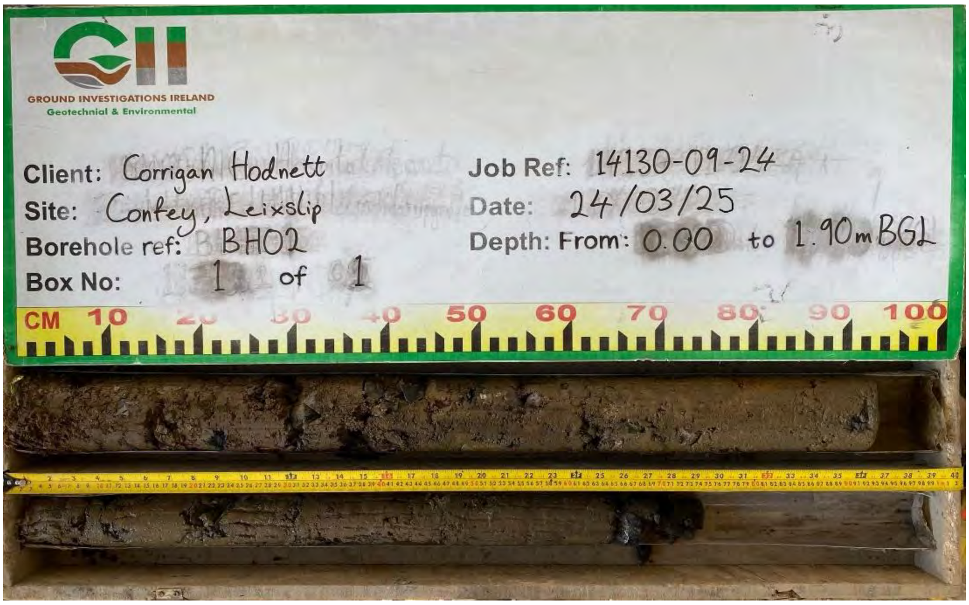
Figure No.
14130-09-24.BH03 WS

Confey Leixlip – Window Sample Photographs

BH01



BH02



Confey Leixlip – Window Sample Photographs

BH03

APPENDIX 5 – Dynamic Probing Records

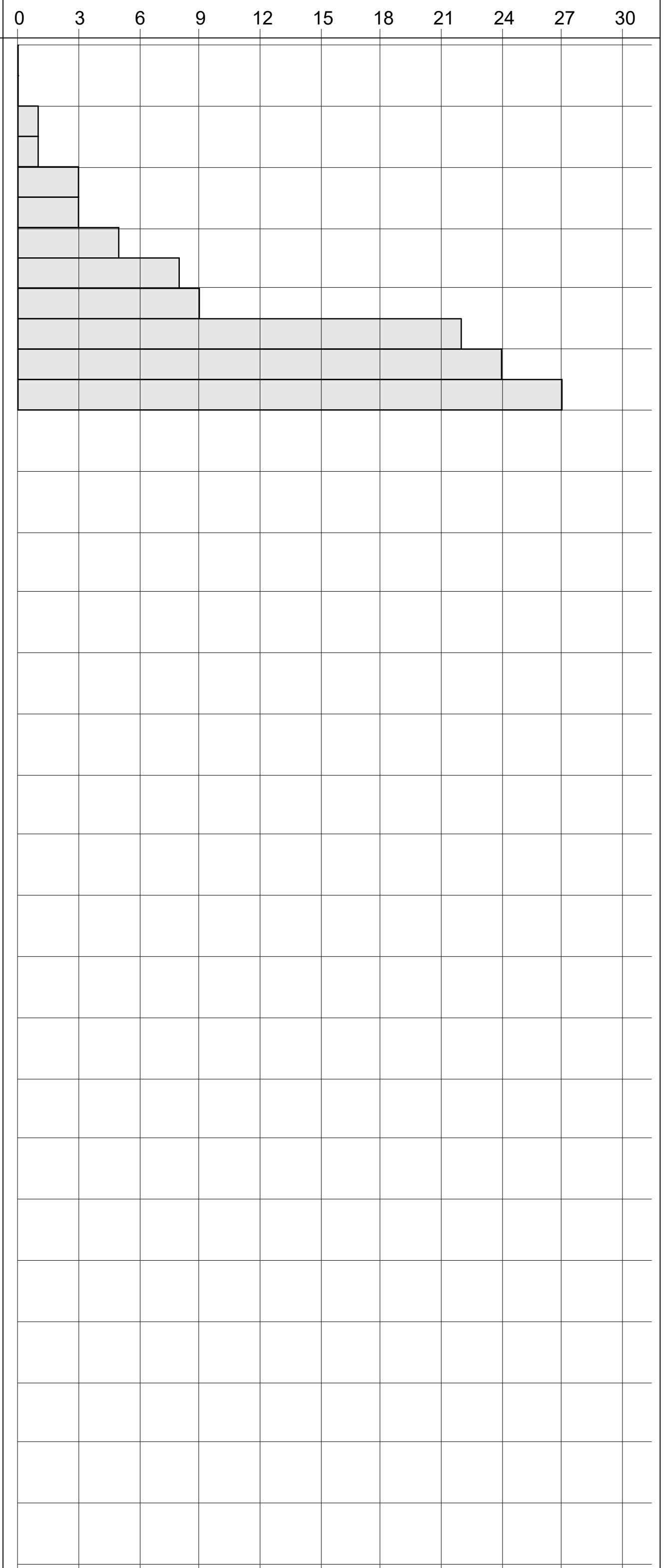
Ground Investigations Ireland Ltd
www.gii.ie

Site	Probe Number
Confey Leixlip	DP01

Method	Cone Dimensions	Ground Level (mOD)	Client	Job Number
Dynamic Probe Heavy (DPH) Hammer drop height 500mm Hammer weight 50kg	Diameter 43.7mm, Angle 90°	55.77	Corrigan Hodnett	14130-09-24
	Location	**Dates**	**Engineer**	**Sheet**
	701445.7 E 737066.9 N	18/10/2024	Corrigan Hodnett	1/1

Depth (m)	Blows for Depth Increment	Field Records	Level (mOD)	Depth (m)
0.00-0.10	0		55.77	0.00
0.10-0.20	0			
0.20-0.30	1			
0.30-0.40	1			
0.40-0.50	3			
0.50-0.60	3		55.27	0.50
0.60-0.70	5			
0.70-0.80	8			
0.80-0.90	9			
0.90-1.00	22			
1.00-1.10	24		54.77	1.00
1.10-1.20	27			
			54.27	1.50
			53.77	2.00
			53.27	2.50
			52.77	3.00
			52.27	3.50
			51.77	4.00
			51.27	4.50
			50.77	5.00

Blows for Depth Increment



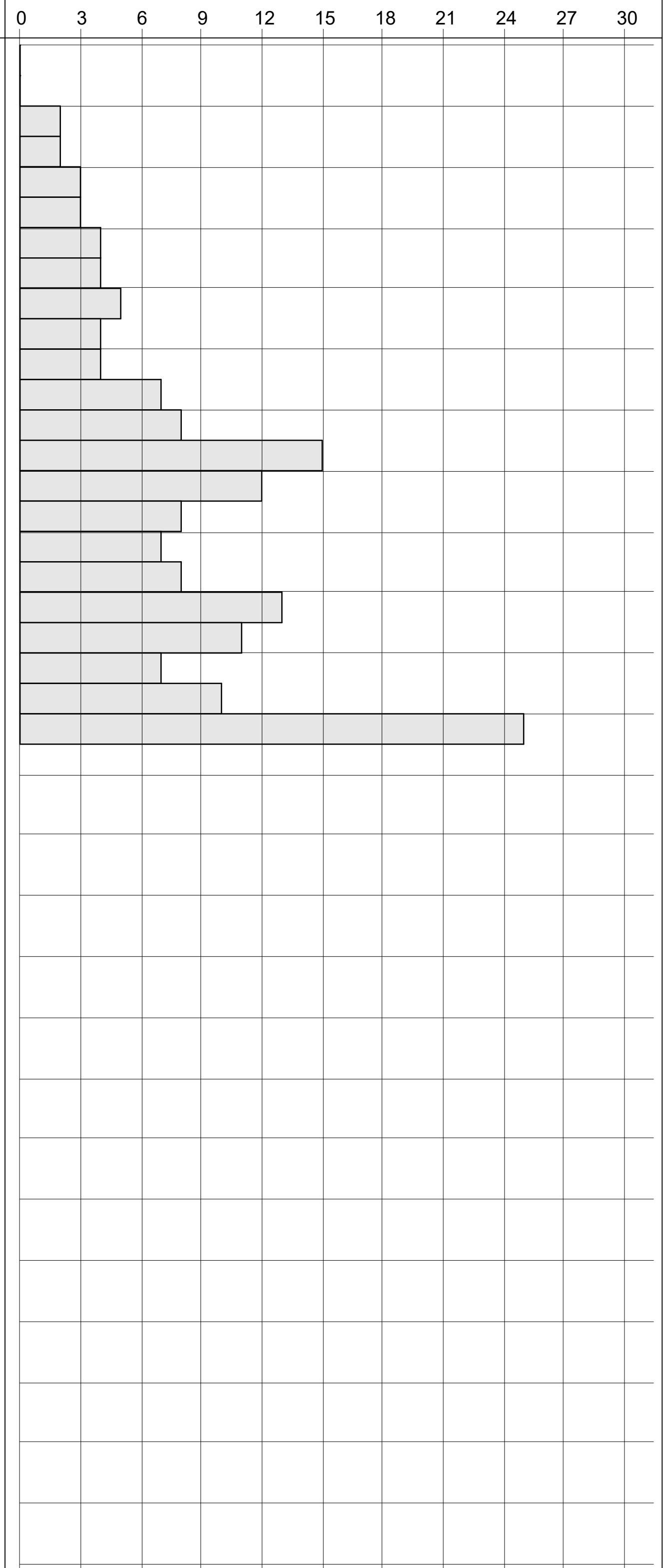
Remarks	Scale (approx)	Logged By
Dynamic Probe refusal at 1.20m BGL, 27 blows over 100mm.	1:25	CE
	Figure No.	
	14130-09-24.DP01	

Ground Investigations Ireland Ltd www.gii.ie	Site Confey Leixlip	Probe Number **DP02**

Method	Cone Dimensions	Ground Level (mOD)	Client	Job Number
Dynamic Probe Heavy (DPH) Hammer drop height 500mm Hammer weight 50kg	Diameter 43.7mm, Angle 90°	55.38	Corrigan Hodnett	14130-09-24
	Location	**Dates**	**Engineer**	**Sheet**
	701387.5 E 737097.1 N	18/10/2024	Corrigan Hodnett	1/1

Depth (m)	Blows for Depth Increment	Field Records	Level (mOD)	Depth (m)
0.00-0.10	0		55.38	0.00
0.10-0.20	0			
0.20-0.30	2			
0.30-0.40	2			
0.40-0.50	3			
0.50-0.60	3		54.88	0.50
0.60-0.70	4			
0.70-0.80	4			
0.80-0.90	5			
0.90-1.00	4			
1.00-1.10	4		54.38	1.00
1.10-1.20	7			
1.20-1.30	8			
1.30-1.40	15			
1.40-1.50	12			
1.50-1.60	8		53.88	1.50
1.60-1.70	7			
1.70-1.80	8			
1.80-1.90	13			
1.90-2.00	11			
2.00-2.10	7		53.38	2.00
2.10-2.20	10			
2.20-2.30	25			
			52.88	2.50
			52.38	3.00
			51.88	3.50
			51.38	4.00
			50.88	4.50
			50.38	5.00

Blows for Depth Increment



Remarks
Dynamic Probe refusal at 2.30m BGL, 25 blows over 100mm.

Scale (approx)	Logged By
1:25	CE

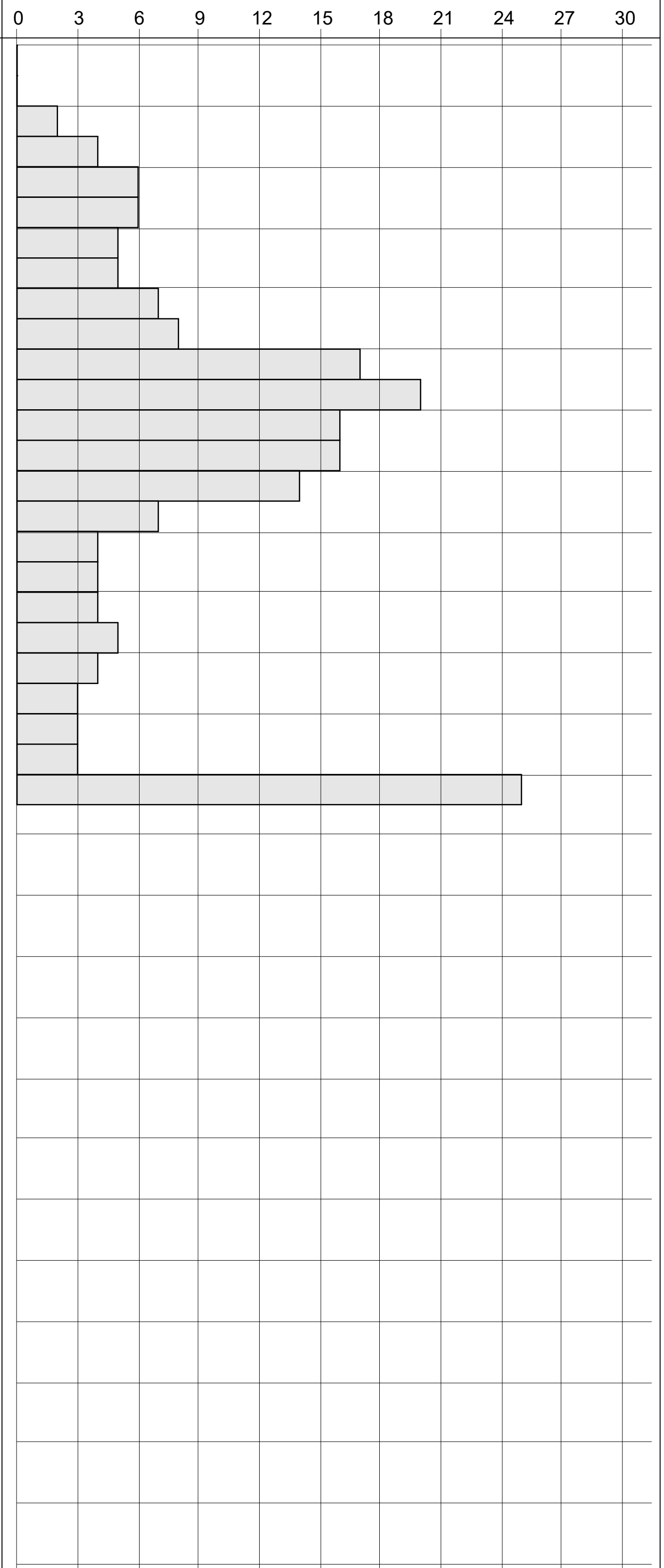
Figure No.
14130-09-24.DP02

Ground Investigations Ireland Ltd www.gii.ie	Site: Confey Leixlip	Probe Number: DP03

Method	Cone Dimensions	Ground Level (mOD)	Client	Job Number
Dynamic Probe Heavy (DPH) Hammer drop height 500mm Hammer weight 50kg	Diameter 43.7mm, Angle 90°	55.65	Corrigan Hodnett	14130-09-24
	Location	**Dates**	**Engineer**	**Sheet**
	701366.1 E 737069.7 N	18/10/2024	Corrigan Hodnett	1/1

Depth (m)	Blows for Depth Increment	Field Records	Level (mOD)	Depth (m)
0.00-0.10	0		55.65	0.00
0.10-0.20	0			
0.20-0.30	2			
0.30-0.40	4			
0.40-0.50	6			
0.50-0.60	6		55.15	0.50
0.60-0.70	5			
0.70-0.80	5			
0.80-0.90	7			
0.90-1.00	8			
1.00-1.10	17		54.65	1.00
1.10-1.20	20			
1.20-1.30	16			
1.30-1.40	16			
1.40-1.50	14			
1.50-1.60	7		54.15	1.50
1.60-1.70	4			
1.70-1.80	4			
1.80-1.90	4			
1.90-2.00	5			
2.00-2.10	4		53.65	2.00
2.10-2.20	3			
2.20-2.30	3			
2.30-2.40	3			
2.40-2.50	25			
			53.15	2.50
			52.65	3.00
			52.15	3.50
			51.65	4.00
			51.15	4.50
			50.65	5.00

Blows for Depth Increment



Remarks
Dynamic Probe refusal at 2.50m BGL, 25 blows over 100mm.

Scale (approx)	Logged By
1:25	CE

Figure No. 14130-09-24.DP03

Ground Investigations Ireland Ltd
www.gii.ie

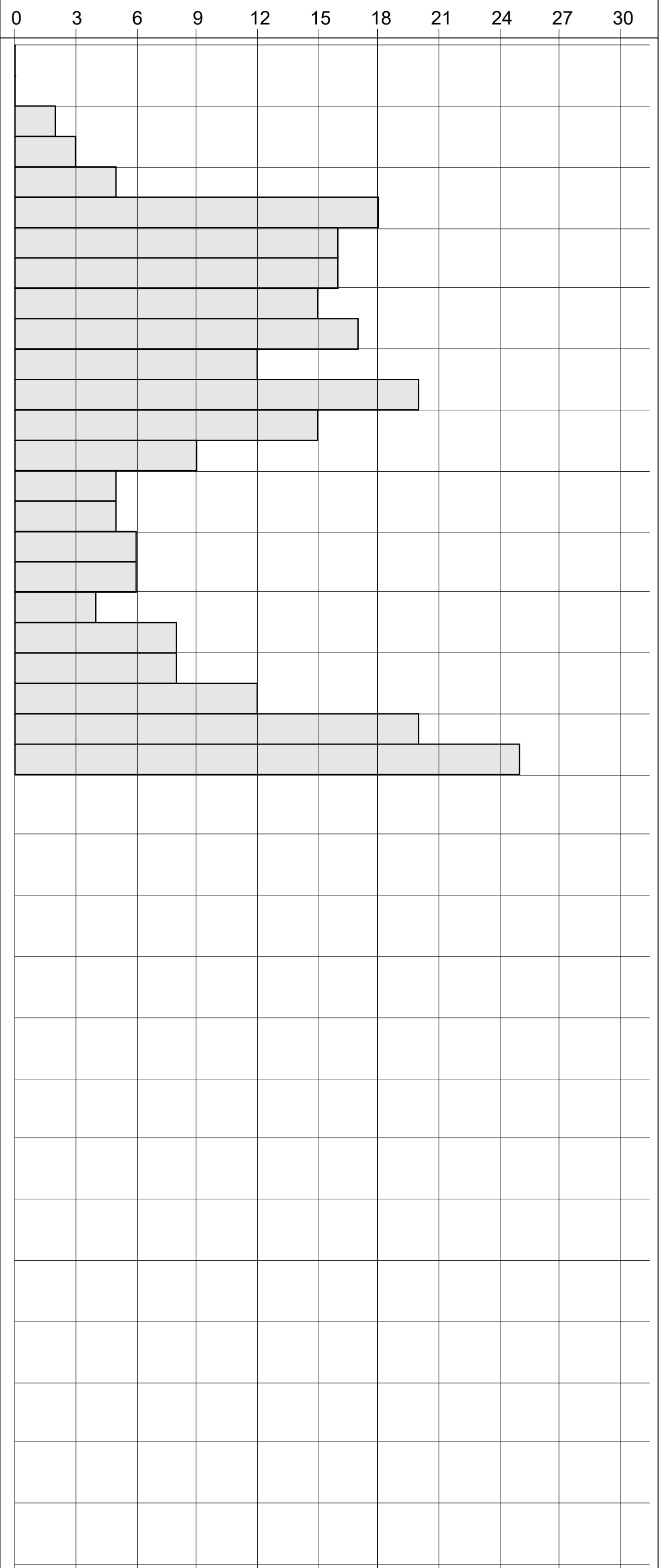
Site	Probe Number
Confey Leixlip	DP04

Method	Cone Dimensions	Ground Level (mOD)	Client	Job Number
Dynamic Probe Heavy (DPH) Hammer drop height 500mm Hammer weight 50kg	Diameter 43.7mm, Angle 90°	55.42	Corrigan Hodnett	14130-09-24
	Location	**Dates**	**Engineer**	**Sheet**
	701362.6 E 737111 N	18/10/2024	Corrigan Hodnett	1/1

Depth (m)	Blows for Depth Increment	Field Records
0.00-0.10	0	
0.10-0.20	0	
0.20-0.30	2	
0.30-0.40	3	
0.40-0.50	5	
0.50-0.60	18	
0.60-0.70	16	
0.70-0.80	16	
0.80-0.90	15	
0.90-1.00	17	
1.00-1.10	12	
1.10-1.20	20	
1.20-1.30	15	
1.30-1.40	9	
1.40-1.50	5	
1.50-1.60	5	
1.60-1.70	6	
1.70-1.80	6	
1.80-1.90	4	
1.90-2.00	8	
2.00-2.10	8	
2.10-2.20	12	
2.20-2.30	20	
2.30-2.40	25	

Level (mOD)	Depth (m)
55.42	0.00
54.92	0.50
54.42	1.00
53.92	1.50
53.42	2.00
52.92	2.50
52.42	3.00
51.92	3.50
51.42	4.00
50.92	4.50
50.42	5.00

Blows for Depth Increment



Remarks
Dynamic Probe refusal at 2.40m BGL, 25 blows over 100mm.

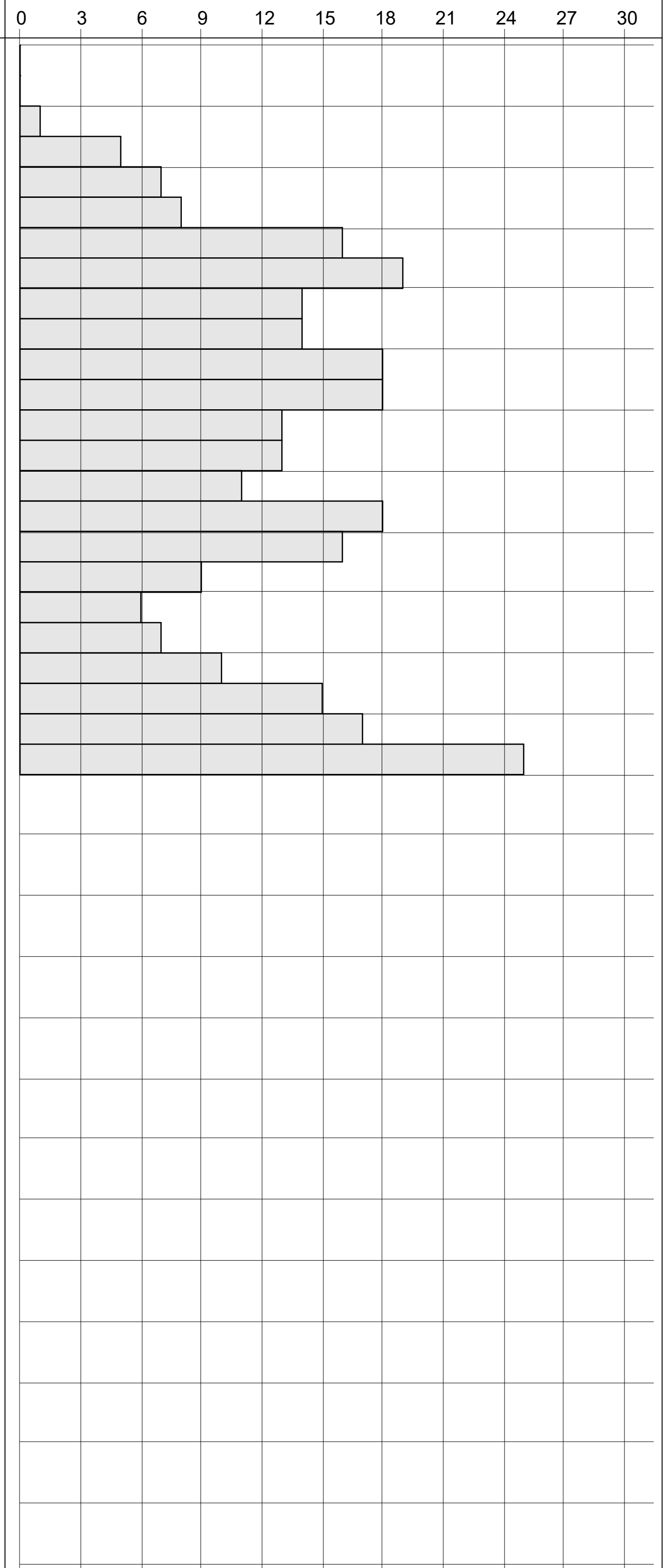
Scale (approx)	Logged By
1:25	CE

Figure No.
14130-09-24.DP04

Ground Investigations Ireland Ltd www.gii.ie			Site: Confey Leixlip	Probe Number: DP05
Method: Dynamic Probe Heavy (DPH) Hammer drop height 500mm Hammer weight 50kg	Cone Dimensions: Diameter 43.7mm, Angle 90°	Ground Level (mOD): 55.48	Client: Corrigan Hodnett	Job Number: 14130-09-24
	Location: 701328.7 E 737086.1 N	Dates: 18/10/2024	Engineer: Corrigan Hodnett	Sheet: 1/1

Depth (m)	Blows for Depth Increment	Field Records	Level (mOD)	Depth (m)
0.00-0.10	0		55.48	0.00
0.10-0.20	0			
0.20-0.30	1			
0.30-0.40	5			
0.40-0.50	7			
0.50-0.60	8		54.98	0.50
0.60-0.70	16			
0.70-0.80	19			
0.80-0.90	14			
0.90-1.00	14			
1.00-1.10	18		54.48	1.00
1.10-1.20	18			
1.20-1.30	13			
1.30-1.40	13			
1.40-1.50	11			
1.50-1.60	18		53.98	1.50
1.60-1.70	16			
1.70-1.80	9			
1.80-1.90	6			
1.90-2.00	7			
2.00-2.10	10		53.48	2.00
2.10-2.20	15			
2.20-2.30	17			
2.30-2.40	25			
			52.98	2.50
			52.48	3.00
			51.98	3.50
			51.48	4.00
			50.98	4.50
			50.48	5.00

Blows for Depth Increment



Remarks
Dynamic Probe refusal at 2.40m BGL, 25 blows over 100mm.

