ENGINEERING SERVICES REPORT

Ratoath South SHD

For Beo Properties Limited

PROJECT NO. L308

23 May 2022

OCSC
O'CONNOR | SUTTON | CRONIN
Multidisciplinary
Consulting Engineers

ENGINEERING SERVICES REPORT

Ratoath South SHD

for Beo Properties Limited

PROJECT NO. L308

23 May 2022

ENGINEERING SERVICES REPORT

for

Ratoath South SHD,

at Ratoath,

Co. Meath.

OCSC
O'CONNOR | SUTTON | CRONIN
Multidisciplinary Consulting Engineers

NOTICE

This document has been produced by O'Connor Sutton Cronin & Associates for its client, *Beo Properties Limited.* It may not be used for any purpose other than that specified by any other person without the written permission of the authors.

DOCUMENT CONTROL & HISTORY

OCSC Job No.: L308	Project Code	Originator	Zone Volume	Level	File Type	Role Type	Number	Status / Suitability Code	Revision
	L308	**OCSC**	**XX**	**XX**	**RP**	**C**	**0003**	**S4**	**P04**

Rev.	Status	Authors	Checked	Authorised	Issue Date
P04	S4	ZB/LA	MK	AH	20.05.2022
P03	S4	ZB/LA	MK	AH	16.04.2022
P02	S4	DR/SMcG	MK	AH	05.10.2021
P01	S2	DR/SMcG	MK	AH	15.09.2021

ENGINEERING SERVICES REPORT

TABLE OF CONTENTS PAGE

APPENDICES

ENGINEERING SERVICES REPORT

1 INTRODUCTION

1.1 Appointment

O'Connor Sutton Cronin & Associates (OCSC) have been appointed by *Beo Properties Limited* to carry out the design of the civil engineering services associated with the proposed Residential Development, located in the south-eastern environs of the town of Ratoath, Co. Meath.

1.2 Administrative Jurisdiction

The proposed development is located in the jurisdiction of Meath County Council (MCC), and therefore the engineering services design was carried out with reference to the following:

- Meath County Development Plan;
- Ratoath Local Area Plan;
- Greater Dublin Strategic Drainage Study (GDSDS);
- The Planning System and Flood Risk Management Guidelines for Planning Authorities (Department of Environment, Heritage and Local Government and the Office of Public Works);

It is noted that due to the number of residential units proposed as part of the proposed development, the planning permission is sought through An Bord Pleanala's (ABP) Strategic Housing Development (SHD) application process.

1.3 Site Location

An irregularly shaped site of approximately c.13.165 ha, located immediately to the south of the existing built area of Ratoath in County Meath. The site, as shown in Figure 1-1**,** is generally bound as follows:

- to the north by Glascarn Lane and the rear of houses at Glascarn Lane;
- to the east and south by existing agricultural fields and by Glascarn Lane;
- and to the west by Fairyhouse Road (R155), the rear of houses at Fairyhouse Road, the Carraig Na Gabhna and Cairn Court developments, and existing agricultural fields.

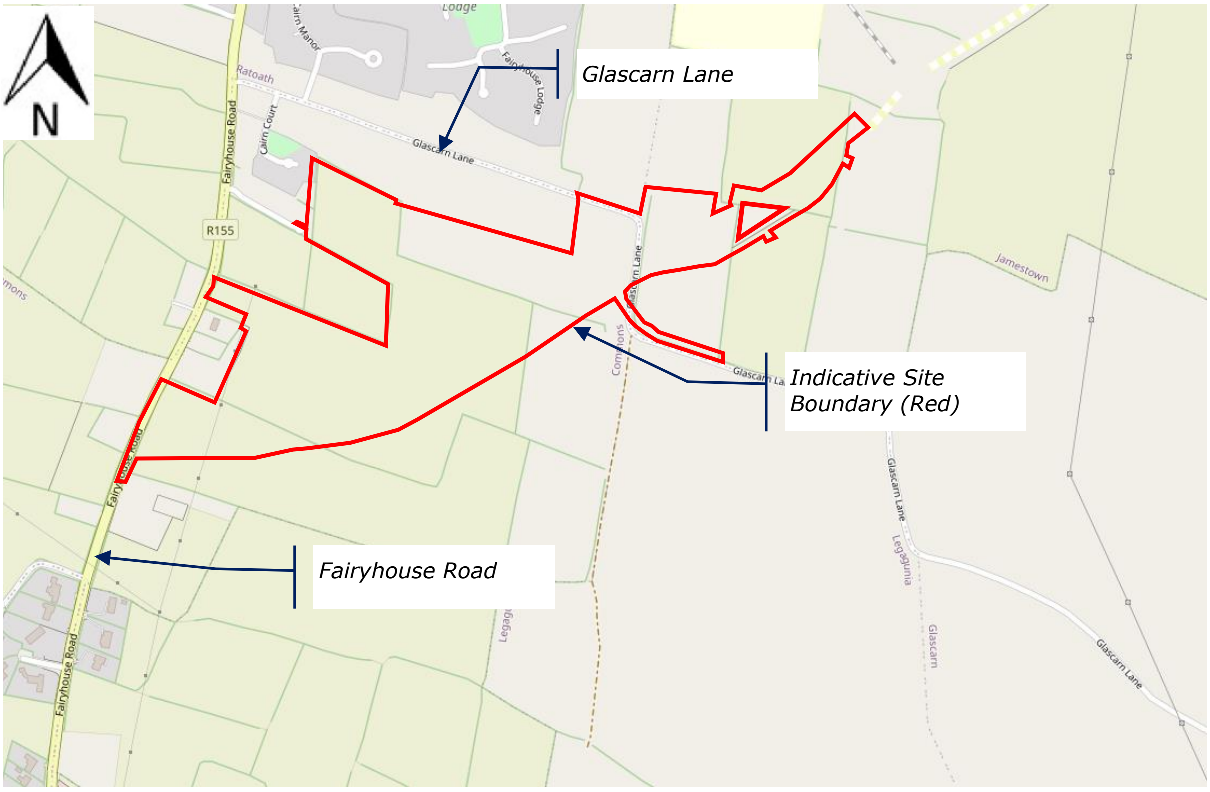


Figure 1-1: Site Location

1.4 Existing Site Overview

The site is currently greenfield and used for agricultural purposes and can be accessed from Glascarn Lane to the east and Fairyhouse Road to the west of the site.

Ground levels across the site fall generally from south-west to north-east towards Glascarn Lane. Levels along the public road forming the south-western boundary of the site are approximately 93.5 mAOD and these fall to approximately 90.5 mAOD along the north-eastern boundaries of the site. There are two local high points of 92.8 mAOD in a small area in the centre of the site surrounded by a plateau area at 92.8 mAOD. Refer to Figure 1-2 for context of existing site levels.

Figure 1-2: Existing Site Levels

1.5 Proposed Development Context

The development will principally consist of the construction of 452 no. residential units which are located in 12 neighbourhoods. Building heights ranging from 2-3 storey terraced houses and 3-4-storey duplex buildings (1 storey ground floor units and 2 storey first and second floor units; 2 storey ground and first floor units and 2 storey second and third floor units) and 6-storey apartment blocks. Private open space associated with the residential units is provided in the form of rear gardens, balconies, terraces and winter gardens. The development includes a crèche with associated outdoor play areas at ground floor and at roof level; 4 no. commercial/retail units; a landscaped public open space which includes a civic plaza; communal open space in the form of communal courtyards for each neighbourhood; associated car and cycle parking serving the full development and uses therein; solar PV panels; a second phase of the Ratoath Outer Relief Road (RORR), that will run along the southern boundary of the application site join up to the existing constructed section of the RORR, with two priority controlled junctions; a series of pedestrian and cycle connections from the Fairyhouse Road (R155), Cairn Court, Glascarn Lane and the new RORR; internal road and shared surface networks including pedestrian and cycle paths; public lighting and all associated site development and infrastructural works, services provision, ESB substations, foul and surface water drainage, extension to the foul network, access roads/footpaths, lighting, landscaping and boundary treatment works and all ancillary works necessary to facilitate the development.

Please refer to the development description within the statutory notices for a complete description of the proposed development.

The proposed site layout is shown in Figure 1-3 below.

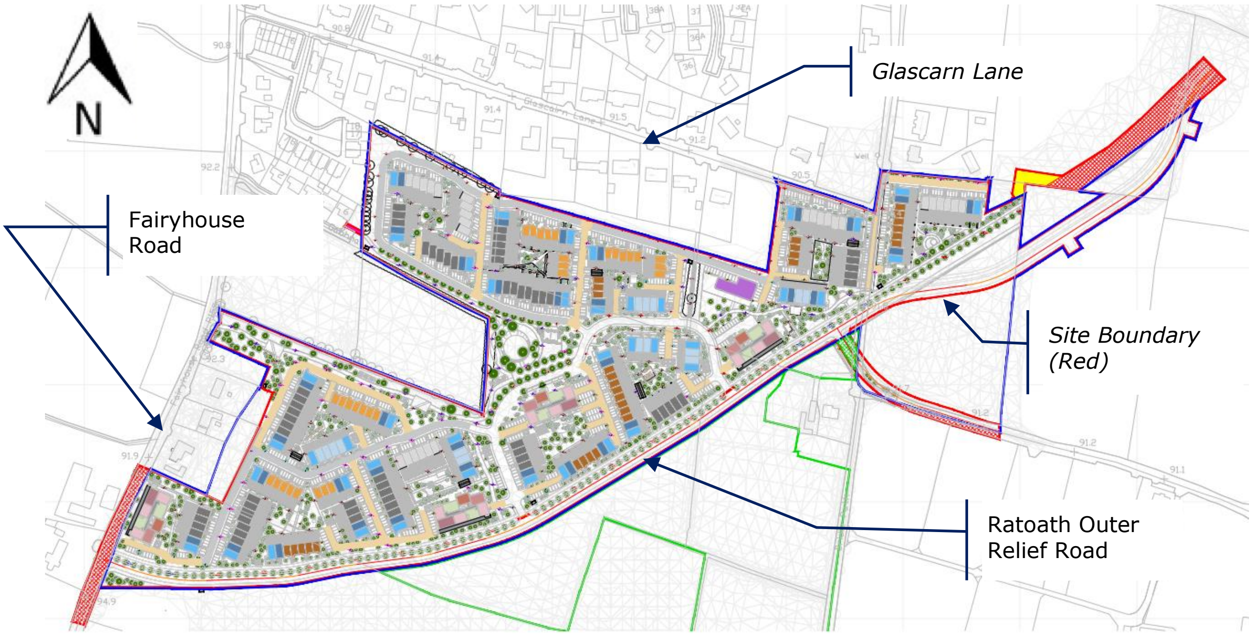


Figure 1-3: Site Layout

2 SCOPE OF THE REPORT

This Engineering Services Report was prepared by reviewing the available data from the Local Authority sources and national bodies *i.e.* Meath County Council, Irish Water, The OPW, and the wider Design Team. The report addresses the following services with respect to the proposed development:

- Surface Water Drainage;
- Wastewater Drainage;
- Potable Water Supply;
- Road Design.

An assessment on the potential flood risk and traffic impact associated with, and as a result of, the proposed development is provided in reports submitted under separate cover as part of this application. This report should be read in conjunction with the OCSC Civil Engineering design drawings.

The proposed design, for the aforementioned services, have been carried out in accordance with the following technical guidelines and information:

- Meath County Council Development Plan 2021-2027;
- Greater Dublin Strategic Drainage Study (GDSDS);
- Greater Dublin Regional Code of Practice for Drainage Works (GDRCOP);
- Irish Water Code of Practice & Standard Details for Wastewater;
- Irish Water Code of Practice & Standard Details for Water Supply;
- The Building Regulations – Technical Guidance Document Part H;
- BE EN 752 – Drainage Outside Buildings;
- BS 7533-13 – Guide for Design of Permeable Pavements;
- Design Manual for Urban roads and Streets;
- Meath County Council and Irish Water Drainage and Watermain Records.

Members of the wider design team cover all other elements of the application pertaining to sustainability, landscaping, planning and architectural detail.

3 SURFACE WATER DRAINAGE

3.1 Design Guidelines Overview

Any planning permission sought on the subject lands are required to adhere to the Local Authority requirements *i.e.* the Meath County Development Plan, Ratoath Local Area Plan, and as such, the Greater Dublin Strategic Drainage Study (Dublin City Council, 2005).

New development must ensure that a comprehensive Sustainable 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, surface water volumes from extreme rainfall events up to a 1 in 100-year rainfall event, more commonly expressed as a 1.0% AEP (Annual Exceedance Probability), *while also allowing for an additional climate change factor of **20%** increase in rainfall intensity*. Any new development must also have the physical capacity to retain surface water volumes as directed under the Greater Dublin Strategic Drainage Strategy (GDSDS) and, if necessary, release these attenuated surface water volumes to an outfall at a controlled flow rate, not greater than the greenfield runoff equivalent.

A further component of the SuDS protocol is to increase the overall water quality of surface water runoff before it enters a natural watercourse or a public sewer, which ultimately discharges to a water body. This is to ensure the highest possible standard of surface water quality.

SuDS are designed in accordance with best practice and the CIRIA C753 (The SuDS Manual) guidance material.

3.2 Existing Site Drainage

3.2.1 Existing Site Catchment Areas

The catchment area for the surface water network is 13.165 hectares which includes the subject development and an additional 2.18 hectares to the west.

The site is split into 2 catchments by virtue of the existing surface water drain onsite. The northern catchment drains in a northerly direction.

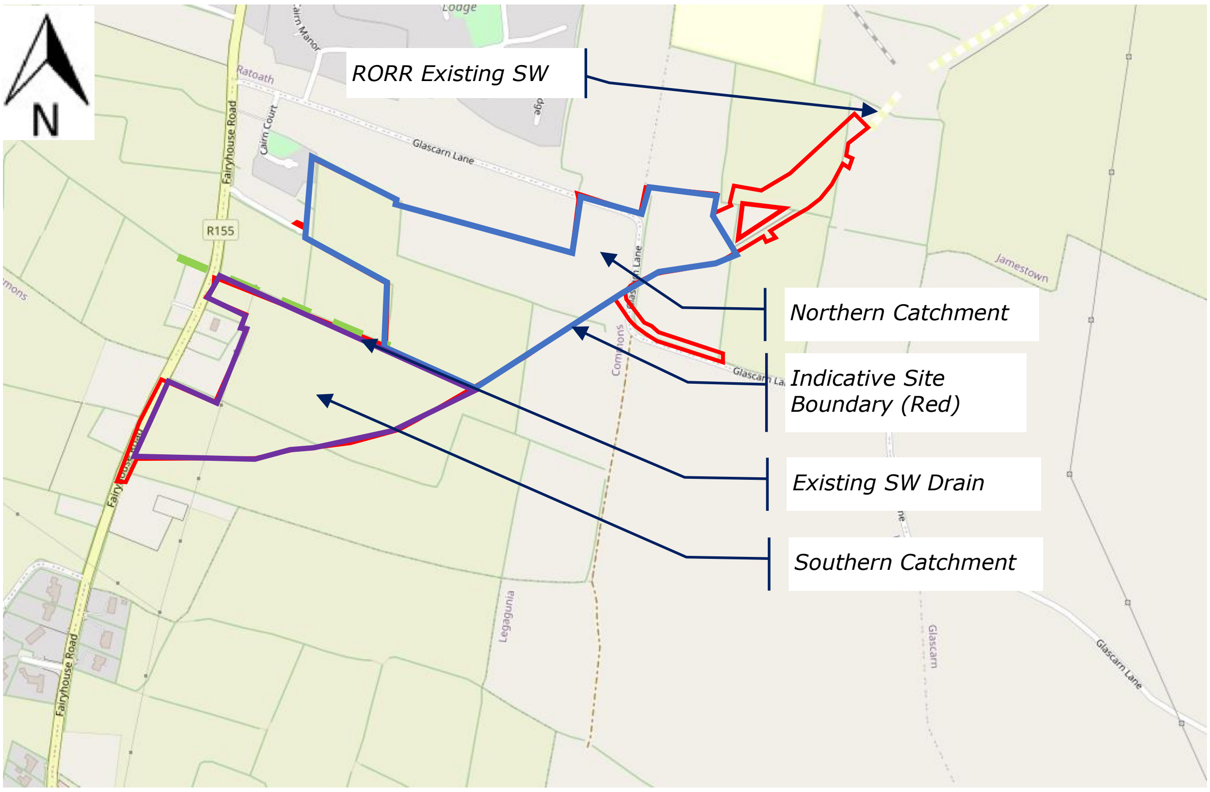


Figure 3-1: Surface Water Catchments

The southern catchment drains naturally to the drainage ditch, which travels under the Fairyhouse Road where it then travels in a westerly direction towards the Bradystown Stream (see Figure 3-2).

While there is an existing drainage ditch onsite, the site is not located in an area which benefits from an OPW Arterial Scheme.

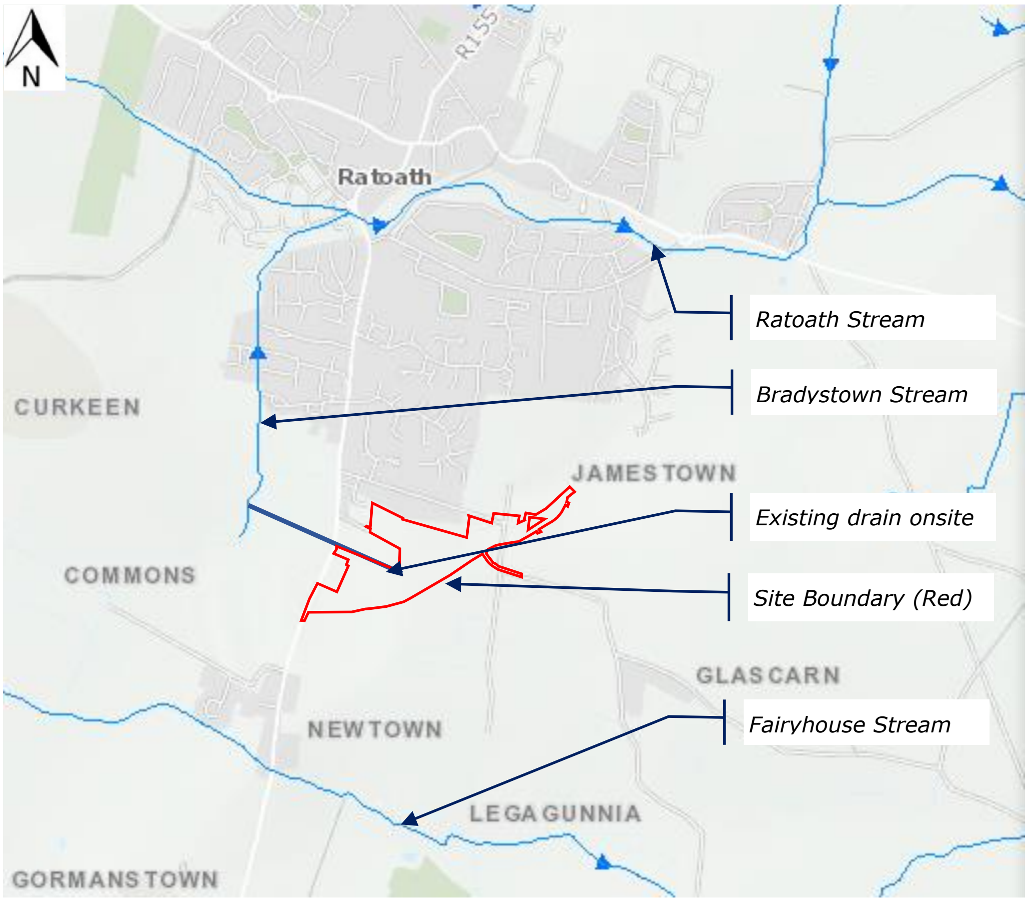


Figure 3-2: EPA Surface Water Map Viewer

3.2.2 Existing Surface Water Drainage Infrastructure

There is minimal surface water infrastructure in the vicinity of the proposed site. There is an existing drain which runs east west within the site boundary which drains the lands at present, see **Error! Reference source not found.**.

There is a surface water network constructed as part of the Ratoath Outer Relief Road to the north-east of the proposed development, please see Figure 3-3. This network has been sized to accommodate greenfield runoff flows from upstream catchment, and discharges attenuated flows to adjacent stream via an attenuation pond.

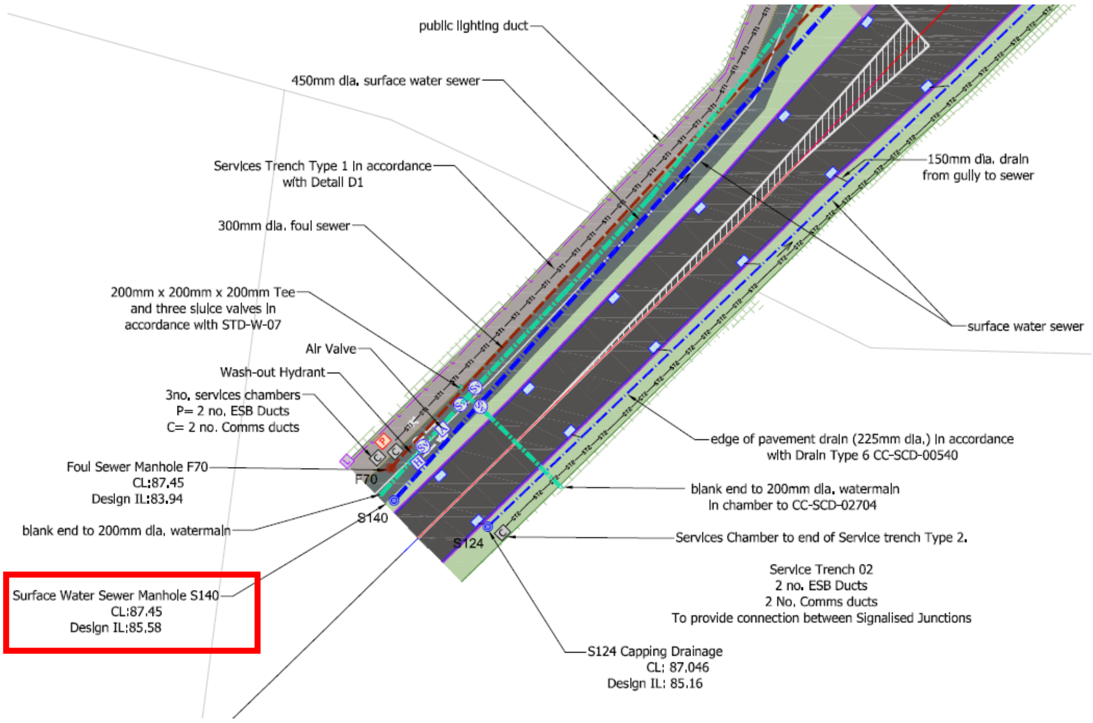


Figure 3-3: Ratoath Outer Relief Road Infrastructure

3.2.3 Existing Site Rainfall Runoff

All surface water runoff on the existing site currently drains naturally to the drainage ditches onsite. Refer to Section 1.4 for overview details of the existing site topography.

A site investigation was carried out by IGSL on the site in September 2020. Infiltration tests were attempted at 4 no locations across the site. There was no fall in water recorded during the tests.

The results of the investigation confirm the presence of glacial till or bounder clay deposits over the site area at depts of up to 10 m below ground level. Please refer to Appendix B for an extract of the site investigation.

Based on the site investigation, a Soil Type of 3 was selected to reflect the clays encountered.

Using the ICPSuDS Input (Flood Studies Report (FSR)) Method, the rainfall runoff discharging from the greenfield site area that is to be developed in its existing condition has been estimated at $QBAR_{RURAL}$ = **54.67 l/s** (3.56 l/s/ha) from the entire development, which includes for a portion of lands to the west of the red line boundary which has been included in the design of the surface water system for future development.

Refer to Appendix C for an excerpt of the results from the MicroDrainage Runoff Calculator, which also provides the calculated QBAR runoff rate along with the discharge rate for varying Annual Recurrence Intervals (ARI).

The southern catchment naturally drains to the existing surface water drain, and as such it is proposed to maintain this drainage route. The maximum attenuation entering the existing drain will be limited to 14.21 l/s (3.56 l/s/ha).

The remainder of the site (including the road) will drain to the existing surface water network to the north, and flows will be limited to 40.46 l/s (3.56 l/s/ha).

3.3 Proposed Surface Water Strategy Overview Surface Water Drainage Network

It is proposed to separate the surface water and wastewater drainage networks, which will serve the proposed development, and provide independent connections to the existing surface water and wastewater sewer networks respectively. Refer to Section 4 for details of the proposed wastewater drainage design.

It is proposed to provide an integrated SuDS network, to serve the proposed development, which will fall by gravity to discharge attenuated flow to the existing network to the north of the site as mentioned above.

A gravity surface water network will be provided throughout the proposed road layout, with the development's surface water runoff being attenuated to restrict the outfall flow rate to equivalent to the greenfield runoff.

Attenuation will be predominantly provided in the form of proprietary underground concrete tank prior to the outfall and at intermediary locations, in order to temporarily store excessive runoff volumes during significant rainfall events.

The attenuation in the central open space will comprise of a of detention basin and landscaped depressions with concrete storage tank below. Runoff from the more frequent events, up to and including the 1 in 30-year return period with a 10% increase in intensities to account for climate change is to be temporarily stored below ground. Less frequent events are to be temporarily stored within the detention basin.

A flow control chamber, immediately downstream of the attenuation systems will act to restrict the development's runoff to a flow rate equivalent to the existing networks.

