

ENGINEERING SERVICES REPORT

PROPOSED DEVELOPMENT AT MERLIN WOODS

For Galway City Council

PROJECT NO. G477

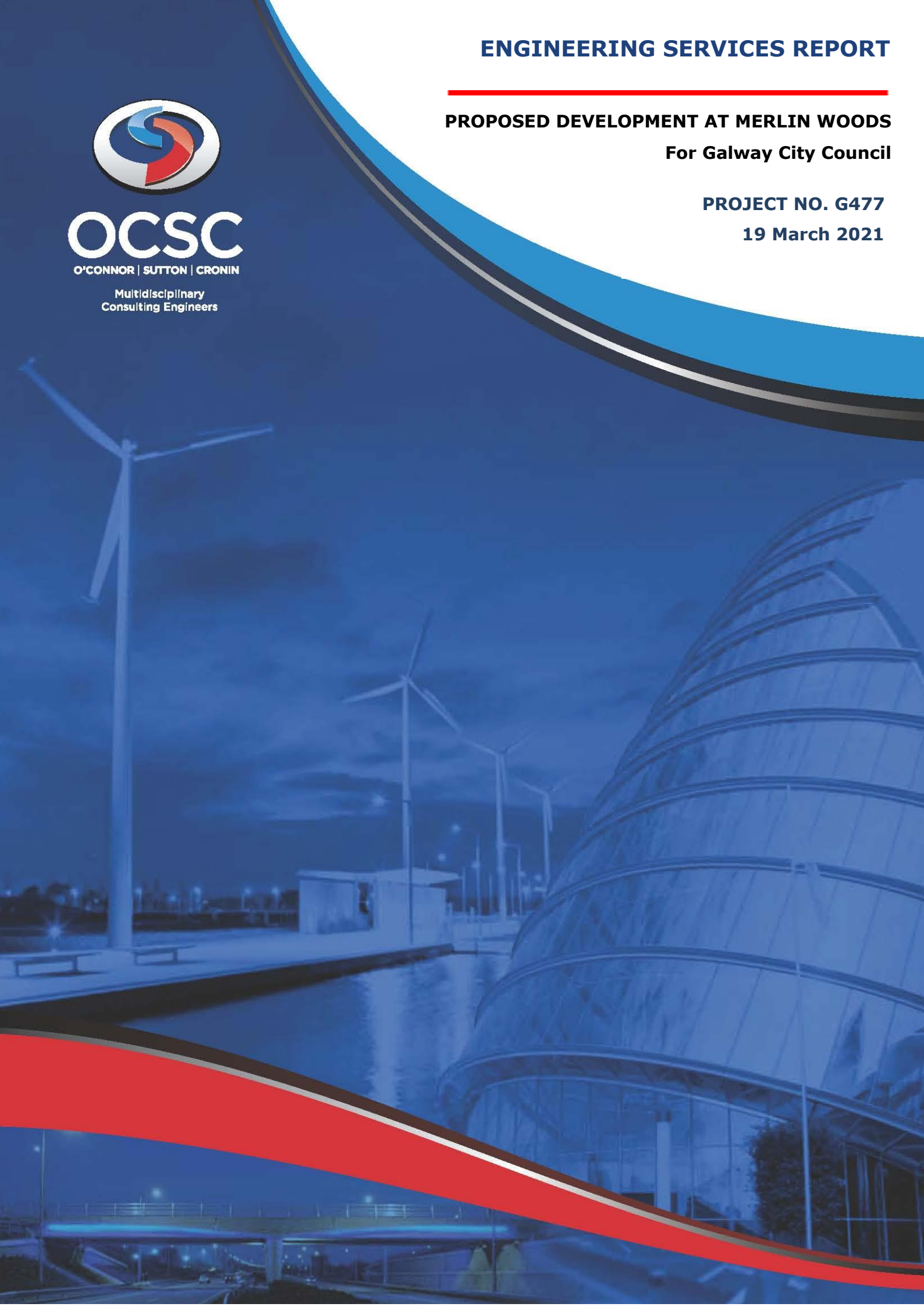
19 March 2021



OCSC

O'CONNOR | SUTTON | CRONIN

Multidisciplinary
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TABLE OF CONTENTS