Scale (approx)	Logged By
1:25	CE

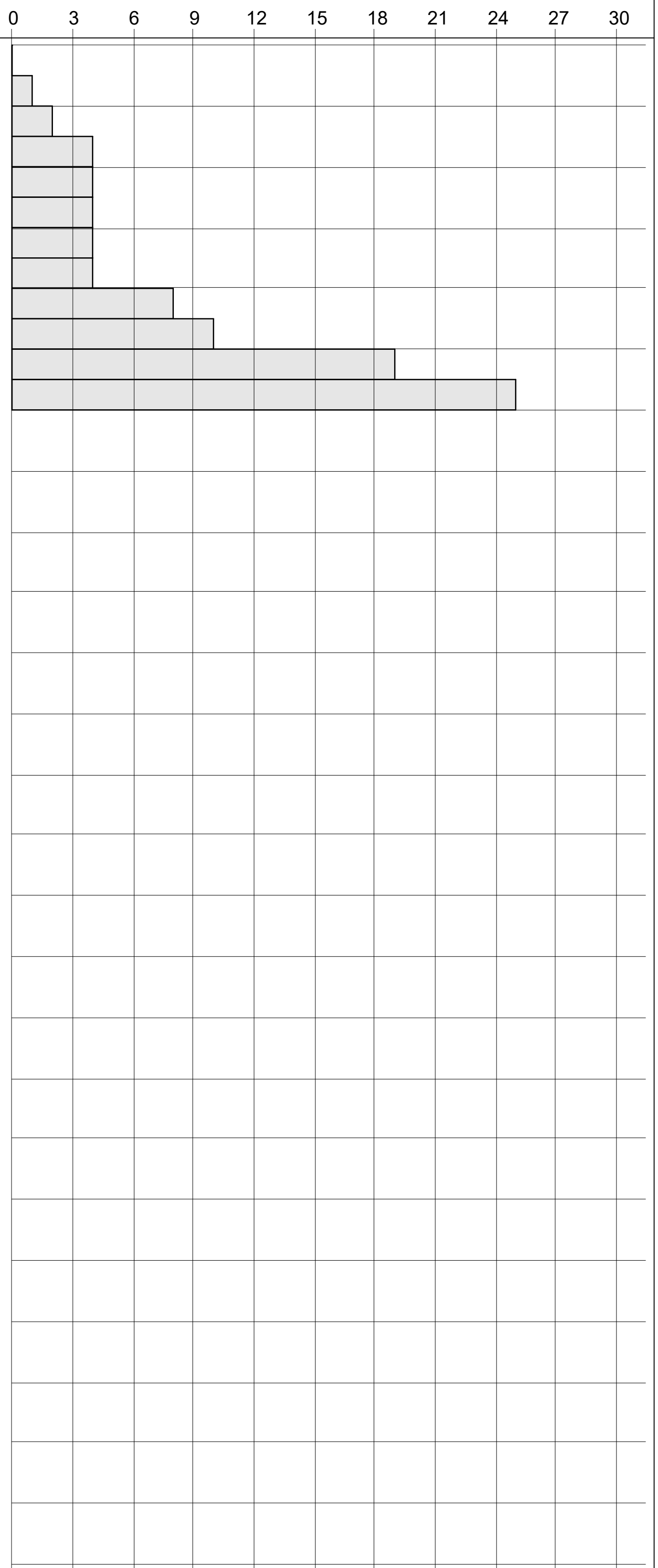
Figure No. 14130-09-24.DP05

Ground Investigations Ireland Ltd www.gii.ie		**Site** Confey Leixlip	**Probe Number** DP06
Method Dynamic Probe Heavy (DPH) Hammer drop height 500mm Hammer weight 50kg	**Cone Dimensions** Diameter 43.7mm, Angle 90° **Location** 701342.7 E 737121.6 N	**Ground Level (mOD)** 55.61 **Dates** 18/10/2024	**Client** Corrigan Hodnett **Engineer** Corrigan Hodnett	**Job Number** 14130-09-24 **Sheet** 1/1

Depth (m)	Blows for Depth Increment	Field Records
0.00-0.10	0	
0.10-0.20	1	
0.20-0.30	2	
0.30-0.40	4	
0.40-0.50	4	
0.50-0.60	4	
0.60-0.70	4	
0.70-0.80	4	
0.80-0.90	8	
0.90-1.00	10	
1.00-1.10	19	
1.10-1.20	25	

Level (mOD)	Depth (m)
55.61	0.00
55.11	0.50
54.61	1.00
54.11	1.50
53.61	2.00
53.11	2.50
52.61	3.00
52.11	3.50
51.61	4.00
51.11	4.50
50.61	5.00

Blows for Depth Increment



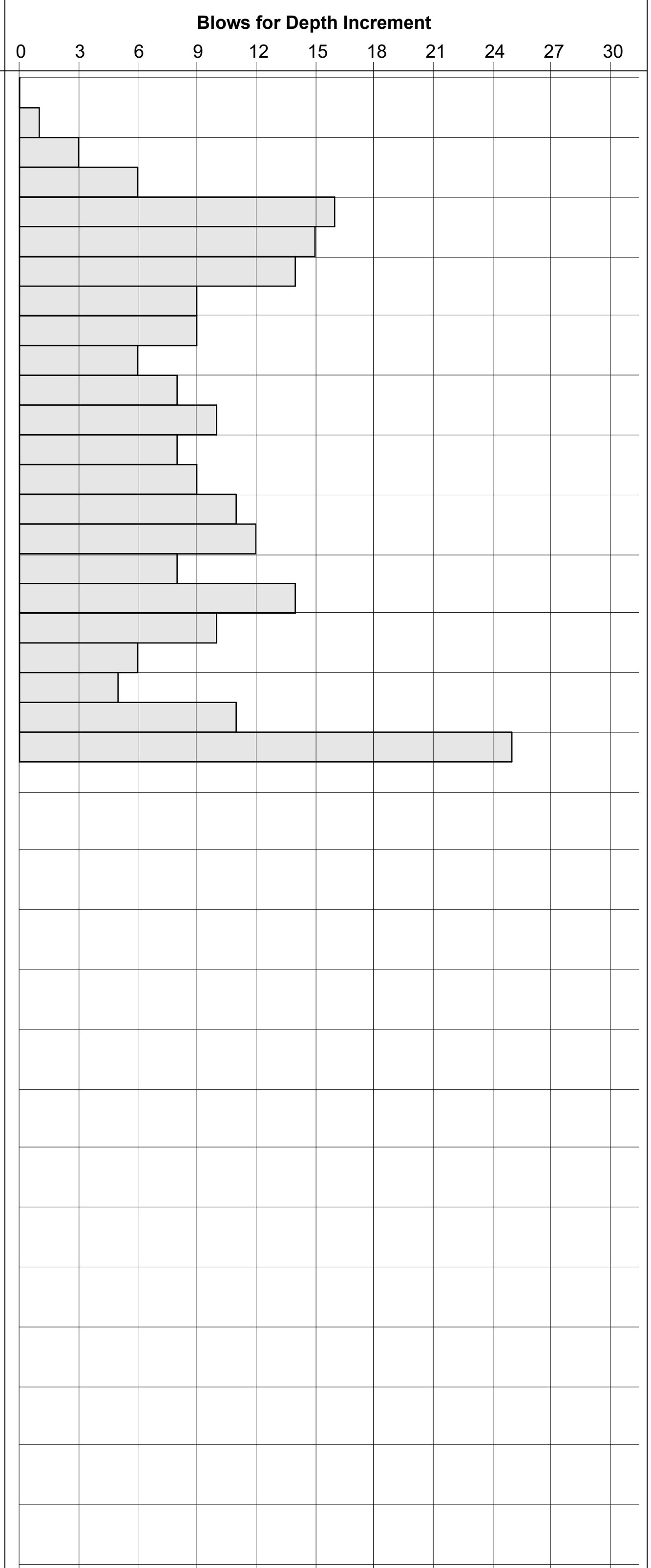
Remarks
Dynamic Probe refusal at 1.20m BGL, 25 blows over 100mm.

Scale (approx)	Logged By
1:25	CE

Figure No.
14130-09-24.DP06

Ground Investigations Ireland Ltd www.gii.ie		Site: Confey Leixlip	Probe Number: DP07
Method: Dynamic Probe Heavy (DPH), Hammer drop height 500mm, Hammer weight 50kg	**Cone Dimensions**: Diameter 43.7mm, Angle 90°	**Ground Level (mOD)**: 55.52	**Client**: Corrigan Hodnett	**Job Number**: 14130-09-24
	Location: 701302 E 737098.3 N	**Dates**: 18/10/2024	**Engineer**: Corrigan Hodnett	**Sheet**: 1/1

Depth (m)	Blows for Depth Increment	Field Records	Level (mOD)	Depth (m)
0.00-0.10	0		55.52	0.00
0.10-0.20	1			
0.20-0.30	3			
0.30-0.40	6			
0.40-0.50	16			
0.50-0.60	15		55.02	0.50
0.60-0.70	14			
0.70-0.80	9			
0.80-0.90	9			
0.90-1.00	6			
1.00-1.10	8		54.52	1.00
1.10-1.20	10			
1.20-1.30	8			
1.30-1.40	9			
1.40-1.50	11			
1.50-1.60	12		54.02	1.50
1.60-1.70	8			
1.70-1.80	14			
1.80-1.90	10			
1.90-2.00	6			
2.00-2.10	5		53.52	2.00
2.10-2.20	11			
2.20-2.30	25			
			53.02	2.50
			52.52	3.00
			52.02	3.50
			51.52	4.00
			51.02	4.50
			50.52	5.00



Remarks
Dynamic Probe refusal at 2.30m BGL, 25 blows over 100mm.

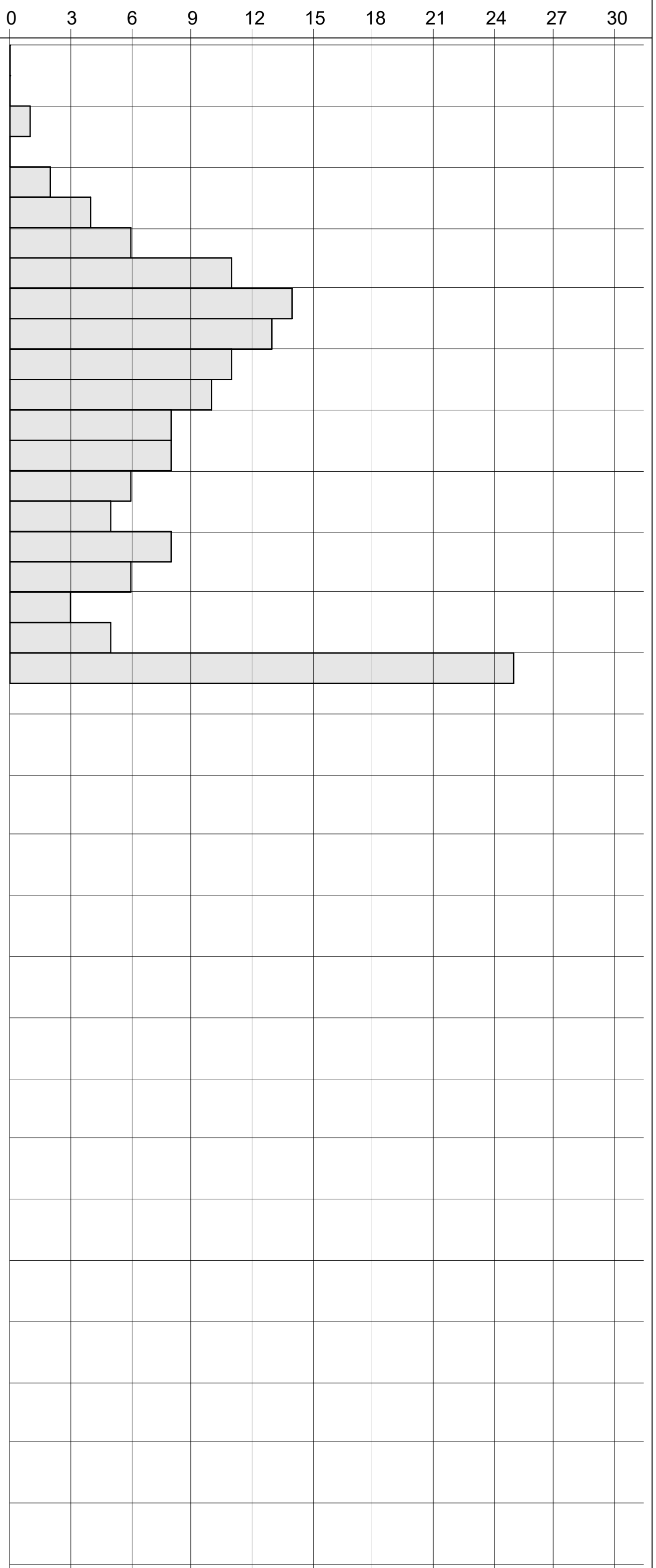
Scale (approx)	Logged By
1:25	CE

Figure No. 14130-09-24.DP07

Ground Investigations Ireland Ltd www.gii.ie			Site Confey Leixlip	Probe Number **DP08**
Method Dynamic Probe Heavy (DPH) Hammer drop height 500mm Hammer weight 50kg	**Cone Dimensions** Diameter 43.7mm, Angle 90°	**Ground Level (mOD)** 55.32	**Client** Corrigan Hodnett	**Job Number** 14130-09-24
	Location 701297.5 E 737076.3 N	**Dates** 18/10/2024	**Engineer** Corrigan Hodnett	**Sheet** 1/1

Depth (m)	Blows for Depth Increment	Field Records	Level (mOD)	Depth (m)
0.00-0.10	0		55.32	0.00
0.10-0.20	0			
0.20-0.30	1			
0.30-0.40	0			
0.40-0.50	2			
0.50-0.60	4		54.82	0.50
0.60-0.70	6			
0.70-0.80	11			
0.80-0.90	14			
0.90-1.00	13			
1.00-1.10	11		54.32	1.00
1.10-1.20	10			
1.20-1.30	8			
1.30-1.40	8			
1.40-1.50	6			
1.50-1.60	5		53.82	1.50
1.60-1.70	8			
1.70-1.80	6			
1.80-1.90	3			
1.90-2.00	5			
2.00-2.10	25		53.32	2.00
			52.82	2.50
			52.32	3.00
			51.82	3.50
			51.32	4.00
			50.82	4.50
			50.32	5.00

Blows for Depth Increment



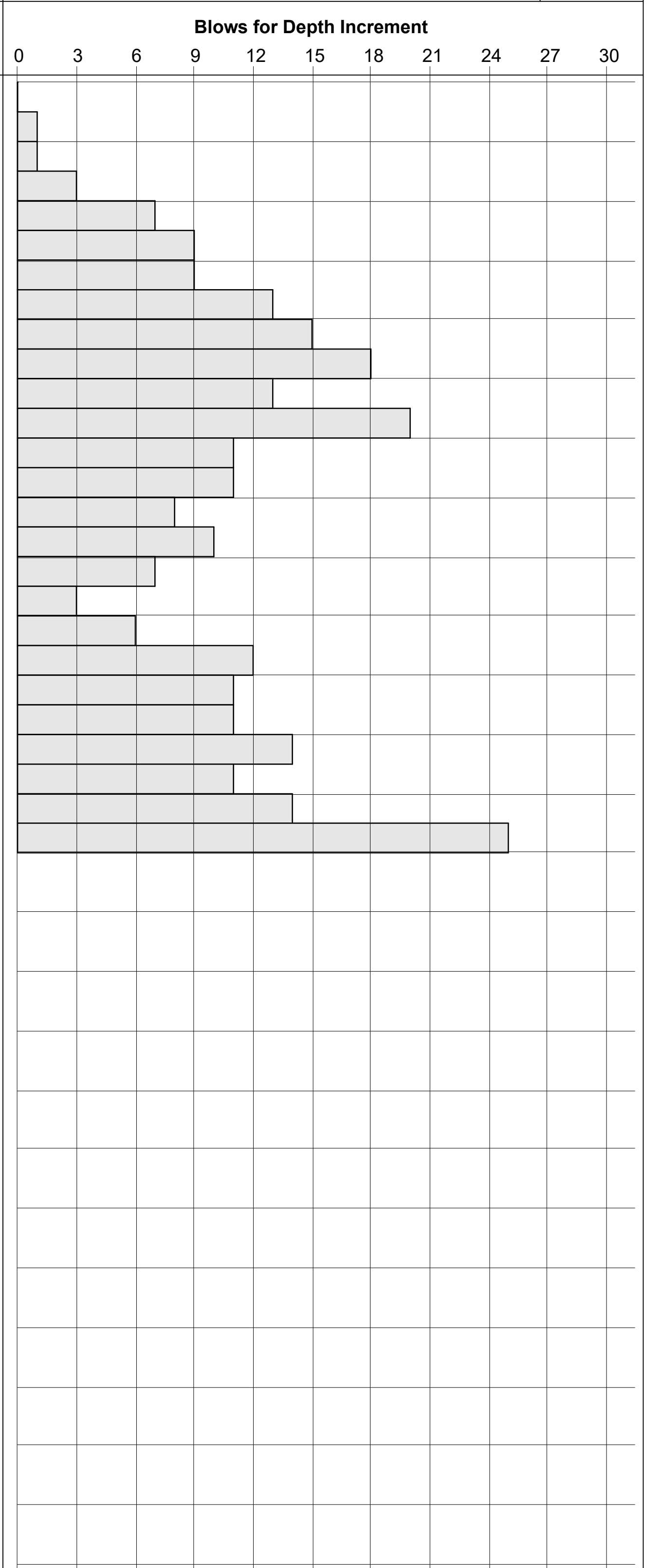
Remarks
Dynamic Probe refusal at 2.10m BGL, 25 blows over 100mm.

Scale (approx)	Logged By
1:25	CE

Figure No.
14130-09-24.DP08

Ground Investigations Ireland Ltd www.gii.ie		Site Confey Leixlip	Probe Number DP09
Method Dynamic Probe Heavy (DPH) Hammer drop height 500mm Hammer weight 50kg	**Cone Dimensions** Diameter 43.7mm, Angle 90° **Location** 701308.2 E 737140.3 N	**Ground Level (mOD)** 55.50 **Dates** 18/10/2024	**Client** Corrigan Hodnett **Engineer** Corrigan Hodnett	**Job Number** 14130-09-24 **Sheet** 1/1

Depth (m)	Blows for Depth Increment	Field Records	Level (mOD)	Depth (m)
0.00-0.10	0		55.50	0.00
0.10-0.20	1			
0.20-0.30	1			
0.30-0.40	3			
0.40-0.50	7			
0.50-0.60	9		55.00	0.50
0.60-0.70	9			
0.70-0.80	13			
0.80-0.90	15			
0.90-1.00	18			
1.00-1.10	13		54.50	1.00
1.10-1.20	20			
1.20-1.30	11			
1.30-1.40	11			
1.40-1.50	8			
1.50-1.60	10		54.00	1.50
1.60-1.70	7			
1.70-1.80	3			
1.80-1.90	6			
1.90-2.00	12			
2.00-2.10	11		53.50	2.00
2.10-2.20	11			
2.20-2.30	14			
2.30-2.40	11			
2.40-2.50	14			
2.50-2.60	25		53.00	2.50
			52.50	3.00
			52.00	3.50
			51.50	4.00
			51.00	4.50
			50.50	5.00



Remarks
Dynamic Probe refusal at 2.60m BGL, 25 blows over 100mm.