The surface water has been designed to cater for the proposed development and an additional 2.18 ha to the west, see Figure 3-4.

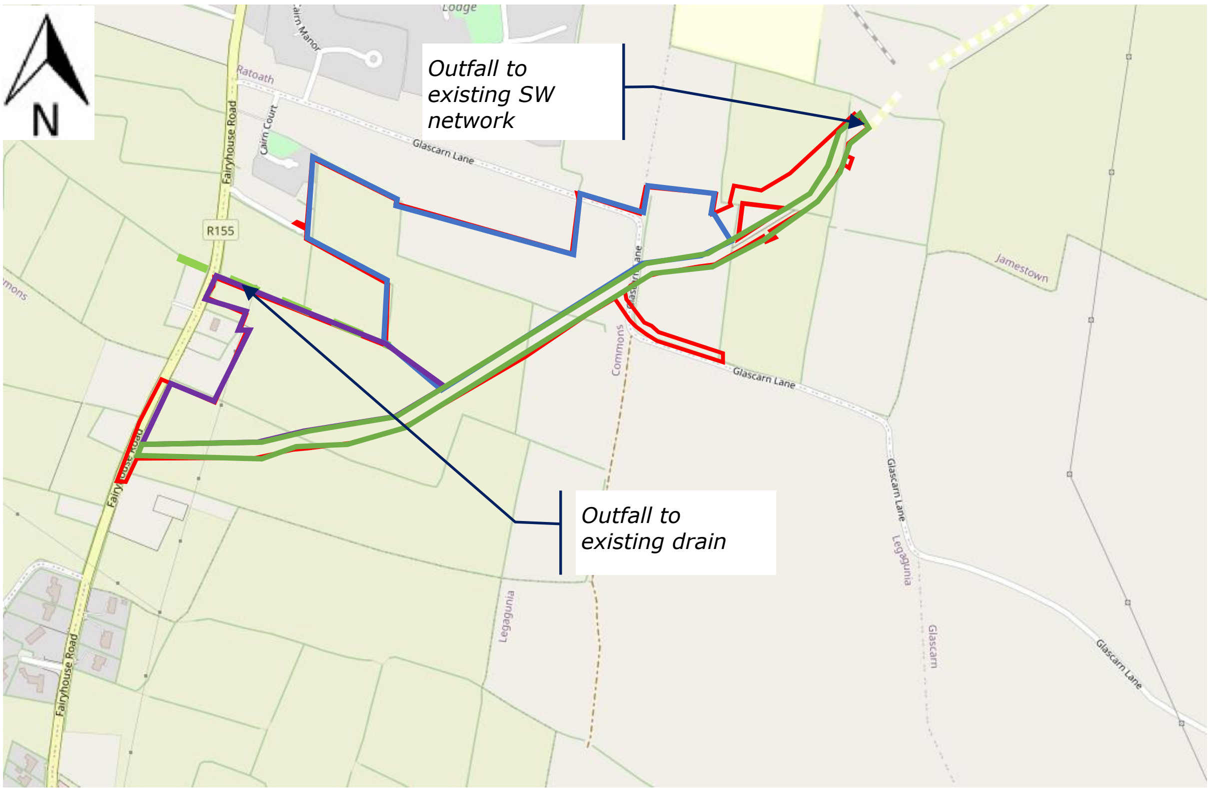


Figure 3-4: Proposed Surface Water catchment

3.3.4 Surface Water Outfall Locations

There are 2 no. surface water outfalls proposed as part of the development, see Figure 3-4. The total discharge from the site to the existing surface water networks will be limited to 54.67 l/s (3.56 l/s/ha).

Surface water from the south-west portion of the site will discharge to the existing surface water drain onsite with the discharge rate at the outfall location is to be restricted to a maximum flow rate of 14.2 l/s, which is the current greenfield equivalent runoff rate.

The remainder of the site will discharge attenuated flows to the existing surface water network on the Ratoath Outer Relief Road to the north-east. The discharge rate at the outfall location is to be restricted to a maximum flow rate of 40.46 l/s (3.56 l/s/ha), which is less than the current greenfield equivalent runoff rate (includes for Ratoath Outer Relief Road drainage).

The above is to ensure that there is no increase in flow rates and volumes, from the development site, being discharged to the receiving infrastructure and waterbodies; thus causing no adverse impact on adjoining and other downstream properties.

3.3.5 Climate Change Allowance

The proposed surface water network has been designed to allow for an additional 20% increase in rainfall intensity, to allow for Climate Change projections, in accordance with the Meath County Council Development Plan.

All discussion within this report with regards to surface water network design calculation and results, include for the allowance of an increase of 20% in rainfall intensity.

3.3.6 Proposed Surface Water Network Strategy

The proposed surface water network is to typically comprise a gravity pipe network, with significant Sustainable Drainage Systems implemented, where practicable.

The typical traditional and Sustainable Drainage Systems (SuDS) provided, all of which have been designed in accordance with CIRIA C753, the SuDS Manual, and the design guidance material listed in Section 2 of this report, are listed and detailed in order of general sequence within the drainage network, as follows:

3.3.6.1 Pervious Paving

Pervious pavements provide a pavement finish suitable for both pedestrian and vehicular traffic. Due to the low permeability of the soil and high groundwater level, the **Type C** pervious paving system is a best fit to the development characteristics, it is generally wrapped in an impermeable, flexible membrane placed above the subgrade. Once the water has filtered through the sub-base, it is conveyed to the outfall via perforated pipes or fin drains.

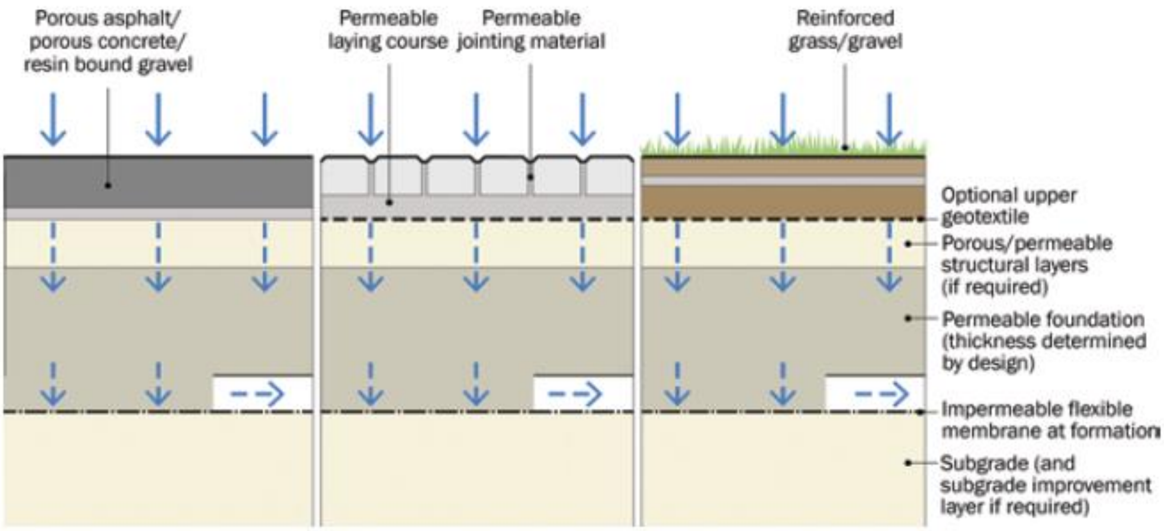


Figure 3-5: Detail of Type C Pervious Paving (CIRIA C753)

Pervious paving systems are an efficient means of treating the rainwater at source by providing initial interception of the rainwater and improving the surface water quality by providing at source treatment of the rainfall runoff leaving the site. This is achieved by helping remove and retain pollutants prior to discharge to the drainage system and / or groundwater system.

Rainfall runoff from roof level of the proposed housing units can also discharge to the permeable base course of the pervious paving, via a diffuser unit. This will allow for initial interception of rainfall, along with attenuation for each individual house unit.

A **Type C** pervious paving, with a 300 mm depth of open graded crushed rock as base course, is to be provided in all in-curtilage car parking spaces, within the proposed development. An overflow pipe, from the base-course, will be provided to the drainage network, which will allow for interception of initial rainfall, groundwater discharge, with an attenuated outflow to the main network in extreme rainfall events.

3.3.6.2 Green Roof

Extensive green roofs are to be considered for use, where large flat roofs are to be provided on both Apartment Blocks. Green roofs are designed to intercept and retain initial rainfall, which reduces the volume and rate at which it enters the surface water network.

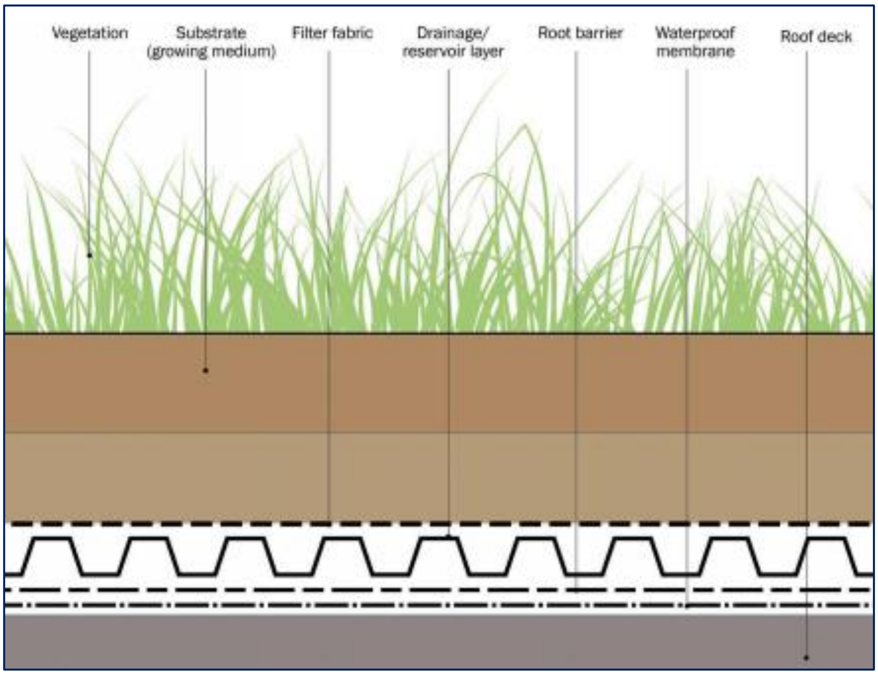


Figure 3.6: Typical Green Roof Build-up

3.3.6.3 Filter drains

Filter drains will be provided at the east side of the development, in an open space close to the access road on Glascarn Lane. Runoffs from the open space area will pass through the crushed rock filter strip. A perforated pipe will be provided near the base of the filter drain to collect the water from the filter drain and convey to the downstream surface water drainage network.

Filter drains can help in reducing the pollutant levels in runoff by filtering the fine sediments, metals, hydrocarbons and other pollutants. It can remove the need for kerbs and gullies when it is located adjacent to the roads.

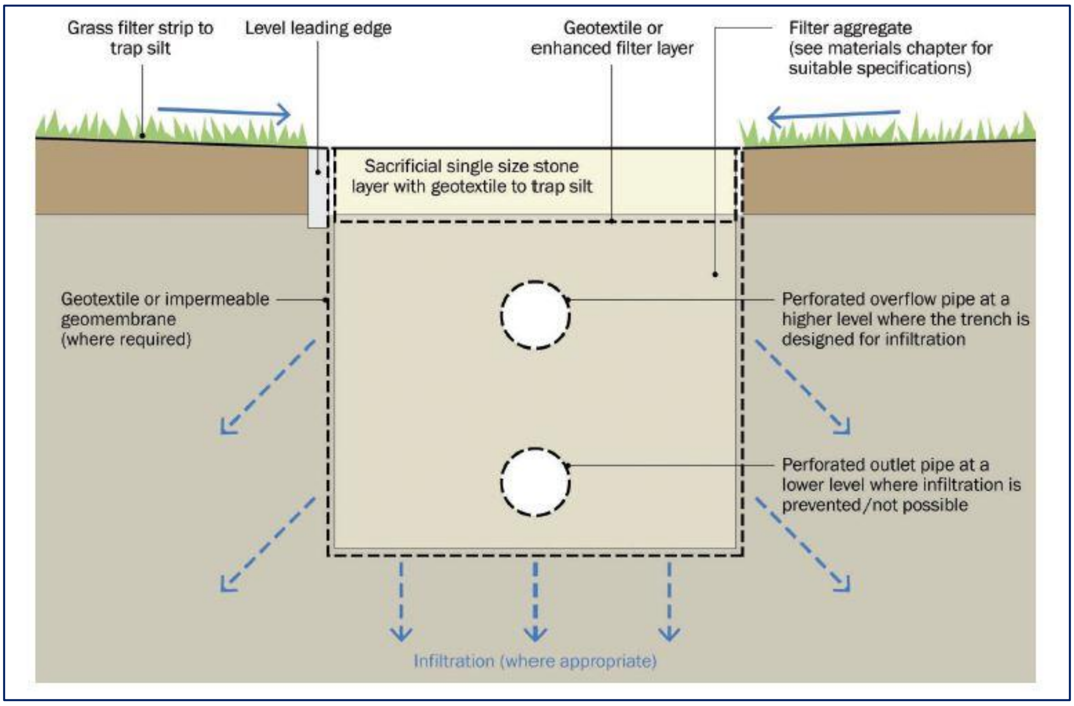


Figure 3-6: Filter Drain (Typical Detail)

3.3.6.4 Underground Pipe Network

A traditional gravity pipe and manhole network will be provided, to convey the collected rainfall runoff as far as the development's outfall. Manholes are provided for maintenance access at branched connections, change in pipe size and gradient, and at intervals no greater than 90 m distance.

3.3.6.5 Trapped Road Gullies

All road gullies serving the proposed development are to be trapped, to help prevent sediment and gross pollutants from entering the surface water network, and thus improving the water quality discharging from site.

The grated covers are to have a minimum load classification of D400, for frequent vehicular traffic, and shall be lockable, as required by MCC.

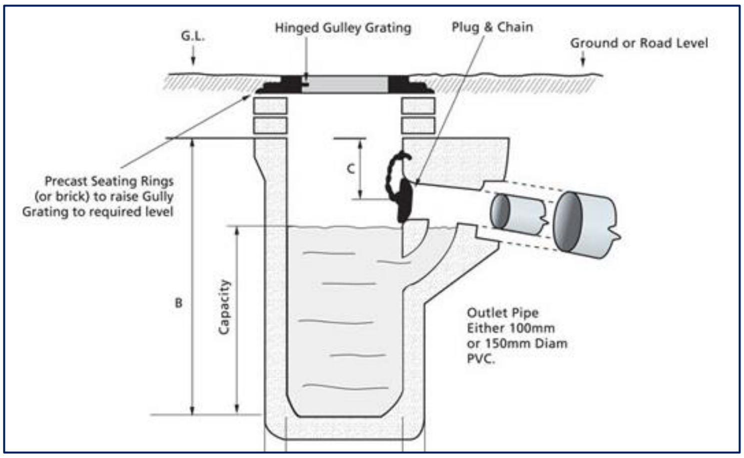


Figure 3-7: Trapped Road Gully (Typical Detail)

3.3.6.6 Silt Traps

All manholes upstream of attenuation systems are to contain a 600 mm sump, below invert level of outlet pipe, in order to trap sediment and other gross pollutants, and prevent from entering the downstream watercourse; thus improving the water quality discharging from site.

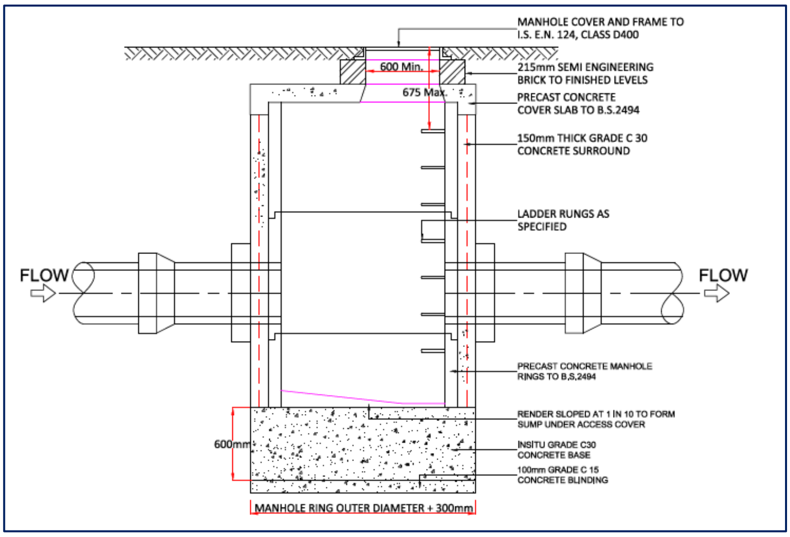


Figure 3-8: Typical Detail of Silt Trap Manhole

3.3.6.7 Oil Separator

Oil separators are designed to separate gross amounts of oil and large (>250 µm) suspended solids from the surface water, mainly through sedimentation process.

The proposed surface water network already provides sufficient mitigation measures, through the provisions listed previously (principally the pervious paving, trapped road gullies and silt traps, and the feature wetland). However, a Class 1 bypass fuel separator is to be provided as an additional and final mitigation measure, upstream of the attenuation system prior to surface water discharge to both the existing public network and watercourse.

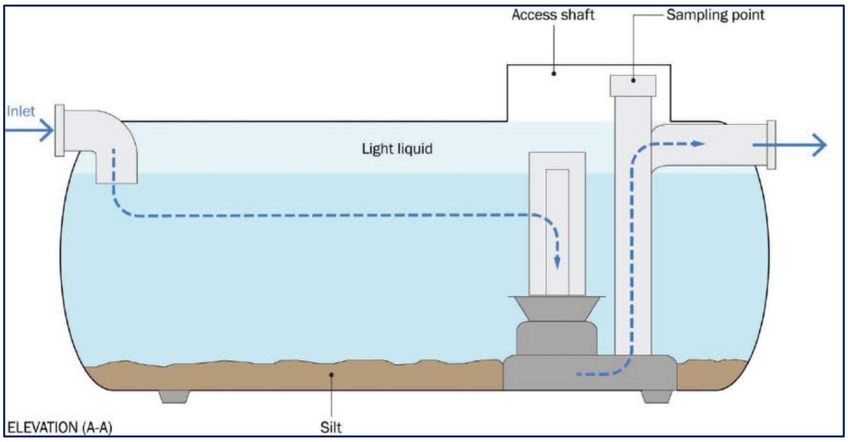


Figure 3-9: Typical Section Detail of Fuel Separator (CIRIA C753)

3.3.6.8 Detention Basins

As part of the overall attenuation system for the proposed development, a landscaped detention basin is to be provided above the concrete storage system in the central open space. The basin will be designed to temporarily store the rainfall events in excess of the 1 in 30-year rainfall event and up to and including the 1 in 100-year rainfall event with a 10% allowance for climate change.

Landscaping of the basin will allow it to be integrated in the developments open spaces and landscaped areas. Landscaping and vegetation can aid in the improvement of water quality while allowing for some infiltration, which will reduce the volume of runoff being discharged to the existing surface water network.

3.3.6.9 Concrete Storage Systems

Proprietary concrete storage units, lined with impermeable geomembrane as a result of relatively high groundwater, are to be provided for the required attenuation systems.

These systems are to provide sufficient temporary storage volume for rainfall events up to, and including, the design 1% AEP rainfall event (including climate change).

Figure 3-10: Concrete Storage System (CIRIA C753)

3.3.6.10 Flow Control Device

Flow Control devices are to be provided immediately downstream of attenuation systems, in order to restrict the surface water discharge from site to a flow rate equivalent, or below, the natural greenfield equivalent runoff rate of **54.67 l/s**.

It is proposed to provide the Hydro-brake optimum vortex flow control unit (or similar approved by MCC) at the 5 no. design locations, downstream of the attenuation systems.

Each flow control chamber is to be fitted with a penstock valve at the inlet and a bypass lever at the outlet (if required), to allow for easy access and maintenance.

Figure 3-11: Vortex Hydro-Brake Flow Control Unit (Hydro International)

3.4 Proposed Surface Water Network Detailed Design

3.4.1 Software Design Criteria

The proposed surface water network has been designed in accordance with the regulations and guidelines outlined in Section 2, using MicroDrainage Network Design package, by Innovyze Inc., which simulates the performance of the integrated drainage network for varying rainfall return periods and storm durations.

The MicroDrainage Network Design software applies the Flood Studies Report (FSR) methodology for analysis of the rainfall profiles. However, the input design parameters that were used, as part of this design, were based on the available Flood Studies Update (FSU) data, *i.e.* the return period rainfall depths for sliding durations, which determine the $\mathbf{M_{5\text{-}60}}$ and **R** values, and the standard annual average rainfall (SAAR); as sourced from Met Éireann.

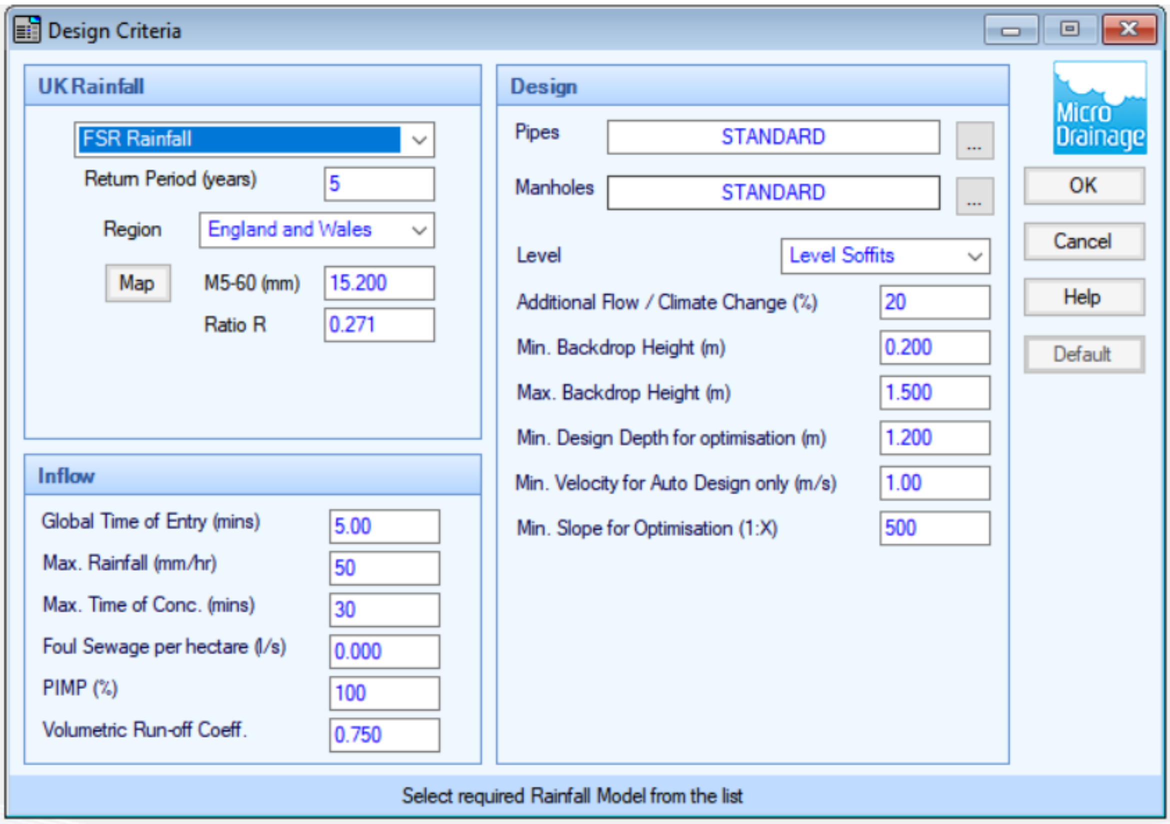


Figure 3-12: Surface Water Design Criteria (MicroDrainage Excerpt)

As indicated in Figure 3-12, the proposed network was designed to allow for an additional 20% increase in rainfall intensity, to allow for Climate Change, in accordance with the Meath County Council Development Plan and the GDSDS.

3.4.2 Proposed Surface Water Catchment Areas

The development drains towards this open area which contains underground attenuation. Interim flow controls are to be provided downstream of the attenuation to restrict flow rates and maximise the volume of storage achieved in this area and reduce the rate at which the runoff from this area enters the receiving environment.

For the purpose of the surface water network design simulation, all external hardstanding areas (roads, pavement, driveways and roofs) as being 100% impermeable; giving a *winter* global runoff coefficient, C_v, of 0.84, in accordance with the HR Wallingford and Modified Rational Method for runoff.

3.4.3 Proposed Development Rainfall Runoff

It is proposed to reduce and restrict the rainfall runoff, discharging from the proposed development to the greenfield equivalent, $QBAR_{RURAL}$, runoff rate, as per the FSR ICP SuDS method, which is based on the IH124 method for catchments smaller than 25 km^2 in area.

This is to be achieved with the provision of a flow restrictor (Hydro-Brake Optimum by Hydro-International, or similar approved) prior to discharging to the existing surface water networks in the Ratoath Outer Relief Road and existing surface water drainage ditch, with the appropriate measures of attenuation provided.

Refer to Figure 3-12 for an excerpt from the results MicroDrainage Runoff Calculator for the entire development catchment area which indicates the greenfield equivalent, $QBAR_{RURAL}$, value of **54.67 l/s** (3.56 l/s/ha) along with the calculated runoff for varying Average Recurrence Intervals (ARI).