PAGE

1 INTRODUCTION	1
1.1 Appointment.....	1
1.2 Administrative Jurisdiction	1
1.3 Site Location	1
1.4 Existing Site Overview	2
1.5 Proposed Development Context	3
2 SCOPE OF SERVICES REPORT	4
3 SURFACE WATER DRAINAGE.....	5
3.1 Design Guidelines Overview	5
3.2 Surface Water Design Strategy Overview	6
3.3 Existing Site Drainage	6
3.3.1 Existing Site Catchment Areas	6
3.3.2 Existing Surface Water Drainage Infrastructure	7
3.3.3 Existing Site Rainfall Runoff	7
3.4 Proposed Surface Water Drainage Design Strategy.....	9
3.4.1 Proposed Surface Water Strategy Overview	9
3.4.2 Climate Change Allowance	9
3.4.3 Proposed Surface Water Network Strategy	9
3.4.3.1 Pervious Paving	10
3.4.3.2 Trapped Road Gullies	11
3.4.3.3 Underground Pipe Network	11
3.4.3.4 Silt Traps	11
3.4.3.5 Infiltration System	12
3.4.3.6 Flow Control Device.....	13
3.4.3.7 Oil Separator.....	13
3.5 Proposed Surface Water Network Detailed Design	14

3.5.1	Software Design Criteria.....	14
3.5.2	Proposed Surface Water Catchment Areas	15
3.5.3	Proposed Development Rainfall Runoff	15
3.5.4	Proposed Surface Water Pipe Network Design	16
3.6	Proposed Surface Water Storage	16
3.7	Surface Water Outfall Location	17
3.8	Water Quality	17
3.9	Maintenance.....	17
3.10	Taking in Charge.....	18
4	WASTEWATER DRAINAGE	19
4.1	Overview	19
4.2	Existing Wastewater Drainage	19
4.3	Consultation	19
4.4	Proposed Wastewater Drainage Strategy	19
4.5	Wastewater Network Design Calculations.....	20
4.6	Taking In Charge.....	20
5	POTABLE WATER SUPPLY	21
5.1	Overview	21
5.2	Existing Watermain Infrastructure	21
5.3	Consultation	21
5.4	Connection to the Existing Network.....	21
5.5	Water Saving Devices	22
5.6	Water Meters.....	22
5.7	Taking in Charge.....	22
6	FLOOD RISK 23	
6.1	Historical Flooding.....	23
6.2	Fluvial Flooding	23
6.3	Tidal Flooding.....	24
6.4	Pluvial Flooding.....	24
6.5	Flood Zone	24

7 ROAD DESIGN 25

7.1	Design Standards	25
7.2	Site Accessibility.....	25
7.3	Proposed Road Network.....	25
7.4	Road Classification	25
7.5	Road Design Speeds	26
7.6	Horizontal and Vertical Geometry.....	27
7.7	Road Cross Section	27
7.7.1	Carriageway.....	27
7.7.2	Footpaths.....	28
7.8	Road Junctions	29
7.9	Consultation	29

APPENDICES

APPENDIX A.	IRISH WATER PUBLIC RECORDS
APPENDIX B.	SITE INVESTIGATION
APPENDIX C.	Q_{BAR} RUNOFF CALCULATIONS
APPENDIX D.	SURFACE WATER DESIGN CALCULATIONS
APPENDIX E.	IRISH WATER CONFIRMATION OF FEASIBILITY
APPENDIX F.	WASTEWATER DESIGN NETWORK TABLES

1 INTRODUCTION

1.1 Appointment

O'Connor Sutton Cronin & Associates (OCSC) have been appointed by *Galway City Council* to carry out the design of the Civil Engineering services (surface water and wastewater drainage, watermain and road infrastructure) associated with the proposed 103 nr. unit residential development and crèche at Merlin Woods, Galway.