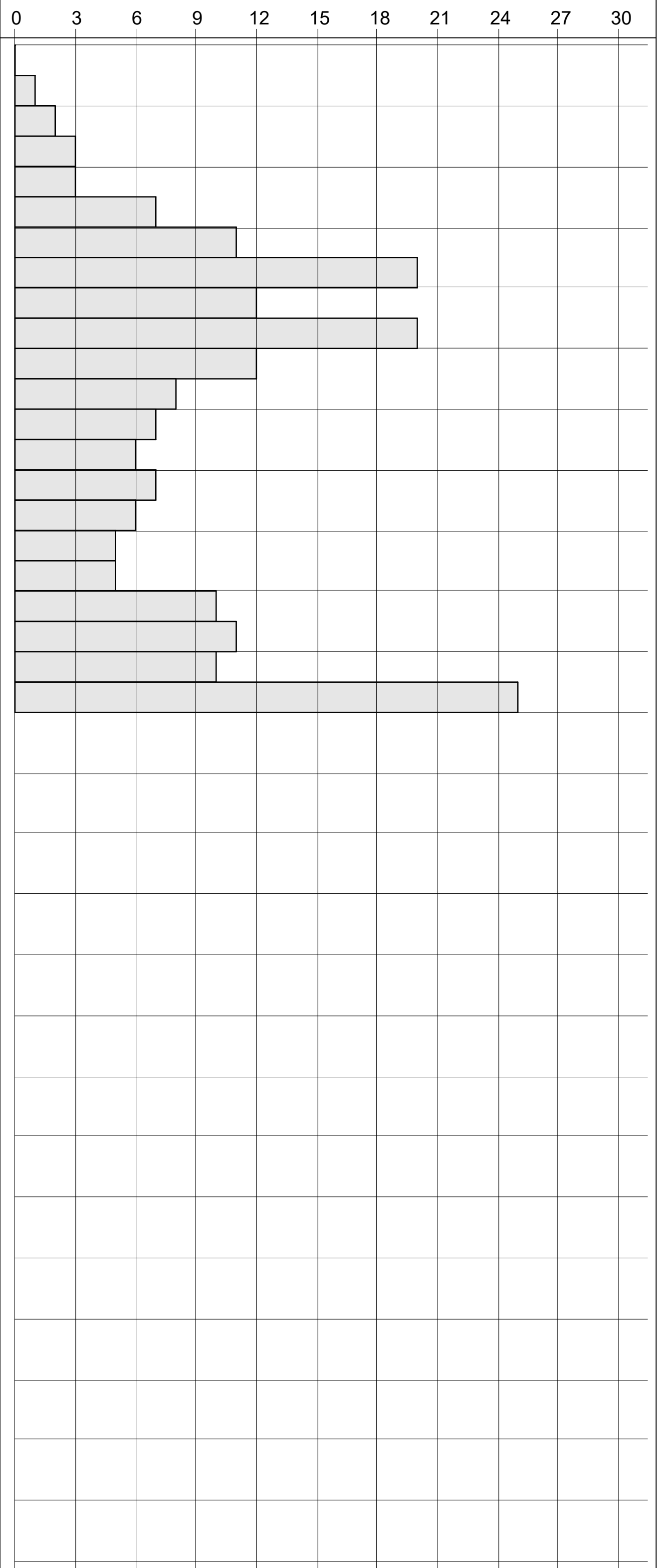
Scale (approx)	Logged By
1:25	CE

Figure No.
14130-09-24.DP09

Ground Investigations Ireland Ltd www.gii.ie			Site: Confey Leixlip	Probe Number: DP10
Method Dynamic Probe Heavy (DPH) Hammer drop height 500mm Hammer weight 50kg	**Cone Dimensions** Diameter 43.7mm, Angle 90°	**Ground Level (mOD)** 55.32	**Client** Corrigan Hodnett	**Job Number** 14130-09-24
	Location 701288.2 E 737149.6 N	**Dates** 18/10/2024	**Engineer** Corrigan Hodnett	**Sheet** 1/1

Depth (m)	Blows for Depth Increment	Field Records	Level (mOD)	Depth (m)
0.00-0.10	0		55.32	0.00
0.10-0.20	1			
0.20-0.30	2			
0.30-0.40	3			
0.40-0.50	3			
0.50-0.60	7		54.82	0.50
0.60-0.70	11			
0.70-0.80	20			
0.80-0.90	12			
0.90-1.00	20			
1.00-1.10	12		54.32	1.00
1.10-1.20	8			
1.20-1.30	7			
1.30-1.40	6			
1.40-1.50	7			
1.50-1.60	6		53.82	1.50
1.60-1.70	5			
1.70-1.80	5			
1.80-1.90	10			
1.90-2.00	11			
2.00-2.10	10		53.32	2.00
2.10-2.20	25			
			52.82	2.50
			52.32	3.00
			51.82	3.50
			51.32	4.00
			50.82	4.50
			50.32	5.00

Blows for Depth Increment



Remarks
Dynamic Probe refusal at 2.20m BGL, 25 blows over 100mm.

Scale (approx)	Logged By
1:25	CE

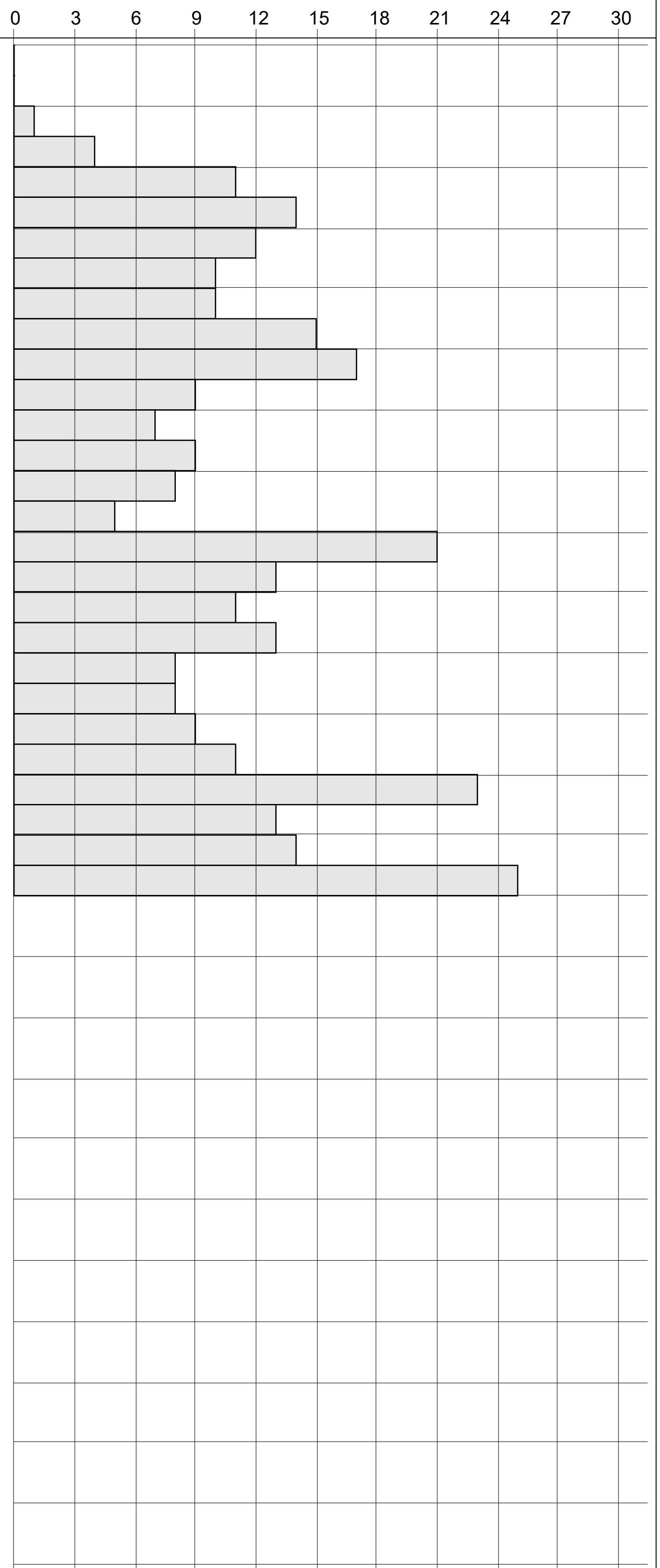
Figure No. 14130-09-24.DP10

Ground Investigations Ireland Ltd www.gii.ie		Site: Confey Leixlip	Probe Number: DP11
Method: Dynamic Probe Heavy (DPH), Hammer drop height 500mm, Hammer weight 50kg	Cone Dimensions: Diameter 43.7mm, Angle 90°	Ground Level (mOD): 55.25	Client: Corrigan Hodnett	Job Number: 14130-09-24
	Location: 701272.8 E 737088.9 N	Dates: 18/10/2024	Engineer: Corrigan Hodnett	Sheet: 1/1

Depth (m)	Blows for Depth Increment	Field Records
0.00-0.10	0	
0.10-0.20	0	
0.20-0.30	1	
0.30-0.40	4	
0.40-0.50	11	
0.50-0.60	14	
0.60-0.70	12	
0.70-0.80	10	
0.80-0.90	10	
0.90-1.00	15	
1.00-1.10	17	
1.10-1.20	9	
1.20-1.30	7	
1.30-1.40	9	
1.40-1.50	8	
1.50-1.60	5	
1.60-1.70	21	
1.70-1.80	13	
1.80-1.90	11	
1.90-2.00	13	
2.00-2.10	8	
2.10-2.20	8	
2.20-2.30	9	
2.30-2.40	11	
2.40-2.50	23	
2.50-2.60	13	
2.60-2.70	14	
2.70-2.80	25	

Level (mOD)	Depth (m)
55.25	0.00
54.75	0.50
54.25	1.00
53.75	1.50
53.25	2.00
52.75	2.50
52.25	3.00
51.75	3.50
51.25	4.00
50.75	4.50
50.25	5.00

Blows for Depth Increment



Remarks
Dynamic Probe refusal at 2.80m BGL, 25 blows over 100mm.

Scale (approx)	Logged By
1:25	CE

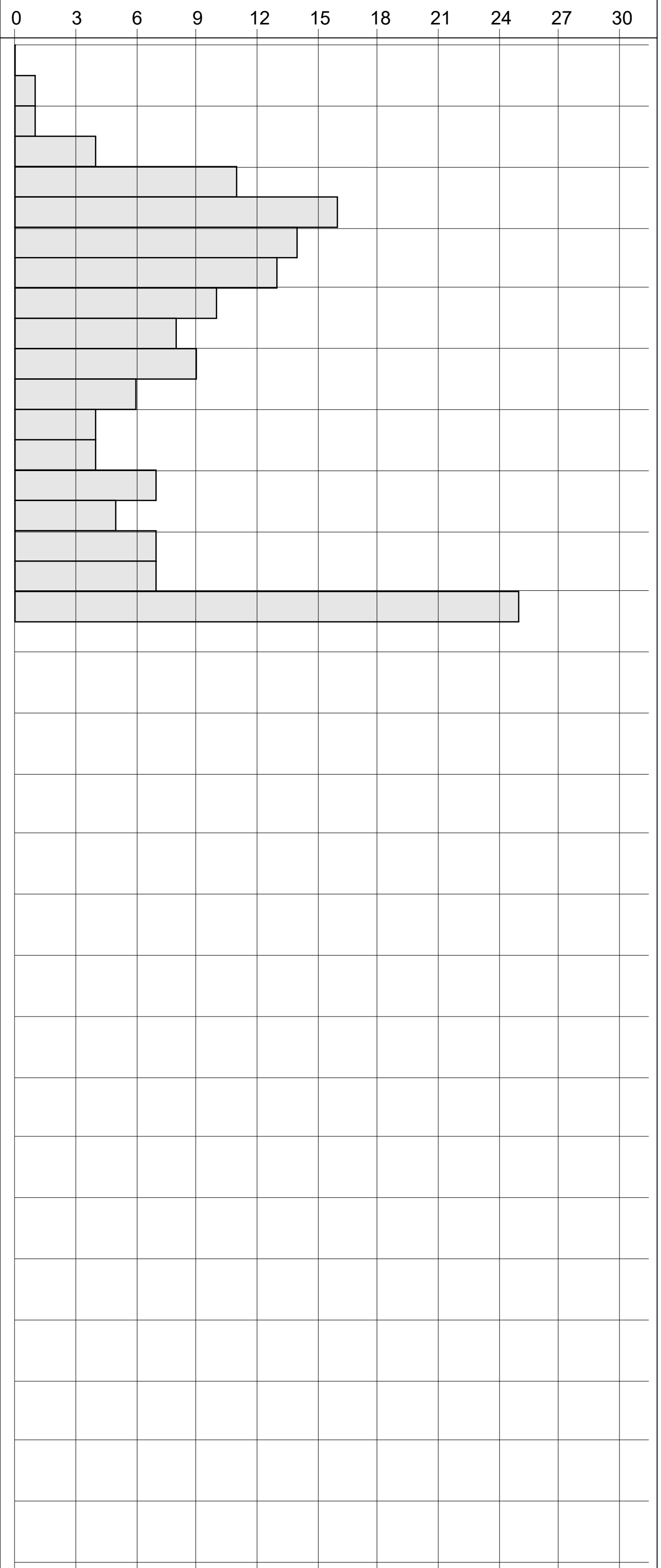
Figure No. 14130-09-24.DP11

Ground Investigations Ireland Ltd www.gii.ie			Site Confey Leixlip	Probe Number DP12
Method Dynamic Probe Heavy (DPH) Hammer drop height 500mm Hammer weight 50kg	**Cone Dimensions** Diameter 43.7mm, Angle 90°	**Ground Level (mOD)** 55.16	**Client** Corrigan Hodnett	**Job Number** 14130-09-24
	Location 701244.4 E 737107.4 N	**Dates** 18/10/2024	**Engineer** Corrigan Hodnett	**Sheet** 1/1

Depth (m)	Blows for Depth Increment	Field Records
0.00-0.10	0	
0.10-0.20	1	
0.20-0.30	1	
0.30-0.40	4	
0.40-0.50	11	
0.50-0.60	16	
0.60-0.70	14	
0.70-0.80	13	
0.80-0.90	10	
0.90-1.00	8	
1.00-1.10	9	
1.10-1.20	6	
1.20-1.30	4	
1.30-1.40	4	
1.40-1.50	7	
1.50-1.60	5	
1.60-1.70	7	
1.70-1.80	7	
1.80-1.90	25	

Level (mOD)	Depth (m)
55.16	0.00
54.66	0.50
54.16	1.00
53.66	1.50
53.16	2.00
52.66	2.50
52.16	3.00
51.66	3.50
51.16	4.00
50.66	4.50
50.16	5.00

Blows for Depth Increment



Remarks
Dynamic Probe refusal at 1.90m BGL, 25 blows over 100mm.

Scale (approx)	Logged By
1:25	CE

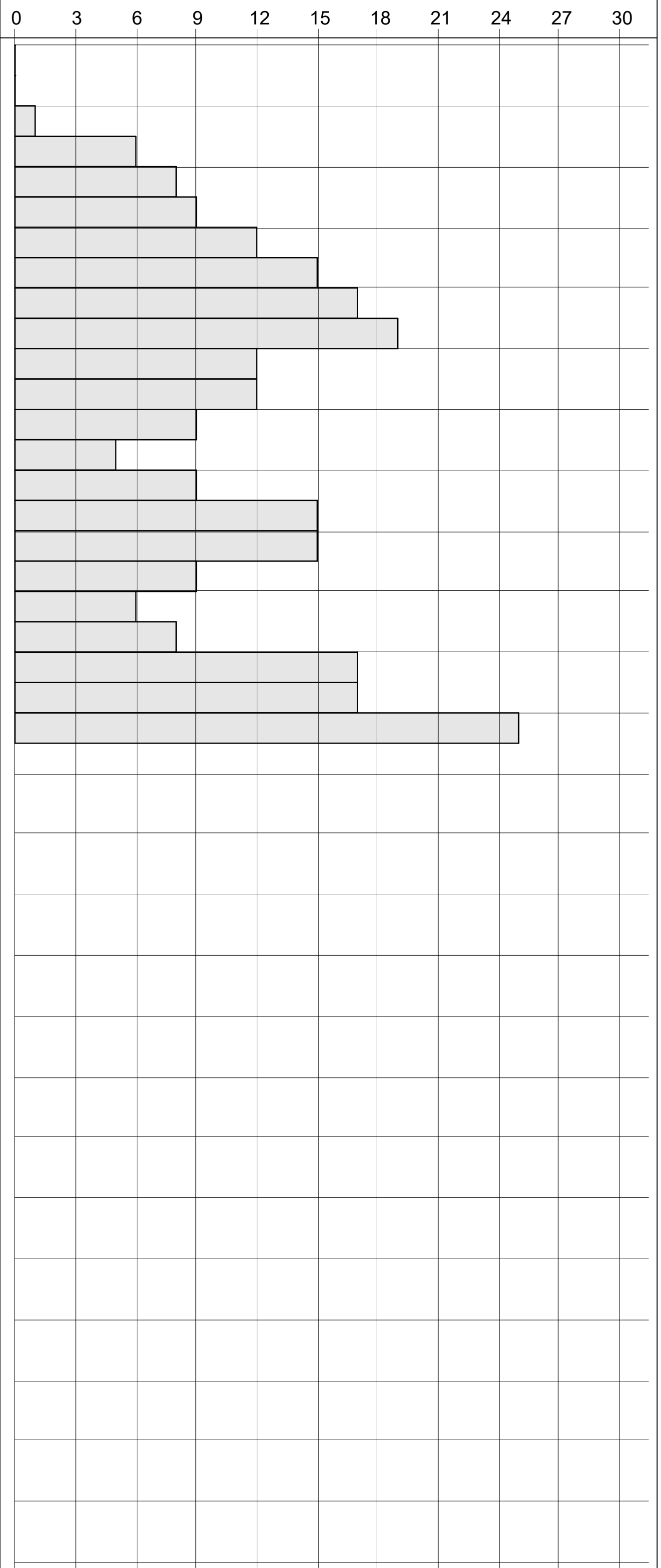
Figure No.
14130-09-24.DP12

Ground Investigations Ireland Ltd www.gii.ie		Site: Confey Leixlip	Probe Number: DP13
Method: Dynamic Probe Heavy (DPH) Hammer drop height 500mm Hammer weight 50kg	Cone Dimensions: Diameter 43.7mm, Angle 90°	Ground Level (mOD): 55.07	Client: Corrigan Hodnett	Job Number: 14130-09-24
	Location: 701232.1 E 737082.4 N	Dates: 18/10/2024	Engineer: Corrigan Hodnett	Sheet: 1/1

Depth (m)	Blows for Depth Increment	Field Records
0.00-0.10	0	
0.10-0.20	0	
0.20-0.30	1	
0.30-0.40	6	
0.40-0.50	8	
0.50-0.60	9	
0.60-0.70	12	
0.70-0.80	15	
0.80-0.90	17	
0.90-1.00	19	
1.00-1.10	12	
1.10-1.20	12	
1.20-1.30	9	
1.30-1.40	5	
1.40-1.50	9	
1.50-1.60	15	
1.60-1.70	15	
1.70-1.80	9	
1.80-1.90	6	
1.90-2.00	8	
2.00-2.10	17	
2.10-2.20	17	
2.20-2.30	25	

Level (mOD)	Depth (m)
55.07	0.00
54.57	0.50
54.07	1.00
53.57	1.50
53.07	2.00
52.57	2.50
52.07	3.00
51.57	3.50
51.07	4.00
50.57	4.50
50.07	5.00

Blows for Depth Increment



Remarks
Dynamic Probe refusal at 2.30m BGL, 25 blows over 100mm.

Scale (approx)	Logged By
1:25	CE

Figure No.
14130-09-24.DP13

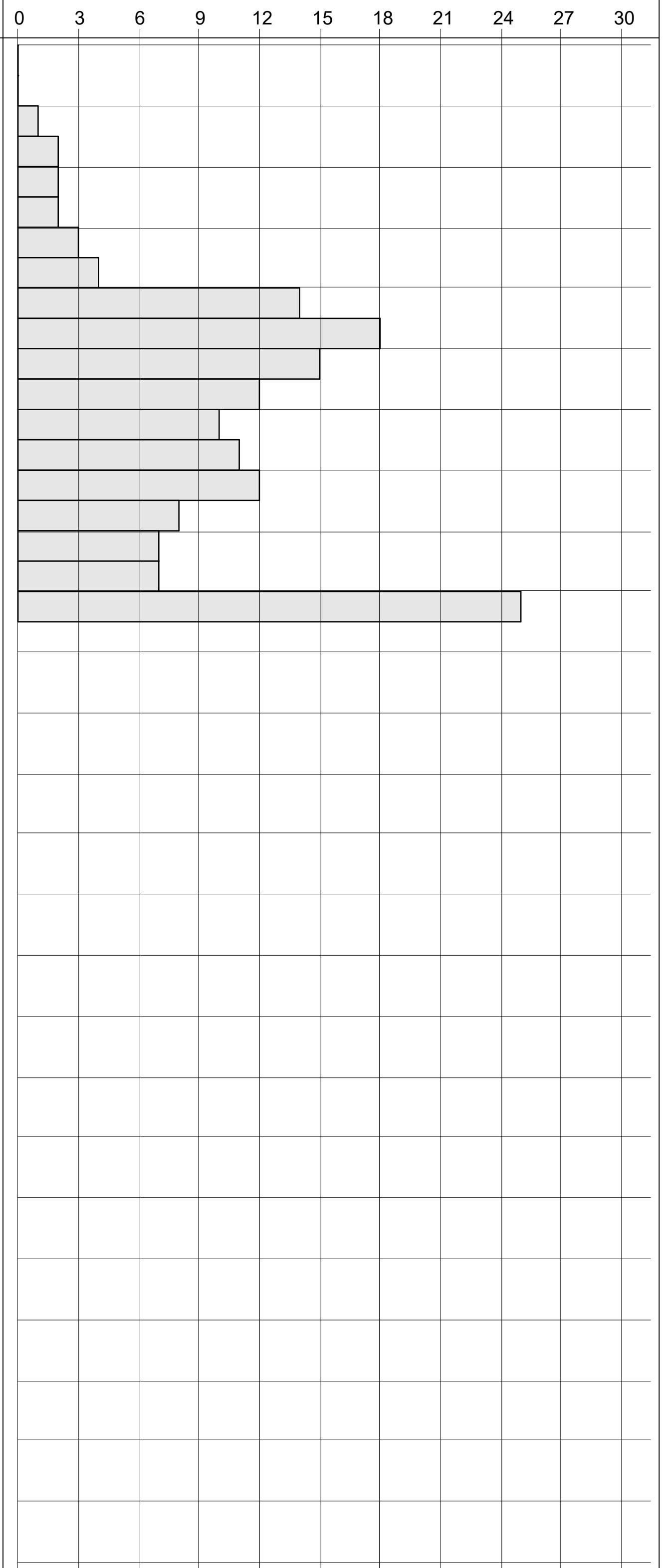
Ground Investigations Ireland Ltd www.gii.ie	Site: Confey Leixlip	Probe Number: DP14

Method	Cone Dimensions	Ground Level (mOD)	Client	Job Number
Dynamic Probe Heavy (DPH) Hammer drop height 500mm Hammer weight 50kg	Diameter 43.7mm, Angle 90°	55.18	Corrigan Hodnett	14130-09-24
	Location	**Dates**	**Engineer**	**Sheet**
	701226.1 E 737116.7 N	18/10/2024	Corrigan Hodnett	1/1

Depth (m)	Blows for Depth Increment	Field Records
0.00-0.10	0	
0.10-0.20	0	
0.20-0.30	1	
0.30-0.40	2	
0.40-0.50	2	
0.50-0.60	2	
0.60-0.70	3	
0.70-0.80	4	
0.80-0.90	14	
0.90-1.00	18	
1.00-1.10	15	
1.10-1.20	12	
1.20-1.30	10	
1.30-1.40	11	
1.40-1.50	12	
1.50-1.60	8	
1.60-1.70	7	
1.70-1.80	7	
1.80-1.90	25	

Level (mOD)	Depth (m)
55.18	0.00
54.68	0.50
54.18	1.00
53.68	1.50
53.18	2.00
52.68	2.50
52.18	3.00
51.68	3.50
51.18	4.00
50.68	4.50
50.18	5.00

Blows for Depth Increment



Remarks
Dynamic Probe refusal at 1.90m BGL, 25 blows over 100mm.