3.4.4 Proposed Surface Water Pipe Network Design

The overall surface water drainage system, serving the proposed development, is to consist of a gravity sewer network that will convey runoff from the roofs and paved areas to the outfall manhole, which will discharge a controlled flow rate to the existing surface water network in the Ratoath Outer Relief Road to the north-east.

The proposed piped network has been designed in accordance with BS EN 752 and all new infrastructure is to be compliant with the requirements of the GDSDS and the GDRCOP for Drainage Works, with minimum full-bore velocities of 1.0 m/s achieved throughout.

All main surface water carrier pipes have been sized to ensure no surcharging of the proposed drainage network for rainfall events up to, and including, the 1 in 5-year ARI event, with a projected climate change allowance of 20% increase in rainfall intensity.

3.5 Proposed Surface Water Attenuation Storage

The proposed development is to attenuate rainfall runoff on site, prior to discharging to the local surface water sewer. The primary function of the attenuation systems will be to temporarily store excessive rainfall runoff, during significant rainfall events, due to the restricted discharge rates (to greenfield equivalent runoff rates) from the development outfalls.

The development is to combine a number of sustainable drainage features along with elements of a traditional drainage system. The developments attenuation is to consist of underground attenuation in the form of a underground concrete attenuation tank.

Pervious paving to be provided within all car parking spaces within the development. This will provide at source treatment of runoff from the roads while also providing interim storage within the base course. A minimum of 300mm stone with a minimum porosity of 30% is to be provided below the pervious paving. Runoff temporarily stored within the base course will be allowed to infiltrate naturally to ground water, an overflow from this is to be provided for events where infiltration is not achieved.

Temporary underground attenuation is to be provided within the developments open space, in order to restrict discharge rates from the development's surface water network to the greenfield equivalent flow rate. The attenuation has been designed to temporarily store the surface water runoff for design rainfall events up to, and including, the 1 in 100-year event with a 20% increase in rainfall intensity. Attenuation will be provided in the form of proprietary underground concrete tank (or equal approved) prior to the outfall and at intermediary locations, in order to temporarily store excessive runoff volumes during significant rainfall events.

A total of 2886.5 m^3 underground temporary storage is to be provided the development, which also provides for the 2.18 ha site to the west outside the current site boundary.

The attenuation in the central open space will comprise of a of detention basin and landscaped depressions with concrete storage tank below. Runoff from the more frequent events, up to and including the 1 in 30-year return period with a 10% increase in intensities to account for climate change is to be temporarily stored below ground. Less frequent events are to be temporarily stored within the detention basin.

The discharge from the development is restricted by a flow control device in the final manhole within the development prior to discharging to the existing surface water networks, which limits discharge from the whole site to the greenfield runoff rate (Q_{bar}) of 54.67 l/s (3.56 l/s/ha).

3.6 Water Quality

The quality of the surface water discharging from site is to be improved through the following provisions, each of which is discussed in greater detail in *Section 3.3.6*:

- Pervious Paving in all parking areas both private driveways and shared surfaces, as described above;
- Filter drains as appropriate;
- Intensive landscaping, where practical;
- Interception storage;
- Trapped road gullies on all road carriageways, to trap silt and gross pollutants;
- Silt traps to be provided on manholes immediately upstream of attenuation systems, as a further preventative measure to trap silt and other gross pollutants;
- Class 1 fuel separator to be provided prior to discharging from site.

3.7 Maintenance

The proposed surface water drainage network has been designed to minimise the risk of blockages throughout the network, mainly through the following provision that limit and restrict the size of pollutants entering the network:

- Pervious paving;
- Green roof;
- Petrol interceptor;
- Trapped road gullies; and
- Silt trap manhole.

Road gullies, green roof, flow control devices and attenuation systems, should be maintained, as appropriate and in accordance with manufacturer's recommendations and guidelines.

Typical operation and maintenance requirement for attenuation tanks are included in CIRIA C753 SuDS Manual and outlines the typical maintenance schedule, required actions and frequency.

3.8 Taking in Charge

It is proposed that all new surface water infrastructure, **will** be offered to be taken in charge by Meath County Council.

4 WASTEWATER DRAINAGE NETWORK

4.1 Overview

All proposed wastewater sewer design has been carried out in accordance with Irish Water’s Code of Practice for Wastewater Infrastructure. The existing site is currently greenfield, with no wastewater discharge to the local wastewater infrastructure.

A new wastewater connection, serving the proposed development, is to be provided to the wastewater infrastructure in the Ratoath Outer Relief Road.

A Pre-Connection Enquiry Form (IW Ref No. CDS21005058) was submitted to Irish Water for the entire development.

A subsequent Statement of Design Acceptance was issued by Irish Water on 20th May 2022. A copy of this letter is provided in Appendix G.

4.2 Existing Wastewater Drainage

Irish Water records indicate that there is minimal existing wastewater infrastructure in the vicinity of the proposed development.

There is an existing 300 mm sewer located in the Ratoath Outer Relief Road which has not been captured on the Irish Water GIS database, see Figure 4-1.

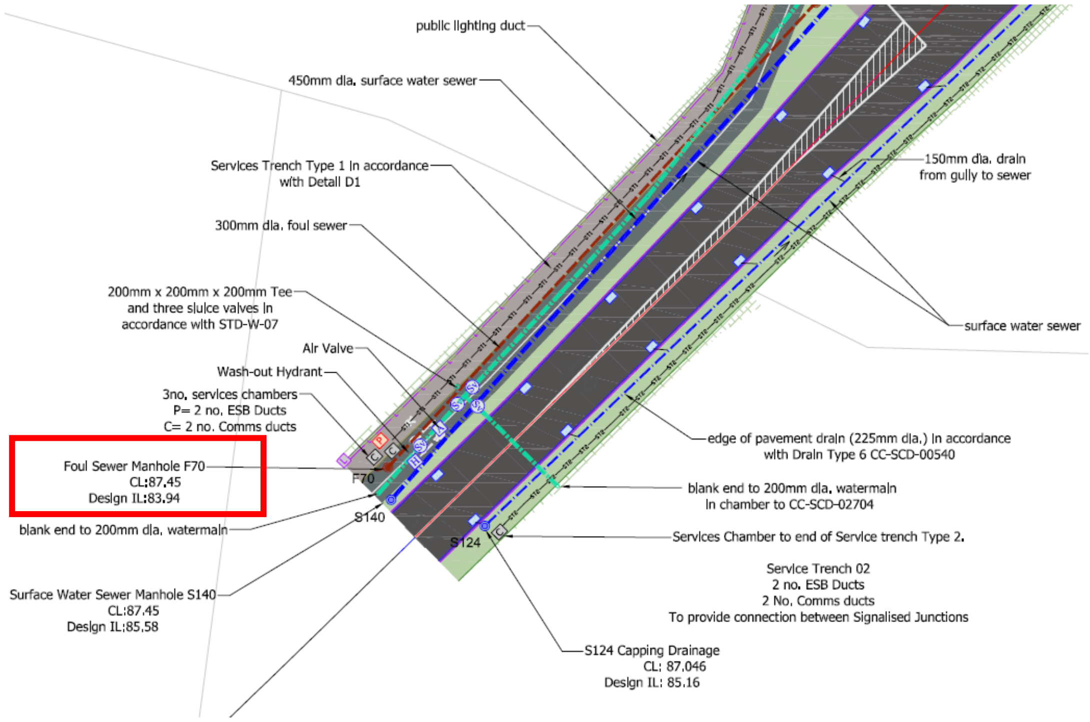


Figure 4-1: Ratoath Outer Relief Road Infrastructure

4.3 Consultation

A Pre-Connection Enquiry Form (IW Ref No. CDS21005058) was submitted to Irish Water for 600 no. domestic units. Irish Water have noted that a connection is feasible subject to the following:

"An approx. 300m network extension is required to connect to the new infrastructure installed as part of the new Ratoath Outer Relief Road, part of this extension is through third party lands, it is the applicants responsibility to obtain the relevant permissions before construction of these works."

Please see Confirmation of Feasibility enclosed in Appendix E.

A subsequent Statement of Design Acceptance was issued by Irish Water on 20th May 2022. A copy of this letter is provided in Appendix G.

4.4 Proposed Wastewater Drainage

It is proposed to separate the wastewater and surface water drainage networks, which will serve the proposed development, and provide independent connections to the local public foul and surface water sewers respectively. Please refer to Section 3 for details of the proposed surface water drainage design strategy.

The wastewater from each unit is to connect to the new gravity pipe network within the development, which has been designed in accordance with the Irish Code of Practice for Wastewater Infrastructure. The proposed wastewater design network, which will serve the proposed development and drain by gravity to an existing wastewater network on Ratoath Outer Relief Road.

The proposed wastewater network is to be designed and constructed in accordance with Irish Water Code of Practice for Wastewater Infrastructure, will be discharge through a gravity sewer from a constructed discharge manhole, at a location to be agreed with Irish Water.

4.5 Wastewater Network Design Calculations

The total peak design flow from this proposed development has been calculated as 7.54 l/s. Refer to Appendix F for wastewater loading calculations and network design tables, which have been carried out in accordance with Irish Water's Code of Practice for Wastewater Infrastructure.

Table 4-1: Wastewater Discharge

Type	No	Demand (l/day)	DWF (l/s)	Peaking factor	Peak (l/s)
Houses	451	446	2.33	3.0	6.98
Creche - Children	140	55	0.09	4.5	0.40
Creche - Staff	30	99	0.03	4.5	0.15
TOTAL			**2.45**		**7.54**

4.6 Taking in Charge

It is proposed that all new surface water infrastructure, **will** be offered to be taken in charge by Irish Water.

5 POTABLE WATER SERVICE NETWORK

5.1 Overview

All proposed potable water design has been carried out in accordance with Irish Water's Code of Practice for Water Infrastructure. The existing site was typically greenfield in nature with no potable water demand.

A new water connection, serving the proposed development, is to be provided to the water infrastructure in the Ratoath Outer Relief Road.

A Pre-Connection Enquiry Form (IW Ref Nr. CDS21005058) was submitted to Irish Water for the entire development.

A subsequent Statement of Design Acceptance was issued by Irish Water on 20th May 2022. A copy of this letter is provided in Appendix G.

5.2 Existing Water Infrastructure

There is an existing watermain located within the site boundary (75mm uPVC).

There is an existing 200 mm watermain located in the Ratoath Outer Relief Road which has not been captured on the Irish Water GIS database, see Figure 5-1. It is proposed to connect to this blank end.

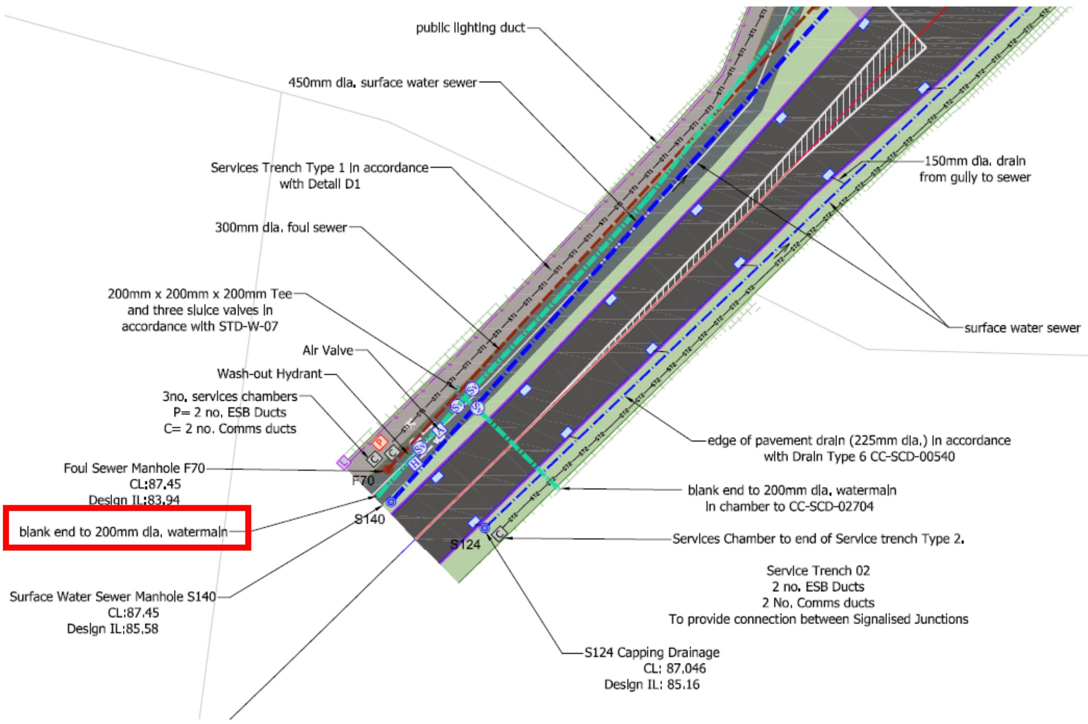


Figure 5-1: Ratoath Outer Relief Road Infrastructure

Refer to **Appendix A** for details of existing water infrastructure.

5.3 Consultation

A Pre-Connection Enquiry Form (IW Ref Nr. CDS21005058) was submitted to Irish Water for 600 no. domestic units. Irish Water have noted that a connection is feasible subject to the following:

"An approx. 300m of 200mm ID pipe network extension is required to connect to the new infrastructure installed as part of the new Ratoath Outer Relief Road, part of this extension is through third party lands, it is the applicants responsibility to obtain the relevant permissions before construction of these works.

At connection stage a capacity check is required at the Fairyhouse pump station. Onsite storage is required for commercial units also."

Please see Confirmation of Feasibility enclosed in Appendix E.

A subsequent Statement of Design Acceptance was issued by Irish Water on 20th May 2022. A copy of this letter is provided in Appendix G.

5.4 Proposed Water Network

A 200 mm HDPE watermain is proposed to connect to a 200 mm watermain on Ratoath Outer Relief Road, it is further proposed 100 mm and 150 mm HDPE watermain branches to serve part of the residential development. Fire Hydrants will be positioned around the site to ensure they are accessible within a maximum 30 m distance from any road edge and that all buildings are within a 46 m radius of the hydrant.

Full details of the proposed connection location will be agreed with Irish Water at Connection Application Stage.

The proposed connection is to be carried out in accordance with Irish Water's Code of Practice for Water Infrastructure, following agreement with Irish Water.

All design details will be subject to an Irish Water Design Verification Assessment and written confirmation from Irish Water will obtained in this regard for the planning application at the appropriate time.

Refer to OCSC drawings for the proposed watermain design layout, which has been designed in accordance with the Irish Water Code of Practice for Water Infrastructure.

5.5 Water Network Design Calculations

The total peak design flow from this proposed development has been calculated as 13.98 l/s, which have been carried out in accordance with Irish Water's Code of Practice for Water Infrastructure.

Table 5-1: Water Demand

Type	No	Demand (l/day)	Average Day (m3/day)	Peak Week (l/s)	Peak Demand (l/s)
Houses	451	405	2.11	2.64	13.21
Creche - Children	140	55	7.7	0.11	0.56
Creche - Staff	30	99	2.97	0.04	0.21
TOTAL			**12.78**	**2.80**	**13.98**

5.6 Water Saving Devices

Water saving devices are to be considered for use within the proposed development units, in order to conserve the use of water, as part of the internal fit-out.

5.7 Water Meters

A bulk water meter is to be provided at the connection to the public water main, at the development entrance, with individual boundary boxes provided at the connection to each individual property. All metering is to be provided in accordance with Irish Water's requirements.

5.8 Taking in Charge

It is proposed that all new surface water infrastructure, **will** be offered to be taken in charge by Irish Water.

6 TRAFFIC AND TRANSPORTATION

6.1 Overview

The roads elements of this Planning application are designed to comply with the following standards.

- *Design Manual for Urban Roads & Streets*
- *The Geometric Design of Junctions – DN-GEO-03060, published by the Transport Infrastructure Ireland (TII);*
- *National Cycle Manual;*
- *Traffic Management Guidelines;*
- *Traffic Signs Manual 2010 with Amendments (July 2013);*
- *DN-PAV-03021: Pavement & Foundation Design;*
- *GE-STY-01024: Road Safety Audit.*

6.1 Consultation

Both the proposed Ratoath Outer Relief Road (RORR) and the SHD scheme was presented to the Transportation Section of Meath County Council (MCC) on Monday 19th of July 2021. Following on from this MCC were again presented with updated drawings on the 19th of July 2021 during the Stage 1 Pre-Application Consultation.

6.2 Traffic

The operation of the local junctions have been assessed using traffic modelling software as detailed in the *Traffic and Transportation Assessment* that accompany this application.

6.3 Road Design Standards

The Design Standards to be adopted for the Ratoath Outer Relief Road (RORR) will be the *Design Manual for Urban Roads and Streets* (DMURS). The adoption of DMURS reflects the urban nature of the scheme which will link the current built section of the Outer Relief Road at Ratoath College to the R155 – Fairyhouse Road. The road layout to the proposed residential development will be designed as a Home zone / Shared Street led concept for, where streets are intended for a range of activities and are primarily places for people, not places for vehicles. The aim will be to improve the quality of life for residents and this takes priority over ease of traffic movement. All Link Roads and Streets within the development showcase their hierarchy through their widths through means of a 6.0m width for the main link road and 5.0 for the minor roads. The internal speed limits is set to be 30.0 kph. All footpaths provided will be a minimum of 1.8m to 2.0m in line with DMURS.

Existing and Proposed RORR

The provision of the RORR is an objective of the Ratoath Local Area Plan 2009 – 2015 (LAP). The road is to run on the eastern side of the town and link the R125 Swords-Ratoath-Dunshaughlin Regional Road with the R155 Fairyhouse-Ratoath-Primatestown Regional Road. In that regard the route is a strategic link which allows for the development of the town whilst removing unnecessary through traffic from the central areas – Figure 1.

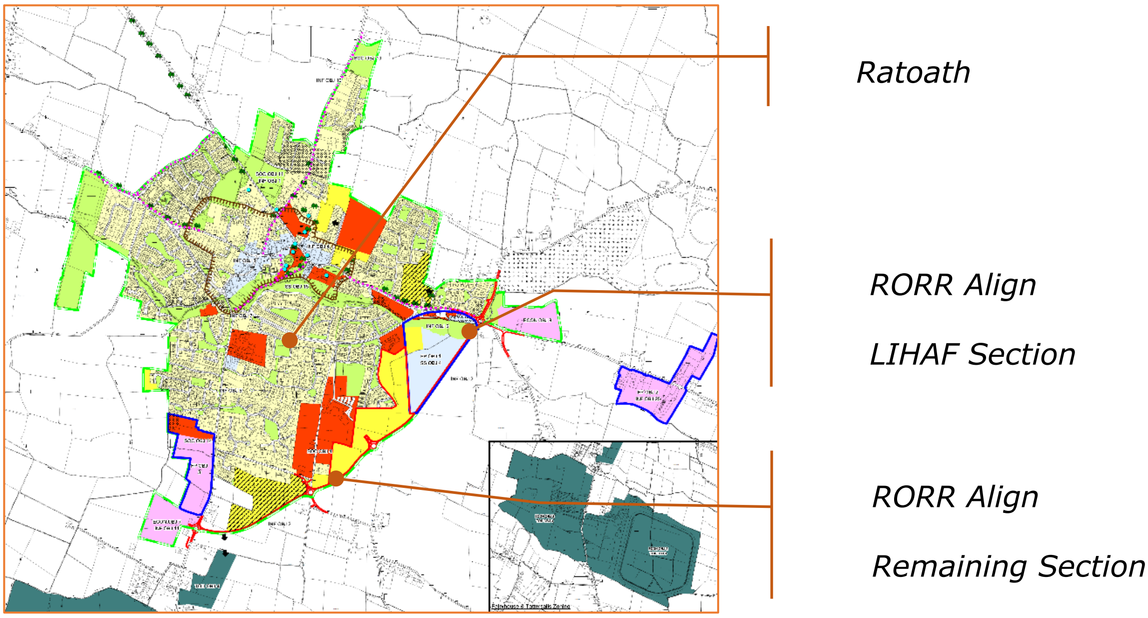


Figure 6-1: Ratoath Land Use Zoning Map (2009 – 2015 LAP)

An initial northern section of the RORR, which has benefitted from Local Infrastructure Housing Activation Fund (LIHAF) funding, has been completed from the R125 southwards to Ratoath College. The section of roadway constructed follows the indicative alignment for the RORR set out in the 2009 – 2015 LAP and runs for approximately 850 m. The remainder of the RORR to the R155 – Fairyhouse Road is approximately 1100 m long and defines the southern section of the zoned lands to Ratoath.

The proposed Ratoath Outer Relief Road will be classified in accordance with Table 3.1 of DMURS as an Arterial Road.

DMURS Description	Roads Act/NRA DMRB	Traffic Management Guidelines	National Cycle Manual
Arterial	National	Primary Distributor Roads	Distributor
Link	Regional (see note 1)	District Distributor Local Collector (see Notes 1 and 2)	Local Collector
Local	Local	Access	Access

Notes

Note 1: Larger Regional/District Distributors may fall into the category of *Arterial* where they are the main links between major centres (i.e. towns) or have an orbital function.

Note 2: Local Distributors may fall into the category of *Local* street where they are relatively short in length and simply link a neighbourhood to the broader street network.

Table 3.1: Terminology used within this Manual compared with other key publications.

Figure 6-4: DMURS Extract

6.4 Road Design Speed

The proposed Ratoath Outer Relief Road will have a Design Speed of 60kph.

This Design Speed complies with Table 4.1 of DMURS below.

PEDESTRIAN PRIORITY — VEHICLE PRIORITY

FUNCTION	CENTRE	N'HOOD	SUBURBAN	BUSINESS/ INDUSTRIAL	RURAL FRINGE
ARTERIAL	30-40 KM/H	40-50 KM/H	40-50 KM/H	50-60 KM/H	60-80 KM/H
LINK	30 KM/H	30-50 KM/H	30-50 KM/H	50-60 KM/H	60-80 KM/H
LOCAL	10-30 KM/H	10-30 KM/H	10-30 KM/H	30-50 KM/H	60 KM/H

CONTEXT

Table 4.1: Design speed selection matrix indicating the links between place, movement and speed that need to be taken into account in order to achieve effective and balanced design solutions.

Figure 6-5: DMURS Extract

6.5 Road Cross Sections

The carriageway cross-section will be 7.00 m (DMURS 4.4.1) as the Ratoath Outer Relief Road will be classified as an Arterial Road with frequent large vehicle use and a low to moderate Design Speed. This carriageway width is illustrated and selected from Figure 4.55 of DMURS.

The width of the footpaths is determined by reference to DMURS Section 4.3.1. where a minimum width of 1.80 m is required. The road is defined as suburban in character and as such a larger footpath width is justified therefore a 2.50 m wide footpath will be provided to the north side of the road to cater for the expected high pedestrian volumes associated with future residential developments. The width of cycle facilities will be determined based on the National Cycle Manual (June 2011) and is dealt with separately below. The width of the road verges will be wide enough to cater for the proposed road signage and traffic lights and in some cases will be defined by the drainage and associated SUDS systems. In the design of the Ratoath Outer Relief Road two grass verges will be provided, on the residential side a 1.50 m verge will be used and on the opposite side a 3.00 m verge.

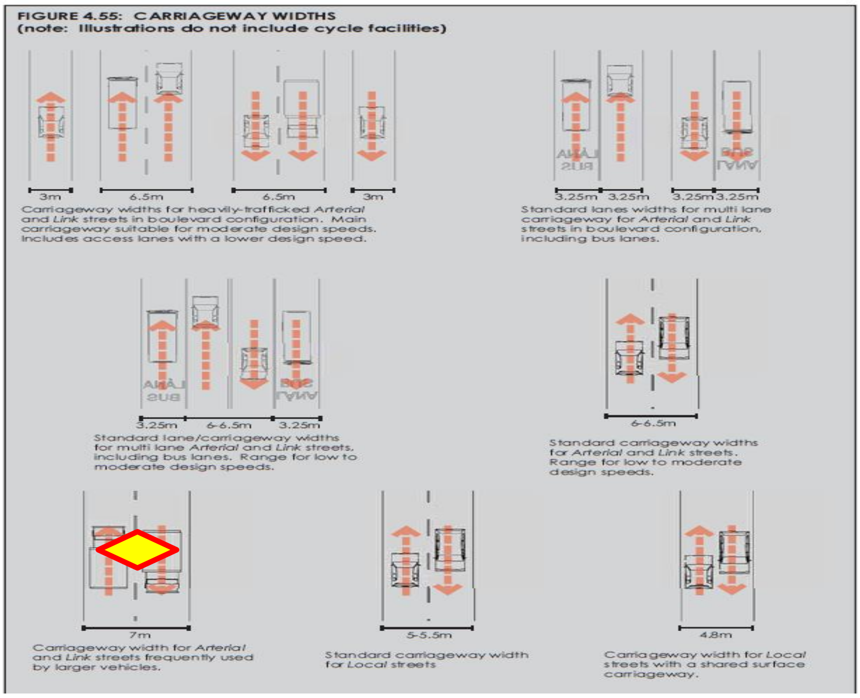


Figure 6-6: DMURS Extract

6.6 Horizontal and Vertical Geometry

The alignment of the Ratoath Outer Relief Road will be designed so that the various geometric elements including horizontal and vertical curvature, super elevation and sight distance will have at least the minimum values consistent with the 50kph Design Speed. It is important that these geometric elements are not exceeded as this can lead to operating speeds greater than the intended Design Speed. The relevant horizontal and vertical geometric design values are illustrated in DMURS Table 4.3 below. A standard carriageway cross fall of 2.50% will be adopted throughout with super elevation applied if necessary, noting that adverse camber is allowable under DMURS designs in accordance with Table 4.3. A cross fall of 2.5% will be used for footpaths and cycle facilities.