1.2 Administrative Jurisdiction

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

- Galway City Council Development Plan 2017-2023;
- 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).

1.3 Site Location

The subject site is located adjacent to the Coillte Mhuirlinne Estate, Galway as shown in Figure 1-1 and is immediately bound by:

- Glasán residential development to the south-west;
- Coillte Mhuirlinne Estate, to the north and east;
- Greenfield to the south-east and south; and
- Brothers of Charity services to the west.

Access to the site is via the Coillte Mhuirlinne Estate.



Figure 1-1: Site Location

1.4 Existing Site Overview

The overall site area is approximately 2.73 hectares, is zoned by Galway City Council for **Residential**. This zoning seeks to 'To protect residential amenities and to provide for limited associated uses'.

The site is currently greenfield. The existing ground levels across the overall site are typically graded from north to south, with typical high-points in the order of 32.64 mAOD along the northern boundary and a low point of 18.50 mAOD at the southern boundary.

A portion of the southern boundary has a steep gradient of 1:8. There are no existing public utilities for water or sanitary service (potable water, wastewater or storm water networks) within the site boundary area of the proposed development. There are existing potable water and wastewater networks within the Coillte Mhurlinne Estate.

1.5 Proposed Development Context

It is proposed to build a social and affordable housing development of 103 units in two and three storey buildings on lands belonging to Galway City Council at Merlin Woods, Galway. The proposed 103 units comprise 79% houses and 21% apartments/duplexes, with the latter all being own-door units. 78% of the units are 2 bed units, 14% are 3 bed units and 4% are 1 bed units and 4 bed units each. Social housing blocks will be integrated into the affordable housing scheme, evenly distributed throughout the site. This proposal will cater for standard, age friendly, live/work opportunities and people with disabilities, on an area of residentially zoned land available for immediate development. See extract from the Proposed Site Layout below.



Figure 1-2: Extract from proposed site layout

Please refer to Architects drawings for further details.

2 SCOPE OF SERVICES REPORT

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

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

An assessment on potential impact on traffic and transportation associated with, and as a result of, the proposed development is provided under separate cover, as part of this application. Refer to document **G477-OCSC-XX-XX-RP-C-0003** for details of the Traffic and Transportation Assessment.

This report should be read in conjunction with the set of OCSC Civil Engineering design drawings that accompany this submission.

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

- Galway City Development Plan 2017-2023;
- Greater Dublin Strategic Drainage Study (GDSDS);
- Greater Dublin Regional Code of Practice for Drainage Works (GDRCOP);
- Irish Water Code of Practice for Wastewater, IW-CDS-5030-03;
- Irish Water Code of Practice for Water Supply, IW-CDS-5020-03;
- 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;
- Irish Water Drainage and Watermain Records; and
- The Planning System and Flood Risk Management – Guidelines for Planning Applications (November 2009).

Members of the wider design team cover all other elements of the application pertaining to landscaping, 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 Galway City Council Development 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 in accordance with the Galway City Council Strategic Flood Risk Assessment.

Any new development must also have the physical capacity to retain surface water volumes as directed under the GDSDS and, if necessary, release these attenuated surface water volumes to an outfall at a controlled flow rate.

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.

As a result of the above, the surface water strategy for the proposed development is to include a number of Sustainable Drainage Systems, prior to discharging to an infiltration system with a controlled discharge to the existing surface water network. Development discharge rates are to be restricted to the greenfield runoff equivalent.

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

3.2 Surface Water Design Strategy Overview

The proposed development is to be served by a gravity surface water drainage network discharging to an infiltration system onsite before a controlled discharge to the existing surface water network to the east.

Sustainable Drainage Systems are to be provided, wherever practicable, and these are discussed in more detail in Section 0, with discharge rates from site to the existing surface water network being restricted to the greenfield equivalent runoff rate, for design rainfall events up to and including the 1% AEP.

3.3 Existing Site Drainage

3.3.1 Existing Site Catchment Areas

As detailed in Section 1.4, the existing c.2.73-hectare site is greenfield. Refer to Figure 3-1 for aerial image of the proposed site for context.