Scale (approx)	Logged By
1:25	CE

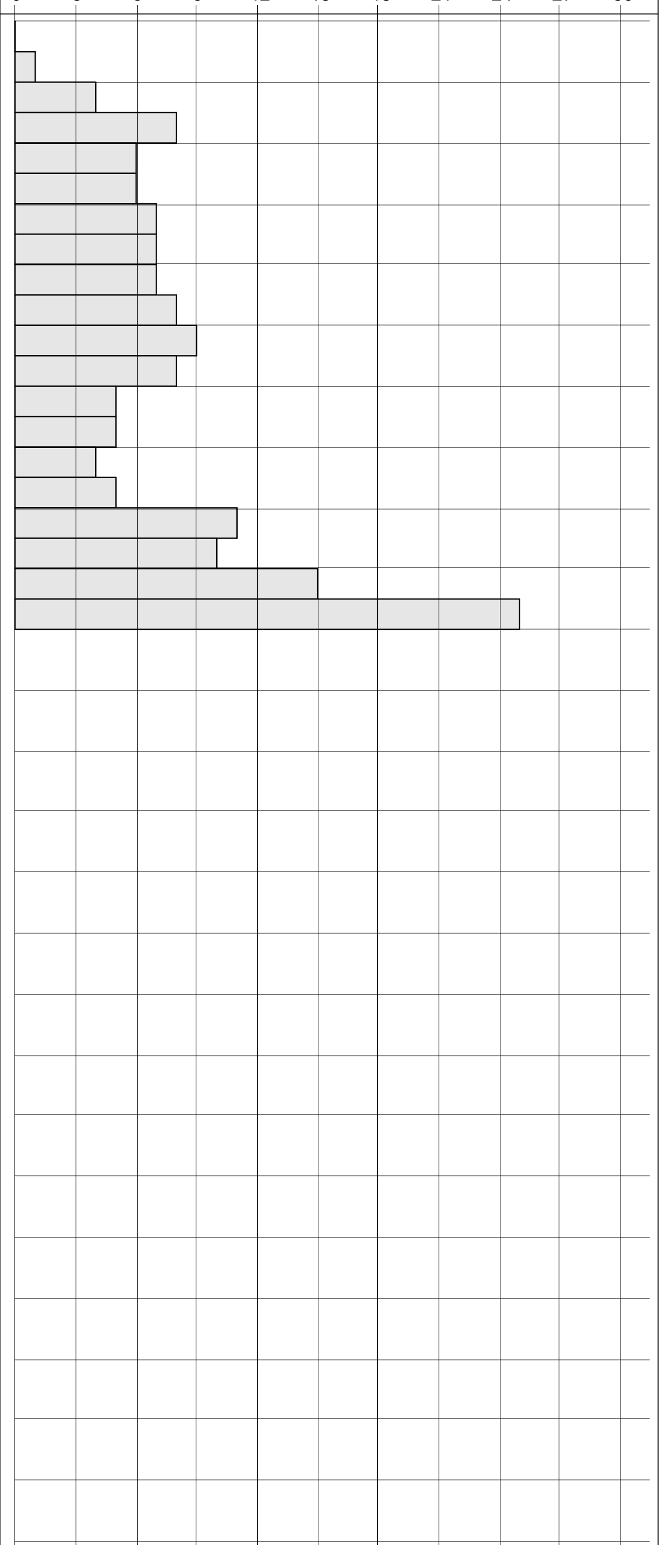
Figure No. 14130-09-24.DP14

Ground Investigations Ireland Ltd www.gii.ie			Site Confey Leixlip	Probe Number **DP15**
Method Dynamic Probe Heavy (DPH) Hammer drop height 500mm Hammer weight 50kg	**Cone Dimensions** Diameter 43.7mm, Angle 90°	**Ground Level (mOD)** 55.22	**Client** Corrigan Hodnett	**Job Number** 14130-09-24
	Location 701228.6 E 737158.1 N	**Dates** 18/10/2024	**Engineer** Corrigan Hodnett	**Sheet** 1/1

Depth (m)	Blows for Depth Increment	Field Records
0.00-0.10	0	
0.10-0.20	1	
0.20-0.30	4	
0.30-0.40	8	
0.40-0.50	6	
0.50-0.60	6	
0.60-0.70	7	
0.70-0.80	7	
0.80-0.90	7	
0.90-1.00	8	
1.00-1.10	9	
1.10-1.20	8	
1.20-1.30	5	
1.30-1.40	5	
1.40-1.50	4	
1.50-1.60	5	
1.60-1.70	11	
1.70-1.80	10	
1.80-1.90	15	
1.90-2.00	25	

Level (mOD)	Depth (m)
55.22	0.00
54.72	0.50
54.22	1.00
53.72	1.50
53.22	2.00
52.72	2.50
52.22	3.00
51.72	3.50
51.22	4.00
50.72	4.50
50.22	5.00

Blows for Depth Increment



Remarks
Dynamic Probe refusal at 2.00m BGL, 25 blows over 100mm.

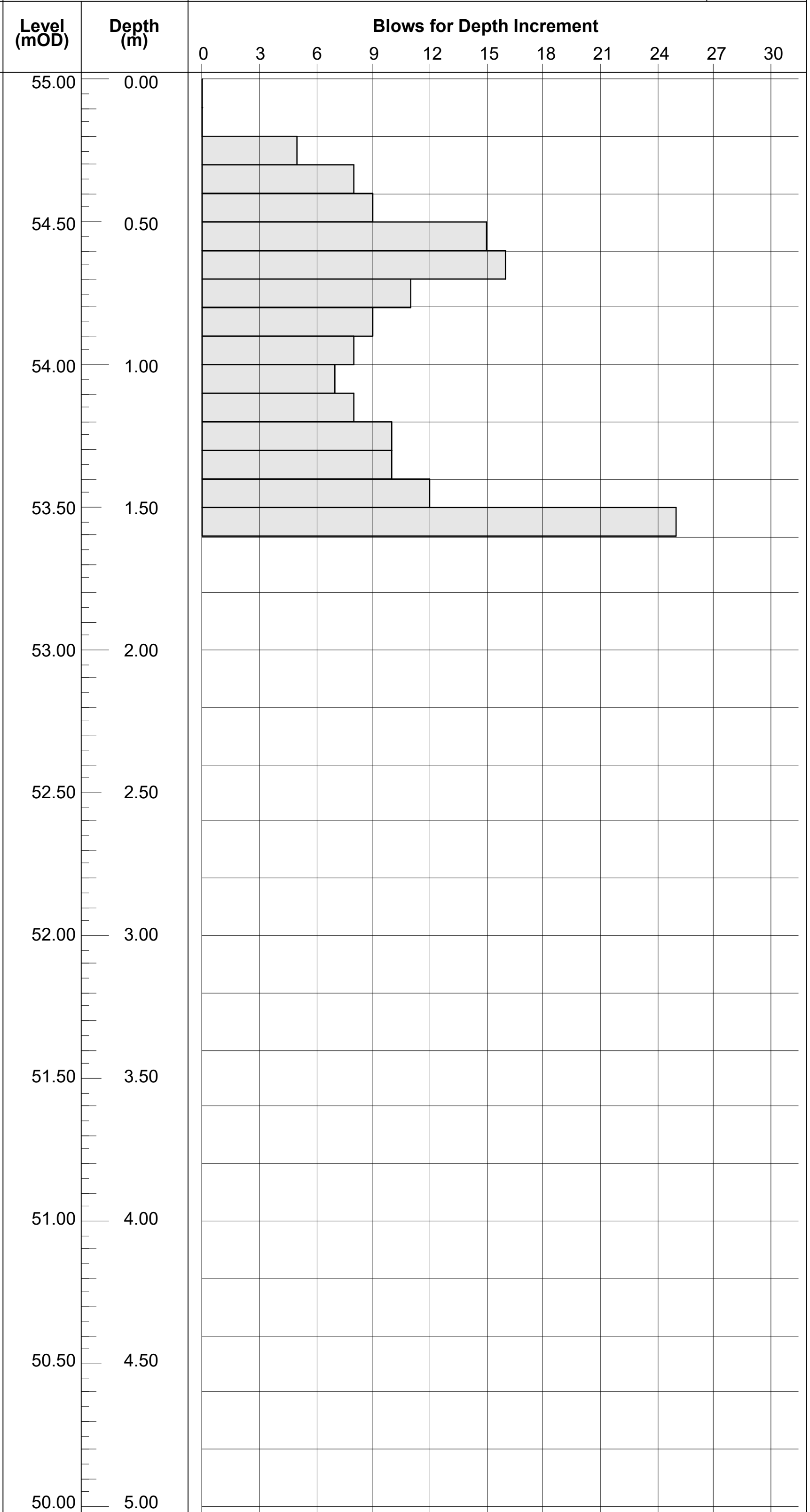
Scale (approx)	Logged By
1:25	CE

Figure No.
14130-09-24.DP15

Ground Investigations Ireland Ltd
www.gii.ie

Method Dynamic Probe Heavy (DPH) Hammer drop height 500mm Hammer weight 50kg	**Cone Dimensions** Diameter 43.7mm, Angle 90°	**Ground Level (mOD)** 55.00	**Site** Confey Leixlip	**Probe Number** **DP16**
	Location 701187.7 E 737108.6 N	**Dates** 24/10/2024	**Client** Corrigan Hodnett	**Job Number** 14130-09-24
			Engineer Corrigan Hodnett	**Sheet** 1/1

Depth (m)	Blows for Depth Increment	Field Records
0.00-0.10	0	
0.10-0.20	0	
0.20-0.30	5	
0.30-0.40	8	
0.40-0.50	9	
0.50-0.60	15	
0.60-0.70	16	
0.70-0.80	11	
0.80-0.90	9	
0.90-1.00	8	
1.00-1.10	7	
1.10-1.20	8	
1.20-1.30	10	
1.30-1.40	10	
1.40-1.50	12	
1.50-1.60	25	



Remarks
Dynamic Probe refusal at 1.60m BGL, 25 blows over 30mm.

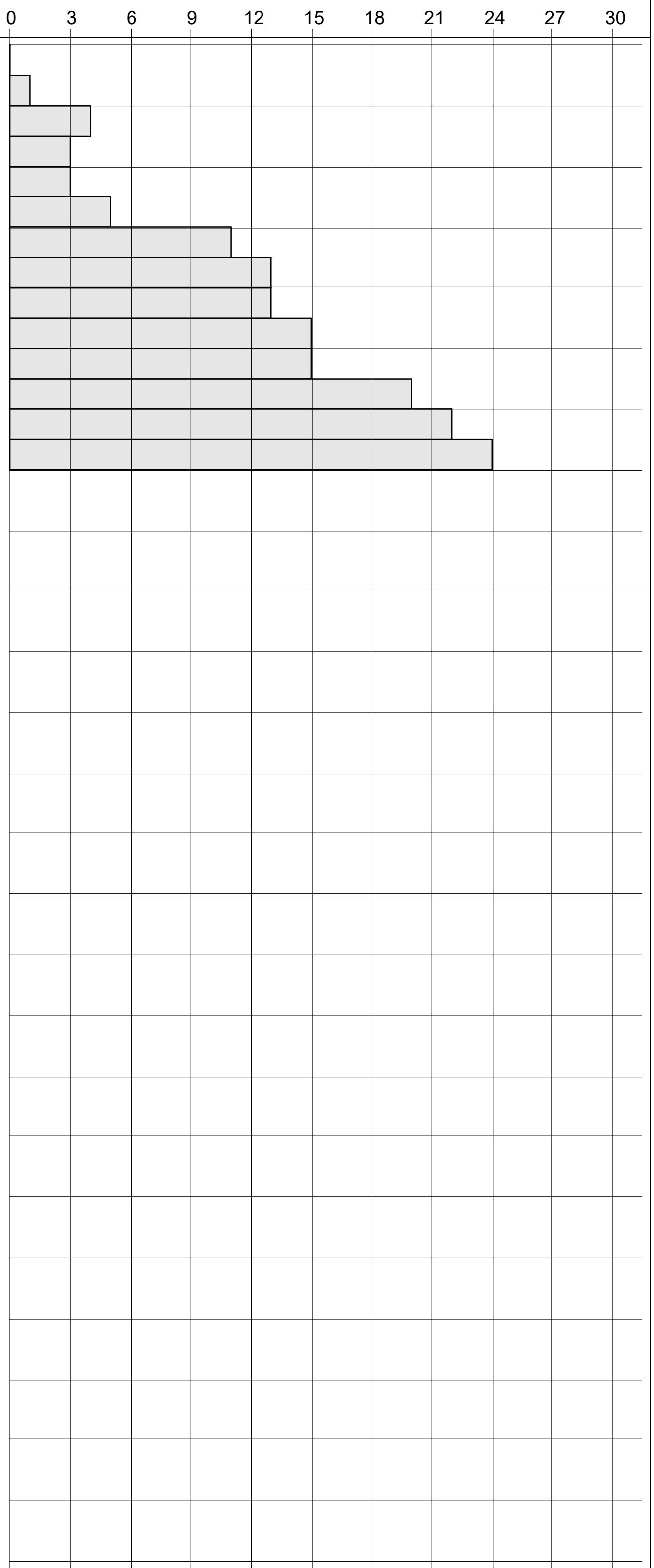
Scale (approx)	**Logged By**
1:25	CE

Figure No.
14130-09-24.DP16

Ground Investigations Ireland Ltd www.gii.ie			Site Confey Leixlip	Probe Number DP17
Method Dynamic Probe Heavy (DPH) Hammer drop height 500mm Hammer weight 50kg	Cone Dimensions Diameter 43.7mm, Angle 90°	Ground Level (mOD) 54.94	Client Corrigan Hodnett	Job Number 14130-09-24
	Location 701178.7 E 737083.3 N	Dates 24/10/2024	Engineer Corrigan Hodnett	Sheet 1/1

Depth (m)	Blows for Depth Increment	Field Records	Level (mOD)	Depth (m)
0.00-0.10	0		54.94	0.00
0.10-0.20	1			
0.20-0.30	4			
0.30-0.40	3			
0.40-0.50	3			
0.50-0.60	5		54.44	0.50
0.60-0.70	11			
0.70-0.80	13			
0.80-0.90	13			
0.90-1.00	15			
1.00-1.10	15		53.94	1.00
1.10-1.20	20			
1.20-1.30	22			
1.30-1.40	24			
			53.44	1.50
			52.94	2.00
			52.44	2.50
			51.94	3.00
			51.44	3.50
			50.94	4.00
			50.44	4.50
			49.94	5.00

Blows for Depth Increment



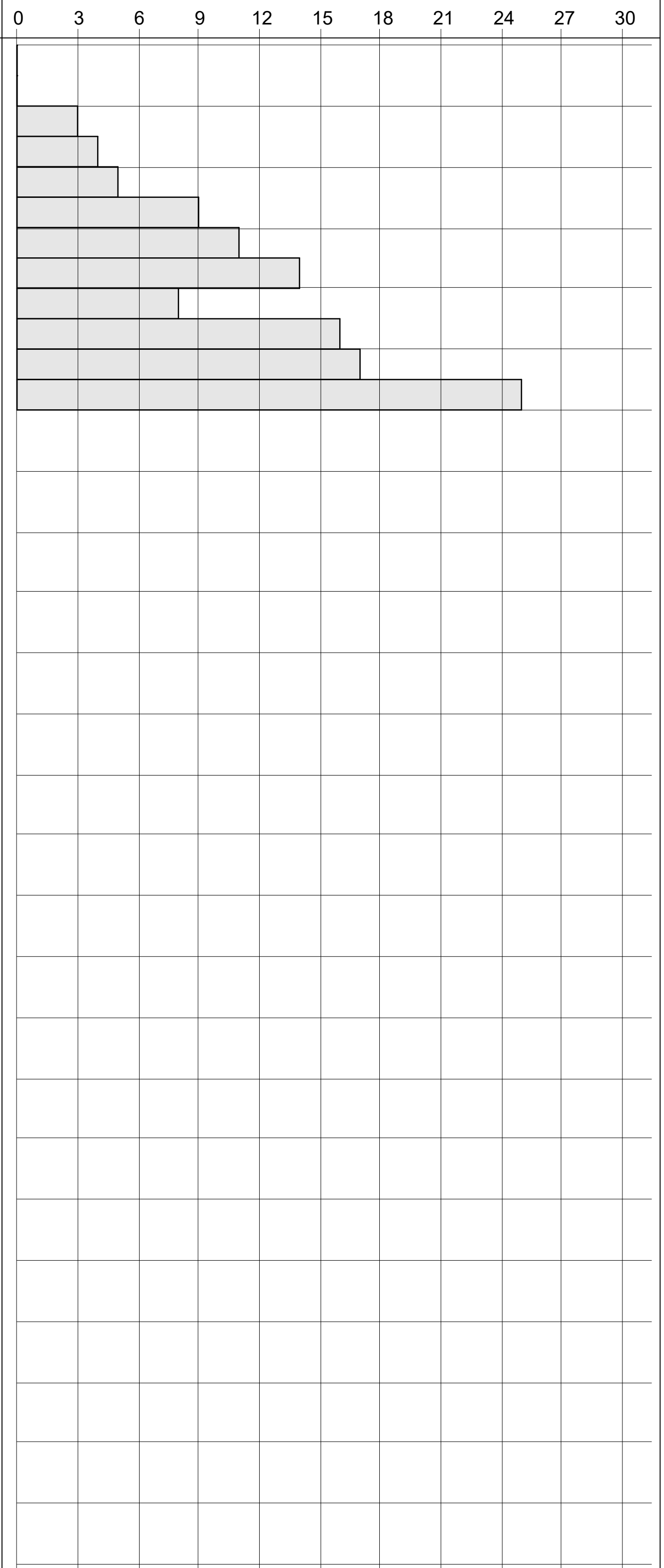
Remarks
Dynamic Probe refusal at 1.40m BGL, 24 blows over 100mm.

Scale (approx)	Logged By
1:25	CE
Figure No. 14130-09-24.DP17	

Ground Investigations Ireland Ltd www.gii.ie			Site: Confey Leixlip	Probe Number: DP18
Method: Dynamic Probe Heavy (DPH), Hammer drop height 500mm, Hammer weight 50kg	Cone Dimensions: Diameter 43.7mm, Angle 90°	Ground Level (mOD): 55.09	Client: Corrigan Hodnett	Job Number: 14130-09-24
	Location: 701169.6 E 737125.3 N	Dates: 24/10/2024	Engineer: Corrigan Hodnett	Sheet: 1/1

Depth (m)	Blows for Depth Increment	Field Records	Level (mOD)	Depth (m)
0.00-0.10	0		55.09	0.00
0.10-0.20	0			
0.20-0.30	3			
0.30-0.40	4			
0.40-0.50	5			
0.50-0.60	9		54.59	0.50
0.60-0.70	11			
0.70-0.80	14			
0.80-0.90	8			
0.90-1.00	16			
1.00-1.10	17		54.09	1.00
1.10-1.20	25			
			53.59	1.50
			53.09	2.00
			52.59	2.50
			52.09	3.00
			51.59	3.50
			51.09	4.00
			50.59	4.50
			50.09	5.00

Blows for Depth Increment



Remarks
Dynamic Probe refusal at 1.20m BGL, 25 blows over 60mm.

Scale (approx)	Logged By
1:25	CE

Figure No. 14130-09-24.DP18

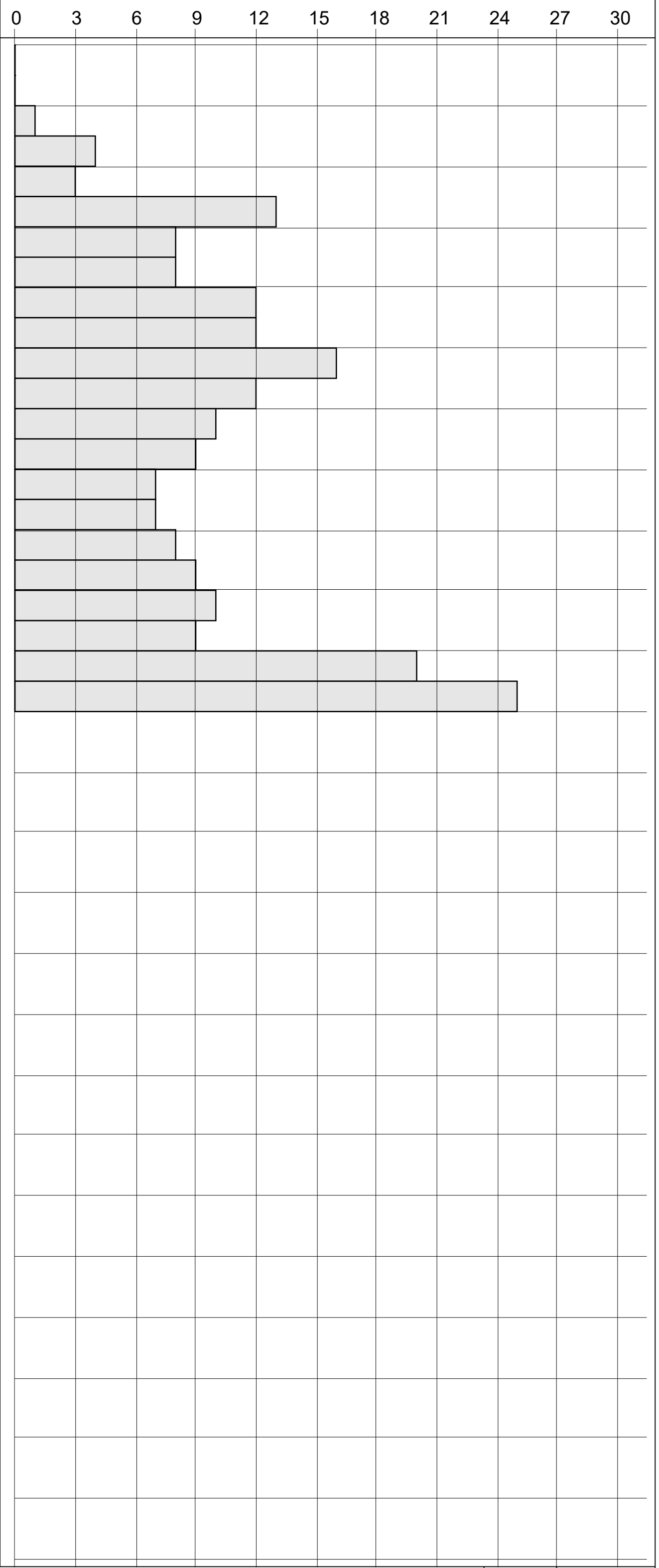
Ground Investigations Ireland Ltd
www.gii.ie

Method	Cone Dimensions	Ground Level (mOD)	Site	Probe Number
Dynamic Probe Heavy (DPH) Hammer drop height 500mm Hammer weight 50kg	Diameter 43.7mm, Angle 90°	55.36	Confey Leixlip	DP19
	Location	**Dates**	**Client**	**Job Number**
	701178.7 E 737162.3 N	24/10/2024	Corrigan Hodnett	14130-09-24
			Engineer	**Sheet**
			Corrigan Hodnett	1/1

Depth (m)	Blows for Depth Increment	Field Records
0.00-0.10	0	
0.10-0.20	0	
0.20-0.30	1	
0.30-0.40	4	
0.40-0.50	3	
0.50-0.60	13	
0.60-0.70	8	
0.70-0.80	8	
0.80-0.90	12	
0.90-1.00	12	
1.00-1.10	16	
1.10-1.20	12	
1.20-1.30	10	
1.30-1.40	9	
1.40-1.50	7	
1.50-1.60	7	
1.60-1.70	8	
1.70-1.80	9	
1.80-1.90	10	
1.90-2.00	9	
2.00-2.10	20	
2.10-2.20	25	

Level (mOD)	Depth (m)
55.36	0.00
54.86	0.50
54.36	1.00
53.86	1.50
53.36	2.00
52.86	2.50
52.36	3.00
51.86	3.50
51.36	4.00
50.86	4.50
50.36	5.00

Blows for Depth Increment



Remarks
Dynamic Probe refusal at 2.20m BGL, 25 blows over 50mm.