HORIZONTAL CURVATURE

Design Speed (km/h)	10	20	30	40	50	60
Minimum Radius with adverse camber of 2.5%	-	11	26	56	104	178
Minimum Radius with superelevation of 2.5 %	-	-	-	46	82	136

VERTICAL CURVATURE

Design Speed (km/h)	10	20	30	40	50	60
Crest Curve K Value	N/A	N/A	N/A	2.6	4.7	8.2
Sag Curve K Value	N/A	N/A	2.3	4.1	6.4	9.2

Table 4.3: Carriageway geometry parameters for horizontal and vertical curvature.

Figure 6-7: DMURS Extract

6.7 Junctions

The primary principle in the design of junctions along the route will be to provide junctions that are safe and consistent with existing layouts to present a uniformity of approach to drivers. In addition, junctions will have sufficient capacity to accommodate design year peak traffic flows therefore optimising network capacity. The primary junction strategy objectives will be:

- *To optimise road safety by ensuring adequate visibility and consistency;*
- *To ensure capacity for the design year;*
- *To function as traffic calming measures;*
- *To provide safe crossing facilities for pedestrians and cyclists;*
- *To provide an economic solution, so that the cost of implementing the design will be, to the maximum possible extent, offset by the economic benefits derived;*
- *To optimise road construction costs;*
- *To minimise environmental impacts, such as air pollution and engine noise, by minimising fuel consumption through reductions in the number of speed changes and the number of stop/starts required.*

Table 6-1: Geometric Parameters RORR

Design Heading	Design Element	Design Requirement*	Standards Ref.
Road Type	Road Type Design Standard	*Link Road/Regional* *Urban*	Table 3.1 DMURS/NRA TD 9/07 DMURS
Design Speed	Mandatory Speed Limit Design Speed	*50 km/h* *50 km/h*	Table 4.1 DMURS Table 4.1 DMURS
Sight Distance	Stopping Sight Distance Stopping Sight Distance on Bus Routes	*45m* *49m*	Table 4.2 DMURS Table 4.2 DMURS
Horizontal Alignment	Road Camber Superelevation Range Min. R (no superelevation) Desirable Minimum R 1-Step below Des. Min. R	*2.5%* *2.5%* *104m* *82m* *56m*	Para 4.4.6 DMURS Para 4.4.6 DMURS Table 4.3 DMURS Table 4.3 DMURS Table 4.3 DMURS
Vertical Alignment	Desirable Minimum Crest K Desirable Minimum Sag K 1-Step Below Des. Min. K	*4.7* *6.4* *4.1* *5%* *8.3%*	Table 4.3 DMURS Table 4.3 DMURS Table 4.3 DMURS Para 4.4.6 DMURS

	Desirable Max. Gradient Max. Gradient with Relaxation Minimum Gradient	*0.5%*	Para 4.4.6 DMURS Para 4.4.6 DMURS
Cross-Section & Headroom	Cross-Section	*7m Single Carriageway (3.5m lane width), 1.50m and 3.00m Verge, 2.50m Cycleway & 2.50m Footpath*	Para 4.4.1 DMURS

In the case of the Ratoath Outer Relief Road, the primary junctions along the route will be designed as priority controlled junctions. The junction with the Fairyhouse Road will be signalised based on the higher traffic volumes and will be designed to achieve the requirements of the *National Cycle Manual* and *DN-GEO-03060 – The Geometric Design of Signalised Junctions*. Intermediate junctions will be created at points along the road appropriate to future developments. In accordance with DMURS 4.4.1 these roads will have widths ranging from 5.5m to 6.0m. Given the local access nature of these spur roads, and in the interest of predictability of junction type, these junctions will form simple crossroads or priority T-junctions as appropriate. All priority T Junctions and Side Road will be designed to achieve the requirements of the National Cycle Manual and DMURS.

6.8 Cycle Standards

The cycle lanes and crossings will be designed in accordance with the *National Cycle Manual*. All cycle facilities along the orbital road will be off-road and segregated. Based on the Cycle Width Calculator in the National Cycle Manual indicated below, the width of the optimum cycle path will be 3.0m which will give generous space for two-way cycling. This cycle facility will be located on the residential side of the Ratoath Outer Relief Road, as with the footpath, which is the optimal location for such a facility. The Greenway, planned to route through the development, will also be 3.0m wide but will be located away from the RORR.

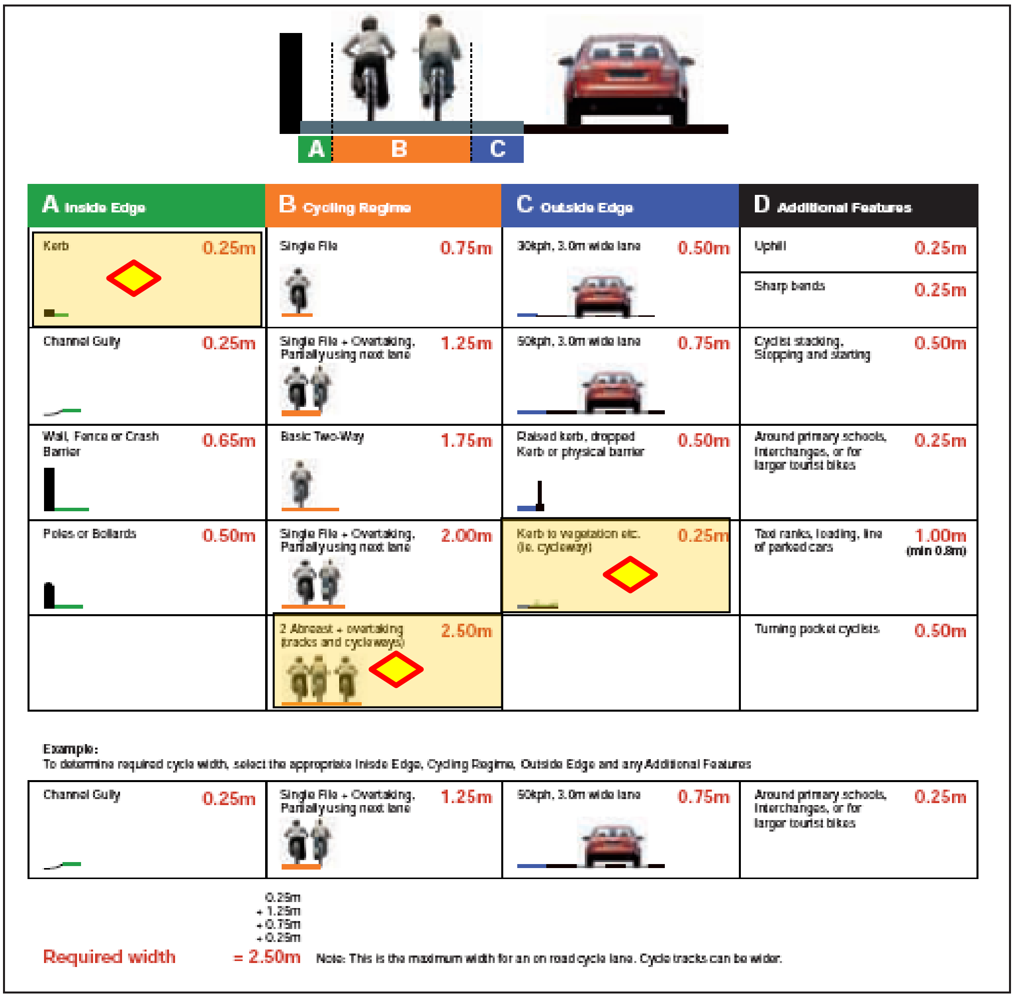


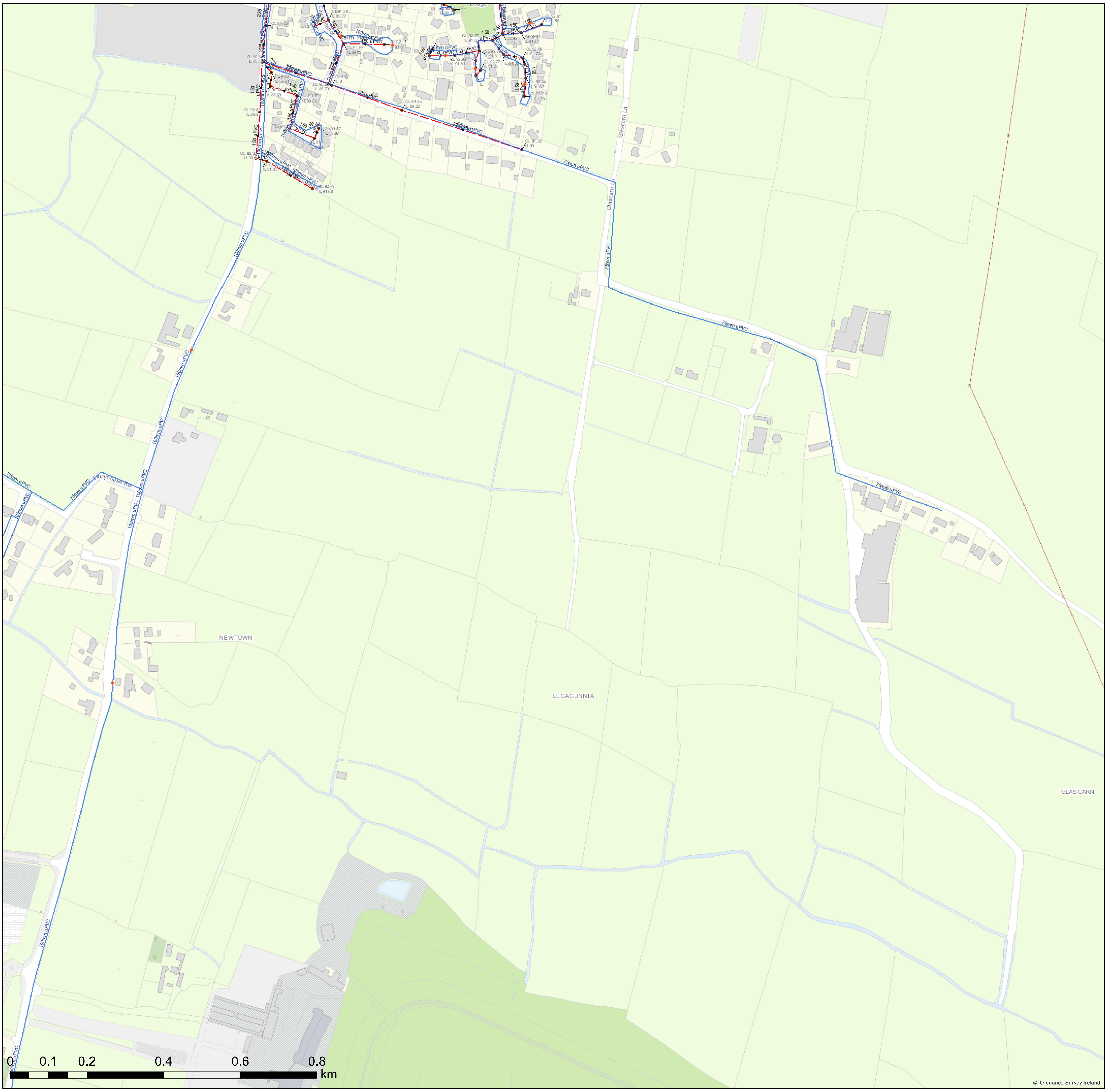
Figure 6-8: National Cycle Manual

APPENDIX A. PUBLIC WATER SERVICE RECORDS

Appendix A

Public Water Service Records

Irish Water Web Map



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

Reservoir
- Potable
- Raw Water

Water Distribution Mains
- Irish Water
- Private

Trunk Water Mains
- Irish Water
- Private

Water Lateral Lines
- Irish Water
- Non IW
- Water Casings
- Water Abandoned Lines
- Boundary Meter
- Bulk/Check Meter
- Group Scheme
- Source Meter
- Waste Meter
- Unknown Meter ; Other Meter
- Non-Return
- PRV
- PSV
- Sluice Line Valve Open/Closed
- Butterfly Line Valve Open/Closed
- Sluice Boundary Valve Open/Closed
- Butterfly Boundary Valve Open/Closed
- Scour Valves

- Single Air Control Valve
- Double Air Control Valve
- Water Stop Valves
- Water Service Connections
- Water Distribution Chambers
- Water Network Junctions
- Pressure Monitoring Point
- Fire Hydrant
- Fire Hydrant/Washout

Water Fittings
- Cap
- Reducer
- Tap
- Other Fittings

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

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

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

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

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

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

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

Sewer Fittings
- Vent/Col
- Other; Unknown

Storm Water Network

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

Inlet Type
- Gully
- Standard
- Other; Unknown

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

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

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

ESB Networks

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

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

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

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

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

UISCE ÉIREANN : IRISH WATER

Print Date: 25/03/2020

Printed by:Irish Water

APPENDIX B. SITE INVESTIGATION

Appendix B

Site Investigation

HOUSING DEVELOPMENT
RATHOAT COUNTY MEATH

PIVOTAL CONSTRUCTION

O'CONNOR SUTTON CRONIN
CONSULTING ENGINEERS

CONTENTS

APPENDICES

FOREWORD

The following Conditions and Notes on Site Investigation Procedures should be read in conjunction with this report.

General.

Recommendations made, and opinions expressed in the report are based on the strata observed in the exploratory holes, together with the results of in-situ and laboratory tests. No responsibility can be held for conditions which have not been revealed by exploratory work, or which occur between exploratory hole locations. Whilst the report may suggest the likely configuration of strata, both between exploratory hole locations, or below the maximum depth of the investigation, this is only indicative, and liability cannot be accepted for its accuracy.

Unless specifically stated, no account has been taken of possible subsidence due to mineral extraction below or close to the site.

Standards

The ground investigation works for this project have been carried out by IGSL in accordance with Eurocode 7 - Part 2: Ground Investigation & Testing (EN 1997-2:2007). This has been used together with complementary documents such as BS 5930 (1999), BS 1377 (Parts 1 to 9) and Engineers Ireland Specification & Related Documents for Ground Investigation in Ireland (2006). The following Irish (IS) and European Standards or Norms are referenced:

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

Routine Sampling.

Undisturbed samples of soils, predominantly cohesive in nature are obtained unless otherwise stated by a 104mm diameter open-drive tube sampler or Piston Sampler. In granular soils, and where undisturbed sampling is inappropriate, disturbed samples are collected. Smaller disturbed samples are also recovered at intervals to allow a visual examination of the full strata section.

In-Situ Testing.

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

Groundwater

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

Engineering Logging

Soil and rock identification has been based on the examination of the samples recovered and conforms with IS EN ISO 14688-1:2002 and IS EN ISO 14689-1:2004.

Where peat has been encountered during site works, samples have been logged in accordance with the Von Post Classification (ref. Von Post, L. 1992. Sveriges Gologiska Undersoknings torvinventering och nogra av dess hittils vunna resultat (SGU peat inventory and some preliminary results) Svenska Mosskulturforeningens Tidskrift, Jonkoping, Swedden, 36, 1-37 & Hobbs N. B. Mire morphology and the properties of some British and foreign peats. QJEG, Vol. 19, 1986).

Retention of Samples.

After satisfactory completion of all the scheduled laboratory tests on any sample, the remaining material is discarded unless a period of retention of samples is agreed, it is our normal practice to discard all soil samples one month after submission of our final report.

Reporting

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

The engineering logs provide ground profiles and configuration of strata relevant to the investigation depths achieved and caution should be taken when extrapolating between exploratory points. No liability is accepted for ground conditions extraneous to the investigation points. Unless specifically stated, no account has been taken of possible subsidence due to mineral extraction, mining works or karstification below or close to the site.

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

REPORT ON A SITE INVESTIGATION
FOR A PROPOSED HOUSING DEVELOPMENT
RATHOAT COUNTY MEATH
FOR
PIVOTAL CONSTRUCTION

O'CONNOR SUTTON CRONIN
CONSULTING ENGINEERS

Report No. 22578 **September 2020**

I Introduction

A new residential development is proposed for a site located south of Rathoat in County Meath.

An investigation of sub soil conditions in the area of the new development has been carried out by IGSL for O'Connor Sutton Cronin, Consulting Engineers, on behalf of Pivotal Construction.

The scheduled site investigation included the following elements.

*	Cable Percussion Boreholes	4 nr.
•	Rotary Holes	1 nr.
•	Trial Pits	6 nr.
•	CBR by Plate Test	15 nr.
•	Infiltration Test to BRE Digest 365	4 nr
•	HD Dynamic Probes	2 nr.
•	Geotechnical Laboratory Testing	
•	Chemical Laboratory Testing	

Note:

Scheduled slit trenches at three locations were cancelled during the investigation period.

This report includes all factual data from completed field and laboratory operations and discusses these findings relative to the proposed new development.

II Fieldwork

This development is to take place on a greenfield site located off the Fairyhouse Road just south of Rathoat Village in County Meath.

The exploratory locations are noted on the OCSC drawing enclosed in Appendix VIII. Locations were marked out by IGSL on site and were surveyed on completion to National Grid and Ordinance Levels were established.

The various elements of the investigation are detailed in the following paragraphs. All field works were supervised by an experienced geotechnical engineer who carefully recorded stratification, took photographs as necessary, recovered samples and prepared detailed records.

Close liaison was maintained throughout with the Consulting Engineer. All appropriate documentation was submitted and approved prior to site commencement. Each location was scanned electronically (CAT) to ensure that existing services were not damaged. A shallow trial pit was also opened by hand at borehole locations to confirm this.

All HSE safety regulations pertaining to COVID 19 were followed for this project.

Boreholes

The exploratory holes (BH01 to BH04) were bored with conventional 200mm cable-tool methods using a Dando Exploratory Rig.

Detailed geotechnical records are contained in Appendix I to this report - the records give details of stratification, sampling, in-situ testing and groundwater. Note is also taken of any obstructions to normal boring requiring the use of the heavy chisel for advancement.

The boreholes reflect a high degree of consistency. Topsoil overlies a stratum of firm to stiff brown gravelly CLAY which continued to approximately 2.00 metres. Stiff to very stiff grey black gravelly CLAY is then encountered and boreholes continued to completion in this stratum at depths ranging from 4.60 to 8.10 metres. Cobbles and occasional boulders were noted randomly during the course of boring. Boreholes were terminated when further advancement was precluded by such boulder presence.

The sub-soils comprise GLACIAL TILL or BOULDER CLAY deposition, typically brown boulder clay overlying black boulder clay or lodgement till. The stratification is quite typical of the general area.

No ground water was encountered during the course of the borehole investigation. A standpipe was installed in BH01 to facilitate long-term ground water observation. Ground water level readings are included with the boring records.

Rotary Core Drilling

Rotary core drilling was scheduled at one location to advance borehole depth and establish rock horizon if practical. The hole was designated RB01.

A GEO 205 rig was used to drill a 100mm diameter hole to a depth of 16.50 metres.

A detailed drilling record is presented in Appendix II. The record confirms the presence of brown and black boulder clay extending to approximately 10.00 metres.

From 10.00 to 16.50 metres alternating layers of gravel and sand were noted with some adverse "blowing" noted in the fine sand layers.

It was not possible to recover core of the granular soils, sample identification was based on examination of fragmented drilling returns.

Standard Penetration Tests (SPT) were carried out at intervals during the course of rotary core drilling with results noted in the RH column of the detailed drilling log.

Trial Pits

Six Trial Pits were excavated using a JCB excavator under engineering supervision. Detailed trial pit logs with photographs are enclosed in Appendix III. Trial Pits are referenced TP01 to TP06. All locations have been surveyed to National Grid.

The records present a high degree of consistency, with surface topsoil initially noted. The topsoil is generally 200mm thick.

Below the topsoil a stratum of firm to stiff brown gravelly CLAY (Brown boulder clay) is encountered. This is consistent with the glacial till or boulder clay noted in the boreholes and continues to depths generally between 1.50 and 2.00 metres.

Very stiff to hard grey black lodgement till underlies the brown boulder clay and excavations were terminated in this stratum at depths between 1.90 and 3.00 metres. Difficulty in excavation in the black boulder clay was noted in each location.

Trial excavations were generally dry and stable throughout the investigation period.

A minor variation to the general pattern was noted in TP03 where the boulder clay becomes sandier and minor water seepage was noted at 2.20 metres.

Pits were backfilled with excavated material and compacted in layers. Disturbed areas were levelled and tidied on completion.

In Situ CBR by Plate Bearing Test

The CBR value of the soils at shallow depth was established at fifteen locations using Plate Bearing Test Apparatus. Tests were carried out at proposed roads or pavement areas. A steel plate is loaded and off-loaded incrementally over two stages and the deflection under load and recovery under off-load is measured by a system of dial gauges. The data is processed and load settlement graphs are prepared. An equivalent CBR value is calculated in accordance with NRA HD25-26/10. At each location testing was carried out at 0.50 metres BGL

Results are summarised in the following table and details are presented in Appendix IV with stratification noted on an appropriate Trial Pit record.

Test No.	CBR at Load Cycle (%)	CBR @ Re-Load (%)
PBT 01	5.8	6.7
PBT 02	15.2	46.3
PBT 03	7.2	27.9
PBT 04	11.0	13.4
PBT 05	11.8	32.5
PBT 06	12.8	36.3
PBT 07	5.0	36.3
PBT 08	4.9	10.2
PBT 09	4.9	9.8
PBT 10	3.4	5.2
PBT 11	3.2	6.1
PBT 12	3.0	4.4
PBT 13	3.6	5.8
PBT 14	5.4	6.9
PBT 15	21.5	45.1

Infiltration Tests

Infiltration testing was performed in accordance with BRE Digest 365 'Soakaway Design' at four locations. Details are presented in Appendix V. The Test Pits were opened to approximately 2.00 metres deep and detailed logs were prepared. The stratification comprised topsoil overlying stiff brown-grey gravelly CLAY.

To obtain a measure of the infiltration rate of the sub-soils, water is poured into the test pit, and records taken of the fall in water level against time. The test is normally carried out over two cycles following initial soakage. The infiltration rate is the volume of water dispersed per unit-exposed area per unit of time, and is generally expressed as metres/minute or metres/second. In these calculations the exposed area is the sum of the base area and the average internal area of the pit sides over the test duration.

No fall in water level was recorded in the first test cycle over the sixty-minute test period, confirming the impermeable nature of the boulder clay deposits.

An Infiltration Rate (f) of 0.00 metres/minute has been recorded at each location, confirming test failure

Heavy Duty Dynamic Probes

Heavy Duty Dynamic Probes were taken at two specified locations. Probing was in accordance with the heavy-duty probe specification of BS 1377: Part 9: 1990. In these tests, the soil resistance is measured in terms of the number of drop-hammer blows required to drive the test probe through each 100 mm increment of penetration. Probing is terminated when the blow count exceeds 25/100mm to avoid damage to the apparatus. Where loose material is present a single blow count may drive the apparatus in excess of 100mm. In this instance blow counts of zero may be recorded. Individual probe records are contained in Appendix VI and are summarised as follows.

Probe No.	SOFT ZONE $N_{100} < 2$	STIFF $N_{100} > 6$	REFUSAL
DP01	0.00 – 0.40	0.60	2.00
DP02	0.00 – 0.50	0.50	2.20

III. Testing

(a) In Situ Standard penetration Tests

Standard penetration tests were carried out at approximate 1.00 metre intervals in the geotechnical boreholes and corehole to measure relative in-situ soil strength. N values are noted in the right hand column of the individual records, representing the blow count required to drive the standard sampler 300mm into the soil, following initial seating blows. Where full test penetration was not achieved the blow count for a specific penetration is recorded, or refusal is indicated where appropriate. The results of the tests are summarised as follows:

STRATUM	N VALUE RANGE	AVERAGE	COMMENT
Brown Gravelly CLAY			
1.0 m BGL	14 to 19	17	Firm to Stiff
2.0 m BGL	22 to 28	25	Stiff
Black Gravelly CLAY			
3.0 m BGL	24 to 34	29	Stiff to Very Stiff
4.0 m BGL	31 to 38	35	Very Stiff
5.0 to 8.0 m BGL	33 to 50	40	Very Stiff to Hard
Rotary Hole			
8.0 to 16.00 metres	> 50	50	Hard

A number of limited penetration SPT tests were recorded on boulders or cobbles within the boulder clay stratum. These high results are not included in the above table or used in assessing average values.

All SPT tests in the rotary holes recorded refusal after limited penetration and are noted as N > 50.

(b) Laboratory Tests

A programme of laboratory testing was scheduled following completion of site operations. Geotechnical testing was carried out by IGSL in it's INAB-Accredited laboratory. Chemical testing was carried out in the UK by EUROFINS. The test programme included the following elements:

- Liquid and Plastic Limits / Moisture Content — IGSL
- PSD Grading by wet sieve and hydrometer. — IGSL
- Sulphate / Chloride / pH — EUROFINS

All laboratory data is presented in Appendix VII and individual tests are briefly discussed as follows.

Liquid and Plastic Limits

Soil samples from the site had Atterberg Limits determined in accordance with BS1377. The results reflect a high degree of uniformity in the gravelly clay stratum. The soils fall consistently into the CL category of the standard Casagrande classification, reflecting sensitive uniformly low plasticity clay-matrix material.

The Natural Moisture Content ranges from 9 to 17%.

PSD Grading

The particle size distribution curves for three samples were determined by wet sieve and hydrometer analysis. The resulting graphs are uniformly and typically straight-line in nature, with smooth particle size distribution from the fine clay to coarse gravel fraction.