Figure 3-1: Existing Site, Aerial Overview (Google Earth)

3.3.2 Existing Surface Water Drainage Infrastructure

There is no surface water infrastructure within the site of the proposed development.

There is an existing surface water network located to the south-east of the site. Please refer to **Appendix A** for surface water records in the area.

3.3.3 Existing Site Rainfall Runoff

All surface water runoff currently infiltrates to the natural ground. Refer to Section 3.3.1 for further details of existing site and catchment area context.

Causeway Geotech Ltd carried out a site investigation in October 2020 on behalf of the client. Four soil infiltration tests to BRE Digest 365 were attempted to determine the suitability of the subsoils to accept surface water discharge to ground via soakaways. The test pits were distributed across the southern portion of the site to coincide with the location of any proposed soak pits, see Figure 3-2.

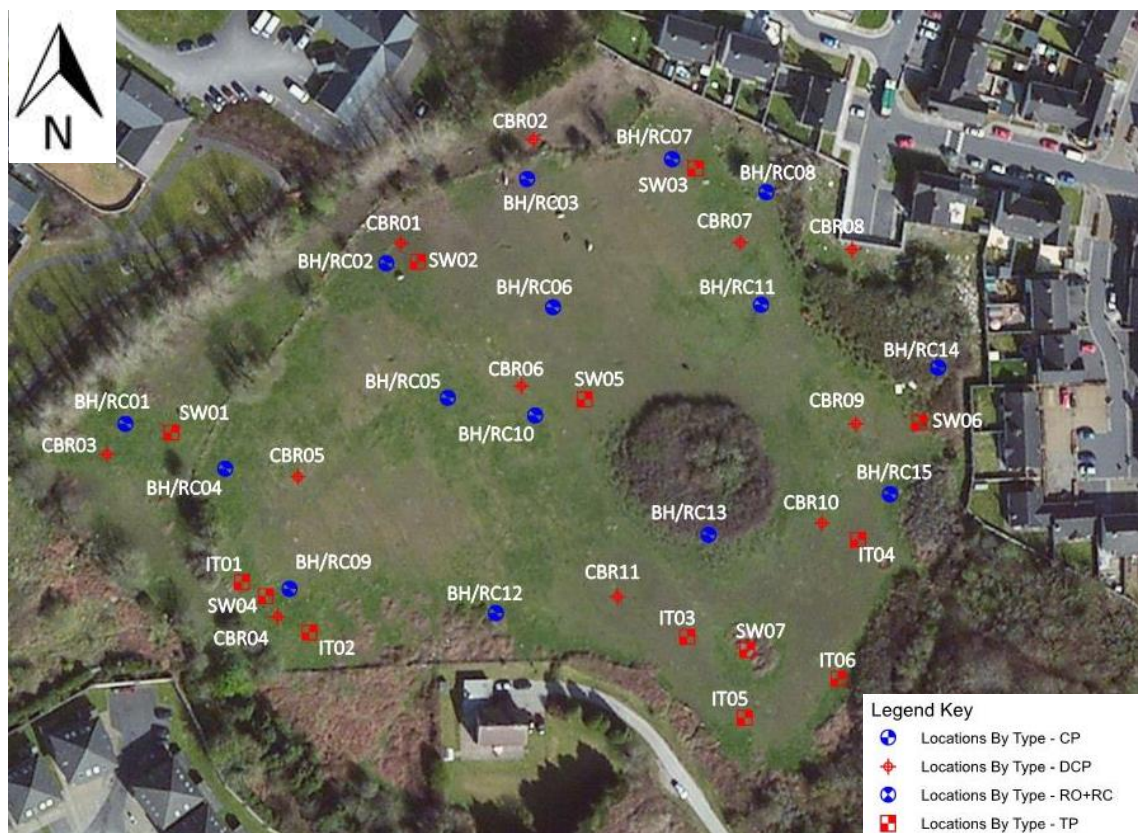


Figure 3-2: Site Investigation location plan

The ground exposed in the trial pits comprised sandy gravelly clay/silt with low cobble content.