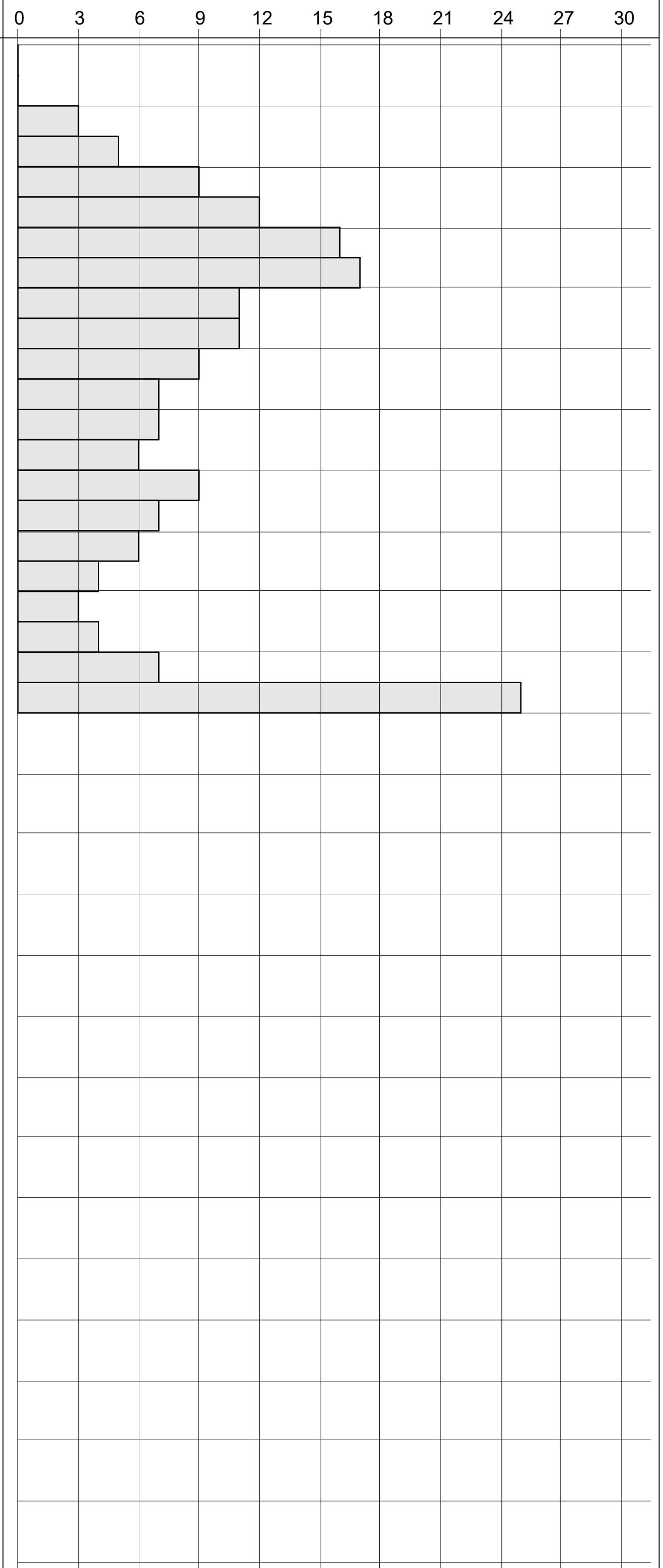
Scale (approx)	Logged By
1:25	CE

Figure No.
14130-09-24.DP19

Ground Investigations Ireland Ltd www.gii.ie			Site Confey Leixlip	Probe Number **DP20**
Method Dynamic Probe Heavy (DPH) Hammer drop height 500mm Hammer weight 50kg	**Cone Dimensions** Diameter 43.7mm, Angle 90°	**Ground Level (mOD)** 54.86	**Client** Corrigan Hodnett	**Job Number** 14130-09-24
	Location 701136.8 E 737155.1 N	**Dates** 24/10/2024	**Engineer** Corrigan Hodnett	**Sheet** 1/1

Depth (m)	Blows for Depth Increment	Field Records	Level (mOD)	Depth (m)
0.00-0.10	0		54.86	0.00
0.10-0.20	0			
0.20-0.30	3			
0.30-0.40	5			
0.40-0.50	9			
0.50-0.60	12		54.36	0.50
0.60-0.70	16			
0.70-0.80	17			
0.80-0.90	11			
0.90-1.00	11			
1.00-1.10	9		53.86	1.00
1.10-1.20	7			
1.20-1.30	7			
1.30-1.40	6			
1.40-1.50	9			
1.50-1.60	7		53.36	1.50
1.60-1.70	6			
1.70-1.80	4			
1.80-1.90	3			
1.90-2.00	4			
2.00-2.10	7		52.86	2.00
2.10-2.20	25			
			52.36	2.50
			51.86	3.00
			51.36	3.50
			50.86	4.00
			50.36	4.50
			49.86	5.00

Blows for Depth Increment



Remarks
Dynamic Probe refusal at 2.20m BGL, 25 blows over 80mm.

Scale (approx)	Logged By
1:25	CE

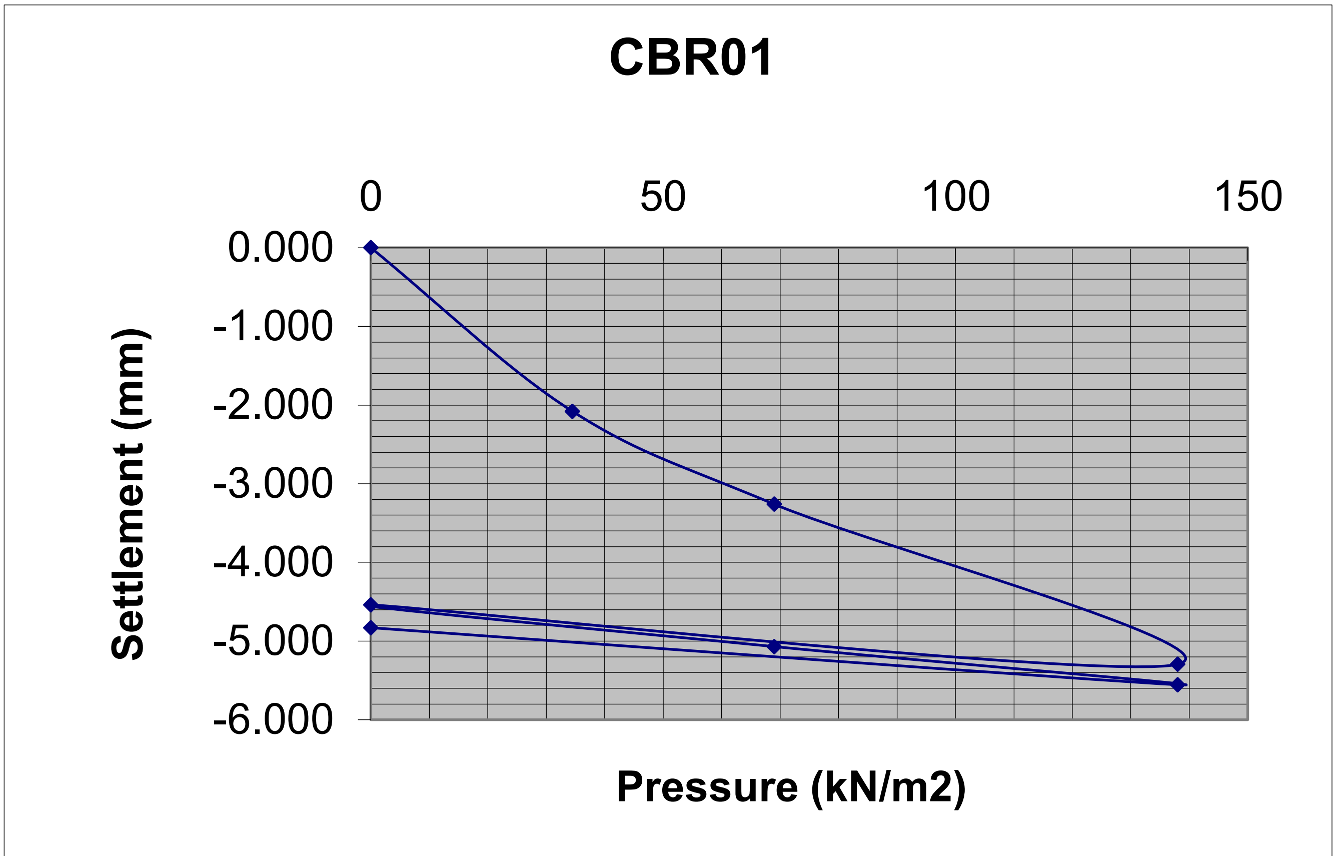
Figure No.
14130-09-24.DP20

APPENDIX 6 – In-situ Plate Bearing Test Records

Applied Load	Gauge settlement
0	**0.000**
34.5	-2.08
69	-3.26
138	-5.295
0	-4.54
69	-5.07
138	-5.555
0	-4.83

GROUND INVESTIGATIONS IRELAND
Geotechnical & Environmental

LOCATION	Confey, Leixlip	**MATERIAL**	Brown slightly sandy slightly gravelly CLAY with low cobble content.
CONTRACT NO.	14130-09-24		
DATE	22/10/2024		
CLIENT	Corrigan Hodnett	**DEPTH**	0.50m
PLATE DIAMETER	305mm	**NOTES**	In TP01
TEST NO.	CBR01	**SAMPLES**	



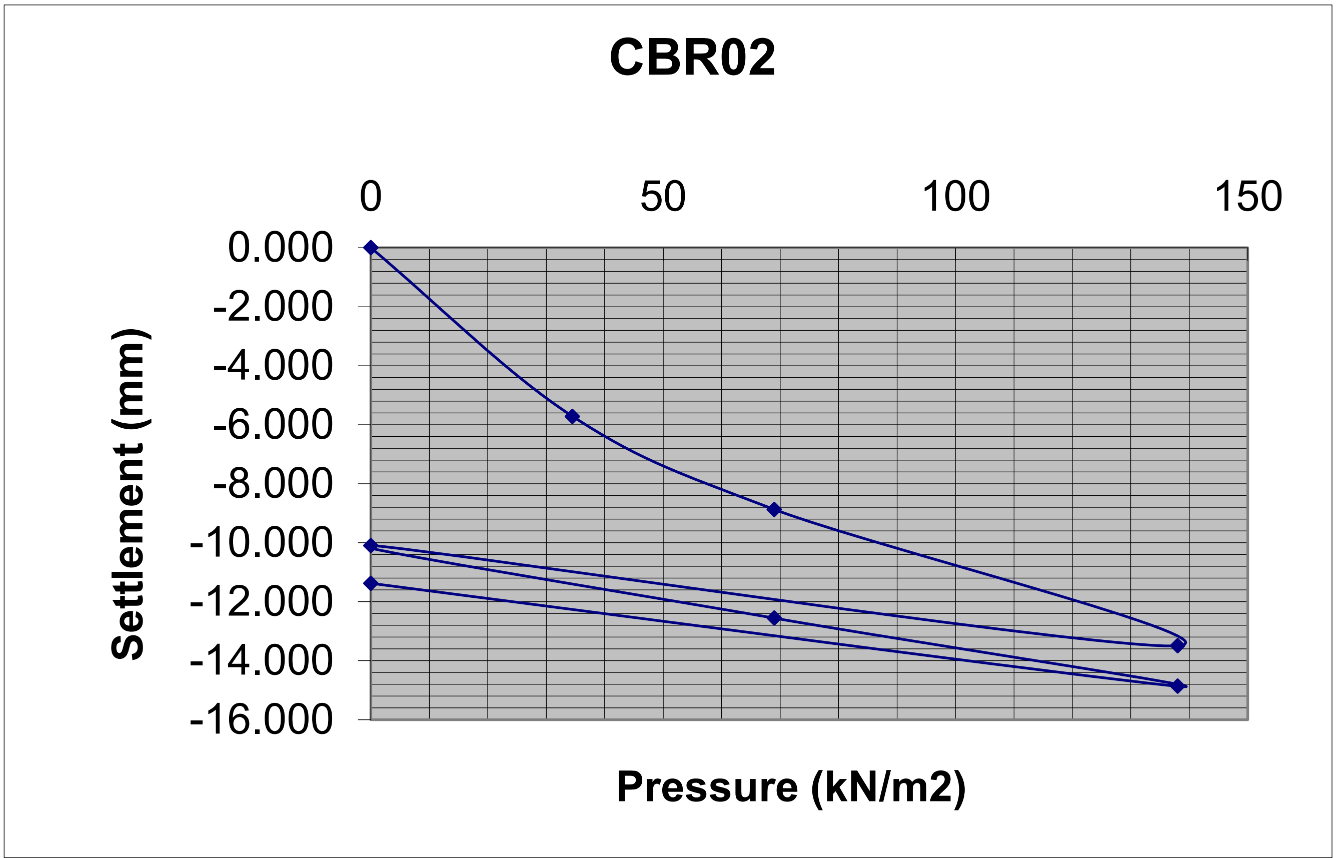
Modulus of subgrade reaction, K (Initial) =	**9.62 MN/m2/m**
Modulus of subgrade reaction, K (Reload) =	**59.17 MN/m2/m**

Equivalent CBR(initial)in accordance with HD25/94 volume7 section2 =	**0.49 %**
Equivalent CBR(reload)in accordance with HD25/94 volume7 section2 =	**11.36 %**

Applied Load	Gauge settlement
0	**0.000**
34.5	-5.715
69	-8.87
138	-13.49
0	-10.09
69	-12.555
138	-14.865
0	-11.375

GROUND INVESTIGATIONS IRELAND
Geotechnical & Environmental

LOCATION	Confey, Leixlip	**MATERIAL**	Brown slightly sandy slightly gravelly CLAY.
CONTRACT NO.	14130-09-24		
DATE	22/10/2024		
CLIENT	Corrigan Hodnett	**DEPTH**	0.40m
PLATE DIAMETER	305mm	**NOTES**	In TP02
TEST NO.	CBR02	**SAMPLES**	



Modulus of subgrade reaction, K (Initial) = **3.54 MN/m2/m**

Modulus of subgrade reaction, K (Reload) = **12.72 MN/m2/m**

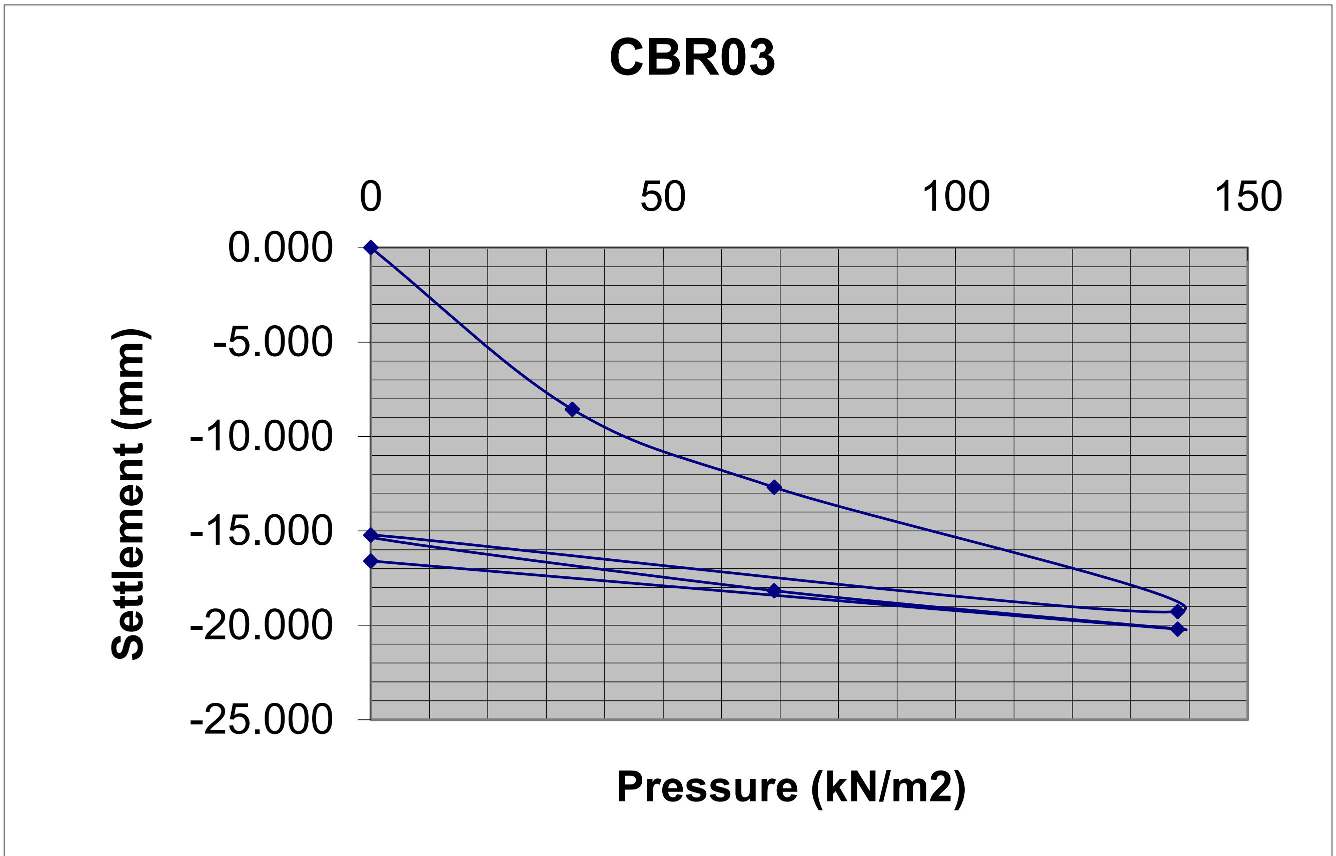
Equivalent CBR(initial)in accordance with HD25/94 volume7 section2 = **0.09 %**

Equivalent CBR(reload)in accordance with HD25/94 volume7 section2 = **0.79 %**

Applied Load	Gauge settlement
0	**0.000**
34.5	-8.565
69	-12.69
138	-19.27
0	-15.215
69	-18.165
138	-20.2
0	-16.59

GROUND INVESTIGATIONS IRELAND
Geotechnical & Environmental

LOCATION	Confey, Leixlip	**MATERIAL**	Brown slightly sandy slightly gravelly CLAY with low cobble content.
CONTRACT NO.	14130-09-24		
DATE	22/10/2024		
CLIENT	Corrigan Hodnett	**DEPTH**	0.40m
PLATE DIAMETER	305mm	**NOTES**	In TP03
TEST NO.	CBR03	**SAMPLES**	



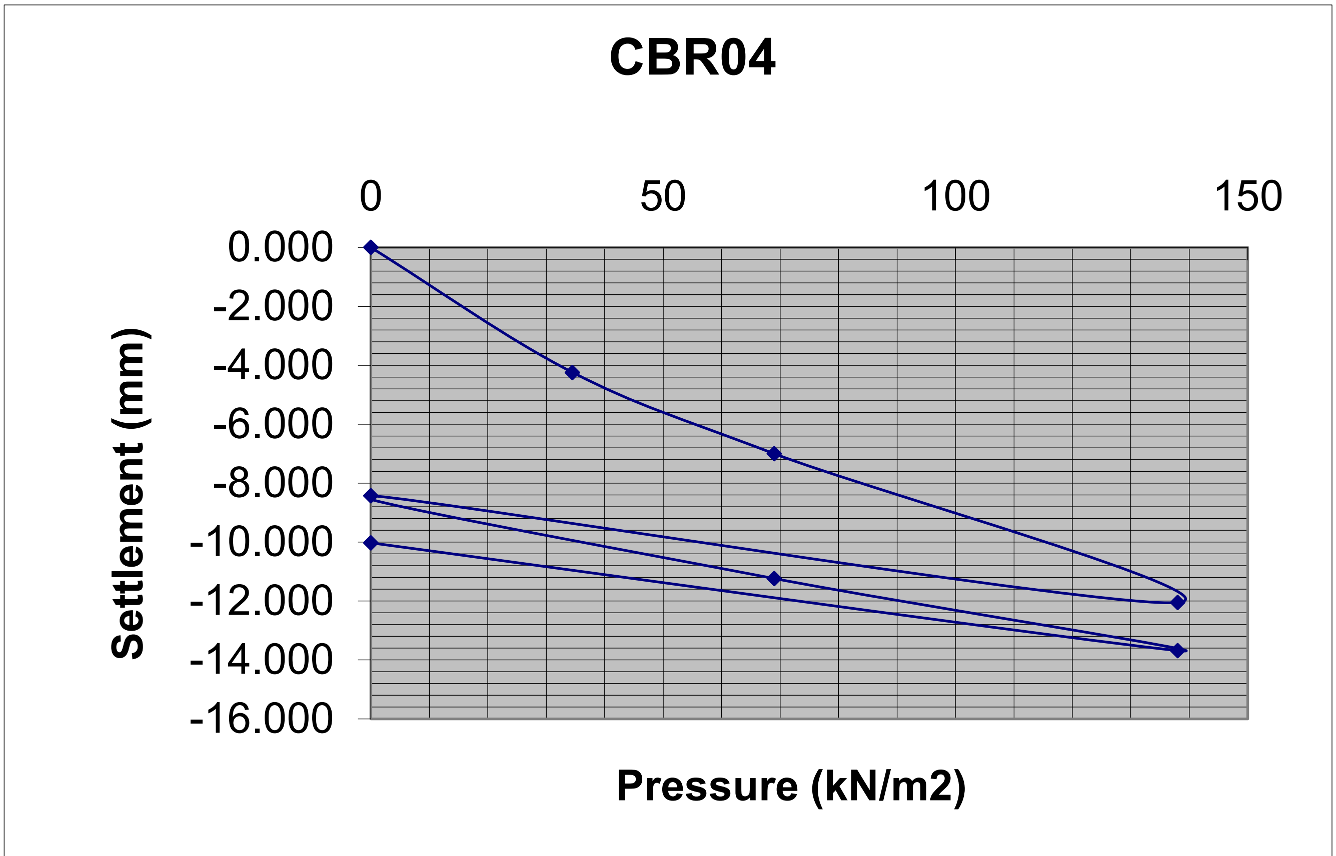
Modulus of subgrade reaction, K (Initial) = **2.47 MN/m2/m**
Modulus of subgrade reaction, K (Reload) = **10.63 MN/m2/m**

Equivalent CBR(initial)in accordance with HD25/94 volume7 section2 = **0.05 %**
Equivalent CBR(reload)in accordance with HD25/94 volume7 section2 = **0.58 %**

Applied Load	Gauge settlement
0	**0.000**
34.5	-4.24
69	-7
138	-12.05
0	-8.425
69	-11.235
138	-13.68
0	-10.025

GROUND INVESTIGATIONS IRELAND
Geotechnical & Environmental

LOCATION	Confey, Leixlip	**MATERIAL**	Brown slightly sandy slightly gravelly CLAY.
CONTRACT NO.	14130-09-24		
DATE	22/10/2024		
CLIENT	Corrigan Hodnett	**DEPTH**	0.40m
PLATE DIAMETER	305mm	**NOTES**	In TP04
TEST NO.	CBR04	**SAMPLES**	



Modulus of subgrade reaction, K (Initial) = **4.48 MN/m2/m**

Modulus of subgrade reaction, K (Reload) = **11.16 MN/m2/m**

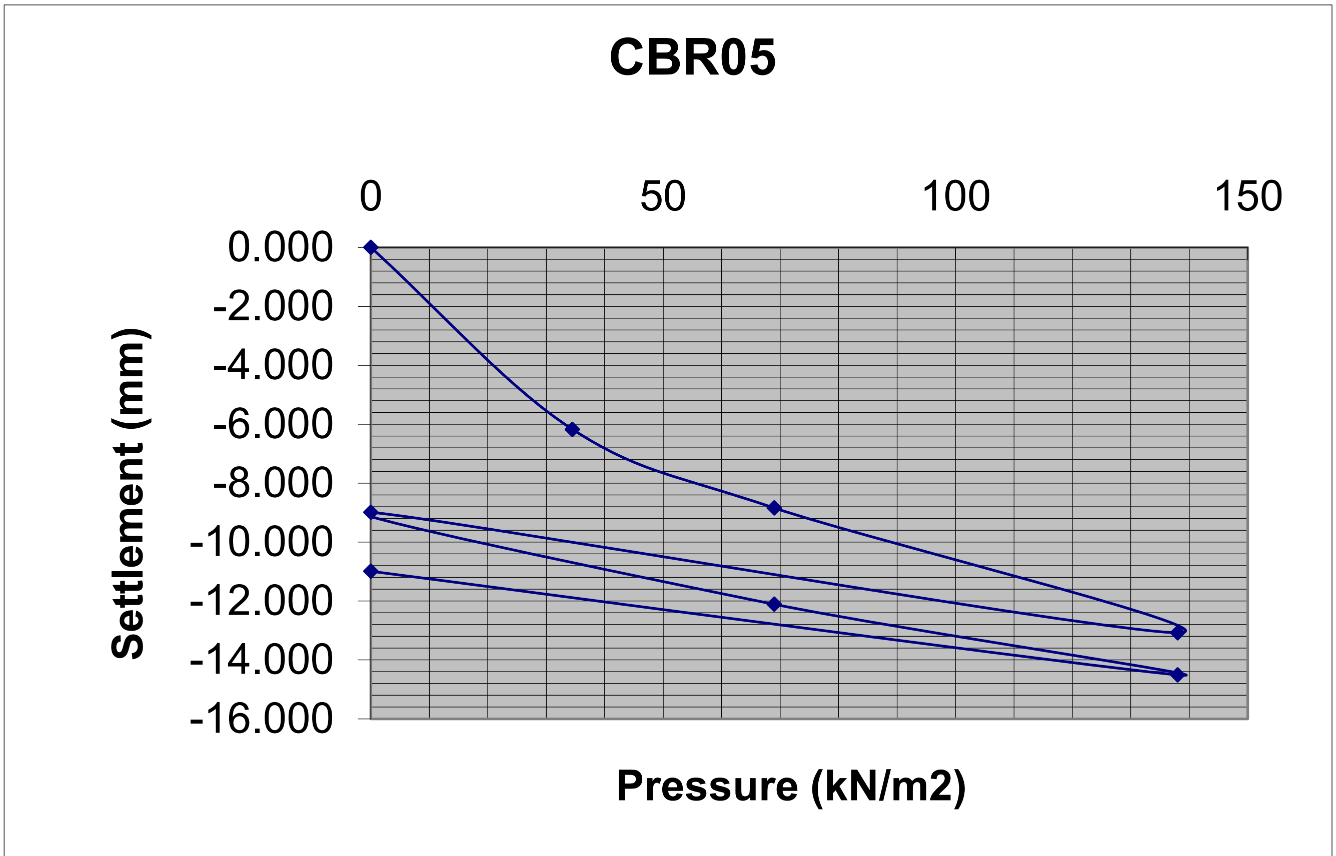
Equivalent CBR(initial)in accordance with HD25/94 volume7 section2 = **0.13 %**