Both Atterberg Limits and PSD Grading results are typical of the local glacial till deposition.

Chemical

Two samples have been analysed to determine sulphate, chloride and pH values. Sulphate concentrations (SO4 2:1 extract) of < 0.010 g/l were established with pH values of 8.0 and 7.5. Water Soluble Chloride contents of < 0.010 g/l were also confirmed.

A sulphate design class of DS-1 (ACEC Classification for Concrete) is indicated for sulphate concentrations lower than 0.5 g/l. No special precautions are therefore deemed necessary for protection of below ground concrete.

IV. Discussion:

The new housing development is to be located on the site as shown on the attached plan. The area is greenfield, in former agricultural use.

A detailed investigation has been carried out under the direction of O'Connor Sutton Cronin. Consulting Engineers. The factual data from field and laboratory is presented in Sections 1 to III of this report.

SUMMARY STRATIFICATION

A high degree of consistency has been confirmed in the borehole and trial pit locations.

Superficial topsoil is present to an average depth of 0.20 metres.

Below the topsoil, GLACIAL TILL or BOULDER CLAY is encountered. This stratum is initially firm to stiff brown sandy gravelly CLAY, extending to about 2.00 metres and overlying stiff to very stiff black gravelly CLAY.

The black boulder clay continues to an approximate depth of 10.00 metres. Rotary drilling has confirmed more granular soils (SAND and GRAVEL) from 10.00 to the final investigation depth of 16.50 metres. Bedrock has not been identified.

No ground water was noted during the course of the borehole investigation and only a minor seepage was noted in an isolated sandy zone in Trial Pit TP03.

A standpipe installed at BH01 recorded water level at 8.20 metres BGL 0n 24/06/2020. A reading taken three weeks later (14/07/2020) recorded ground water standing at 1.74 metres BGL.

ALLOWABLE BEARING PRESSURES

The strength of the soils has been established by In-Situ Standard Penetration Tests in the boreholes and rotary hole. Dynamic Probe resistance is used to assess allowable bearing. Visual assessment of the ground during trial pit operations by experienced IGSL personnel has also been considered in establishing allowable bearing pressures. Geotechnical testing confirms the glacial till characteristics and the high degree of uniformity in the sub soil. The characteristics of the boulder clay in the general area are well documented and the findings on this site are typical of the regional pattern.

Standard Penetration Tests in the boulder clay at respective depths of 1.00, 2.00 and 3.00 metres, with suggested allowable bearing pressures, are indicated as follows:

Depth	N Value Range	Average N Value	ABP (Kn/Sq.m.) Using Lowest N	Using Average N
1.00	14 – 19	17	150	175
2.00	22 – 28	25	200	275
3.00	24 to 34	29	250	300

RECOMMENDED FOUNDATIONS

For conventional two-storey construction an allowable bearing pressure of 150 KPa is generally appropriate.

We would recommend adopting this allowable bearing pressure for conventional reinforced strip or pad foundations placed nominally at a depth of 1.00 metre. Utilising the lower SPT range would permit this allowable bearing pressure.

Maximum settlement of the order of 10mm can be expected in the glacial soils under this load intensity. Differential movement will be negligible.

We strongly recommend visual inspection of foundation excavations by experienced personnel to ensure uniformity and suitability of the founding medium. Any soft or suspect material should be removed and where necessary replaced with low-grade concrete. The soils encountered will be sensitive to moisture content variation and excavations should be protected by blinding or foundation concrete placed rapidly following excavation.

Should higher loading intensities be envisaged or if basement structures are proposed, foundation depth can be increased to avail of higher SPT values and increased allowable bearing pressure.

Excavation / Ground Water

No difficulties are envisaged in excavation in the boulder clay deposits. The lower black lodgement till is quite hard with some boulder presence, however experienced local contractors will have extensive experience in dealing with this stratum. No significant ground-water ingress was recorded some minor water seepages may occur.

Some care should be taken in deep service excavation. Statutory safety regulations prohibit personnel entering unsupported excavations greater than 1.20 metres deep, irrespective of apparent stability.

A final standing water table approximately 1.70 metres BGL has been indicated by standpipe observation. This will not be relevant in short term foundation excavation, but can be used in assessing possible uplift if basement structures are proposed.

Proposed Roads / Paved Areas

CBR values have been established by Plate Bearing Tests. An average CBR of 4 to 5% can be adopted for design purposes using the results at initial load cycle. Visual inspection of excavated formation is again advised to ensure that all organic or unsuitable fill material is removed.

Infiltration

Very low infiltration rates have been established by BRE Digest 365 test. The values are typical of cohesive glacial till or boulder clay material. The results indicate that the soils are unsuitable for dispersion of storm or surface water in conventional soakaways.

Disposal of storm / surface water to a suitable local watercourse or the use of the local authority storm water system should be considered.

Foundation Concrete

Low sulphate and chloride levels and near neutral pH values confirm that normal foundation concrete will be free from aggressive chemical attack.

IGSL/JC
September 2020

Appendix I Boring Records

GEOTECHNICAL BORING RECORD

REPORT NUMBER 22578

CONTRACT Ratoath , Co.Meath		**BOREHOLE NO.** BH01	**SHEET** Sheet 1 of 1
CO-ORDINATES 702,256.00 E 750,600.00 N	**RIG TYPE** DANDO 2000	**DATE COMMENCED** 24/06/2020	
GROUND LEVEL (m AOD) 90.85	**BOREHOLE DIAMETER (mm)** 200	**DATE COMPLETED** 24/06/2020	
	BOREHOLE DEPTH (m) 8.20		
CLIENT Pivotal Construction	**SPT HAMMER REF. NO.**	**BORED BY** W.BUTLER	
ENGINEER OCSC	**ENERGY RATIO (%)**	**PROCESSED BY** F.C	

Description	Legend	Elevation	Depth (m)	Samples Ref. Number	Sample Type	Depth (m)	Recovery	Field Test Results	Standpipe Details
TOPSOIL		90.65	0.20						
Firm to stiff brown/grey sandy SILT/CLAY with occasional gravel				AA135069	B	1.00		N = 19 (1, 3, 4, 5, 4, 6)	
				AA135070	B	2.00		N = 22 (2, 3, 3, 3, 9, 7)	
		88.35	2.50						
Very stiff grey/ black sandy gravelly CLAY with occasional cobbles				AA135071	B	3.00		N = 34 (5, 4, 6, 6, 10, 12)	
		86.65	4.20	AA135072	B	4.00		N = 33 (9, 7, 10, 9, 7, 7)	
Very stiff to hard black sandy gravelly CLAY with some cobbles				AA135073	B	5.00		N = 45 (8, 6, 9, 10, 12, 14)	
				AA135074	B	6.00		N = 50/225 mm (9, 13, 22, 19, 9)	
				AA135075	B	7.00		N = 50/150 mm (6, 15, 23, 27)	
		82.75	8.10	AA135076	B	8.00		N = 50/75 mm (25, 50)	
End of Borehole at 8.20 m									

HARD STRATA BORING/CHISELLING

From (m)	To (m)	Time (h)	Comments
6.7	6.9	1	
7.4	7.6	0.5	
8	8.1	1.5	

WATER STRIKE DETAILS

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

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type
24-06-20	8.10	1.00	8.10	50mm SP

GROUNDWATER PROGRESS

Date	Hole Depth	Casing Depth	Depth to Water	Comments

REMARKS Covid 19 Safe Working Area erected . CAT scanned location and hand dug inspection pit carried out .

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

GEOTECHNICAL BORING RECORD

REPORT NUMBER 22578

CONTRACT Ratoath , Co.Meath		**BOREHOLE NO.**	**BH02**
		SHEET	Sheet 1 of 1
CO-ORDINATES 701,888.00 E 750,443.00 N	**RIG TYPE** DANDO 2000	**DATE COMMENCED**	23/06/2020
GROUND LEVEL (m AOD) 91.98	**BOREHOLE DIAMETER (mm)** 200	**DATE COMPLETED**	23/06/2020
	BOREHOLE DEPTH (m) 6.90		
CLIENT Pivotal Construction	**SPT HAMMER REF. NO.**	**BORED BY**	W.BUTLER
ENGINEER OCSC	**ENERGY RATIO (%)**	**PROCESSED BY**	F.C

Depth (m)	Description	Legend	Elevation	Depth (m)	Samples: Ref. Number	Sample Type	Depth (m)	Recovery	Field Test Results	Standpipe Details
0	TOPSOIL		91.73	0.25						
	Firm light brown/grey sandy SILT/CLAY with occasional gravel									
1					AA135063	B	1.00		N = 14 (2, 2, 3, 4, 3, 4)	
			90.08	1.90						
2	Stiff to very stiff grey and grey/black sandy gravelly CLAY with occasional cobbles				AA135064	B	2.00		N = 28 (2, 3, 7, 6, 7, 8)	
3					AA135065	B	3.00		N = 28 (5, 4, 4, 5, 9, 10)	
4					AA135066	B	4.00		N = 31 (20, 6, 7, 7, 8, 9)	
			87.18	4.80						
5	Very stiff to hard black very gravelly sandy CLAY with some cobbles				AA135067	B	5.00		N = 54 (7, 7, 10, 11, 14, 19)	
6					AA135068	B	6.00		N = 61 (9, 8, 12, 14, 16, 19)	
			85.08	6.90					N = 50/75 mm (8, 17, 50)	
7	Obstruction End of Borehole at 6.90 m									
8										
9										

HARD STRATA BORING/CHISELLING

From (m)	To (m)	Time (h)	Comments
6	6.2	1	
6.4	6.6	0.5	
6.7	6.9	1.5	

WATER STRIKE DETAILS

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

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type

GROUNDWATER PROGRESS

Date	Hole Depth	Casing Depth	Depth to Water	Comments

REMARKS Covid 19 Safe Working Area erected . CAT scanned location and hand dug inspection pit carried out .

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

GEOTECHNICAL BORING RECORD

REPORT NUMBER 22578

CONTRACT	Ratoath , Co.Meath	**BOREHOLE NO.**	**BH03**
		SHEET	Sheet 1 of 1
CO-ORDINATES	701,691.00 E 750,277.00 N	**RIG TYPE**	DANDO 2000
GROUND LEVEL (m AOD)	93.65	**BOREHOLE DIAMETER (mm)**	200
		BOREHOLE DEPTH (m)	7.90
DATE COMMENCED	22/06/2020	**DATE COMPLETED**	22/06/2020
CLIENT	Pivotal Construction	**SPT HAMMER REF. NO.**	
ENGINEER	OCSC	**ENERGY RATIO (%)**	
BORED BY	W.BUTLER	**PROCESSED BY**	F.C

Depth (m)	Description	Legend	Elevation	Depth (m)	Samples: Ref. Number	Sample Type	Depth (m)	Recovery	Field Test Results	Standpipe Details
0	TOPSOIL		93.45	0.20						
	Firm light brown sandy SILT/CLAY with occasional cobbles		92.45	1.20						
1					AA135055	B	1.00		N = 16 (2, 2, 5, 4, 3, 4)	
	Firm grey sandy SILT/CLAY		91.65	2.00						
2	Stiff grey and grey/black sandy gravelly silty CLAY with occasional cobbles		89.85	3.80	AA135056	B	2.00		N = 27 (3, 3, 6, 9, 6, 6)	
3					AA135057	B	3.00		N = 24 (3, 4, 4, 4, 9, 7)	
4	Very stiff to hard black sandy gravelly CLAY with some cobbles		85.75	7.90	AA135058	B	4.00		N = 35 (12, 6, 7, 9, 8, 11)	
5					AA135059	B	5.00		N = 33 (9, 7, 6, 8, 9, 10)	
6					AA135060	B	6.00		N = 64 (6, 10, 14, 21, 15, 14)	
7					AA135061	B	7.00		N = 50/150 mm (7, 15, 25, 25)	
8	Obstruction End of Borehole at 7.90 m				AA135062	B	7.90		N = 50/75 mm (25, 50)	
9										

HARD STRATA BORING/CHISELLING

From (m)	To (m)	Time (h)	Comments
6.3	6.5	0.75	
7.7	7.9	2	

WATER STRIKE DETAILS

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

GROUNDWATER PROGRESS

Date	Hole Depth	Casing Depth	Depth to Water	Comments

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type

REMARKS Covid 19 Safe Working Area erected . CAT scanned location and hand dug inspection pit carried out .

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

GEOTECHNICAL BORING RECORD

IGSL

REPORT NUMBER
22578

CONTRACT	Ratoath , Co.Meath	BOREHOLE NO.	BH04
		SHEET	Sheet 1 of 1
CO-ORDINATES	701,754.00 E 749,952.00 N	RIG TYPE	DANDO 2000
GROUND LEVEL (m AOD)	92.58	BOREHOLE DIAMETER (mm)	200
		BOREHOLE DEPTH (m)	5.10
		DATE COMMENCED	25/06/2020
		DATE COMPLETED	26/06/2020
CLIENT	Pivotal Construction	SPT HAMMER REF. NO.	
ENGINEER	OCSC	ENERGY RATIO (%)	
BORED BY	W.BUTLER	PROCESSED BY	F.C

Depth (m)	Description	Legend	Elevation	Depth (m)	Samples: Ref. Number	Sample Type	Depth (m)	Recovery	Field Test Results	Standpipe Details
0	TOPSOIL		92.43	0.15						
	Firm light brown sandy SILT/CLAY with occasional gravel		90.78	1.80	AA135077	B	1.00		N = 15 (2, 2, 3, 2, 4, 6)	
	Stiff grey and grey/black sandy gravelly SILT/CLAY		89.68	2.90	AA135078	B	2.00		N = 24 (4, 3, 5, 5, 6, 8)	
	Very stiff to hard black very gravelly sandy CLAY with some cobbles		87.98	4.60	AA135079	B	3.00		N = 35 (3, 9, 10, 9, 6, 10)	
					AA135080	B	4.00		N = 39 (6, 7, 8, 8, 12, 11)	
	Obstruction									
5	End of Borehole at 5.10 m								N = 50/150 mm (6, 17, 23, 27)	

HARD STRATA BORING/CHISELLING

From (m)	To (m)	Time (h)	Comments
4.1	4.3	0.75	
4.4	4.5	0.5	
4.9	5.1	1.5	

WATER STRIKE DETAILS

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

GROUNDWATER PROGRESS

Date	Hole Depth	Casing Depth	Depth to Water	Comments
26-06-20			4.00	Start of 2nd day

INSTALLATION DETAILS

Date	Tip Depth	RZ Top	RZ Base	Type

REMARKS Covid 19 Safe Working Area erected . CAT scanned location and hand dug inspection pit carried out .

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

In Situ Groundwater Monitoring

IGSL Ltd.

Site Location	Ratoath, Co. Meath
Project No.	22578
Client	Pivotal Construction
Engineer	OCSC

			Date of Monitoring				
Exploratory Hole No.	Ground Level (m OD)	Standpipe	End of Boring (m bgl)	14/07/2020 (m bgl)	(m bgl)	(m bgl)	(m OD)
BH01	90.85	SP 50mm	8.2	1.74			

Appendix II Rotary Core Logs

Appendix IV Plate Bearing Tests

Appendix V BRE Digest 365 Tests

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

Contract:	Ratoath	Contract No.	22578
Test No.	SA01		
Client	Pivotal Construction		
Date:	27/06/2020		

Summary of ground conditions

from	to	Description	Ground water
0.00	0.30	TOPSOIL.	No ingress observed
0.30	1.00	Firm brown slightly silty slightly sandy gravelly CLAY with low cobble content	
1.00	1.80	Firm grey/brown slightly silty slightly sandy gravelly CLAY with medium cobble content and low boulder content. Boulders <	
1.80	1.95	Firm to stiff dark grey slightly sandy gravelly CLAY with medium cobble content and low boulder content. Boulders < 220mm.	

Field Data

Depth to Water (m)	Elapsed Time (min)
0.84	0.00
0.84	1.00
0.84	2.00
0.84	3.00
0.85	4.00
0.85	5.00
0.85	6.00
0.85	7.00
0.85	8.00
0.85	9.00
0.85	10.00
0.85	12.00
0.85	14.00
0.85	16.00
0.85	18.00
0.85	20.00
0.85	25.00
0.85	30.00
0.85	40.00
0.85	50.00
0.85	60.00

Field Test

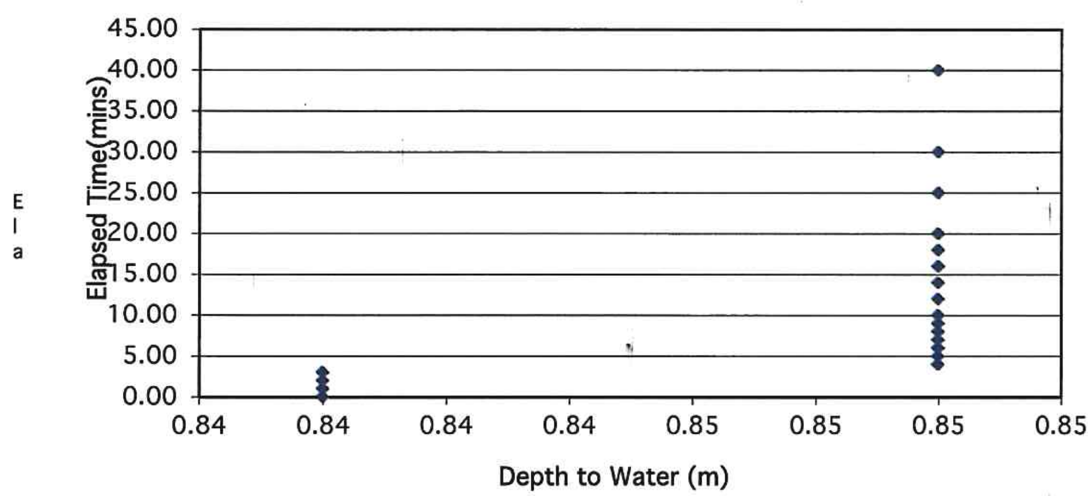
Depth of Pit (D)	1.95	m
Width of Pit (B)	0.40	m
Length of Pit (L)	1.90	m
Initial depth to Water =	0.84	m
Final depth to water =	0.85	m
Elapsed time (mins)=	60.00	
Top of permeable soil		m
Base of permeable soil		m
Base area=	0.76	m2
*Av. side area of permeable stratum over test period	5.083	m2
Total Exposed area =	5.843	m2

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

f= 0 m/min or 0 m/sec

No fall in water level after 3 minutes - test failed

Depth of water vs Elapsed Time (mins)



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

Contract:	Ratoath	Contract No.	22578
Test No.	SA02		
Client	Pivotal Construction		
Date:	27/06/2020		

Summary of ground conditions

from	to	Description	Ground water
0.00	0.20	TOPSOIL.	No ingress observed
0.20	0.90	Firm grey/brown slightly sandy gravelly CLAY with medium cobble content.	
0.90	2.00	Firm to stiff brown slightly sandy gravelly CLAY with medium cobble content and low boulder content. Boulders < 400mm.	

Field Data

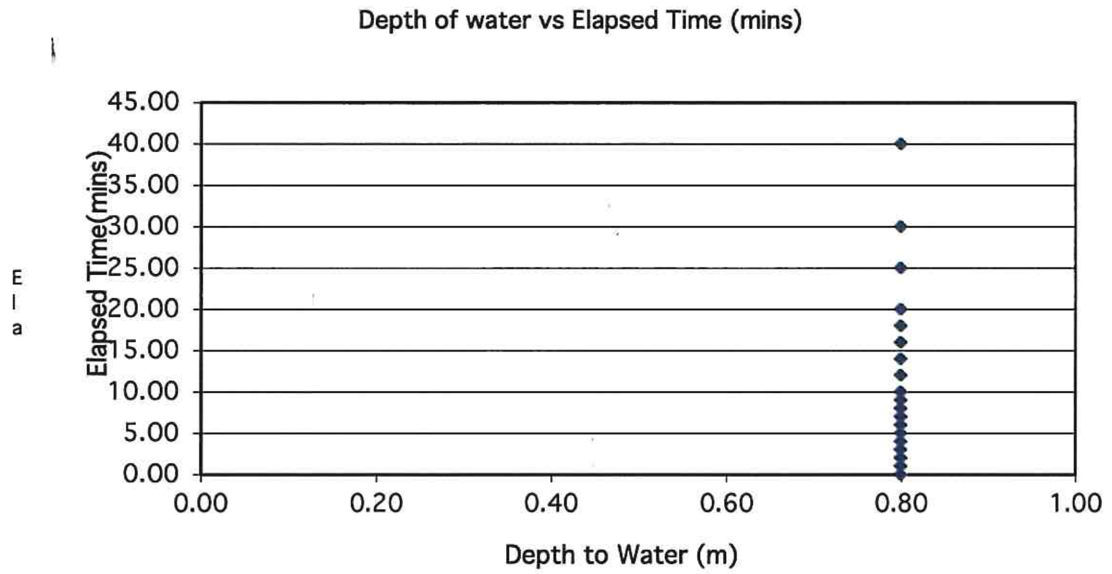
Depth to Water (m)	Elapsed Time (min)
0.80	0.00
0.80	1.00
0.80	2.00
0.80	3.00
0.80	4.00
0.80	5.00
0.80	6.00
0.80	7.00
0.80	8.00
0.80	9.00
0.80	10.00
0.80	12.00
0.80	14.00
0.80	16.00
0.80	18.00
0.80	20.00
0.80	25.00
0.80	30.00
0.80	40.00
0.80	50.00
0.80	60.00

Field Test

Depth of Pit (D)	2.00	m
Width of Pit (B)	0.40	m
Length of Pit (L)	1.80	m
Initial depth to Water =	0.80	m
Final depth to water =	0.80	m
Elapsed time (mins)=	60.00	
Top of permeable soil		m
Base of permeable soil		m
Base area=	0.72	m2
*Av. side area of permeable stratum over test period	5.28	m2
Total Exposed area =	6	m2

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

f= 0 m/min or 0 m/sec



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

Contract:	Ratoath	Contract No.	22578
Test No.	SA03		
Client	Pivotal Construction		
Date:	27/06/2020		

Summary of ground conditions

from	to	Description	Ground water
0.00	0.30	TOPSOIL.	No ingress observed
0.30	1.70	Firm to stiff brown mottled grey slightly sandy gravelly CLAY with medium cobble content and low boulder content. Boulders <	
1.70	2.10	Stiff dark grey/black slightly sandy gravelly CLAY with medium cobble content and low boulder content. Boulders < 330mm.	

Field Data

Depth to Water (m)	Elapsed Time (min)
0.87	0.00
0.87	1.00
0.87	2.00
0.87	3.00
0.87	4.00
0.87	5.00
0.87	6.00
0.87	7.00
0.87	8.00
0.87	9.00
0.87	10.00
0.87	12.00
0.87	14.00
0.87	16.00
0.87	18.00
0.87	20.00
0.88	25.00
0.88	30.00
0.88	40.00
0.88	50.00
0.88	60.00

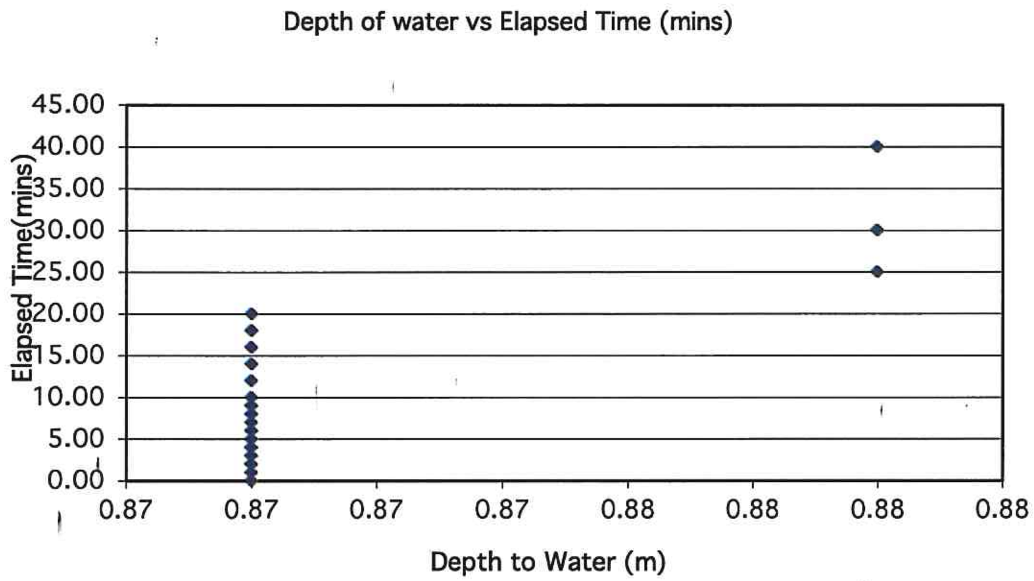
Field Test

Depth of Pit (D)	2.10	m
Width of Pit (B)	0.40	m
Length of Pit (L)	1.80	m
Initial depth to Water =	0.87	m
Final depth to water =	0.88	m
Elapsed time (mins)=	60.00	
Top of permeable soil		m
Base of permeable soil		m
Base area=	0.72	m2
*Av. side area of permeable stratum over test period	5.39	m2
Total Exposed area =	6.11	m2

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

f= 0 m/min or 0 m/sec

No fall in water level after 20 minutes - test failed



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

Contract:	Ratoath	Contract No.	22578
Test No.	SA04		
Client	Pivotal Construction		
Date:	27/06/2020		

Summary of ground conditions

from	to	Description	Ground water
0.00	0.25	TOPSOIL.	None observed
0.25	1.70	Firm to stiff brown mottled grey slightly sandy gravelly CLAY with medium cobble content.	
1.70	2.00	Firm to stiff dark grey/black very slightly sandy gravelly CLAY with medium cobble content.	