An infiltration test was carried out in four of the six trial pits in accordance with BRE Digest 365. Tests were successfully carried out in trial pits IT01, IT02 and IT06 and the rate of infiltration was calculated at 0.034, 0.023 and 0.021 m/hr respectively. A further test was attempted in IT04 but the infiltration rates were too low to complete the assessment. An extract of the site investigation is included in Appendix B. While the Causeway Geotech report indicates that infiltration rates are suitable for onsite surface water disposal at IT01, IT02 and IT06, the rates are below the minimum 0.036m/hr recommended in the CIRIS SuDS Manual Section 25.2.1. An infiltration rate of 0.025 m/hr was used in the design of the infiltration system as it was the average infiltration rate encountered onsite. The infiltration rate will be confirmed post-planning at the location and depth of the proposed infiltration system.

Bedrock was encountered at between 0.6 m below ground level at RC10 to 3.85 m below ground level at RC03 and was generally shallower in the south east areas of the site.

A soil **Type 3**, consistent with the confirmed soil material found on site (sandy gravelly clay/silt) was therefore applied in runoff calculations.

The Standard Average Annual Rainfall (SAAR) value for the development site, as sourced directly from Met Éireann, is 1176 mm.

Using the ICPSuDS Input, (Flood Studies Report (FSR)) Method, the rainfall runoff discharging from the total greenfield site area that is to be developed, in its existing condition, has been estimated at **QBAR_{RURAL} = 15.5 l/s** (*i.e.* 5.67 l/s/ha). Refer to Appendix B 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).

3.4 Proposed Surface Water Drainage Design Strategy

3.4.1 Proposed Surface Water Strategy Overview

It is proposed to separate the surface water and wastewater drainage networks, which will serve the proposed development, and provide independent connections to the adjacent surface and wastewater sewer networks respectively.

Refer to Section 4 for details of the proposed wastewater drainage design.

The surface water volume generated by storms will discharge to an underground infiltration system with an outfall to the existing surface water network at a controlled rate.

Refer to drawing **G477-OCSC-XX-XX-DR-C-0500** for the proposed drainage layout.

3.4.2 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 Galway City Council Strategic Flood Risk Assessment.

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.

3.4.3 Proposed Surface Water Network Strategy

The proposed surface water network is to discharge to an infiltration system with discharge at a controlled rate to the existing surface water network adjacent to the south-east boundary of the site and with an element of infiltration to ground.

The surface water network is to typically comprise a gravity pipe network, with significant Sustainable Drainage Systems implemented, such as pervious paving and filter drains.

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:

3.4.3.1 Pervious Paving

Pervious pavements provide a pavement finish suitable for both pedestrian and vehicular traffic, while also allowing rainwater to infiltrate the surface layer and into the underlying pervious structural layers. Here, the rainwater is temporarily stored beneath the overlying finished surface before either infiltration to the ground or / and discharge to the main surface water drainage network.