Equivalent CBR(reload)in accordance with HD25/94 volume7 section2 = **0.63 %**

Applied Load	Gauge settlement
0	**0.000**
34.5	-6.175
69	-8.84
138	-13.075
0	-8.99
69	-12.11
138	-14.505
0	-10.99

GROUND INVESTIGATIONS IRELAND
Geotechnical & Environmental

LOCATION	Confey, Leixlip	**MATERIAL**	Brown slightly sandy slightly gravelly CLAY with low cobble content.
CONTRACT NO.	14130-09-24		
DATE	22/10/2024		
CLIENT	Corrigan Hodnett	**DEPTH**	0.40m
PLATE DIAMETER	305mm	**NOTES**	In TP05
TEST NO.	CBR05	**SAMPLES**	



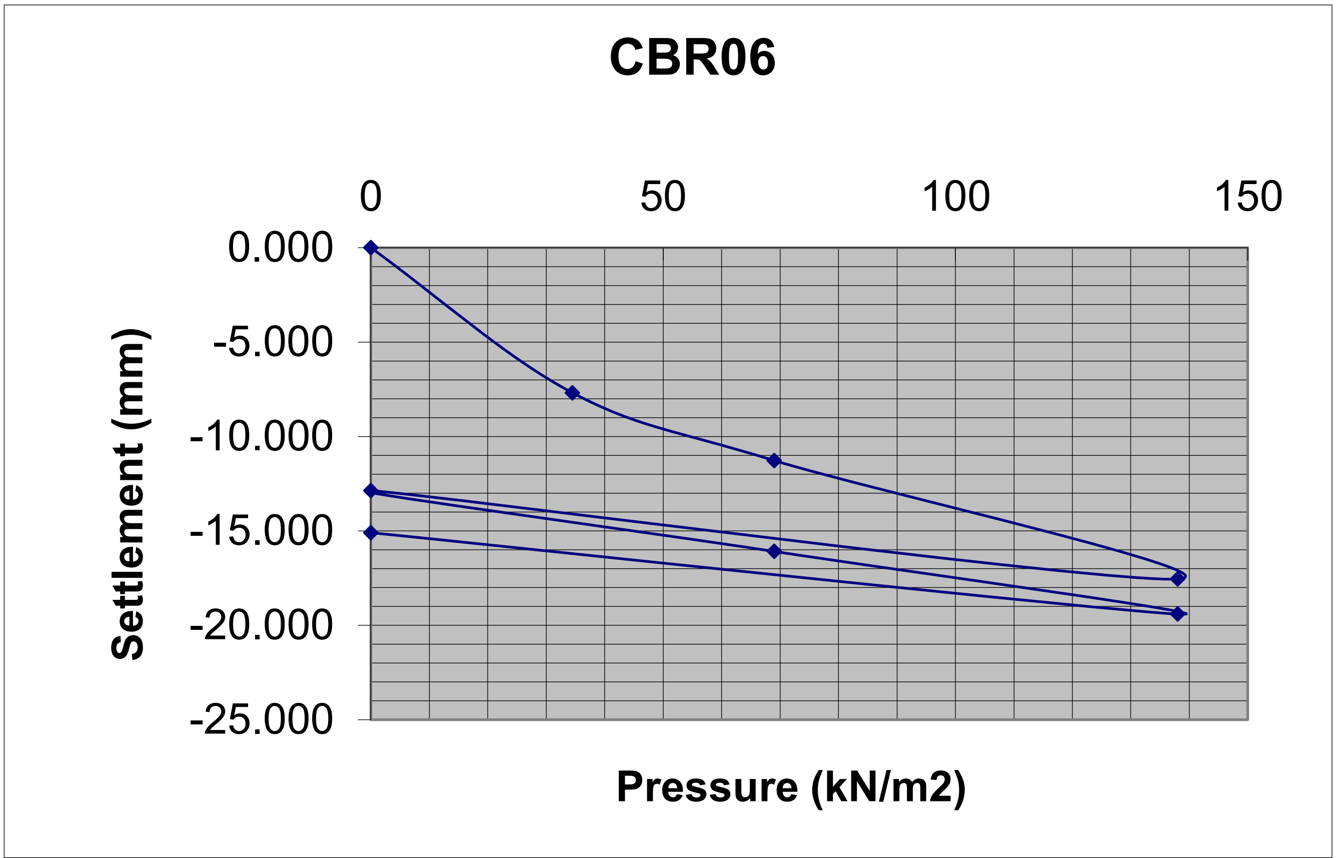
Modulus of subgrade reaction, K (Initial) = **3.55 MN/m2/m**
Modulus of subgrade reaction, K (Reload) = **10.05 MN/m2/m**

Equivalent CBR(initial)in accordance with HD25/94 volume7 section2 = **0.09 %**
Equivalent CBR(reload)in accordance with HD25/94 volume7 section2 = **0.53 %**

Applied Load	Gauge settlement
0	**0.000**
34.5	-7.685
69	-11.27
138	-17.545
0	-12.865
69	-16.085
138	-19.405
0	-15.09

GROUND INVESTIGATIONS IRELAND
Geotechnical & Environmental

LOCATION	Confey, Leixlip	**MATERIAL**	Brown slightly sandy slightly gravelly CLAY with low cobble content.
CONTRACT NO.	14130-09-24		
DATE	22/10/2024		
CLIENT	Corrigan Hodnett	**DEPTH**	0.35m
PLATE DIAMETER	305mm	**NOTES**	In TP06
TEST NO.	CBR06	**SAMPLES**	



Modulus of subgrade reaction, K (Initial) = **2.78 MN/m2/m**

Modulus of subgrade reaction, K (Reload) = **9.74 MN/m2/m**

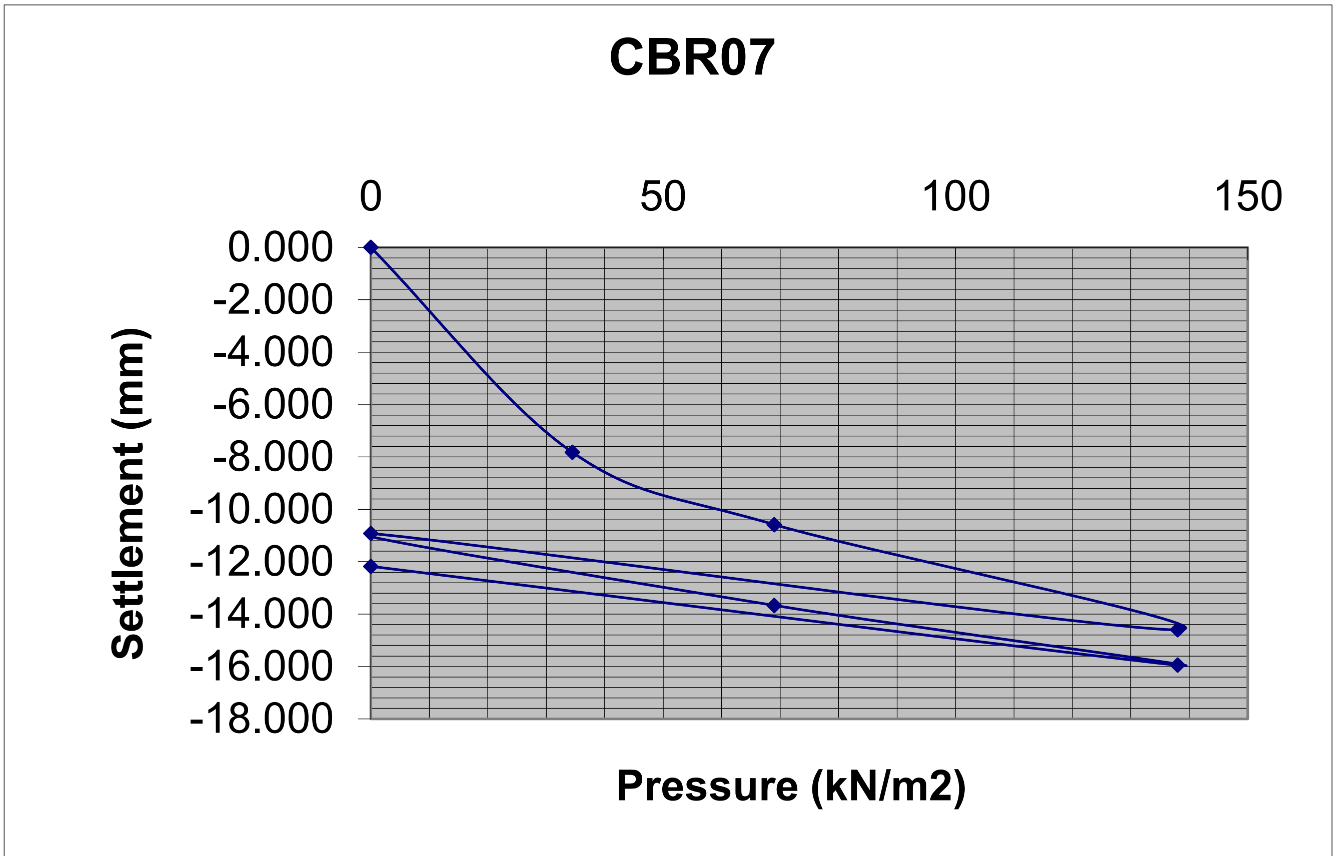
Equivalent CBR(initial)in accordance with HD25/94 volume7 section2 = **0.06 %**

Equivalent CBR(reload)in accordance with HD25/94 volume7 section2 = **0.50 %**

Applied Load	Gauge settlement
0	**0.000**
34.5	-7.825
69	-10.58
138	-14.6
0	-10.925
69	-13.665
138	-15.95
0	-12.175

GROUND INVESTIGATIONS IRELAND
Geotechnical & Environmental

LOCATION	Confey, Leixlip	**MATERIAL**	Brown slightly sandy slightly gravelly CLAY with low cobble content.
CONTRACT NO.	14130-09-24		
DATE	22/10/2024		
CLIENT	Corrigan Hodnett	**DEPTH**	0.40m
PLATE DIAMETER	305mm	**NOTES**	In TP07
TEST NO.	CBR07	**SAMPLES**	



Modulus of subgrade reaction, K (Initial) = **2.96 MN/m2/m**
Modulus of subgrade reaction, K (Reload) = **11.45 MN/m2/m**

Equivalent CBR(initial)in accordance with HD25/94 volume7 section2 = **0.06 %**
Equivalent CBR(reload)in accordance with HD25/94 volume7 section2 = **0.66 %**

APPENDIX 7 – Laboratory Testing

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

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Ground Investigations Ireland
Catherinestown House
Hazelhatch Road
Newcastle
Co. Dublin
Ireland
D22 K5P8

Attention :	Mike Sutton
Date :	7th November, 2024
Your reference :	14130-09-24
Our reference :	Test Report 24/18438 Batch 1
Location :	Confew Leixlip
Date samples received :	30th October, 2024
Status :	Final Report
Issue :	202411071549

Seven samples were received for analysis on 30th October, 2024 of which seven were scheduled for analysis. Please find attached our Test Report which should be read with notes at the end of the report and should include all sections if reproduced. Interpretations and opinions are outside the scope of any accreditation, and all results relate only to samples supplied.
All analysis is carried out on as received samples and reported on a dry weight basis unless stated otherwise. Results are not surrogate corrected.

The greenhouse gas emissions generated (in Carbon – Co2e) to obtain the results in this report are estimated as:

Scope 1&2 emissions - 34.028 kg of CO2

Scope 1&2&3 emissions - 80.417 kg of CO2

Authorised By:

Sean Anglish
Project Coordinator

Client Name: Ground Investigations Ireland
Reference: 14130-09-24
Location: Confew Leixlip
Contact: Mike Sutton
EMT Job No: 24/18438

Report : Solid

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

Please see attached notes for all abbreviations and acronyms

EMT Sample No.	1-3	4-8	9-12	13-16	17-20	21-24	25-28						
Sample ID	TP01	TP02	TP03	TP04	TP05	TP06	TP07						
Depth	2.00	0.50	0.50	0.50	0.50	1.00	0.50						
COC No / misc	ES	ES	ES	ES	ES	ES	ES						
Containers	V J T	V J T	V J T	V J T	V J T	V J T	V J T						
Sample Date	22/10/2024	22/10/2024	23/10/2024	23/10/2024	23/10/2024	23/10/2024	23/10/2024						
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil						
Batch Number	1	1	1	1	1	1	1				LOD/LOR	Units	Method No.
Date of Receipt	30/10/2024	30/10/2024	30/10/2024	30/10/2024	30/10/2024	30/10/2024	30/10/2024						
Antimony	1	2	2	3	2	2	4				<1	mg/kg	TM30/PM15
Arsenic #	7.3	9.1	11.9	11.1	10.3	8.3	16.3				<0.5	mg/kg	TM30/PM15
Barium #	45	65	126	80	59	50	81				<1	mg/kg	TM30/PM15
Cadmium #	1.9	2.8	2.3	2.1	2.5	1.8	4.6				<0.1	mg/kg	TM30/PM15
Chromium #	20.2	43.2	44.0	70.0	60.3	52.8	43.3				<0.5	mg/kg	TM30/PM15
Copper #	21	27	26	32	31	25	51				<1	mg/kg	TM30/PM15
Lead #	10	15	22	20	17	12	23				<5	mg/kg	TM30/PM15
Mercury #	<0.1	<0.1	0.1	0.1	<0.1	<0.1	<0.1				<0.1	mg/kg	TM30/PM15
Molybdenum #	3.2	3.6	3.7	5.7	6.1	6.3	6.3				<0.1	mg/kg	TM30/PM15
Nickel #	26.2	42.3	45.8	44.9	46.0	32.8	81.7				<0.7	mg/kg	TM30/PM15
Selenium #	1	2	2	2	2	1	2				<1	mg/kg	TM30/PM15
Zinc #	89	79	109	109	110	81	144				<5	mg/kg	TM30/PM15
PAH MS													
Naphthalene #	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04				<0.04	mg/kg	TM4/PM8
Acenaphthylene	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03				<0.03	mg/kg	TM4/PM8
Acenaphthene #	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05				<0.05	mg/kg	TM4/PM8
Fluorene #	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04				<0.04	mg/kg	TM4/PM8
Phenanthrene #	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03				<0.03	mg/kg	TM4/PM8
Anthracene #	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04				<0.04	mg/kg	TM4/PM8
Fluoranthene #	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03				<0.03	mg/kg	TM4/PM8
Pyrene #	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03				<0.03	mg/kg	TM4/PM8
Benzo(a)anthracene #	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06				<0.06	mg/kg	TM4/PM8
Chrysene #	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02				<0.02	mg/kg	TM4/PM8
Benzo(bk)fluoranthene #	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07				<0.07	mg/kg	TM4/PM8
Benzo(a)pyrene #	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04				<0.04	mg/kg	TM4/PM8
Indeno(123cd)pyrene #	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04				<0.04	mg/kg	TM4/PM8
Dibenzo(ah)anthracene #	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04				<0.04	mg/kg	TM4/PM8
Benzo(ghi)perylene #	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04				<0.04	mg/kg	TM4/PM8
Coronene	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04				<0.04	mg/kg	TM4/PM8
PAH 6 Total #	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22				<0.22	mg/kg	TM4/PM8
PAH 17 Total	<0.64	<0.64	<0.64	<0.64	<0.64	<0.64	<0.64				<0.64	mg/kg	TM4/PM8
Benzo(b)fluoranthene	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05				<0.05	mg/kg	TM4/PM8
Benzo(k)fluoranthene	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02				<0.02	mg/kg	TM4/PM8
Benzo(j)fluoranthene	<1	<1	<1	<1	<1	<1	<1				<1	mg/kg	TM4/PM8
PAH Surrogate % Recovery	95	90	94	90	92	94	89				<0	%	TM4/PM8
Mineral Oil (C10-C40) (EH_CU_1D_AL)	<30	<30	<30	<30	<30	<30	<30				<30	mg/kg	TM5/PM8/PM16

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

Element Materials Technology

Client Name: Ground Investigations Ireland
Reference: 14130-09-24
Location: Confew Leixlip
Contact: Mike Sutton
EMT Job No: 24/18438

Report : **Solid**

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

Please see attached notes for all abbreviations and acronyms

EMT Sample No.	1-3	4-8	9-12	13-16	17-20	21-24	25-28				LOD/LOR	Units	Method No.
Sample ID	TP01	TP02	TP03	TP04	TP05	TP06	TP07						
Depth	2.00	0.50	0.50	0.50	0.50	1.00	0.50						
COC No / misc	ES	ES	ES	ES	ES	ES	ES						
Containers	V J T	V J T	V J T	V J T	V J T	V J T	V J T						
Sample Date	22/10/2024	22/10/2024	23/10/2024	23/10/2024	23/10/2024	23/10/2024	23/10/2024						
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil						
Batch Number	1	1	1	1	1	1	1						
Date of Receipt	30/10/2024	30/10/2024	30/10/2024	30/10/2024	30/10/2024	30/10/2024	30/10/2024						
TPH CWG													
Aliphatics													
>C5-C6 (HS_1D_AL)#	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1				<0.1	mg/kg	TM36/PM12
>C6-C8 (HS_1D_AL)#	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1				<0.1	mg/kg	TM36/PM12
>C8-C10 (HS_1D_AL)	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1				<0.1	mg/kg	TM36/PM12
>C10-C12 (EH_CU_1D_AL)#	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2				<0.2	mg/kg	TM5/PM8/PM16
>C12-C16 (EH_CU_1D_AL)#	<4	<4	<4	<4	<4	<4	<4				<4	mg/kg	TM5/PM8/PM16
>C16-C21 (EH_CU_1D_AL)#	<7	<7	<7	<7	<7	<7	<7				<7	mg/kg	TM5/PM8/PM16
>C21-C35 (EH_CU_1D_AL)#	<7	<7	<7	<7	<7	<7	<7				<7	mg/kg	TM5/PM8/PM16
>C35-C40 (EH_CU_1D_AL)	<7	<7	<7	<7	<7	<7	<7				<7	mg/kg	TM5/PM8/PM16
Total aliphatics C5-40 (EH_CU+HS_1D_AL)	<26	<26	<26	<26	<26	<26	<26				<26	mg/kg	TM5/TM36/PM8/PM12/PM16
>C6-C10 (HS_1D_AL)	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1				<0.1	mg/kg	TM36/PM12
>C10-C25 (EH_CU_1D_AL)	<10	<10	<10	<10	<10	<10	<10				<10	mg/kg	TM5/PM8/PM16
>C25-C35 (EH_CU_1D_AL)	<10	<10	<10	<10	<10	<10	<10				<10	mg/kg	TM5/PM8/PM16
Aromatics													
>C5-EC7 (HS_1D_AR)#	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1				<0.1	mg/kg	TM36/PM12
>EC7-EC8 (HS_1D_AR)#	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1				<0.1	mg/kg	TM36/PM12
>EC8-EC10 (HS_1D_AR)#	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1				<0.1	mg/kg	TM36/PM12
>EC10-EC12 (EH_CU_1D_AR)#	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2				<0.2	mg/kg	TM5/PM8/PM16
>EC12-EC16 (EH_CU_1D_AR)#	<4	<4	<4	<4	<4	<4	<4				<4	mg/kg	TM5/PM8/PM16
>EC16-EC21 (EH_CU_1D_AR)#	<7	<7	<7	<7	<7	<7	<7				<7	mg/kg	TM5/PM8/PM16
>EC21-EC35 (EH_CU_1D_AR)#	<7	<7	<7	<7	<7	<7	<7				<7	mg/kg	TM5/PM8/PM16
>EC35-EC40 (EH_CU_1D_AR)	<7	<7	<7	<7	<7	<7	<7				<7	mg/kg	TM5/PM8/PM16
Total aromatics C5-40 (EH_CU+HS_1D_AR)	<26	<26	<26	<26	<26	<26	<26				<26	mg/kg	TM5/TM36/PM8/PM12/PM16
Total aliphatics and aromatics(C5-40) (EH_CU+HS_1D_Total)	<52	<52	<52	<52	<52	<52	<52				<52	mg/kg	TM5/TM36/PM8/PM12/PM16
>EC6-EC10 (HS_1D_AR)#	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1				<0.1	mg/kg	TM36/PM12
>EC10-EC25 (EH_CU_1D_AR)	<10	<10	<10	<10	<10	<10	<10				<10	mg/kg	TM5/PM8/PM16
>EC25-EC35 (EH_CU_1D_AR)	<10	<10	<10	<10	<10	<10	<10				<10	mg/kg	TM5/PM8/PM16
MTBE#	<5	<5	<5	<5	<5	<5	<5				<5	ug/kg	TM36/PM12
Benzene#	<5	<5	<5	<5	<5	<5	<5				<5	ug/kg	TM36/PM12
Toluene#	<5	<5	<5	<5	<5	<5	<5				<5	ug/kg	TM36/PM12
Ethylbenzene#	<5	<5	<5	<5	<5	<5	<5				<5	ug/kg	TM36/PM12
m/p-Xylene#	<5	<5	<5	<5	<5	<5	<5				<5	ug/kg	TM36/PM12
o-Xylene#	<5	<5	<5	<5	<5	<5	<5				<5	ug/kg	TM36/PM12
PCB 28#	<5	<5	<5	<5	<5	<5	<5				<5	ug/kg	TM17/PM8
PCB 52#	<5	<5	<5	<5	<5	<5	<5				<5	ug/kg	TM17/PM8
PCB 101#	<5	<5	<5	<5	<5	<5	<5				<5	ug/kg	TM17/PM8
PCB 118#	<5	<5	<5	<5	<5	<5	<5				<5	ug/kg	TM17/PM8
PCB 138#	<5	<5	<5	<5	<5	<5	<5				<5	ug/kg	TM17/PM8
PCB 153#	<5	<5	<5	<5	<5	<5	<5				<5	ug/kg	TM17/PM8
PCB 180#	<5	<5	<5	<5	<5	<5	<5				<5	ug/kg	TM17/PM8
Total 7 PCBs#	<35	<35	<35	<35	<35	<35	<35				<35	ug/kg	TM17/PM8

Client Name: Ground Investigations Ireland
Reference: 14130-09-24
Location: Confew Leixlip
Contact: Mike Sutton
EMT Job No: 24/18438