Field Data

Depth to Water (m)	Elapsed Time (min)
0.71	0.00
0.71	1.00
0.71	2.00
0.71	3.00
0.71	4.00
0.71	5.00
0.71	6.00
0.71	7.00
0.71	8.00
0.71	9.00
0.71	10.00
0.71	12.00
0.71	14.00
0.71	16.00
0.71	18.00
0.71	20.00
0.71	25.00
0.71	30.00
0.72	40.00
0.72	50.00
0.72	60.00

Field Test

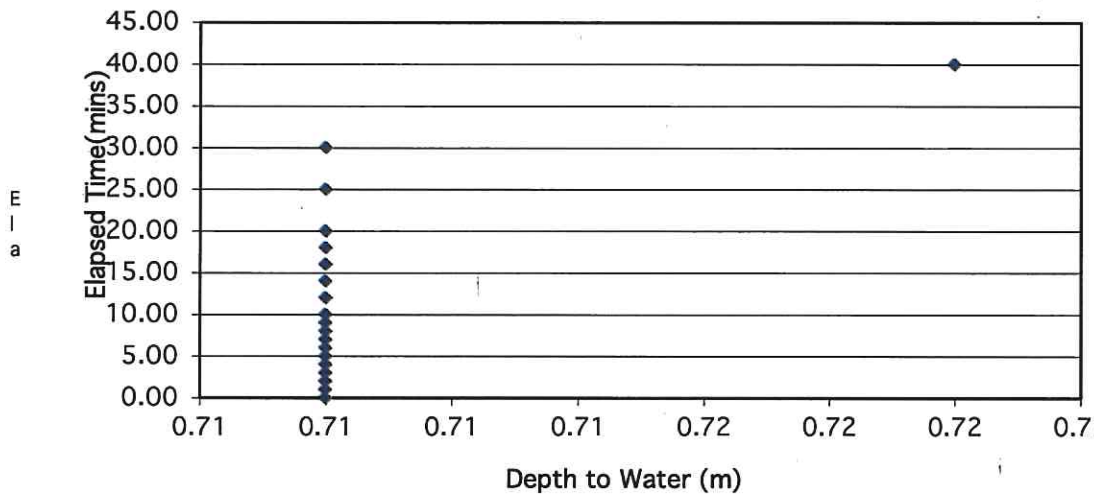
Depth of Pit (D)	2.00	m
Width of Pit (B)	0.40	m
Length of Pit (L)	1.70	m
Initial depth to Water =	0.71	m
Final depth to water =	0.72	m
Elapsed time (mins)=	60.00	
Top of permeable soil		m
Base of permeable soil		m
Base area=	0.68	m2
*Av. side area of permeable stratum over test period	5.397	m2
Total Exposed area =	6.077	m2

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

f= 0 m/min or 0 m/sec

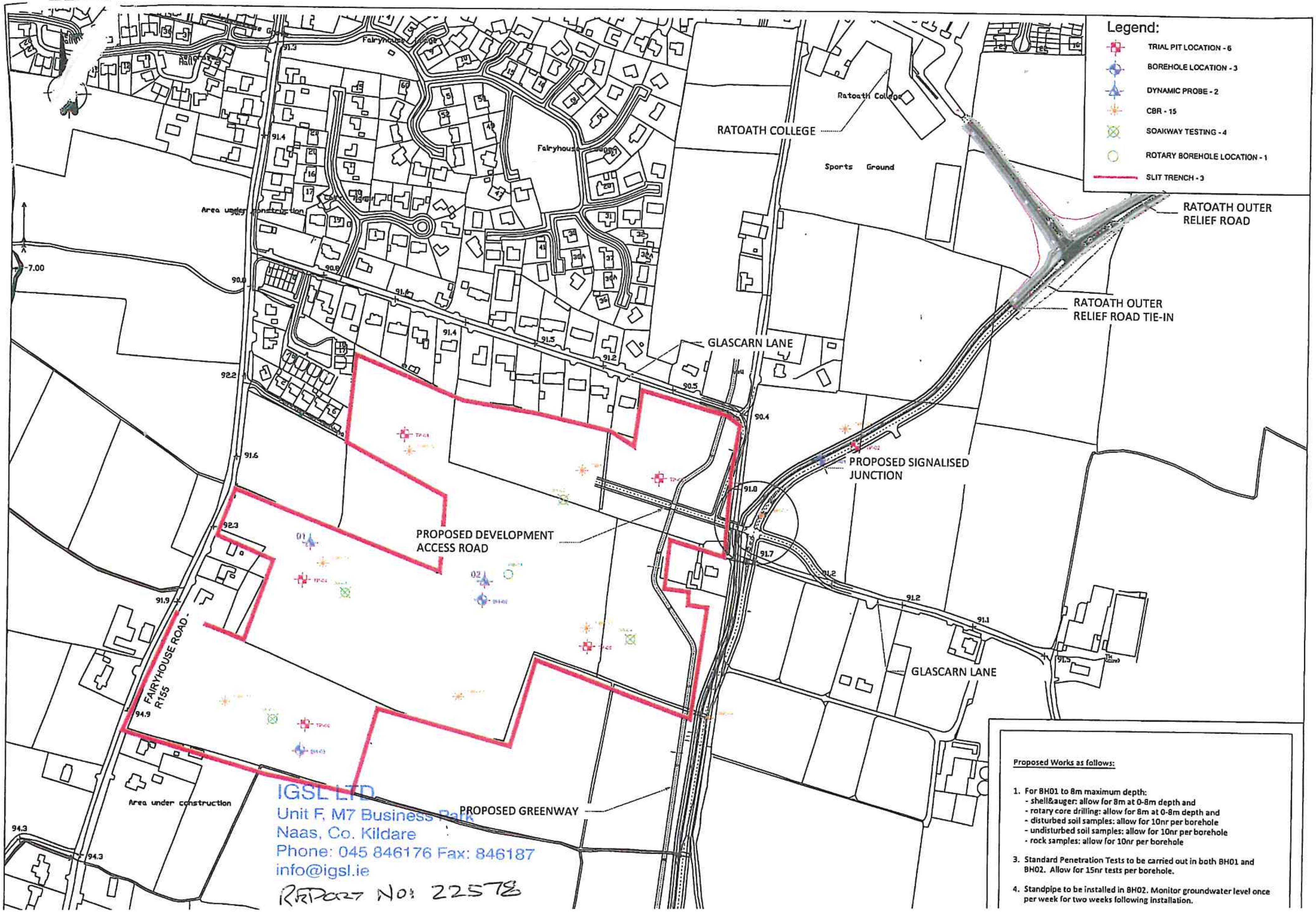
No fall in water during initial 50 minutes - test failed

Depth of water vs Elapsed Time (mins)



Appendix VI Dynamic Cone Records

Appendix VII   Laboratory Data


Legend:
TRIAL PIT LOCATION - 6
BOREHOLE LOCATION - 3
DYNAMIC PROBE - 2
CBR - 15
SOAKWAY TESTING - 4
ROTARY BOREHOLE LOCATION - 1
SLIT TRENCH - 3
RATOATH OUTER RELIEF ROAD
RATOATH OUTER RELIEF ROAD TIE-IN
RATOATH COLLEGE
Ratoath College
Sports Ground
Fairyhouse
GLASCARN LANE
PROPOSED SIGNALISED JUNCTION
PROPOSED DEVELOPMENT ACCESS ROAD
GLASCARN LANE
FAIRYHOUSE ROAD - R155
PROPOSED GREENWAY
Area under construction
Area under construction
Proposed Works as follows:
1. For BH01 to 8m maximum depth:
- shell&auger: allow for 8m at 0-8m depth and
- rotary core drilling: allow for 8m at 0-8m depth and
- disturbed soil samples: allow for 10nr per borehole
- undisturbed soil samples: allow for 10nr per borehole
- rock samples: allow for 10nr per borehole
3. Standard Penetration Tests to be carried out in both BH01 and BH02. Allow for 15nr tests per borehole.
4. Standpipe to be installed in BH02. Monitor groundwater level once per week for two weeks following installation.
IGSL LTD
Unit F, M7 Business Park
Naas, Co. Kildare
Phone: 045 846176 Fax: 846187
info@igsl.ie
REPORT NO: 22578

APPENDIX C. Q_{BAR} RUNOFF CALCULATIONS & MET ÉIREANN DATA

Appendix C

Q_{BAR} Runoff Calculations & Met Éireann Data

Mean Annual Flood Flow Rate Equation for Greenfield Catchments IH124

(Based on Institute of Hydrology report No. 124)

Project title: **BEO SHD, Ratoath**

Project no.: **L308**

Designed: **DR** Date: **21/07/2021**

(Complete figures in **blue** only)

Q Bar = 0.00108 x Area $^{0.89}$ x SAAR$^{1.17}$ x Soil$^{2.17}$

Where			**Units**
Q Bar	=	Mean Annual Peak Flow	m^3/s
Area	=	Catchment area	km^2
SARR	=	Standard Annual Average Rainfall	mm
Soil	=	Soil Index	-

Area description:

Soil characteristics: Soil type (See Table 1) **3** (Intermediate soils - Silty)

=> Soil index = 0.37

Area = 0.5 km^2 (**148063.30** m^2)

SAAR = 842 mm

Q Bar = 0.1783 m^3/s

= 178.29 l/s

or

= 12.04 l/s/ha

Linear Interpolation of Q Bar based on ratio of development to 50 ha

Peak greenfield discharge rate, Q_{Bar}	=	**52.80**	**l/s**

Met Eireann
Return Period Rainfall Depths for sliding Durations
Irish Grid: Easting: 302263, Northing: 250666,

	Interval		Years													
DURATION	6months,	1year,	2,	3,	4,	5,	10,	20,	30,	50,	75,	100,	150,	200,	250,	500,
5 mins	2.6,	3.5,	4.0,	4.8,	5.3,	5.7,	6.9,	8.3,	9.2,	10.4,	11.5,	12.3,	13.6,	14.6,	15.4,	N/A ,
10 mins	3.6,	4.9,	5.6,	6.7,	7.4,	7.9,	9.6,	11.5,	12.8,	14.5,	16.0,	17.2,	19.0,	20.4,	21.5,	N/A ,
15 mins	4.2,	5.8,	6.6,	7.8,	8.7,	9.3,	11.3,	13.6,	15.0,	17.1,	18.9,	20.2,	22.4,	24.0,	25.3,	N/A ,
30 mins	5.6,	7.6,	8.6,	10.1,	11.1,	11.9,	14.3,	17.1,	18.8,	21.3,	23.4,	25.0,	27.5,	29.4,	31.0,	N/A ,
1 hours	7.4,	9.9,	11.2,	13.0,	14.2,	15.2,	18.2,	21.4,	23.6,	26.5,	29.0,	30.9,	33.9,	36.1,	38.0,	N/A ,
2 hours	9.8,	12.9,	14.5,	16.7,	18.2,	19.4,	23.0,	27.0,	29.5,	33.0,	36.0,	38.3,	41.7,	44.4,	46.5,	N/A ,
3 hours	11.5,	15.1,	16.8,	19.4,	21.1,	22.4,	26.5,	30.8,	33.6,	37.5,	40.8,	43.3,	47.1,	50.0,	52.4,	N/A ,
4 hours	13.0,	16.8,	18.8,	21.6,	23.4,	24.8,	29.2,	33.9,	36.9,	41.1,	44.6,	47.3,	51.4,	54.4,	56.9,	N/A ,
6 hours	15.3,	19.6,	21.8,	25.0,	27.1,	28.6,	33.5,	38.8,	42.1,	46.7,	50.6,	53.5,	58.0,	61.4,	64.1,	N/A ,
9 hours	18.0,	22.9,	25.4,	29.0,	31.3,	33.0,	38.5,	44.4,	48.1,	53.1,	57.4,	60.6,	65.5,	69.2,	72.2,	N/A ,
12 hours	20.2,	25.6,	28.3,	32.2,	34.7,	36.6,	42.5,	48.8,	52.8,	58.1,	62.7,	66.2,	71.4,	75.3,	78.5,	N/A ,
18 hours	23.8,	29.9,	33.0,	37.3,	40.1,	42.2,	48.8,	55.8,	60.2,	66.1,	71.1,	74.9,	80.6,	84.9,	88.4,	N/A ,
24 hours	26.7,	33.4,	36.7,	41.4,	44.5,	46.8,	53.9,	61.4,	66.1,	72.4,	77.8,	81.8,	87.9,	92.4,	96.1,	108.5,
2 days	33.3,	41.0,	44.8,	50.1,	53.5,	56.0,	63.8,	72.0,	77.1,	84.0,	89.8,	94.1,	100.5,	105.3,	109.2,	122.2,
3 days	38.7,	47.2,	51.4,	57.1,	60.8,	63.6,	72.1,	80.9,	86.3,	93.6,	99.7,	104.3,	111.1,	116.2,	120.3,	133.9,
4 days	43.5,	52.7,	57.2,	63.4,	67.3,	70.3,	79.3,	88.6,	94.4,	102.1,	108.5,	113.3,	120.5,	125.8,	130.0,	144.2,
6 days	52.0,	62.4,	67.4,	74.4,	78.8,	82.0,	92.0,	102.3,	108.6,	116.9,	123.9,	129.2,	136.8,	142.6,	147.2,	162.4,
8 days	59.6,	71.1,	76.5,	84.1,	88.9,	92.4,	103.2,	114.3,	121.1,	130.0,	137.5,	143.1,	151.3,	157.4,	162.2,	178.3,
10 days	66.7,	79.0,	84.9,	93.1,	98.2,	102.0,	113.5,	125.3,	132.5,	142.0,	149.9,	155.8,	164.4,	170.8,	176.0,	192.9,
12 days	73.3,	86.5,	92.8,	101.4,	106.9,	110.9,	123.1,	135.5,	143.1,	153.1,	161.4,	167.6,	176.7,	183.4,	188.7,	206.4,
16 days	85.7,	100.4,	107.4,	117.0,	123.0,	127.4,	140.9,	154.5,	162.7,	173.6,	182.7,	189.3,	199.1,	206.4,	212.2,	231.2,
20 days	97.2,	113.4,	121.0,	131.4,	137.9,	142.7,	157.2,	171.9,	180.8,	192.4,	202.1,	209.3,	219.7,	227.5,	233.6,	253.8,
25 days	110.9,	128.6,	136.9,	148.3,	155.4,	160.6,	176.4,	192.2,	201.8,	214.4,	224.8,	232.5,	243.7,	251.9,	258.5,	280.1,

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

OCSC
O'CONNOR | SUTTON | CRONIN
Multidisciplinary Consulting Engineers

APPENDIX D. SURFACE WATER DESIGN & ATTENUATION CALCULATIONS

- **Design Criteria;**
- **Network Design & Results Table;**
- **Simulation Criteria;**
- **Attenuation Design;**
- **Summary of Results**

Appendix D

Surface Water Design & Attenuation Calculations

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Surface Network 1

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - Scotland and Ireland

Return Period (years)	5	PIMP (%)	100
M5-60 (mm)	15.200	Add Flow / Climate Change (%)	20
Ratio R	0.271	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	1.500
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Inverts

Network Design Table for Surface Network 1

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
S1.000	21.900	0.110	200.0	0.066	5.00	0.0	0.600	o	225	Pipe/Conduit	🔒
S1.001	30.247	0.151	200.0	0.044	0.00	0.0	0.600	o	225	Pipe/Conduit	🔓
S1.002	5.856	0.029	200.0	0.003	0.00	0.0	0.600	o	225	Pipe/Conduit	🔓
S1.003	20.071	0.100	200.0	0.010	0.00	0.0	0.600	o	225	Pipe/Conduit	🔓
S1.004	44.765	0.224	200.0	0.157	0.00	0.0	0.600	o	300	Pipe/Conduit	🔓
S2.000	16.450	0.329	50.0	0.019	5.00	0.0	0.600	o	225	Pipe/Conduit	🔒
S2.001	9.571	0.191	50.0	0.004	0.00	0.0	0.600	o	225	Pipe/Conduit	🔒
S1.005	41.089	0.206	199.7	0.026	0.00	0.0	0.600	o	300	Pipe/Conduit	🔓
S3.000	58.675	0.345	170.0	0.086	5.00	0.0	0.600	o	225	Pipe/Conduit	🔒
S3.001	7.384	0.043	170.0	0.004	0.00	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)
S1.000	50.00	5.40	89.400	0.066	0.0	0.0	1.8	0.92	36.6	10.7
S1.001	50.00	5.94	89.291	0.110	0.0	0.0	3.0	0.92	36.6	17.8
S1.002	50.00	6.05	89.139	0.113	0.0	0.0	3.1	0.92	36.6	18.3
S1.003	50.00	6.41	89.110	0.123	0.0	0.0	3.3	0.92	36.6	19.9
S1.004	49.29	7.09	89.010	0.279	0.0	0.0	7.5	1.11	78.3	44.8
S2.000	50.00	5.15	89.979	0.019	0.0	0.0	0.5	1.85	73.7	3.0
S2.001	50.00	5.23	89.650	0.022	0.0	0.0	0.6	1.85	73.7	3.6
S1.005	47.57	7.70	88.786	0.328	0.0	0.0	8.5	1.11	78.4	50.7
S3.000	50.00	5.98	89.524	0.086	0.0	0.0	2.3	1.00	39.8	14.0
S3.001	50.00	6.10	89.179	0.090	0.0	0.0	2.4	1.00	39.8	14.6

Network Design Table for Surface Network 1

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
S3.002	29.503	0.174	170.0	0.033	0.00	0.0	0.600	o	225	Pipe/Conduit	
S3.003	26.688	0.157	170.0	0.061	0.00	0.0	0.600	o	225	Pipe/Conduit	
S3.004	38.182	0.225	170.0	0.084	0.00	0.0	0.600	o	300	Pipe/Conduit	
S1.006	23.407	0.087	268.0	0.031	0.00	0.0	0.600	o	375	Pipe/Conduit	
S4.000	63.322	0.317	200.0	0.105	5.00	0.0	0.600	o	225	Pipe/Conduit	
S5.000	19.305	0.276	70.0	0.059	5.00	0.0	0.600	o	225	Pipe/Conduit	
S5.001	6.323	0.090	70.3	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S4.001	84.889	0.424	200.0	0.138	0.00	0.0	0.600	o	300	Pipe/Conduit	
S4.002	34.499	0.172	200.0	0.081	0.00	0.0	0.600	o	300	Pipe/Conduit	
S4.003	30.068	0.150	200.0	0.066	0.00	0.0	0.600	o	300	Pipe/Conduit	
S1.007	10.200	0.038	270.0	0.007	0.00	0.0	0.600	o	525	Pipe/Conduit	
S1.008	13.106	0.049	270.0	0.000	0.00	0.0	0.600	o	525	Pipe/Conduit	
S6.000	12.610	0.063	200.0	0.019	5.00	0.0	0.600	o	225	Pipe/Conduit	
S7.000	34.432	0.172	200.0	0.036	5.00	0.0	0.600	o	225	Pipe/Conduit	
S7.001	7.484	0.037	202.3	0.004	0.00	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)
S3.002	50.00	6.59	89.135	0.123	0.0	0.0	3.3	1.00	39.8	20.0
S3.003	49.43	7.04	88.962	0.184	0.0	0.0	4.9	1.00	39.8	29.5
S3.004	47.94	7.57	88.805	0.268	0.0	0.0	7.0	1.20	85.0	41.8
S1.006	46.65	8.06	88.580	0.627	0.0	0.0	15.8	1.10	121.7	95.1
S4.000	50.00	6.15	89.557	0.105	0.0	0.0	2.9	0.92	36.6	17.1
S5.000	50.00	5.21	89.607	0.059	0.0	0.0	1.6	1.57	62.2	9.7
S5.001	50.00	5.27	89.331	0.059	0.0	0.0	1.6	1.56	62.1	9.7
S4.001	48.34	7.42	89.240	0.303	0.0	0.0	7.9	1.11	78.3	47.6
S4.002	46.95	7.94	88.816	0.384	0.0	0.0	9.8	1.11	78.3	58.6
S4.003	45.82	8.39	88.643	0.450	0.0	0.0	11.2	1.11	78.3	67.0
S1.007	45.52	8.52	88.493	1.084	0.0	0.0	26.7	1.36	294.0	160.4
S1.008	45.14	8.68	88.455	1.084	0.0	0.0	26.7	1.36	294.0	160.4
S6.000	50.00	5.23	90.212	0.019	0.0	0.0	0.5	0.92	36.6	3.0
S7.000	50.00	5.62	90.358	0.036	0.0	0.0	1.0	0.92	36.6	5.9
S7.001	50.00	5.76	90.186	0.040	0.0	0.0	1.1	0.92	36.4	6.5

Network Design Table for Surface Network 1

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
S6.001	55.724	0.279	200.0	0.116	0.00	0.0	0.600	o	225	Pipe/Conduit	
S8.000	22.619	0.565	40.0	0.039	5.00	0.0	0.600	o	225	Pipe/Conduit	
S8.001	7.356	0.184	40.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S6.002	35.969	0.180	200.0	0.042	0.00	0.0	0.600	o	300	Pipe/Conduit	
S9.000	4.916	0.049	100.0	0.000	5.00	0.0	0.600	o	225	Pipe/Conduit	
S9.001	3.981	0.040	100.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S6.003	51.684	0.258	200.3	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	
S1.009	26.989	0.100	270.0	0.000	0.00	0.0	0.600	o	525	Pipe/Conduit	
S1.010	44.952	0.166	270.0	0.000	0.00	0.0	0.600	o	525	Pipe/Conduit	
S10.000	44.811	0.640	70.0	0.064	5.00	0.0	0.600	o	225	Pipe/Conduit	
S10.001	77.268	1.104	70.0	0.244	0.00	0.0	0.600	o	225	Pipe/Conduit	
S10.002	14.803	0.211	70.0	0.021	0.00	0.0	0.600	o	225	Pipe/Conduit	
S11.000	60.000	1.000	60.0	0.140	5.00	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)
S6.001	50.00	6.77	90.149	0.175	0.0	0.0	4.7	0.92	36.6	28.4
S8.000	50.00	5.18	90.619	0.039	0.0	0.0	1.1	2.07	82.5	6.4
S8.001	50.00	5.24	90.054	0.039	0.0	0.0	1.1	2.07	82.5	6.4
S6.002	48.65	7.31	89.870	0.256	0.0	0.0	6.7	1.11	78.3	40.4
S9.000	50.00	5.06	90.772	0.000	0.0	0.0	0.0	1.31	52.0	0.0
S9.001	50.00	5.11	90.723	0.000	0.0	0.0	0.0	1.31	52.0	0.0
S6.003	47.03	7.91	89.690	0.256	0.0	0.0	6.7	1.43	227.9	40.4
S1.009	44.38	9.01	88.406	1.340	0.0	0.0	32.2	1.36	294.0	193.3
S1.010	43.19	9.56	88.306	1.340	0.0	0.0	32.2	1.36	294.0	193.3
S10.000	50.00	5.48	90.323	0.064	0.0	0.0	1.7	1.57	62.2	10.4
S10.001	50.00	6.30	89.683	0.309	0.0	0.0	8.4	1.57	62.2	50.1
S10.002	50.00	6.46	88.579	0.330	0.0	0.0	8.9	1.57	62.2	53.6
S11.000	50.00	5.59	91.092	0.140	0.0	0.0	3.8	1.69	67.3	22.7

Network Design Table for Surface Network 1

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
S10.003	15.876	0.228	69.5	0.012	0.00	0.0	0.600	o	300	Pipe/Conduit	
S1.011	13.168	0.049	270.0	0.002	0.00	0.0	0.600	o	600	Pipe/Conduit	
S1.012	19.897	0.074	270.0	0.034	0.00	0.0	0.600	o	600	Pipe/Conduit	
S1.013	30.241	0.112	270.0	0.055	0.00	0.0	0.600	o	600	Pipe/Conduit	
S1.014	25.525	0.095	270.0	0.089	0.00	0.0	0.600	o	600	Pipe/Conduit	
S12.000	45.537	0.759	60.0	0.069	5.00	0.0	0.600	o	225	Pipe/Conduit	
S12.001	31.524	0.525	60.0	0.070	0.00	0.0	0.600	o	225	Pipe/Conduit	
S13.000	26.655	0.444	60.0	0.023	5.00	0.0	0.600	o	225	Pipe/Conduit	
S12.002	28.705	0.478	60.0	0.025	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.015	15.423	0.057	270.0	0.017	0.00	0.0	0.600	o	600	Pipe/Conduit	
S14.000	19.268	0.193	100.0	0.055	5.00	0.0	0.600	o	225	Pipe/Conduit	
S14.001	22.506	0.225	100.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.016	7.696	0.029	270.0	0.000	0.00	0.0	0.600	o	600	Pipe/Conduit	
S15.000	26.162	0.262	100.0	0.038	5.00	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)
S10.003	50.00	6.60	88.368	0.482	0.0	0.0	13.0	1.89	133.5	78.2
S1.011	42.88	9.71	88.140	1.824	0.0	0.0	42.4	1.48	417.7	254.2
S1.012	42.42	9.94	88.091	1.858	0.0	0.0	42.7	1.48	417.7	256.2
S1.013	41.76	10.28	88.017	1.913	0.0	0.0	43.3	1.48	417.7	259.6
S1.014	41.21	10.56	87.905	2.002	0.0	0.0	44.7	1.48	417.7	268.2
S12.000	50.00	5.45	89.574	0.069	0.0	0.0	1.9	1.69	67.3	11.2
S12.001	50.00	5.76	88.815	0.139	0.0	0.0	3.8	1.69	67.3	22.6
S13.000	50.00	5.26	89.869	0.023	0.0	0.0	0.6	1.69	67.3	3.7
S12.002	50.00	6.04	88.290	0.187	0.0	0.0	5.1	1.69	67.3	30.4
S1.015	40.89	10.74	87.811	2.206	0.0	0.0	48.9	1.48	417.7	293.2
S14.000	50.00	5.25	90.298	0.055	0.0	0.0	1.5	1.31	52.0	9.0
S14.001	50.00	5.53	90.105	0.055	0.0	0.0	1.5	1.31	52.0	9.0
S1.016	40.74	10.83	87.753	2.262	0.0	0.0	49.9	1.48	417.7	299.4
S15.000	50.00	5.33	91.096	0.038	0.0	0.0	1.0	1.31	52.0	6.3