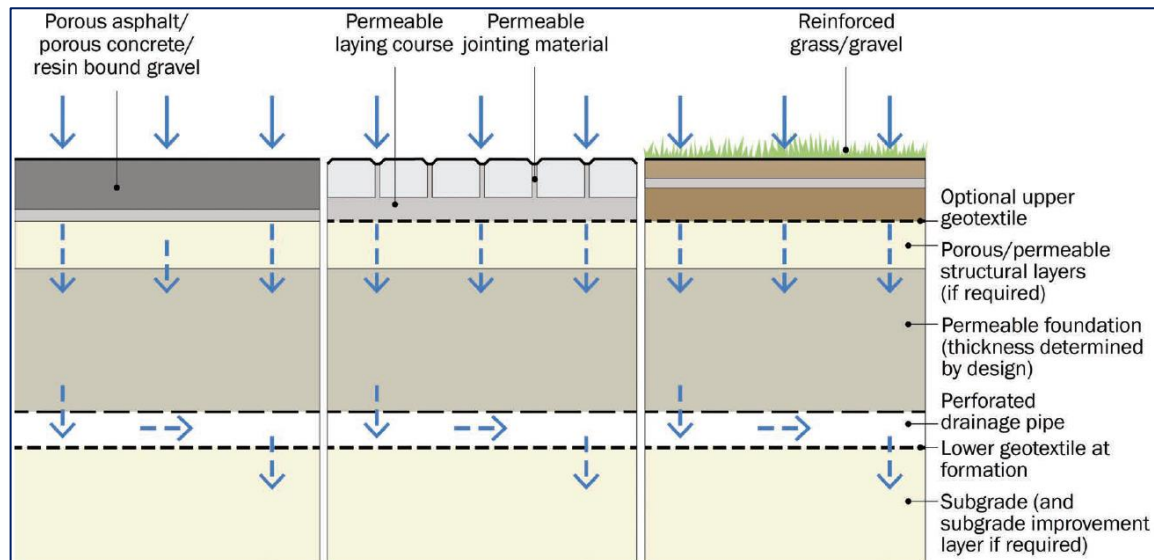


Figure 3-3: Detail of Type B Pervious Paving (CIRIA C753)

Pervious paving systems are an efficient means of treating the rainwater at source by providing initial interception of the rainwater, reducing the volume and frequency of the runoff 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.

A **Type B** pervious paving, with a 300mm (typical) depth of open graded crushed rock as base course, is to be provided in all 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.

3.4.3.2 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.

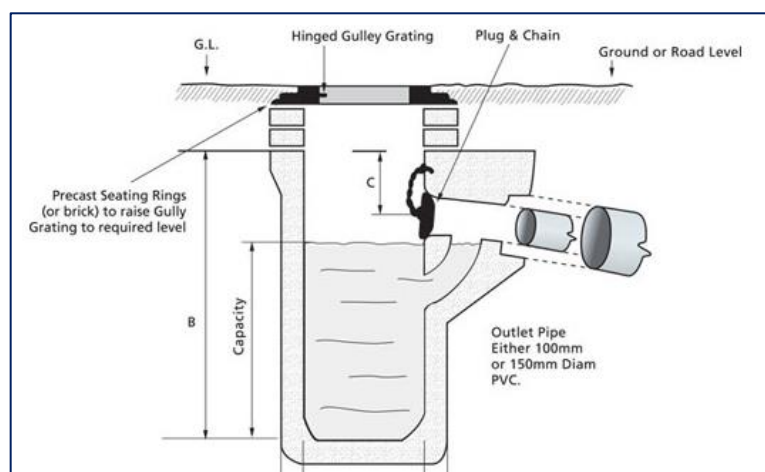


Figure 3-4: Trapped Road Gully (Typical Detail)

3.4.3.3 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, compliant with the GDSDS and GDR COP, are provided for maintenance access at branched connections, change in pipe size and gradient, and at intervals no greater than 90m distance.

3.4.3.4 Silt Traps

The manholes upstream of the infiltration system is to contain a 600mm 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.

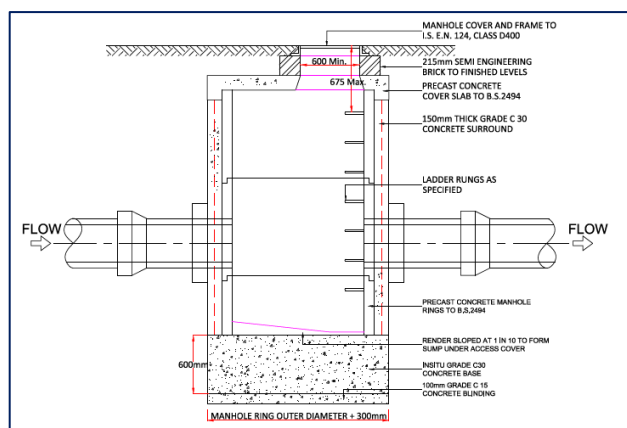


Figure 3-5: Typical Detail of Silt Trap Manhole

3.4.3.5 Infiltration System

An unlined infiltration system is to be provided for the storage of rainfall runoff for the site.