Report : Solid

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

Please see attached notes for all abbreviations and acronyms

EMT Sample No.	1-3	4-8	9-12	13-16	17-20	21-24	25-28						
Sample ID	TP01	TP02	TP03	TP04	TP05	TP06	TP07						
Depth	2.00	0.50	0.50	0.50	0.50	1.00	0.50						
COC No / misc	ES	ES	ES	ES	ES	ES	ES						
Containers	V J T	V J T	V J T	V J T	V J T	V J T	V J T						
Sample Date	22/10/2024	22/10/2024	23/10/2024	23/10/2024	23/10/2024	23/10/2024	23/10/2024						
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil						
Batch Number	1	1	1	1	1	1	1				LOD/LOR	Units	Method No.
Date of Receipt	30/10/2024	30/10/2024	30/10/2024	30/10/2024	30/10/2024	30/10/2024	30/10/2024						
Natural Moisture Content	10.5	17.2	17.6	19.0	14.8	10.2	18.2				<0.1	%	PM4/PM0
Moisture Content (% Wet Weight)	9.5	14.7	15.0	15.9	12.9	9.2	15.4				<0.1	%	PM4/PM0
Hexavalent Chromium #	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3				<0.3	mg/kg	TM38/PM20
Sulphate as SO4 (2:1 Ext) #	0.0052	-	0.0075	-	-	-	0.0052				<0.0015	g/l	TM38/PM20
Chromium III	20.2	43.2	44.0	70.0	60.3	52.8	43.3				<0.5	mg/kg	NONE/NONE
Total Organic Carbon #	0.41	0.67	0.89	0.93	0.68	0.42	0.71				<0.02	%	TM21/PM24
pH #	8.68	8.42	7.82	8.39	8.40	8.60	7.87				<0.01	pH units	TM73/PM11

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

Client Name: Ground Investigations Ireland
Reference: 14130-09-24
Location: Confew Leixlip
Contact: Mike Sutton
EMT Job No: 24/18438

Report : CEN 10:1 1 Batch

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

Please see attached notes for all abbreviations and acronyms

EMT Sample No.	1-3	4-8	9-12	13-16	17-20	21-24	25-28				LOD/LOR	Units	Method No.
Sample ID	TP01	TP02	TP03	TP04	TP05	TP06	TP07						
Depth	2.00	0.50	0.50	0.50	0.50	1.00	0.50						
COC No / misc	ES	ES	ES	ES	ES	ES	ES						
Containers	V J T	V J T	V J T	V J T	V J T	V J T	V J T						
Sample Date	22/10/2024	22/10/2024	23/10/2024	23/10/2024	23/10/2024	23/10/2024	23/10/2024						
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil						
Batch Number	1	1	1	1	1	1	1						
Date of Receipt	30/10/2024	30/10/2024	30/10/2024	30/10/2024	30/10/2024	30/10/2024	30/10/2024						
Dissolved Antimony #	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002				<0.002	mg/l	TM30/PM17
Dissolved Antimony (A10) #	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02				<0.02	mg/kg	TM30/PM17
Dissolved Arsenic #	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025				<0.0025	mg/l	TM30/PM17
Dissolved Arsenic (A10) #	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025				<0.025	mg/kg	TM30/PM17
Dissolved Barium #	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003				<0.003	mg/l	TM30/PM17
Dissolved Barium (A10) #	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03				<0.03	mg/kg	TM30/PM17
Dissolved Cadmium #	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005				<0.0005	mg/l	TM30/PM17
Dissolved Cadmium (A10) #	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005				<0.005	mg/kg	TM30/PM17
Dissolved Chromium #	<0.0015	<0.0015	<0.0015	<0.0015	<0.0015	<0.0015	<0.0015				<0.0015	mg/l	TM30/PM17
Dissolved Chromium (A10) #	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015				<0.015	mg/kg	TM30/PM17
Dissolved Copper #	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007				<0.007	mg/l	TM30/PM17
Dissolved Copper (A10) #	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07				<0.07	mg/kg	TM30/PM17
Dissolved Lead #	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005				<0.005	mg/l	TM30/PM17
Dissolved Lead (A10) #	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05				<0.05	mg/kg	TM30/PM17
Dissolved Molybdenum #	0.007	0.008	<0.002	<0.002	<0.002	0.003	<0.002				<0.002	mg/l	TM30/PM17
Dissolved Molybdenum (A10) #	0.07	0.08	<0.02	<0.02	<0.02	0.03	<0.02				<0.02	mg/kg	TM30/PM17
Dissolved Nickel #	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002				<0.002	mg/l	TM30/PM17
Dissolved Nickel (A10) #	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02				<0.02	mg/kg	TM30/PM17
Dissolved Selenium #	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003				<0.003	mg/l	TM30/PM17
Dissolved Selenium (A10) #	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03				<0.03	mg/kg	TM30/PM17
Dissolved Zinc #	<0.003	<0.003	<0.003	0.004	<0.003	<0.003	0.005				<0.003	mg/l	TM30/PM17
Dissolved Zinc (A10) #	<0.03	<0.03	<0.03	0.04	<0.03	<0.03	0.05				<0.03	mg/kg	TM30/PM17
Mercury Dissolved by CVAF #	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001				<0.00001	mg/l	TM61/PM0
Mercury Dissolved by CVAF #	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001				<0.0001	mg/kg	TM61/PM0
Phenol	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01				<0.01	mg/l	TM26/PM0
Phenol	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1				<0.1	mg/kg	TM26/PM0
Fluoride	0.4	<0.3	0.4	0.8	0.4	<0.3	<0.3				<0.3	mg/l	TM173/PM0
Fluoride	4	<3	4	8	4	<3	<3				<3	mg/kg	TM173/PM0
Sulphate as SO4 #	<0.5	<0.5	0.6	0.9	<0.5	<0.5	0.8				<0.5	mg/l	TM38/PM0
Sulphate as SO4 #	<5	<5	6	9	<5	<5	8				<5	mg/kg	TM38/PM0
Mass of raw test portion	0.0992	0.1013	0.105	0.107	0.0994	0.0967	0.1039					kg	NONE/PM17
Chloride #	<0.3	0.4	<0.3	0.7	<0.3	<0.3	0.4				<0.3	mg/l	TM38/PM0
Chloride #	<3	4	<3	7	<3	<3	4				<3	mg/kg	TM38/PM0
Mass of dried test portion	0.09	0.09	0.09	0.09	0.09	0.09	0.09					kg	NONE/PM17
Dissolved Organic Carbon	<2	5	<2	<2	<2	<2	2				<2	mg/l	TM60/PM0
Dissolved Organic Carbon	<20	50	<20	<20	<20	<20	20				<20	mg/kg	TM60/PM0
pH	7.75	7.87	6.71	7.86	7.86	7.97	7.77				<0.01	pH units	TM73/PM0

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

Client Name: Ground Investigations Ireland
Reference: 14130-09-24
Location: Confew Leixlip
Contact: Mike Sutton
EMT Job No: 24/18438

Report : CEN 10:1 1 Batch

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

Please see attached notes for all abbreviations and acronyms

EMT Sample No.	1-3	4-8	9-12	13-16	17-20	21-24	25-28						
Sample ID	TP01	TP02	TP03	TP04	TP05	TP06	TP07						
Depth	2.00	0.50	0.50	0.50	0.50	1.00	0.50						
COC No / misc	ES	ES	ES	ES	ES	ES	ES						
Containers	V J T	V J T	V J T	V J T	V J T	V J T	V J T						
Sample Date	22/10/2024	22/10/2024	23/10/2024	23/10/2024	23/10/2024	23/10/2024	23/10/2024						
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil						
Batch Number	1	1	1	1	1	1	1				LOD/LOR	Units	Method No.
Date of Receipt	30/10/2024	30/10/2024	30/10/2024	30/10/2024	30/10/2024	30/10/2024	30/10/2024						
Total Dissolved Solids #	40	64	<35	70	53	38	<35				<35	mg/l	TM20/PM0
Total Dissolved Solids #	400	640	<350	700	530	380	<350				<350	mg/kg	TM20/PM0

Client Name: Ground Investigations Ireland
Reference: 14130-09-24
Location: Confew Leixlip
Contact: Mike Sutton
EMT Job No: 24/18438

Report : **EN12457_2**

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

Please see attached notes for all abbreviations and acronyms

EMT Sample No.	1-3	4-8	9-12	13-16	17-20	21-24	25-28				Inert	Stable Non-reactive	Hazardous	LOD LOR	Units	Method No.
Sample ID	TP01	TP02	TP03	TP04	TP05	TP06	TP07									
Depth	2.00	0.50	0.50	0.50	0.50	1.00	0.50									
COC No / misc	ES	ES	ES	ES	ES	ES	ES									
Containers	V J T	V J T	V J T	V J T	V J T	V J T	V J T									
Sample Date	22/10/2024	22/10/2024	23/10/2024	23/10/2024	23/10/2024	23/10/2024	23/10/2024									
Sample Type	Soil	Soil	Soil	Soil	Soil	Soil	Soil									
Batch Number	1	1	1	1	1	1	1									
Date of Receipt	30/10/2024	30/10/2024	30/10/2024	30/10/2024	30/10/2024	30/10/2024	30/10/2024									
Solid Waste Analysis																
Total Organic Carbon #	0.41	0.67	0.89	0.93	0.68	0.42	0.71				3	5	6	<0.02	%	TM21/PM24
Sum of BTEX	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025				6	-	-	<0.025	mg/kg	TM36/PM12
Sum of 7 PCBs #	<0.035	<0.035	<0.035	<0.035	<0.035	<0.035	<0.035				1	-	-	<0.035	mg/kg	TM17/PM8
Mineral Oil	<30	<30	<30	<30	<30	<30	<30				500	-	-	<30	mg/kg	TM5/PM8/PM16
PAH Sum of 6 #	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22	<0.22				-	-	-	<0.22	mg/kg	TM4/PM8
PAH Sum of 17	<0.64	<0.64	<0.64	<0.64	<0.64	<0.64	<0.64				100	-	-	<0.64	mg/kg	TM4/PM8
CEN 10:1 Leachate																
Arsenic #	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025				0.5	2	25	<0.025	mg/kg	TM30/PM17
Barium #	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03				20	100	300	<0.03	mg/kg	TM30/PM17
Cadmium #	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005				0.04	1	5	<0.005	mg/kg	TM30/PM17
Chromium #	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015				0.5	10	70	<0.015	mg/kg	TM30/PM17
Copper #	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07				2	50	100	<0.07	mg/kg	TM30/PM17
Mercury #	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001				0.01	0.2	2	<0.0001	mg/kg	TM61/PM0
Molybdenum #	0.07	0.08	<0.02	<0.02	<0.02	0.03	<0.02				0.5	10	30	<0.02	mg/kg	TM30/PM17
Nickel #	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02				0.4	10	40	<0.02	mg/kg	TM30/PM17
Lead #	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05				0.5	10	50	<0.05	mg/kg	TM30/PM17
Antimony #	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02				0.06	0.7	5	<0.02	mg/kg	TM30/PM17
Selenium #	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03				0.1	0.5	7	<0.03	mg/kg	TM30/PM17
Zinc #	<0.03	<0.03	<0.03	0.04	<0.03	<0.03	0.05				4	50	200	<0.03	mg/kg	TM30/PM17
Total Dissolved Solids #	400	640	<350	700	530	380	<350				4000	60000	100000	<350	mg/kg	TM20/PM0
Dissolved Organic Carbon	<20	50	<20	<20	<20	<20	20				500	800	1000	<20	mg/kg	TM60/PM0
Mass of raw test portion	0.0992	0.1013	0.105	0.107	0.0994	0.0967	0.1039				-	-	-		kg	NONE/PM17
Dry Matter Content Ratio	90.5	88.7	85.6	83.9	90.3	92.9	86.4				-	-	-	<0.1	%	NONE/PM4
Leachant Volume	0.891	0.888	0.885	0.883	0.89	0.893	0.886				-	-	-		l	NONE/PM17
Moisture Content 105C (% Dry Weight)	10.5	12.8	16.8	19.2	10.8	7.7	15.8				-	-	-	<0.1	%	PM4/PM0
pH #	8.68	8.42	7.82	8.39	8.40	8.60	7.87				-	-	-	<0.01	pH units	TM73/PM11
Phenol	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1				1	-	-	<0.1	mg/kg	TM26/PM0
Fluoride	4	<3	4	8	4	<3	<3				10	150	500	<3	mg/kg	TM173/PM0
Sulphate as SO4 #	<5	<5	6	9	<5	<5	8				1000	20000	50000	<5	mg/kg	TM38/PM0
Chloride #	<3	4	<3	7	<3	<3	4				800	15000	25000	<3	mg/kg	TM38/PM0

Client Name: Ground Investigations Ireland

Reference: 14130-09-24

Location: Confew Leixlip

Contact: Mike Sutton

Matrix : Solid

EMT Job No.	Batch	Sample ID	Depth	EMT Sample No.	EPH Interpretation
24/18438	1	TP01	2.00	1-3	No interpretation possible
24/18438	1	TP02	0.50	4-8	No interpretation possible
24/18438	1	TP03	0.50	9-12	No interpretation possible
24/18438	1	TP04	0.50	13-16	No interpretation possible
24/18438	1	TP05	0.50	17-20	No interpretation possible
24/18438	1	TP06	1.00	21-24	No interpretation possible
24/18438	1	TP07	0.50	25-28	No interpretation possible

Client Name: Ground Investigations Ireland
Reference: 14130-09-24
Location: Confew Leixlip
Contact: Mike Sutton

Note:

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

The LOQ of the Asbestos Quantification is 0.001% dry fibre of dry mass of sample.

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

Where trace asbestos is reported the amount of asbestos will be <0.1%.

EMT Job No.	Batch	Sample ID	Depth	EMT Sample No.	Analyst Name	Date Of Analysis	Analysis	Result
24/18438	1	TP01	2.00	3	Emily Smith	01/11/2024	**General Description (Bulk Analysis)**	Brown soil with stones
					Emily Smith	01/11/2024	**Asbestos Fibres**	NAD
					Emily Smith	01/11/2024	**Asbestos ACM**	NAD
					Emily Smith	01/11/2024	**Asbestos Type**	NAD
24/18438	1	TP02	0.50	7	Anthony Carman	01/11/2024	**General Description (Bulk Analysis)**	Brown Soil/Stones
					Anthony Carman	01/11/2024	**Asbestos Fibres**	NAD
					Anthony Carman	01/11/2024	**Asbestos ACM**	NAD
					Anthony Carman	01/11/2024	**Asbestos Type**	NAD
24/18438	1	TP03	0.50	12	Anthony Carman	01/11/2024	**General Description (Bulk Analysis)**	Brown Soil/Stones
					Anthony Carman	01/11/2024	**Asbestos Fibres**	NAD
					Anthony Carman	01/11/2024	**Asbestos ACM**	NAD
					Anthony Carman	01/11/2024	**Asbestos Type**	NAD
24/18438	1	TP04	0.50	16	Emily Smith	01/11/2024	**General Description (Bulk Analysis)**	Brown soil with stones
					Emily Smith	01/11/2024	**Asbestos Fibres**	NAD
					Emily Smith	01/11/2024	**Asbestos ACM**	NAD
					Emily Smith	01/11/2024	**Asbestos Type**	NAD
24/18438	1	TP05	0.50	20	Emily Smith	01/11/2024	**General Description (Bulk Analysis)**	Brown soil with stones
					Emily Smith	01/11/2024	**Asbestos Fibres**	NAD
					Emily Smith	01/11/2024	**Asbestos ACM**	NAD
					Emily Smith	01/11/2024	**Asbestos Type**	NAD
24/18438	1	TP06	1.00	24	Catherine Coles	01/11/2024	**General Description (Bulk Analysis)**	brown soil,stone
					Catherine Coles	01/11/2024	**Asbestos Fibres**	NAD
					Catherine Coles	01/11/2024	**Asbestos ACM**	NAD
					Catherine Coles	01/11/2024	**Asbestos Type**	NAD
24/18438	1	TP07	0.50	28	Emily Smith	01/11/2024	**General Description (Bulk Analysis)**	Brown soil with stones
					Emily Smith	01/11/2024	**Asbestos Fibres**	NAD
					Emily Smith	01/11/2024	**Asbestos ACM**	NAD
					Emily Smith	01/11/2024	**Asbestos Type**	NAD

Element Materials Technology

Notification of Deviating Samples

Client Name: Ground Investigations Ireland
Reference: 14130-09-24
Location: Confew Leixlip
Contact: Mike Sutton

EMT Job No.	Batch	Sample ID	Depth	EMT Sample No.	Analysis	Reason
No deviating sample report results for job 24/18438						

Please note that only samples that are deviating are mentioned in this report. If no samples are listed it is because none were deviating. Only analyses which are accredited are recorded as deviating if set criteria are not met.
It is a requirement under ISO 17025 that we inform clients if samples are deviating i.e. outside what is expected. A deviating sample indicates that the sample 'may' be compromised but not necessarily will be compromised. The result is still accredited and our analytical reports will still show accreditation on the relevant analytes.

SOILS and ASH

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

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

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

All samples will be discarded one month after the date of reporting, unless we are instructed to the contrary. Asbestos samples are retained for 6 months.

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

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

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

Where Mineral Oil is quoted, this refers to Total Aliphatics C10-C40.

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

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

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

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

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

WATERS

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

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

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

Where Mineral Oil is quoted, this refers to Total Aliphatics C10-C40.

STACK EMISSIONS

Where an MCERTS report has been requested, you will be notified within 48 hours of any samples that have been identified as being outside our MCERTS scope. As validation for Dioxins and Furans and Dioxin like PCBs has been performed on XAD-2 Resin, only samples which use this resin will be within our MCERTS scope.

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

DEVIATING SAMPLES

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

SURROGATES

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

DILUTIONS

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

BLANKS

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

NOTE

Data is only reported if the laboratory is confident that the data is a true reflection of the samples analysed. Data is only reported as accredited when all the requirements of our Quality System have been met. In certain circumstances where all the requirements of the Quality System have not been met, for instance if the associated AQC has failed, the reason is fully investigated and documented. The sample data is then evaluated alongside the other quality control checks performed during analysis to determine its suitability. Following this evaluation, provided the sample results have not been effected, the data is reported but accreditation is removed. It is a requirement of our Accreditation Body for data not reported as accredited to be considered indicative only, but this does not mean the data is not valid.
Where possible, and if requested, samples will be re-extracted and a revised report issued with accredited results. Please do not hesitate to contact the laboratory if further details are required of the circumstances which have led to the removal of accreditation.
Laboratory records are kept for a period of no less than 6 years.

REPORTS FROM THE SOUTH AFRICA LABORATORY

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

Measurement Uncertainty

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

Customer Provided Information

Sample ID and depth is information provided by the customer.

Age of Diesel

The age of release estimation is based on the nC17/pristane ratio only as prescribed by Christensen and Larsen (1993) and Kaplan, Galperin, Alimi et al., (1996).
Age estimation should be treated with caution as it can be influenced by site specific factors of which the laboratory are not aware.

Tentatively Identified Compounds (TICs)

Where Tentatively Identified Compounds (TICs) are reported, up to 10 Tentatively Identified Compounds will be listed where there is found to be a greater than 80% match with the NIST library. The reported concentration is determined semi-quantitively, with a matrix specific limit of detection. Note, other compounds may be present but are not reported.

ABBREVIATIONS and ACRONYMS USED

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

HWOL ACRONYMS AND OPERATORS USED

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

EMT Job No: 24/18438

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

EMT Job No: 24/18438

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

EMT Job No: 24/18438

Test Method No.	Description	Prep Method No. (if appropriate)	Description	ISO 17025 (UKAS/SANAS)	MCERTS (UK soils only)	Analysis done on As Received (AR) or Dried (AD)	Reported on dry weight basis
TM61	Determination of Mercury by Cold Vapour Atomic Fluorescence - WATERS: Modified USEPA Method 245.7, Rev 2, Feb 2005. SOILS: Modified USEPA Method 7471B, Rev.2, Feb 2007	PM0	No preparation is required.	Yes		AR	Yes
TM65	Asbestos Bulk Identification method based on HSG 248 Second edition (2021)	PM42	Modified SCA Blue Book V.12 draft 2017 and WM3 1st Edition v1.1:2018. Solid samples undergo a thorough visual inspection for asbestos fibres prior to asbestos identification using TM065.	Yes		AR	
TM73	Modified US EPA methods 150.1 (1982) and 9045D Rev. 4 - 2004) and BS1377-3:1990. Determination of pH by Metrohm automated probe analyser.	PM0	No preparation is required.			AR	Yes
TM73	Modified US EPA methods 150.1 (1982) and 9045D Rev. 4 - 2004) and BS1377-3:1990. Determination of pH by Metrohm automated probe analyser.	PM11	Extraction of as received solid samples using one part solid to 2.5 parts deionised water.	Yes		AR	No
TM173	Analysis of fluoride by ISE (Ion Selective Electrode) using modified ISE method 9214 - 340.2 (EPA 1998)	PM0	No preparation is required.			AR	Yes
NONE	No Method Code	NONE	No Method Code			AD	Yes
NONE	No Method Code	PM17	Modified method BS EN12457-2:2002 As received solid samples are leached with water in a 10:1 water to soil ratio for 24 hours, the moisture content of the sample is included in the ratio.				
NONE	No Method Code	PM4	Gravimetric measurement of Natural Moisture Content and % Moisture Content at either 35 degrees Celsius or 105 degrees Celsius. Calculation based on ISO 11465:1993(E) and BS1377-2:1990.			AR	

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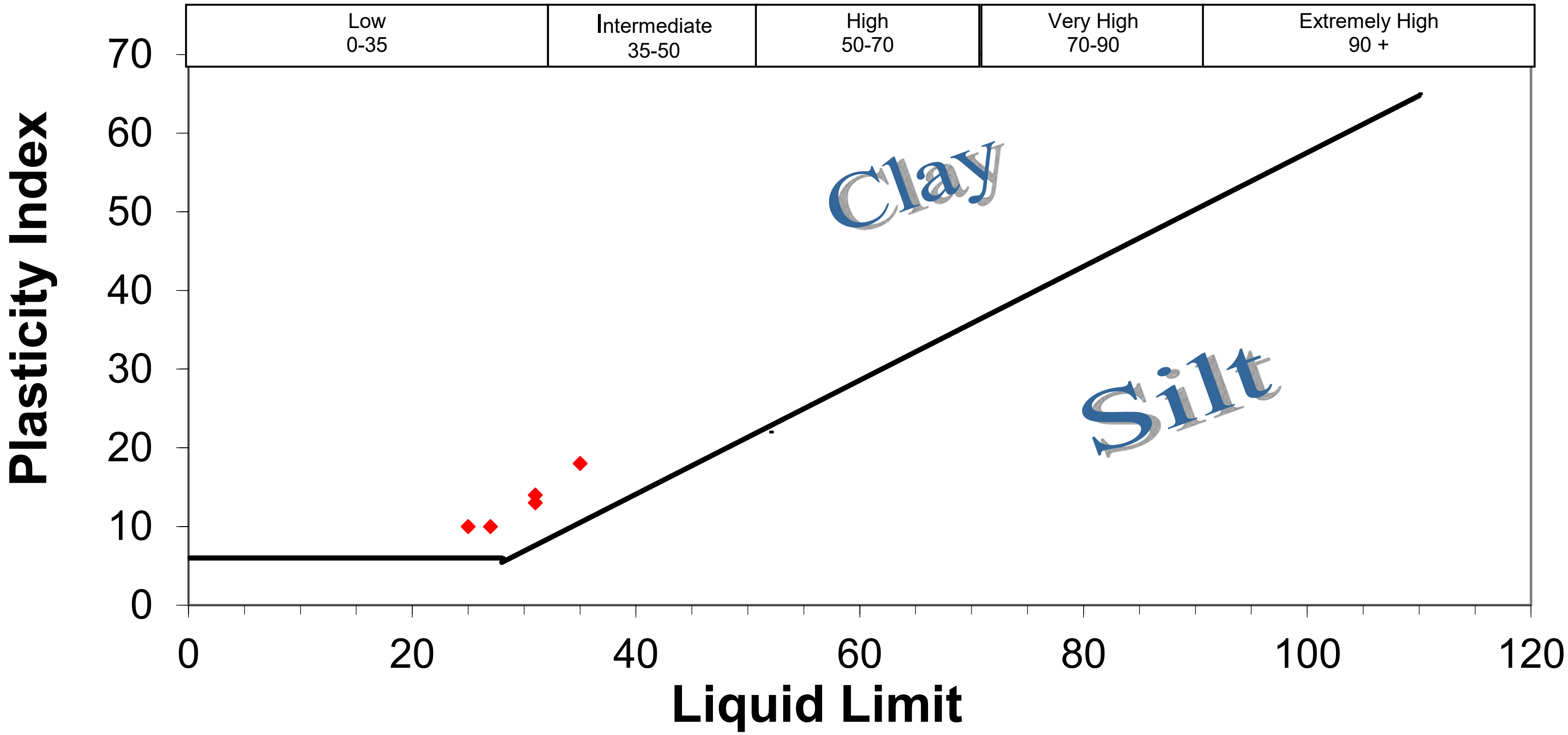
SUMMARY OF TEST RESULTS