Network Design Table for Surface Network 1

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
S15.001	31.745	0.317	100.1	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S15.002	15.504	0.155	100.0	0.009	0.00	0.0	0.600	o	225	Pipe/Conduit	
S16.000	14.946	0.149	100.0	0.028	5.00	0.0	0.600	o	225	Pipe/Conduit	
S16.001	27.012	0.270	100.0	0.027	0.00	0.0	0.600	o	225	Pipe/Conduit	
S15.003	29.926	0.299	100.0	0.091	0.00	0.0	0.600	o	225	Pipe/Conduit	
S17.000	31.894	0.159	200.6	0.159	5.00	0.0	0.600	o	225	Pipe/Conduit	
S17.001	7.589	0.038	200.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S15.004	18.664	2.338	8.0	0.014	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.017	22.506	0.083	271.2	0.000	0.00	0.0	0.600	o	600	Pipe/Conduit	
S1.018	35.739	0.132	270.0	0.018	0.00	0.0	0.600	o	600	Pipe/Conduit	
S18.000	43.030	0.215	200.0	0.075	5.00	0.0	0.600	o	225	Pipe/Conduit	
S19.000	30.618	0.612	50.0	0.034	5.00	0.0	0.600	o	225	Pipe/Conduit	
S18.001	6.941	0.035	196.9	0.004	0.00	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)
S15.001	50.00	5.74	90.834	0.038	0.0	0.0	1.0	1.31	51.9	6.3
S15.002	50.00	5.94	90.517	0.047	0.0	0.0	1.3	1.31	52.0	7.7
S16.000	50.00	5.19	90.781	0.028	0.0	0.0	0.7	1.31	52.0	4.5
S16.001	50.00	5.53	90.632	0.055	0.0	0.0	1.5	1.31	52.0	8.9
S15.003	50.00	6.32	90.362	0.193	0.0	0.0	5.2	1.31	52.0	31.3
S17.000	50.00	5.58	90.260	0.159	0.0	0.0	4.3	0.92	36.6	25.8
S17.001	50.00	5.72	90.101	0.159	0.0	0.0	4.3	0.92	36.6	25.8
S15.004	50.00	6.38	90.062	0.365	0.0	0.0	9.9	4.66	185.3	59.4
S1.017	40.28	11.08	87.724	2.627	0.0	0.0	57.3	1.47	416.8	343.9
S1.018	39.59	11.48	87.641	2.645	0.0	0.0	57.3	1.48	417.7	343.9
S18.000	50.00	5.78	89.479	0.075	0.0	0.0	2.0	0.92	36.6	12.1
S19.000	50.00	5.28	89.876	0.034	0.0	0.0	0.9	1.85	73.7	5.6
S18.001	50.00	5.90	89.264	0.113	0.0	0.0	3.1	0.93	36.9	18.3

Network Design Table for Surface Network 1

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
S20.000	53.873	0.770	70.0	0.151	5.00	0.0	0.600	o	225	Pipe/Conduit	
S18.002	17.919	0.090	200.0	0.024	0.00	0.0	0.600	o	300	Pipe/Conduit	
S18.003	11.428	0.057	200.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S1.019	22.976	0.085	270.0	0.009	0.00	0.0	0.600	o	600	Pipe/Conduit	
S1.020	30.329	0.112	270.0	0.069	0.00	0.0	0.600	o	600	Pipe/Conduit	
S1.021	21.052	0.078	270.0	0.031	0.00	0.0	0.600	o	600	Pipe/Conduit	
S1.022	26.305	0.097	270.0	0.007	0.00	0.0	0.600	o	600	Pipe/Conduit	
S21.000	74.187	0.371	200.0	0.132	5.00	0.0	0.600	o	225	Pipe/Conduit	
S21.001	29.820	0.149	200.0	0.064	0.00	0.0	0.600	o	225	Pipe/Conduit	
S22.000	32.817	0.219	150.0	0.061	5.00	0.0	0.600	o	225	Pipe/Conduit	
S22.001	45.384	0.303	150.0	0.052	0.00	0.0	0.600	o	225	Pipe/Conduit	
S21.002	58.082	0.290	200.0	0.156	0.00	0.0	0.600	o	300	Pipe/Conduit	
S21.003	5.572	0.028	200.0	0.003	0.00	0.0	0.600	o	300	Pipe/Conduit	
S1.023	34.358	0.127	270.0	0.000	0.00	0.0	0.600	o	675	Pipe/Conduit	
S1.024	3.230	0.012	270.0	0.000	0.00	0.0	0.600	o	675	Pipe/Conduit	
S1.025	3.000	0.011	270.0	0.000	0.00	0.0	0.600	o	675	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)
S20.000	50.00	5.57	89.998	0.151	0.0	0.0	4.1	1.57	62.2	24.6
S18.002	50.00	6.17	89.228	0.288	0.0	0.0	7.8	1.11	78.3	46.8
S18.003	50.00	6.34	89.139	0.288	0.0	0.0	7.8	1.11	78.3	46.8
S1.019	39.16	11.74	87.509	2.942	0.0	0.0	62.4	1.48	417.7	374.4
S1.020	38.61	12.08	87.424	3.010	0.0	0.0	63.0	1.48	417.7	377.8
S1.021	38.24	12.32	87.311	3.041	0.0	0.0	63.0	1.48	417.7	378.0
S1.022	37.79	12.62	87.233	3.049	0.0	0.0	63.0	1.48	417.7	378.0
S21.000	50.00	6.34	88.814	0.132	0.0	0.0	3.6	0.92	36.6	21.5
S21.001	49.90	6.88	88.443	0.197	0.0	0.0	5.3	0.92	36.6	31.9
S22.000	50.00	5.51	88.815	0.061	0.0	0.0	1.7	1.07	42.4	9.9
S22.001	50.00	6.22	88.596	0.113	0.0	0.0	3.1	1.07	42.4	18.4
S21.002	47.43	7.76	88.293	0.466	0.0	0.0	12.0	1.11	78.3	71.8
S21.003	47.21	7.84	88.003	0.469	0.0	0.0	12.0	1.11	78.3	71.9
S1.023	37.27	12.98	87.136	3.517	0.0	0.0	71.0	1.59	569.0	426.0
S1.024	37.22	13.01	87.009	3.517	0.0	0.0	71.0	1.59	569.0	426.0
S1.025	37.17	13.04	86.997	3.517	0.0	0.0	71.0	1.59	569.0	426.0

Network Design Table for Surface Network 1

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
S1.026	54.593	0.202	270.0	0.000	0.00	0.0	0.600	o	675	Pipe/Conduit	
S1.027	8.051	0.030	268.4	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S1.028	42.277	0.157	270.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S1.029	26.360	0.098	269.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S1.030	32.256	0.119	271.1	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S1.031	67.451	0.250	269.8	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S1.032	18.182	0.067	271.4	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S1.033	77.715	0.288	269.8	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)
S1.026	36.38	13.62	86.985	3.517	0.0	0.0	71.0	1.59	569.0	426.0
S1.027	50.00	5.14	86.783	0.000	33.3	0.0	5.6	0.95	67.5	33.3
S1.028	50.00	5.88	86.753	0.000	33.3	0.0	6.7	0.95	67.3	40.0
S1.029	50.00	6.34	86.597	0.000	33.3	0.0	6.7	0.95	67.4	40.0
S1.030	49.82	6.91	86.499	0.000	33.3	0.0	6.7	0.95	67.2	40.0
S1.031	46.58	8.09	86.380	0.000	33.3	0.0	6.7	0.95	67.3	40.0
S1.032	45.79	8.41	86.130	0.000	33.3	0.0	6.7	0.95	67.1	40.0
S1.033	42.77	9.77	86.063	0.000	33.3	0.0	6.7	0.95	67.3	40.0

Storage Structures for Surface Network 1

Tank or Pond Manhole: S9, DS/PN: S1.009

Invert Level (m) 88.406

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	220.0	0.700	220.0	1.400	220.0	2.100	0.0
0.100	220.0	0.800	220.0	1.500	220.0	2.200	0.0
0.200	220.0	0.900	220.0	1.600	220.0	2.300	0.0
0.300	220.0	1.000	220.0	1.700	220.0	2.400	0.0
0.400	220.0	1.100	220.0	1.800	220.0	2.500	0.0
0.500	220.0	1.200	220.0	1.950	220.0		
0.600	220.0	1.300	220.0	2.000	0.0		

Tank or Pond Manhole: S17, DS/PN: S1.017

Invert Level (m) 87.724

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	350.0	0.700	350.0	1.400	350.0	2.100	0.0
0.100	350.0	0.800	350.0	1.500	350.0	2.200	0.0
0.200	350.0	0.900	350.0	1.600	350.0	2.300	0.0
0.300	350.0	1.000	350.0	1.700	350.0	2.400	0.0
0.400	350.0	1.100	350.0	1.800	350.0	2.500	0.0
0.500	350.0	1.200	350.0	1.900	0.0		
0.600	350.0	1.300	350.0	2.000	0.0		

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Surface Network 2

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - Scotland and Ireland

Return Period (years)	5	PIMP (%)	100
M5-60 (mm)	15.200	Add Flow / Climate Change (%)	20
Ratio R	0.271	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	1.500
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Inverts

Network Design Table for Surface Network 2

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
S1.000	31.280	0.209	150.0	0.152	5.00	0.0	0.600	o	225	Pipe/Conduit	
S1.001	9.125	0.046	200.0	0.032	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.002	30.288	0.151	200.0	0.020	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.003	47.272	0.598	79.1	0.182	0.00	0.0	0.600	o	300	Pipe/Conduit	
S1.004	57.115	0.722	79.1	0.036	0.00	0.0	0.600	o	300	Pipe/Conduit	
S2.000	19.570	0.065	300.0	0.213	5.00	0.0	0.600	o	300	Pipe/Conduit	
S2.001	24.845	0.083	300.0	0.024	0.00	0.0	0.600	o	300	Pipe/Conduit	
S2.002	36.464	0.122	298.9	0.027	0.00	0.0	0.600	o	300	Pipe/Conduit	
S3.000	55.298	0.553	100.0	0.053	5.00	0.0	0.600	o	225	Pipe/Conduit	
S3.001	10.000	0.100	100.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S3.002	30.986	0.310	100.0	0.049	0.00	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)
S1.000	50.00	5.49	92.300	0.152	0.0	0.0	4.1	1.07	42.4	24.7
S1.001	50.00	5.65	92.091	0.184	0.0	0.0	5.0	0.92	36.6	29.9
S1.002	50.00	6.20	92.046	0.204	0.0	0.0	5.5	0.92	36.6	33.2
S1.003	50.00	6.65	91.894	0.387	0.0	0.0	10.5	1.77	125.1	62.8
S1.004	49.00	7.19	91.297	0.422	0.0	0.0	11.2	1.77	125.1	67.3
S2.000	50.00	5.36	91.400	0.213	0.0	0.0	5.8	0.90	63.8	34.5
S2.001	50.00	5.82	91.335	0.237	0.0	0.0	6.4	0.90	63.8	38.5
S2.002	50.00	6.49	91.252	0.264	0.0	0.0	7.2	0.90	63.9	42.9
S3.000	50.00	5.70	92.142	0.053	0.0	0.0	1.4	1.31	52.0	8.5
S3.001	50.00	5.83	91.589	0.053	0.0	0.0	1.4	1.31	52.0	8.5
S3.002	50.00	6.23	91.489	0.102	0.0	0.0	2.8	1.31	52.0	16.5

Network Design Table for Surface Network 2

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
S3.003	4.861	0.049	99.2	0.003	0.00	0.0	0.600	o	225	Pipe/Conduit	
S2.003	76.533	0.255	300.0	0.207	0.00	0.0	0.600	o	375	Pipe/Conduit	
S2.004	39.550	0.132	300.0	0.148	0.00	0.0	0.600	o	375	Pipe/Conduit	
S2.005	50.347	0.168	299.1	0.114	0.00	0.0	0.600	o	450	Pipe/Conduit	
S1.005	80.864	0.270	300.0	0.163	0.00	0.0	0.600	o	525	Pipe/Conduit	
S4.000	21.095	0.070	300.0	0.060	5.00	0.0	0.600	o	300	Pipe/Conduit	
S4.001	21.033	0.070	300.0	0.036	0.00	0.0	0.600	o	300	Pipe/Conduit	
S5.000	21.801	0.073	300.0	0.020	5.00	0.0	0.600	o	225	Pipe/Conduit	
S5.001	13.733	0.046	300.0	0.017	0.00	0.0	0.600	o	225	Pipe/Conduit	
S4.002	24.966	0.083	300.0	0.031	0.00	0.0	0.600	o	300	Pipe/Conduit	
S4.003	7.262	0.024	300.0	0.015	0.00	0.0	0.600	o	300	Pipe/Conduit	
S4.004	80.025	0.267	300.0	0.132	0.00	0.0	0.600	o	300	Pipe/Conduit	
S4.005	10.523	0.035	300.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S1.006	9.197	0.031	300.0	0.000	0.00	0.0	0.600	o	525	Pipe/Conduit	
S1.007	55.240	0.184	300.0	0.024	0.00	0.0	0.600	o	525	Pipe/Conduit	
S1.008	16.386	0.055	297.9	0.000	0.00	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)
S3.003	50.00	6.29	91.179	0.104	0.0	0.0	2.8	1.31	52.2	16.9
S2.003	47.53	7.72	91.130	0.575	0.0	0.0	14.8	1.04	115.0	88.9
S2.004	45.92	8.35	90.875	0.723	0.0	0.0	18.0	1.04	115.0	107.9
S2.005	44.25	9.07	90.743	0.837	0.0	0.0	20.1	1.17	186.1	120.4
S1.005	42.07	10.11	90.575	1.422	0.0	0.0	32.4	1.29	278.8	194.5
S4.000	50.00	5.39	90.856	0.060	0.0	0.0	1.6	0.90	63.8	9.8
S4.001	50.00	5.78	90.786	0.097	0.0	0.0	2.6	0.90	63.8	15.7
S5.000	50.00	5.48	90.834	0.020	0.0	0.0	0.5	0.75	29.8	3.2
S5.001	50.00	5.79	90.761	0.037	0.0	0.0	1.0	0.75	29.8	6.0
S4.002	50.00	6.25	90.715	0.165	0.0	0.0	4.5	0.90	63.8	26.8
S4.003	50.00	6.39	90.632	0.180	0.0	0.0	4.9	0.90	63.8	29.3
S4.004	47.15	7.86	90.608	0.312	0.0	0.0	8.0	0.90	63.8	47.9
S4.005	46.65	8.06	90.341	0.312	0.0	0.0	8.0	0.90	63.8	47.9
S1.006	41.84	10.23	90.305	1.734	0.0	0.0	39.3	1.29	278.8	235.9
S1.007	40.52	10.95	90.275	1.758	0.0	0.0	39.3	1.29	278.8	235.9
S1.008	50.00	5.36	90.090	0.000	14.2	0.0	2.4	0.75	29.9	14.2

Storage Structures for Surface Network 2

Tank or Pond Manhole: 8, DS/PN: S1.007

Invert Level (m) 90.275

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	988.0	0.700	988.0	1.400	0.0	2.100	0.0
0.100	988.0	0.800	988.0	1.500	0.0	2.200	0.0
0.200	988.0	0.900	988.0	1.600	0.0	2.300	0.0
0.300	988.0	1.000	988.0	1.700	0.0	2.400	0.0
0.400	988.0	1.100	0.0	1.800	0.0	2.500	0.0
0.500	988.0	1.200	0.0	1.900	0.0		
0.600	988.0	1.300	0.0	2.000	0.0		

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Surface Network 3

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - Scotland and Ireland

Return Period (years)	5	PIMP (%)	100
M5-60 (mm)	15.200	Add Flow / Climate Change (%)	20
Ratio R	0.271	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	1.500
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Network Design Table for Surface Network 3

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
S1.000	30.609	0.161	190.0	0.060	5.00	0.0	0.600	o	1200	Pipe/Conduit	
S1.001	29.878	0.157	190.0	0.051	0.00	0.0	0.600	o	1200	Pipe/Conduit	
S1.002	37.698	0.198	190.0	0.063	0.00	0.0	0.600	o	1200	Pipe/Conduit	
S1.003	51.641	0.272	190.0	0.088	0.00	0.0	0.600	o	1200	Pipe/Conduit	
S1.004	53.689	0.283	190.0	0.091	0.00	0.0	0.600	o	1200	Pipe/Conduit	
S1.005	65.274	0.344	190.0	0.111	0.00	0.0	0.600	o	1200	Pipe/Conduit	
S1.006	54.374	0.286	190.0	0.092	0.00	0.0	0.600	o	1200	Pipe/Conduit	
S1.007	30.036	0.158	190.0	0.051	0.00	0.0	0.600	o	1200	Pipe/Conduit	
S1.008	23.440	0.123	190.0	0.039	0.00	0.0	0.600	o	1200	Pipe/Conduit	
S1.009	73.019	0.384	190.0	0.124	0.00	0.0	0.600	o	1200	Pipe/Conduit	
S1.010	73.019	0.384	190.0	0.124	0.00	0.0	0.600	o	1200	Pipe/Conduit	
S1.011	87.764	0.462	190.0	0.147	0.00	0.0	0.600	o	1200	Pipe/Conduit	
S1.012	74.465	0.392	190.0	0.126	0.00	0.0	0.600	o	1200	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)
S1.000	50.00	5.19	91.500	0.060	0.0	0.0	1.6	2.71	3066.0	9.7
S1.001	50.00	5.37	91.339	0.110	0.0	0.0	3.0	2.71	3066.0	17.9
S1.002	50.00	5.60	91.182	0.174	0.0	0.0	4.7	2.71	3066.0	28.2
S1.003	50.00	5.92	90.983	0.261	0.0	0.0	7.1	2.71	3066.0	42.5
S1.004	50.00	6.25	90.711	0.352	0.0	0.0	9.5	2.71	3066.0	57.2
S1.005	50.00	6.65	90.429	0.463	0.0	0.0	12.5	2.71	3066.0	75.2
S1.006	49.58	6.99	90.085	0.555	0.0	0.0	14.9	2.71	3066.0	89.4
S1.007	49.05	7.17	89.799	0.606	0.0	0.0	16.1	2.71	3066.0	96.5
S1.008	48.63	7.32	89.641	0.645	0.0	0.0	17.0	2.71	3066.0	101.9
S1.009	47.41	7.76	89.518	0.769	0.0	0.0	19.7	2.71	3066.0	118.4
S1.010	46.26	8.21	89.133	0.893	0.0	0.0	22.4	2.71	3066.0	134.2
S1.011	44.97	8.75	88.749	1.039	0.0	0.0	25.3	2.71	3066.0	151.9
S1.012	43.94	9.21	88.287	1.166	0.0	0.0	27.7	2.71	3066.0	166.5

Network Design Table for Surface Network 3

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
S1.013	42.999	0.226	190.0	0.073	0.00	0.0	0.600	o	1200	Pipe/Conduit	
S1.014	74.853	0.394	190.0	0.128	0.00	0.0	0.600	o	1200	Pipe/Conduit	
S1.015	21.934	0.115	190.0	0.036	0.00	0.0	0.600	o	1200	Pipe/Conduit	
S1.016	75.741	0.399	190.0	0.128	0.00	0.0	0.600	o	1200	Pipe/Conduit	
S1.017	69.567	0.366	190.0	0.118	0.00	0.0	0.600	o	1200	Pipe/Conduit	
S1.018	34.687	0.183	190.0	0.057	0.00	0.0	0.600	o	1200	Pipe/Conduit	
S1.019	28.336	0.149	190.0	0.048	0.00	0.0	0.600	o	1200	Pipe/Conduit	
S1.020	24.581	0.129	190.0	0.043	0.00	0.0	0.600	o	1200	Pipe/Conduit	
S1.021	10.869	0.057	190.7	0.046	0.00	0.0	0.600	o	300	Pipe/Conduit	
S1.022	3.230	0.151	21.4	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S1.023	10.869	0.054	200.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S1.024	14.306	0.072	200.0	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)
S1.013	43.37	9.48	87.895	1.239	0.0	0.0	29.1	2.71	3066.0	174.7
S1.014	42.43	9.94	87.669	1.367	0.0	0.0	31.4	2.71	3066.0	188.5
S1.015	42.16	10.07	87.275	1.403	0.0	0.0	32.0	2.71	3066.0	192.2
S1.016	41.27	10.54	87.160	1.531	0.0	0.0	34.2	2.71	3066.0	205.3
S1.017	40.49	10.96	86.761	1.648	0.0	0.0	36.2	2.71	3066.0	216.9
S1.018	40.12	11.18	86.395	1.705	0.0	0.0	37.1	2.71	3066.0	222.3
S1.019	39.82	11.35	86.212	1.753	0.0	0.0	37.8	2.71	3066.0	226.8
S1.020	39.56	11.50	86.063	1.796	0.0	0.0	38.5	2.71	3066.0	230.9
S1.021	50.00	5.16	85.934	0.000	6.6	0.0	1.1	1.14	80.2	6.6
S1.022	50.00	5.18	85.877	0.000	6.6	0.0	1.3	3.41	241.3	7.9
S1.023	50.00	5.34	85.726	0.000	6.6	0.0	1.3	1.11	78.3	7.9
S1.024	50.00	5.55	85.672	0.000	6.6	0.0	1.3	1.11	78.3	7.9

OCSC

O'CONNOR | SUTTON | CRONIN

Multidisciplinary
Consulting Engineers

APPENDIX E. IRISH WATER CONFIRMATION OF FEASIBILITY

Appendix E

Irish Water Confirmation Of Feasibility

UISCE ÉIREANN : IRISH WATER

Deirdre Ryan

9 Prussia Street
Dublin 7
Dublin
D07KT57

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

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

www.water.ie

5 October 2021

Re: CDS21005058 pre-connection enquiry - Subject to contract | Contract denied

Connection for Multi/Mixed Use Development of 601 unit(s) at Newtown, Rathoath, Meath

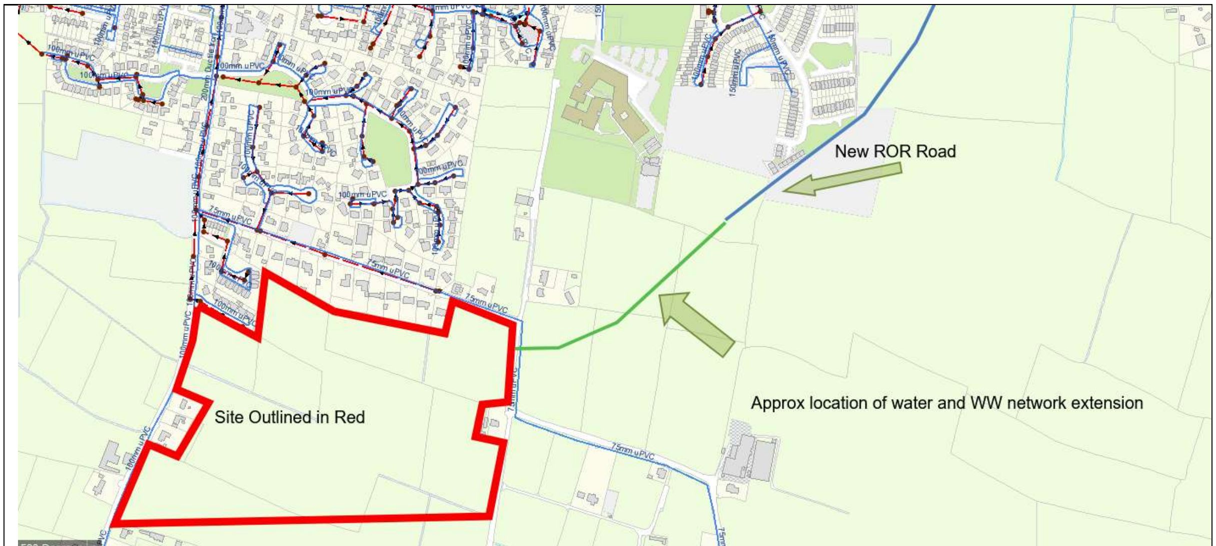
Dear Sir/Madam,

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

SERVICE	**OUTCOME OF PRE-CONNECTION ENQUIRY** **THIS IS NOT A CONNECTION OFFER. YOU MUST APPLY FOR A CONNECTION(S) TO THE IRISH WATER NETWORK(S) IF YOU WISH TO PROCEED.**
Water Connection	Feasible without infrastructure upgrade by Irish Water
Wastewater Connection	Feasible without infrastructure upgrade by Irish Water
SITE SPECIFIC COMMENTS	
Water Connection	An approx. 300m of 200mm ID pipe network extension is required to connect to the new infrastructure installed as part of the new Ratoath Outer Relief Road, part of this extension is through third party lands, it is the applicants responsibility to obtain the relevant permissions before construction of these works. At connection stage a capacity check is required at the Fairyhouse pump station. Onsite storage is required for commercial units also.
Wastewater Connection	An approx. 300m network extension is required to connect to the new infrastructure installed as part of the new Ratoath Outer Relief Road, part of this extension is through third party lands, it is the applicants responsibility to obtain the relevant permissions before construction of these works.

The design and construction of the Water & Wastewater pipes and related infrastructure to be installed in this development shall comply with the Irish Water Connections and Developer Services Standard Details and Codes of Practice that are available on the Irish Water website. Irish Water reserves the right to supplement these requirements with Codes of Practice and these will be issued with the connection agreement.

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



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

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

General Notes:

1) The initial assessment referred to above is carried out taking into account water demand and wastewater discharge volumes and infrastructure details on the date of the assessment. **The availability of capacity may change at any date after this assessment.**
2) This feedback does not constitute a contract in whole or in part to provide a connection to any Irish Water infrastructure. All feasibility assessments are subject to the constraints of the Irish Water Capital Investment Plan.

3) The feedback provided is subject to a Connection Agreement/contract being signed at a later date.
4) A Connection Agreement will be required to commencing the connection works associated with the enquiry this can be applied for at https://www.water.ie/connections/get-connected/
5) A Connection Agreement cannot be issued until all statutory approvals are successfully in place.
6) Irish Water Connection Policy/ Charges can be found at https://www.water.ie/connections/information/connection-charges/
7) Please note the Confirmation of Feasibility does not extend to your fire flow requirements.
8) Irish Water is not responsible for the management or disposal of storm water or ground waters. You are advised to contact the relevant Local Authority to discuss the management or disposal of proposed storm water or ground water discharges
9) To access Irish Water Maps email datarequests@water.ie
10) All works to the Irish Water infrastructure, including works in the Public Space, shall have to be carried out by Irish Water.

If you have any further questions, please contact Paul Lowry from the design team on 018230377 or email paullowr@water.ie For further information, visit **www.water.ie/connections.**

Yours sincerely,

Yvonne Harris

Head of Customer Operations

APPENDIX F. WASTEWATER CALCULATIONS & DESIGN NETWORK TABLES

Appendix F

Wastewater Calculations & Design Network Tables

FOUL SEWERAGE DESIGN

Design Criteria for Foul Network 1

Pipe Sizes STANDARD Manhole Sizes STANDARD

Industrial Flow (l/s/ha)	0.00	Add Flow / Climate Change (%)	0
Industrial Peak Flow Factor	0.00	Minimum Backdrop Height (m)	0.200
Flow Per Person (l/per/day)	150.00	Maximum Backdrop Height (m)	1.500
Persons per House	2.70	Min Design Depth for Optimisation (m)	1.200
Domestic (l/s/ha)	0.00	Min Vel for Auto Design only (m/s)	1.00
Domestic Peak Flow Factor	6.00	Min Slope for Optimisation (1:X)	500

Designed with Level Inverts

Network Design Table for Foul Network 1

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	31.338	0.522	60.0	0.000	37	0.0	1.500	o	225	Pipe/Conduit	
F1.001	8.304	0.138	60.0	0.000	0	0.0	1.500	o	225	Pipe/Conduit	
F1.002	27.209	0.453	60.0	0.000	0	0.0	1.500	o	225	Pipe/Conduit	
F1.003	43.528	0.725	60.0	0.000	15	0.0	1.500	o	225	Pipe/Conduit	
F1.004	61.963	1.033	60.0	0.000	4	0.0	1.500	o	225	Pipe/Conduit	
F2.000	71.891	0.719	100.0	0.000	15	0.0	1.500	o	150	Pipe/Conduit	
F1.005	50.063	0.250	200.0	0.000	9	0.0	1.500	o	225	Pipe/Conduit	
F1.006	41.311	0.207	200.0	0.000	19	0.0	1.500	o	225	Pipe/Conduit	
F3.000	51.051	0.851	60.0	0.000	9	0.0	1.500	o	150	Pipe/Conduit	
F3.001	8.887	0.148	60.0	0.000	0	0.0	1.500	o	150	Pipe/Conduit	
F3.002	33.973	0.566	60.0	0.000	0	0.0	1.500	o	150	Pipe/Conduit	

Network Results Table

PN	US/IL (m)	Σ Area (ha)	Σ Base Flow (l/s)	Σ Hse	Add Flow (l/s)	P.Dep (mm)	P.Vel (m/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
F1.000	92.400	0.000	0.0	37	0.0	21	0.56	1.48	59.0	1.0
F1.001	91.878	0.000	0.0	37	0.0	21	0.56	1.48	59.0	1.0
F1.002	91.739	0.000	0.0	37	0.0	21	0.56	1.48	59.0	1.0
F1.003	91.286	0.000	0.0	52	0.0	25	0.62	1.48	59.0	1.5
F1.004	90.560	0.000	0.0	56	0.0	25	0.63	1.48	59.0	1.6
F2.000	90.246	0.000	0.0	15	0.0	17	0.37	0.88	15.5	0.4
F1.005	89.527	0.000	0.0	80	0.0	40	0.46	0.81	32.2	2.3
F1.006	89.277	0.000	0.0	99	0.0	45	0.50	0.81	32.2	2.8
F3.000	91.477	0.000	0.0	9	0.0	12	0.38	1.13	20.0	0.3
F3.001	90.626	0.000	0.0	9	0.0	12	0.38	1.13	20.0	0.3
F3.002	90.478	0.000	0.0	9	0.0	12	0.38	1.13	20.0	0.3

Network Design Table for Foul Network 1

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
F3.003	4.861	0.081	60.0	0.000	0	0.0	1.500	o	150	Pipe/Conduit	
F3.004	38.676	0.387	100.0	0.000	15	0.0	1.500	o	225	Pipe/Conduit	
F3.005	37.395	0.374	100.0	0.000	7	0.0	1.500	o	225	Pipe/Conduit	
F1.007	52.870	0.264	200.0	0.000	3	0.0	1.500	o	225	Pipe/Conduit	
F4.000	49.536	0.826	60.0	0.000	7	0.0	1.500	o	150	Pipe/Conduit	
F4.001	8.040	0.134	60.0	0.000	4	0.0	1.500	o	150	Pipe/Conduit	
F4.002	22.112	0.369	60.0	0.000	0	0.0	1.500	o	150	Pipe/Conduit	
F1.008	24.842	0.124	200.0	0.000	3	0.0	1.500	o	225	Pipe/Conduit	
F1.009	21.083	0.105	200.0	0.000	0	0.0	1.500	o	225	Pipe/Conduit	
F1.010	25.987	0.130	200.0	0.000	0	0.0	1.500	o	225	Pipe/Conduit	
F5.000	32.736	1.091	30.0	0.000	12	0.0	1.500	o	150	Pipe/Conduit	
F5.001	19.362	0.645	30.0	0.000	0	0.0	1.500	o	150	Pipe/Conduit	
F1.011	8.523	0.043	200.0	0.000	0	0.0	1.500	o	225	Pipe/Conduit	
F6.000	33.357	0.556	60.0	0.000	37	0.0	0.600	o	225	Pipe/Conduit	
F6.001	27.677	0.461	60.0	0.000	0	0.0	0.600	o	225	Pipe/Conduit	
F6.002	15.610	0.260	60.0	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)
F3.003	89.912	0.000	0.0	9	0.0	12	0.38	1.13	20.0	0.3
F3.004	89.831	0.000	0.0	24	0.0	19	0.41	1.15	45.6	0.7
F3.005	89.444	0.000	0.0	31	0.0	22	0.44	1.15	45.6	0.9
F1.007	89.070	0.000	0.0	133	0.0	52	0.54	0.81	32.2	3.7
F4.000	90.133	0.000	0.0	7	0.0	11	0.35	1.13	20.0	0.2
F4.001	89.307	0.000	0.0	11	0.0	13	0.40	1.13	20.0	0.3
F4.002	89.173	0.000	0.0	11	0.0	13	0.40	1.13	20.0	0.3
F1.008	88.805	0.000	0.0	147	0.0	54	0.56	0.81	32.2	4.1
F1.009	88.681	0.000	0.0	147	0.0	54	0.56	0.81	32.2	4.1
F1.010	88.575	0.000	0.0	147	0.0	54	0.56	0.81	32.2	4.1
F5.000	90.181	0.000	0.0	12	0.0	12	0.52	1.60	28.3	0.3
F5.001	89.090	0.000	0.0	12	0.0	12	0.52	1.60	28.3	0.3
F1.011	88.444	0.000	0.0	159	0.0	57	0.57	0.81	32.2	4.5
F6.000	91.026	0.000	0.0	37	0.0	19	0.62	1.69	67.3	1.0
F6.001	90.470	0.000	0.0	37	0.0	19	0.62	1.69	67.3	1.0
F6.002	90.009	0.000	0.0	37	0.0	19	0.62	1.69	67.3	1.0

Network Design Table for Foul Network 1

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
F6.003	15.610	0.260	60.0	0.000	8	0.0	0.600	o	225	Pipe/Conduit	
F6.004	48.495	0.808	60.0	0.000	0	0.0	0.600	o	225	Pipe/Conduit	
F6.005	16.740	0.279	60.0	0.000	0	0.0	0.600	o	225	Pipe/Conduit	
F1.012	26.761	0.134	200.0	0.000	0	0.0	1.500	o	225	Pipe/Conduit	
F7.000	20.056	0.334	60.0	0.000	0	0.0	1.500	o	225	Pipe/Conduit	
F1.013	64.390	0.322	200.0	0.000	37	0.0	1.500	o	225	Pipe/Conduit	
F8.000	36.729	0.918	40.0	0.000	10	0.0	1.500	o	150	Pipe/Conduit	
F8.001	20.231	0.405	50.0	0.000	4	0.0	1.500	o	150	Pipe/Conduit	
F9.000	13.982	0.233	60.0	0.000	5	0.0	1.500	o	150	Pipe/Conduit	
F8.002	43.793	0.876	50.0	0.000	7	0.0	1.500	o	225	Pipe/Conduit	
F8.003	11.980	0.240	50.0	0.000	4	0.0	1.500	o	225	Pipe/Conduit	
F1.014	28.806	0.144	200.0	0.000	0	0.0	1.500	o	225	Pipe/Conduit	
F10.000	20.897	0.348	60.0	0.000	6	0.0	1.500	o	150	Pipe/Conduit	
F10.001	32.150	0.536	60.0	0.000	3	0.0	1.500	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)
F6.003	89.749	0.000	0.0	45	0.0	21	0.66	1.69	67.3	1.3
F6.004	89.488	0.000	0.0	45	0.0	21	0.66	1.69	67.3	1.3
F6.005	88.680	0.000	0.0	45	0.0	21	0.66	1.69	67.3	1.3
F1.012	88.401	0.000	0.0	204	0.0	64	0.61	0.81	32.2	5.7
F7.000	90.700	0.000	0.0	0	0.0	0	0.00	1.48	59.0	0.0
F1.013	88.267	0.000	0.0	241	0.0	70	0.64	0.81	32.2	6.8
F8.000	90.383	0.000	0.0	10	0.0	12	0.45	1.39	24.5	0.3
F8.001	89.465	0.000	0.0	14	0.0	14	0.46	1.24	21.9	0.4
F9.000	91.000	0.000	0.0	5	0.0	9	0.31	1.13	20.0	0.1
F8.002	89.060	0.000	0.0	26	0.0	17	0.53	1.63	64.6	0.7
F8.003	88.185	0.000	0.0	30	0.0	18	0.55	1.63	64.6	0.8
F1.014	87.945	0.000	0.0	271	0.0	75	0.66	0.81	32.2	7.6
F10.000	90.152	0.000	0.0	6	0.0	10	0.33	1.13	20.0	0.2
F10.001	89.804	0.000	0.0	9	0.0	12	0.38	1.13	20.0	0.3

Network Design Table for Foul Network 1

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
F10.002	11.021	0.184	60.0	0.000	0	0.0	1.500	o	150	Pipe/Conduit	
F10.003	16.169	0.269	60.0	0.000	0	0.0	1.500	o	150	Pipe/Conduit	
F10.004	41.245	0.275	150.0	0.000	10	0.0	1.500	o	150	Pipe/Conduit	
F10.005	40.446	0.202	200.0	0.000	2	0.0	1.500	o	225	Pipe/Conduit	
F11.000	24.993	0.417	60.0	0.000	5	0.0	1.500	o	150	Pipe/Conduit	
F11.001	7.042	0.117	60.0	0.000	2	0.0	1.500	o	150	Pipe/Conduit	
F11.002	28.413	0.474	59.9	0.000	0	0.0	1.500	o	150	Pipe/Conduit	
F12.000	19.551	0.652	30.0	0.000	0	0.0	1.500	o	225	Pipe/Conduit	
F11.003	63.796	1.063	60.0	0.000	9	0.0	1.500	o	225	Pipe/Conduit	
F10.006	30.369	0.152	200.0	0.000	5	0.0	1.500	o	225	Pipe/Conduit	
F10.007	27.105	0.136	200.0	0.000	4	0.0	1.500	o	225	Pipe/Conduit	
F10.008	33.620	0.168	200.0	0.000	6	0.0	1.500	o	225	Pipe/Conduit	
F13.000	49.462	0.824	60.0	0.000	9	0.0	1.500	o	150	Pipe/Conduit	
F14.000	41.416	1.035	40.0	0.000	9	0.0	1.500	o	150	Pipe/Conduit	
F14.001	2.049	0.052	39.4	0.000	0	0.0	1.500	o	150	Pipe/Conduit	

Network Results Table

PN	US/IL (m)	Σ Area (ha)	Σ Base Flow (l/s)	Σ Hse	Add Flow (l/s)	P.Dep (mm)	P.Vel (m/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
F10.002	89.268	0.000	0.0	9	0.0	12	0.38	1.13	20.0	0.3
F10.003	89.084	0.000	0.0	9	0.0	12	0.38	1.13	20.0	0.3
F10.004	88.815	0.000	0.0	19	0.0	21	0.35	0.71	12.6	0.5
F10.005	88.540	0.000	0.0	21	0.0	21	0.31	0.81	32.2	0.6
F11.000	90.409	0.000	0.0	5	0.0	9	0.31	1.13	20.0	0.1
F11.001	89.992	0.000	0.0	7	0.0	11	0.35	1.13	20.0	0.2
F11.002	89.875	0.000	0.0	7	0.0	11	0.35	1.13	20.0	0.2
F12.000	91.100	0.000	0.0	0	0.0	0	0.00	2.10	83.5	0.0
F11.003	89.401	0.000	0.0	16	0.0	14	0.43	1.48	59.0	0.5
F10.006	88.337	0.000	0.0	42	0.0	30	0.38	0.81	32.2	1.2
F10.007	88.186	0.000	0.0	46	0.0	31	0.39	0.81	32.2	1.3
F10.008	88.050	0.000	0.0	52	0.0	33	0.41	0.81	32.2	1.5
F13.000	89.525	0.000	0.0	9	0.0	12	0.38	1.13	20.0	0.3
F14.000	89.788	0.000	0.0	9	0.0	11	0.43	1.39	24.5	0.3
F14.001	88.753	0.000	0.0	9	0.0	11	0.43	1.40	24.7	0.3

Network Design Table for Foul Network 1

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
F13.001	49.230	0.492	100.0	0.000	4	0.0	1.500	o	225	Pipe/Conduit	
F13.002	32.722	0.327	100.0	0.000	6	0.0	1.500	o	225	Pipe/Conduit	
F10.009	5.198	0.026	200.0	0.000	0	0.0	1.500	o	225	Pipe/Conduit	
F10.010	11.139	0.056	200.0	0.000	0	0.0	1.500	o	225	Pipe/Conduit	
F1.015	20.070	0.100	200.0	0.000	0	0.0	1.500	o	225	Pipe/Conduit	
F1.016	54.052	0.270	200.0	0.000	18	0.0	1.500	o	225	Pipe/Conduit	
F15.000	52.362	0.873	60.0	0.000	3	0.0	1.500	o	150	Pipe/Conduit	
F1.017	16.744	0.084	200.0	0.000	0	0.0	1.500	o	225	Pipe/Conduit	
F1.018	13.730	0.069	200.0	0.000	0	0.0	1.500	o	225	Pipe/Conduit	
F1.019	33.290	0.166	200.0	0.000	8	0.0	1.500	o	225	Pipe/Conduit	
F1.020	14.838	0.074	200.0	0.000	0	0.0	1.500	o	225	Pipe/Conduit	
F16.000	28.425	0.948	30.0	0.000	5	0.0	1.500	o	150	Pipe/Conduit	
F16.001	33.299	1.110	30.0	0.000	0	0.0	1.500	o	150	Pipe/Conduit	
F1.021	61.546	0.308	200.0	0.000	37	0.0	1.500	o	225	Pipe/Conduit	
F1.022	46.443	0.233	199.1	0.000	0	0.0	1.500	o	225	Pipe/Conduit	

Network Results Table

PN	US/IL (m)	Σ Area (ha)	Σ Base Flow (l/s)	Σ Hse	Add Flow (l/s)	P.Dep (mm)	P.Vel (m/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
F13.001	88.701	0.000	0.0	22	0.0	19	0.40	1.15	45.6	0.6
F13.002	88.208	0.000	0.0	28	0.0	21	0.43	1.15	45.6	0.8
F10.009	87.881	0.000	0.0	80	0.0	40	0.46	0.81	32.2	2.3
F10.010	87.855	0.000	0.0	80	0.0	40	0.46	0.81	32.2	2.3
F1.015	87.799	0.000	0.0	351	0.0	85	0.71	0.81	32.2	9.9
F1.016	87.699	0.000	0.0	369	0.0	88	0.72	0.81	32.2	10.4
F15.000	89.900	0.000	0.0	3	0.0	7	0.26	1.13	20.0	0.1
F1.017	87.429	0.000	0.0	372	0.0	88	0.72	0.81	32.2	10.5
F1.018	87.345	0.000	0.0	372	0.0	88	0.72	0.81	32.2	10.5
F1.019	87.276	0.000	0.0	380	0.0	89	0.73	0.81	32.2	10.7
F1.020	87.110	0.000	0.0	380	0.0	89	0.73	0.81	32.2	10.7
F16.000	91.100	0.000	0.0	5	0.0	8	0.39	1.60	28.3	0.1
F16.001	90.153	0.000	0.0	5	0.0	8	0.39	1.60	28.3	0.1
F1.021	87.036	0.000	0.0	422	0.0	95	0.75	0.81	32.2	11.9
F1.022	86.728	0.000	0.0	422	0.0	94	0.75	0.81	32.3	11.9

Network Design Table for Foul Network 1

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
F17.000	23.605	0.787	30.0	0.000	4	0.0	1.500	o	150	Pipe/Conduit	
F17.001	12.612	0.316	39.9	0.000	0	0.0	1.500	o	150	Pipe/Conduit	
F18.000	44.672	1.489	30.0	0.000	0	0.0	1.500	o	150	Pipe/Conduit	
F17.002	26.713	0.668	40.0	0.000	0	0.0	1.500	o	150	Pipe/Conduit	
F17.003	49.819	1.245	40.0	0.000	12	0.0	1.500	o	150	Pipe/Conduit	
F1.023	43.679	0.218	200.0	0.000	0	0.0	1.500	o	225	Pipe/Conduit	
F19.000	48.219	0.804	60.0	0.000	10	0.0	1.500	o	150	Pipe/Conduit	
F19.001	42.308	0.705	60.0	0.000	0	0.0	1.500	o	150	Pipe/Conduit	
F19.002	32.891	0.329	100.0	0.000	6	0.0	1.500	o	150	Pipe/Conduit	
F20.000	32.888	0.822	40.0	0.000	7	0.0	1.500	o	150	Pipe/Conduit	
F20.001	43.835	1.096	40.0	0.000	7	0.0	1.500	o	150	Pipe/Conduit	
F19.003	56.726	0.567	100.0	0.000	11	0.0	1.500	o	225	Pipe/Conduit	
F19.004	11.733	0.117	100.0	0.000	0	0.0	1.500	o	225	Pipe/Conduit	
F1.024	70.000	0.350	200.0	0.000	0	0.0	1.500	o	225	Pipe/Conduit	
F1.025	71.923	0.360	200.0	0.000	0	0.0	1.500	o	225	Pipe/Conduit	

Network Results Table

PN	US/IL (m)	Σ Area (ha)	Σ Base Flow (l/s)	Σ Hse	Add Flow (l/s)	P.Dep (mm)	P.Vel (m/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
F17.000	89.512	0.000	0.0	4	0.0	7	0.36	1.60	28.3	0.1
F17.001	88.725	0.000	0.0	4	0.0	8	0.33	1.39	24.6	0.1
F18.000	89.898	0.000	0.0	0	0.0	0	0.00	1.60	28.3	0.0
F17.002	88.409	0.000	0.0	4	0.0	8	0.33	1.39	24.5	0.1
F17.003	87.741	0.000	0.0	16	0.0	14	0.52	1.39	24.5	0.5
F1.023	86.495	0.000	0.0	438	0.0	96	0.76	0.81	32.2	12.3
F19.000	88.800	0.000	0.0	10	0.0	13	0.39	1.13	20.0	0.3
F19.001	87.996	0.000	0.0	10	0.0	13	0.39	1.13	20.0	0.3
F19.002	87.291	0.000	0.0	16	0.0	18	0.38	0.88	15.5	0.5
F20.000	88.880	0.000	0.0	7	0.0	10	0.40	1.39	24.5	0.2
F20.001	88.058	0.000	0.0	14	0.0	14	0.50	1.39	24.5	0.4
F19.003	86.962	0.000	0.0	41	0.0	25	0.48	1.15	45.6	1.2
F19.004	86.395	0.000	0.0	41	0.0	25	0.48	1.15	45.6	1.2
F1.024	86.276	0.000	0.0	479	0.0	101	0.77	0.81	32.2	13.5
F1.025	85.926	0.000	0.0	479	0.0	101	0.77	0.81	32.2	13.5

Network Design Table for Foul Network 1

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
F1.026	24.942	0.125	200.0	0.000	0	0.0	1.500	o	225	Pipe/Conduit	
F1.027	29.503	0.148	200.0	0.000	0	0.0	1.500	o	225	Pipe/Conduit	
F1.028	71.115	0.356	200.0	0.000	0	0.0	1.500	o	225	Pipe/Conduit	
F1.029	44.168	0.221	200.0	0.000	0	0.0	1.500	o	225	Pipe/Conduit	
F1.030	44.168	0.221	200.0	0.000	0	0.0	1.500	o	225	Pipe/Conduit	

Network Results Table

PN	US/IL (m)	Σ Area (ha)	Σ Base Flow (l/s)	Σ Hse	Add Flow (l/s)	P.Dep (mm)	P.Vel (m/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
F1.026	85.567	0.000	0.0	479	0.0	101	0.77	0.81	32.2	13.5
F1.027	85.442	0.000	0.0	479	0.0	101	0.77	0.81	32.2	13.5
F1.028	85.295	0.000	0.0	479	0.0	101	0.77	0.81	32.2	13.5
F1.029	84.939	0.000	0.0	479	0.0	101	0.77	0.81	32.2	13.5
F1.030	84.718	0.000	0.0	479	0.0	101	0.77	0.81	32.2	13.5

O'CONNOR | SUTTON | CRONIN
Multidisciplinary Consulting Engineers

APPENDIX G. STATEMENT OF DESIGN ACCEPTANCE

Appendix G

Statement of Design Acceptance

UISCE ÉIREANN : IRISH WATER

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

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

www.water.ie

Zeljka Beronja
9 Prussia Street
Dublin 7, Dublin D07KT57

20 May 2022

Re: Design Submission for Newtown, Rathoath, Meath (the "Development") (the "Design Submission") / Connection Reference No: CDS21005058

Dear Zeljka Beronja,

Many thanks for your recent Design Submission.

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

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

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

If you have any further questions, please contact your Irish Water representative:
Name: Antonio Garzón
Phone: 0838983711
Email: antonio.garzon@water.ie

Yours sincerely,

Yvonne Harris

Yvonne Harris
Head of Customer Operations

Appendix A

Document Title & Revision

- L308-OCSC-XX-XX-DR-C-0551 (P07) (Watermain layout)
- L308-OCSC-XX-XX-DR-C-0552 (P07) (Watermain layout)
- L308-OCSC-XX-XX-DR-C-0553 (P07) (Watermain layout)
- L308-OCSC-XX-XX-DR-C-0554 (P07) (Watermain layout)
- L308-OCSC-XX-XX-DR-C-0500 (P07) (Drainage layout)
- L308-OCSC-XX-XX-DR-C-0501 (P05) (Drainage layout)
- L308-OCSC-XX-XX-DR-C-0502 (P05) (Drainage layout)
- L308-OCSC-XX-XX-DR-C-0503 (P06) (Drainage layout)
- L308-OCSC-XX-XX-DR-C-0504 (P06) (Drainage layout)
- L308-OCSC-XX-XX-DR-C-0505 (P03) (Foul network)
- L308-OCSC-XX-XX-DR-C-0536 (P03) (Drainage longitudinal sections)
- L308-OCSC-XX-XX-DR-C-0537 (P03) (Drainage longitudinal sections)
- L308-OCSC-XX-XX-DR-C-0538 (P03) (Drainage longitudinal sections)
- L308-OCSC-XX-XX-DR-C-0539 (P03) (Drainage longitudinal sections)

Additional Comments

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

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

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