				Particle			Index Properties		Bulk	Cell	Undrained Triaxial Tests		Lab	
BH/TP	Depth	Sample	Moisture	Density	<425um	LL	PL	PI	Density	Presssure	Compressive	Strain at	Vane	Remarks
No	m	No.	%	Mg/m3	%	%	%	%	Mg/m3	kPa	Stress kPa	Failure %	kPa	
TP01	2.00	B	12.5		30.6	25	15	10						
TP03	3.00	B	12.1		56.9	35	17	18						
TP04	0.50	B	8.6		35.1	27	17	10						
TP05	1.00	B	15.3		36.1	31	17	14						
TP06	1.00	B	10.0		47.7	31	18	13						

NMTL	Notes :	Job ref No.	NMTL 3819	GII Project ID: 14130-09-24
	1. All BS tests carried out using preferred (definitive) method unless otherwise stated.	Location	Confey, Leixlip	

Revision-02

NMTL LTD	**Contract:**	**Confey, Leixlip**			
Unit 18c, Tullow Industrial Estate	**Client:**	**Ground Investigations Ireland ltd**			
Tullow	**Engineer:**	**Mike Sutton**			
County Carlow	**GII Project ID**	**14130-09-24**			
Tel: 00353 59 9180822	**Date:**	**18/11/2024**			
Mob: 00353 872575508	**Tested By:**	**Js**	**Checked:**	**Bc**	
billa@nmtl.ie	**Job ref No.**	**NMTL 3819**			



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Determination of Particle Size Distribution

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

Sieve Size mm	% Passing
125.000	100.0
75.000	82.4
63.000	74.2
50.000	70.5
37.500	65.7
28.000	63.6
20.000	62.6
14.000	59.1
10.000	54.6
6.300	49.0
5.000	45.6
3.350	43.0
2.000	38.7
1.180	35.0
0.600	31.7
0.425	30.6
0.300	29.8
0.212	29.1
0.150	28.3
0.063	26.7
0.055	25.7
0.040	22.7
0.020	15.9
0.011	11.1
0.008	9.0
0.005	7.7
0.004	6.7
0.002	3.8

Percentage Particle Size

Clay	Fine Medium Coarse Silt	Fine Medium Coarse Sand	Fine Medium Coarse Gravel	Cobbles	Boulder
3.8	22.9	12.0	35.5	25.8	0.0

Sample Description	Brown slightly sandy gravelly silty CLAY.	Project No.	NMTL 3819
		BH/TP No.	TP01
Project	Confey, Leixlip — GII PROJECT ID:14130-09-24	Sample No.	B

Operator	Js	Checked	Nc	Approved	Bc	Date sample tested	08/11/2024	Depth	2.00m

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Sieve Size mm	% Passing
125.000	100.0
75.000	100.0
63.000	100.0
50.000	85.9
37.500	80.1
28.000	76.1
20.000	75.5
14.000	73.6
10.000	72.1
6.300	69.1
5.000	67.4
3.350	66.3
2.000	63.7
1.180	61.1
0.600	58.2
0.425	56.9
0.300	55.5
0.212	54.1
0.150	52.8
0.063	49.9
0.051	48.1
0.037	44.7
0.019	36.7
0.010	27.9
0.007	25.1
0.005	21.0
0.004	17.8
0.002	13.7

Determination of Particle Size Distribution

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

Percentage Particle Size

Clay	Fine Medium Coarse Silt	Fine Medium Coarse Sand	Fine Medium Coarse Gravel	Cobbles	Boulder
13.7	36.2	13.7	36.3	0.0	0.0

Sample Description	Black/grey slightly sandy gravelly silty CLAY.	Project No.	NMTL 3819
		BH/TP No.	TP03
Project	Confey, Leixlip — GII PROJECT ID:14130-09-24	Sample No.	B

Operator	Js	Checked	Nc	Approved	Bc	Date sample tested	08/11/2024	Depth	3.00m

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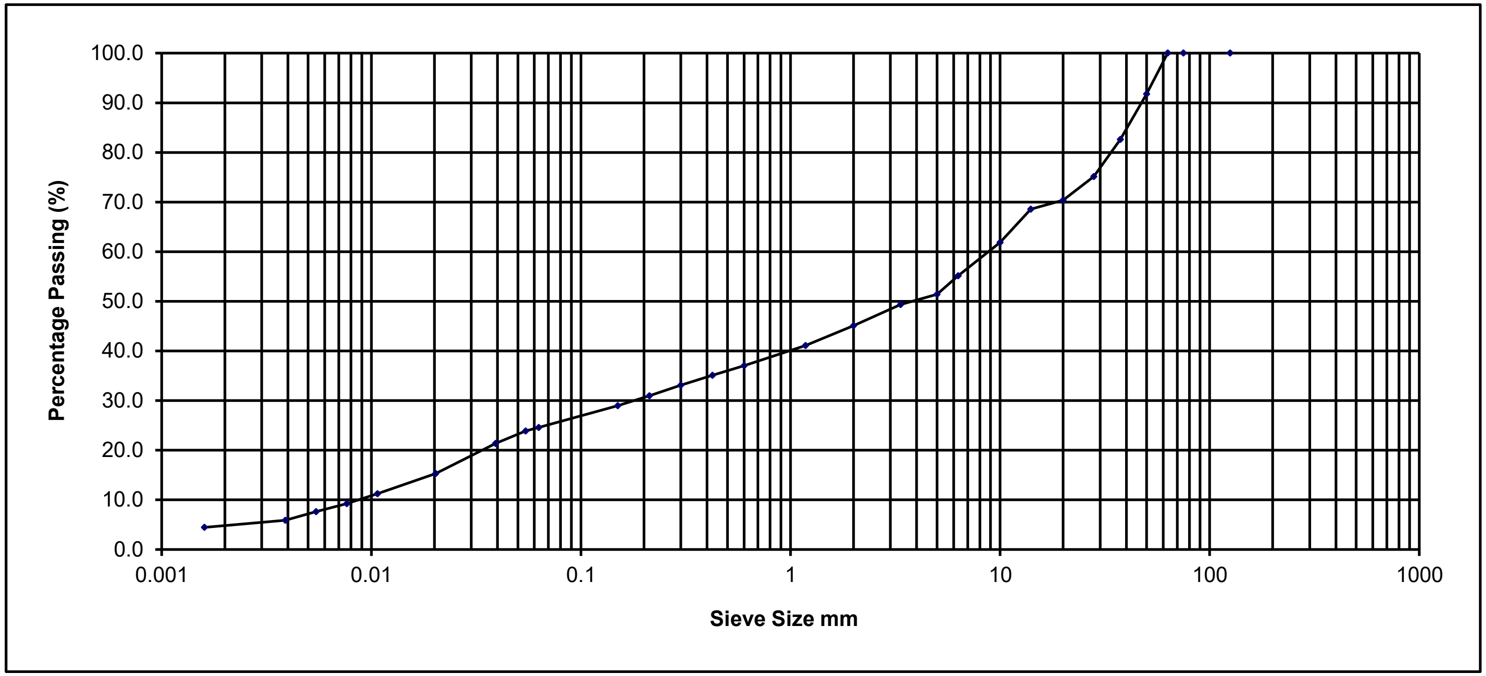
Determination of Particle Size Distribution

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

Sieve Size mm	% Passing
125.000	100.0
75.000	100.0
63.000	100.0
50.000	91.8
37.500	82.6
28.000	75.1
20.000	70.4
14.000	68.5
10.000	61.9
6.300	55.2
5.000	51.4
3.350	49.3
2.000	45.1
1.180	41.1
0.600	37.0
0.425	35.1
0.300	33.1
0.212	31.0
0.150	29.0
0.063	24.6
0.055	23.9
0.039	21.4
0.020	15.3
0.011	11.2
0.008	9.3
0.005	7.7
0.004	5.9
0.002	4.5



Percentage Particle Size

Clay	Silt (Fine Medium Coarse)	Sand (Fine Medium Coarse)	Gravel (Fine Medium Coarse)	Cobbles	Boulder
4.5	20.1	20.5	54.9	0.0	0.0

Sample Description	Brown slightly sandy slightly gravelly silty CLAY.	Project No.	NMTL 3819
		BH/TP No.	TP04
Project	Confey, Leixlip — GII PROJECT ID:14130-09-24	Sample No.	B

Operator	Js	Checked	Nc	Approved	Bc	Date sample tested	08/11/2024	Depth	1.00m

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Sieve Size mm	% Passing
125.000	100.0
75.000	81.1
63.000	70.5
50.000	64.7
37.500	56.7
28.000	53.2
20.000	52.4
14.000	50.7
10.000	48.4
6.300	46.5
5.000	45.4
3.350	44.4
2.000	42.7
1.180	40.4
0.600	37.5
0.425	36.1
0.300	34.6
0.212	32.9
0.150	31.1
0.063	27.0
0.052	26.2
0.038	24.2
0.019	19.7
0.010	15.9
0.007	13.7
0.005	12.0
0.004	9.8
0.002	8.3

Determination of Particle Size Distribution

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

Percentage Particle Size

Clay	Fine Medium Coarse (Silt)	Fine Medium Coarse (Sand)	Fine Medium Coarse (Gravel)	Cobbles	Boulder
8.3	18.7	15.7	27.8	29.5	0.0

Sample Description	Brown slightly sandy slightly gravelly silty CLAY.	Project No.	NMTL 3819
		BH/TP No.	TP05
Project	Confey, Leixlip — GII PROJECT ID:14130-09-24	Sample No.	B

Operator	Js	Checked	Nc	Approved	Bc	Date sample tested	08/11/2024	Depth	1.00m

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NMTL Ltd

Sieve Size mm	% Passing
125.000	100.0
75.000	100.0
63.000	88.3
50.000	79.8
37.500	72.4
28.000	68.4
20.000	65.1
14.000	62.4
10.000	60.4
6.300	58.4
5.000	57.2
3.350	56.1
2.000	54.3
1.180	52.1
0.600	49.3
0.425	47.7
0.300	45.9
0.212	43.9
0.150	41.8
0.063	37.1
0.052	35.4
0.038	32.9
0.019	28.4
0.010	21.5
0.007	18.8
0.005	16.3
0.004	13.1
0.002	10.2

Determination of Particle Size Distribution

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

Percentage Particle Size

Clay	Fine Medium Coarse Silt	Fine Medium Coarse Sand	Fine Medium Coarse Gravel	Cobbles	Boulder
10.2	26.9	17.2	34.0	11.7	0.0

Sample Description	Brown slightly sandy slightly gravelly silty CLAY.	Project No.	NMTL 3819
		BH/TP No.	TP06
Project	Confey, Leixlip — GII PROJECT ID:14130-09-24	Sample No.	B

Operator	Js	Checked	Nc	Approved	Bc	Date sample tested	08/11/2024	Depth	1.00m

NM TL Ltd

Corrigan Hodnett Consulting
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SUDS MAINTENANCE PLAN

Project:	Confey Lands LRD, Leixlip
Client	Leixlip and Newbridge SPV Limited
Location:	Character Area R5, Confey Lands, Leixlip, County Kildare – Entire Site
Prepared by:	Corrigan Hodnett Consulting Limited
Purpose:	Identification of SuDS maintenance requirements for the operational stage of the development.
Our Ref.:	CHC-XX-XX-CO-M-00001

SuDS Maintenance Plan

This SuDS Maintenance Plan has been prepared as a standalone appendix to the Infrastructure Design Report for Character Area R5, Confey Lands, Leixlip. It addresses the Sustainable Drainage Systems identified in Section 5.0 of the report, namely rainwater butts, permeable paving, green roof areas, tree pits, conveyance swales with infiltration trenches, infiltration blanket/interception storage areas, flow control devices, oil and silt interceptors, outfalls and associated carrier pipework.

The purpose of this plan is to set out the inspection, maintenance and record keeping regime required to preserve the hydraulic, water quality, amenity and biodiversity functions of the proposed SuDS network for the lifetime of the development. The maintenance regime is based on the principles of the CIRIA SuDS Manual C753, the Greater Dublin Strategic Drainage Study and Irish nature-based surface water management guidance.

1.0 Responsibility for Maintenance

Prior to occupation, the developer shall confirm the party responsible for the long-term management and maintenance of all communal SuDS assets. This may be a management company, local authority or other approved maintaining body, subject to agreement as part of the planning, taking-in-charge or estate management process. Private SuDS assets located within individual residential curtilages, including rainwater butts and private permeable paved areas, shall be maintained by the relevant homeowner or occupier unless otherwise assigned under the estate management arrangements.

A SuDS asset register shall be prepared and retained by the maintaining body. The register should identify each SuDS component, its location, catchment reference, design function, inspection frequency, maintenance

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Registered Address: Balheary Demesne, Balheary Road, Swords, County Dublin, K67 E5A0
Registered in Dublin, Ireland Company No. 576756

requirements and any health and safety considerations. The asset register should be reviewed following construction and updated following any material change, repair, replacement or alteration to the drainage system.

2.0 General Inspection and Maintenance Principles

Routine inspections shall be undertaken to confirm that inlets, outlets, flow controls, swales, permeable surfaces, tree pits, green roofs and interception storage features remain free from blockage, sediment build-up, excessive vegetation, damage or unauthorised alteration. Additional inspections should be carried out after significant rainfall events, during the establishment period for landscaped SuDS features and following any construction or utility works in the vicinity of the drainage network.

Maintenance shall be undertaken using appropriate methods that avoid compaction of soils, damage to root zones, contamination of planted areas or displacement of permeable pavement jointing material. Sediment, litter, hydrocarbons and arisings removed from SuDS components shall be disposed of in accordance with applicable waste management requirements.

3.0 Maintenance Schedule

SuDS Element	Inspection / Maintenance Requirement	Frequency	Responsible Party
Rainwater butts	Check taps, lids, overflow connections and leaf guards. Remove debris, confirm overflow routes remain clear and ensure butts remain stable and watertight.	Every 6 months and after severe storms	Homeowner / occupier
Permeable paving	Inspect for ponding, clogging, deformation, settlement, blocked joints, contamination and weed growth. Sweep/vacuum surface and reinstate jointing grit where required.	Quarterly visual inspection; annual specialist clean; additional cleaning if ponding is observed	Management company / homeowner as applicable
Green roof areas	Inspect vegetation condition, drainage outlets, inspection chambers, edging, erosion, bare patches and invasive species. Remove litter and unwanted vegetation. Replace failed planting where required.	Twice yearly, preferably spring and autumn; more frequently during establishment	Management company / building owner
Tree pits	Check inlets, overflows, mulch, planting condition, sediment build-up and evidence of standing water. Remove litter and silt from inlet	Quarterly; monthly during first growing season; after severe storms	Management company / landscape contractor / Local

	zones. Maintain planting and replace failed trees or shrubs.		Authority when taken in charge
Conveyance swales with infiltration trenches	Inspect vegetation, side slopes, erosion, silt deposition, ponding, blockages, inlets, outlets and check dams if present. Remove litter and sediment, reinstate erosion damage and maintain grass/planting height suitable for conveyance.	Quarterly and after severe storms; grass cutting as required during growing season	Landscape contractor / Local Authority when taken in charge
Infiltration blanket / interception storage areas	Confirm that overlying swale and inlet arrangements remain clear and that prolonged standing water is not evident. Investigate any persistent ponding or loss of storage performance.	Quarterly and after severe storms	Developer / Local Authority when taken in charge
Flow control devices	Inspect chambers and Hydrobrake or similar control units for blockage, sediment, damage, debris, corrosion and unauthorised adjustment. Remove debris and silt. Confirm discharge control is unobstructed.	Every 6 months and after severe storms	Developer / Local Authority when taken in charge
Oil and silt interceptors	Inspect oil level, silt depth, alarms where fitted, baffles, covers and structural condition. Empty and clean when required by manufacturer guidance or when silt/oil storage capacity is reduced.	Every 6 months; empty as required; after pollution incident	Developer (using licensed waste contractor) / Local Authority when taken in charge
Outfalls to watercourse	Inspect headwalls, aprons, erosion protection, flap valves where present, screens and banks for obstruction, erosion, undermining, structural damage or unauthorised works. Remove debris and repair erosion protection as required.	Every 6 months and after severe storms	Developer / Local Authority when taken in charge
Carrier pipes, manholes and gullies	Inspect covers, benching, channels, gullies and pipework for sediment, damage, root ingress or blockage. Jet or cleanse only where necessary and avoid discharging sediment downstream.	Annual inspection; cleanse as required; after blockage or flood incident	Developer / Local Authority when taken in charge

4.0 Planned Preventative and Response Maintenance Regime

The maintenance regime shall comprise planned preventative maintenance, reactive response maintenance and emergency maintenance/repairs. Planned preventative maintenance shall be scheduled in advance and shall include routine inspections, cleaning, vegetation management, sediment removal, specialist cleansing, testing of alarms and flow controls where applicable, review of access arrangements and updating of the SuDS asset register. The objective of planned preventative maintenance is to preserve hydraulic capacity, water quality treatment, amenity and biodiversity performance before defects become operational failures.

Reactive response maintenance shall be undertaken where inspections, resident reports, management company observations or monitoring identify a defect or emerging performance issue. Response actions may include clearance of blocked inlets, gullies, chambers, flow controls or outfalls; removal of accumulated silt, litter or debris; localised reinstatement of eroded swales or landscaped SuDS areas; repair of damaged covers, gratings, kerbs, check dams, headwalls, overflow routes or access points; and investigation of persistent ponding, surcharge or exceedance flow paths.

Emergency maintenance and repairs shall be carried out where there is an immediate or significant risk of flooding, pollution, structural failure, public safety hazard, blockage of a critical drainage route, damage following severe weather, collapse or displacement of drainage infrastructure, uncontrolled discharge, contamination by oils/chemicals/silt, or any condition that may result in environmental harm. Emergency response shall include making the area safe, isolating the affected drainage route where practicable, removing blockages, containing spills, arranging specialist cleansing or pumping where required, notifying relevant stakeholders and authorities where appropriate, and undertaking temporary or permanent repairs to restore safe operation.

Emergency repairs checklist:

- Confirm the nature and location of the incident, including whether it relates to flooding, blockage, pollution, collapse, erosion, damaged covers/gratings, outfall obstruction or failure of a flow control device.
- Make the area safe, restrict public access where required and implement appropriate temporary traffic, pedestrian or site safety measures.
- Identify the affected drainage catchment and isolate the drainage route where practicable to prevent further flooding, surcharge, uncontrolled discharge or pollution migration.
- Notify the management company, maintaining body, drainage contractor and any relevant stakeholders. Notify the local authority, Inland Fisheries Ireland, Uisce Éireann or environmental regulator where the incident presents a potential public drainage, watercourse, wastewater or pollution risk.

- Remove blockages, litter, sediment, debris or obstructions from inlets, gullies, manholes, flow controls, swales, outfalls and overflow routes as required to restore hydraulic performance.
- Contain and recover oils, fuels, chemicals, concrete washout, silt-laden runoff or other contaminants using spill kits, temporary bunding, drain mats, specialist vacuum tankering or other appropriate measures.
- Arrange specialist cleansing, pumping, CCTV survey, interceptor emptying, structural inspection or emergency excavation where required to determine the cause and extent of the defect.
- Carry out temporary repairs where necessary to maintain safe operation, including temporary covers, barriers, localised reinstatement, temporary diversion, emergency patch repair or temporary erosion protection.
- Complete permanent repairs as soon as practicable, including replacement of damaged covers, gratings, pipework, headwalls, flow controls, kerbs, check dams, erosion protection, planting, permeable pavement jointing material or other affected SuDS components.
- Confirm that the repaired asset is operating correctly, that exceedance routes are unobstructed and that no residual pollution, sediment, flood debris or safety hazard remains.
- Record the incident, response time, persons notified, photographs, weather conditions, cause, actions taken, waste disposal records, temporary works, permanent repairs and any follow-up inspection or maintenance requirement.
- Review the incident to determine whether inspection frequency, maintenance procedures, emergency contacts, contractor response arrangements or asset condition ratings require amendment.

The maintaining body shall keep an emergency contact list for the management company, drainage maintenance contractor, landscape contractor, specialist interceptor contractor, spill response contractor, local authority drainage contact and other relevant parties. Emergency call-out arrangements shall be confirmed prior to occupation and reviewed periodically. Where temporary works are required to maintain drainage service, permanent reinstatement shall be programmed as soon as practicable and the cause of the incident shall be reviewed to identify any required change to inspection frequency, maintenance method or asset condition rating.

5.0 Establishment Period

During the first two years following completion, landscaped SuDS elements shall be inspected more frequently to confirm successful establishment. This shall include watering during dry periods, replacement of failed planting, removal of invasive or nuisance species, reinstatement of eroded areas, checking inlet levels and confirming that sediment is not preventing runoff from entering the intended SuDS feature.

6.0 Severe Weather, Emergency Response and Pollution Incidents

Following intense rainfall, prolonged rainfall, named storms, flooding reports or any indication of surcharge, erosion or blockage, the maintaining body shall inspect all critical inlets, outlets, flow controls, swales, interception storage areas, manholes, gullies and outfalls. Any blockage, damage, structural defect or obstruction that could impair the performance of the system shall be treated as a response maintenance item and addressed as soon as practicable. Where there is an immediate flood risk, public safety risk or environmental risk, emergency call-out procedures shall be activated.

In the event of a pollution incident, the affected drainage route shall be isolated where practicable and specialist clean-up measures shall be implemented. Interceptors, affected manholes, gullies, permeable paving areas and SuDS components shall be inspected and cleaned by an appropriately competent contractor. Contaminated material shall be removed and disposed of in accordance with applicable waste legislation. The maintaining body shall record the incident, corrective actions, disposal documentation, photographs and any notifications made to relevant authorities or stakeholders.

7.0 Inspection Records

The maintaining body shall keep a written record of all SuDS inspections, planned preventative maintenance, response maintenance, emergency call-outs and repairs. Records should include the inspection date, weather conditions, inspector name, assets inspected, condition rating where used, defects observed, photographs where relevant, maintenance actions completed, materials used, waste disposal records, contractor details, time taken to respond, temporary measures installed, permanent repair requirements and any follow-up actions required. Records should be retained for review by the maintaining body, residents' management company, local authority or other relevant stakeholder as required.

8.0 Prohibited Activities

The following activities shall not be permitted without approval from the maintaining body and, where relevant, the drainage designer or local authority: covering or paving over SuDS features; altering inlet, outlet or overflow levels; storing materials within swales or tree pits; compacting landscaped SuDS areas; discharging concrete washout, oils, chemicals or silt-laden water to the drainage network; removing planting without reinstatement; or modifying flow control devices.

9.0 Review of Plan

This SuDS Maintenance Plan shall be reviewed following completion of the as-built drainage records and thereafter at intervals not exceeding five years, or sooner if operational issues are identified. The review shall confirm whether the inspection frequencies, maintenance procedures and responsible parties remain appropriate for the condition and performance of the SuDS network

The review shall include consideration of all emergency maintenance and repair records, recurring defects, response times, complaints, flooding reports, pollution incidents, asset condition trends and any changes in ownership or maintenance responsibility. Where recurring defects are identified, the maintaining body shall implement corrective action, which may include increasing inspection frequency, changing maintenance methods, undertaking remedial works or seeking specialist engineering advice.

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