The system is to provide sufficient storage volume for rainfall events up to, and including, the design 1% AEP rainfall event (including climate change). Typical stone storage systems comprise open graded crushed stone (typically 30% porosity), with a perforated distribution pipe through the centre.

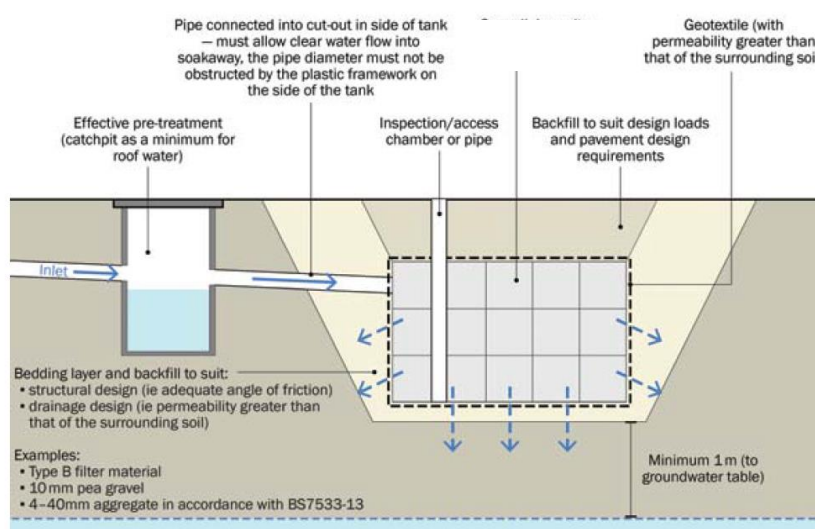


Figure 3-6: Infiltration Systems

3.4.3.6 Flow Control Device

A Flow Control device is to be provided immediately downstream of infiltration system, in order to restrict the surface water discharge from site to a flow rate equivalent, or below, the natural greenfield runoff rate.

The restricted flow rate would be no greater than 15.5 l/s (**5.67 l/s/ha**), which is the greenfield runoff equivalent.

It is proposed to provide the Hydro-brake optimum vortex flow control unit (or similar approved by Galway City Council) downstream of the infiltration system.

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 3-7: Vortex Hydro-Brake Flow Control Unit (Hydro International)

3.4.3.7 Oil Separator

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

A Class 1 Bypass fuel separator is to be provided immediately upstream of the infiltration system, as an additional and final mitigation measure, prior to surface water discharge to the surface water network.

3.5 Proposed Surface Water Network Detailed Design

3.5.1 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 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 **M₅₋₆₀** and **R** values, and the standard annual average rainfall (SAAR); as sourced from Met Éireann.

Figure 3-8: Surface Water Network Design Criteria (MicroDrainage Excerpt)

3.5.2 Proposed Surface Water Catchment Areas

The catchment includes the proposed road network, footpaths, paved areas, and housing. All car parking areas are to comprise pervious paving finishes.

Elsewhere, an area of open soft landscaping is to be provided with further planting and landscaping provided within residential development boundary.

3.5.3 Proposed Development Rainfall Runoff

Run-off from the site will be managed by infiltrating to ground through the proposed infiltration system with a controlled discharge to the existing surface water network.

It is proposed to reduce and restrict the rainfall runoff, discharging from the proposed development to the existing surface water network to the greenfield runoff rate equivalent, $QBAR_{RURAL}$, as per the FSR ICP SuDS method, which is based on the IH124 method for catchments smaller than 25km² 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 network.

Refer to Appendix C for an excerpt from the results MicroDrainage Runoff Calculator for the development catchment area (c.2.73-hectares), which indicates the greenfield equivalent, $QBAR_{RURAL}$, value of **15.5 l/s** (5.67 l/s/ha) along with the calculated runoff for varying Average Recurrence Intervals (ARI).

This maximum flow rate (i.e. greenfield equivalent) was incorporated into the integrated drainage network design.

For the purpose of the surface water network design simulation, all external (roads, pavement, and roofs) areas 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.

3.5.4 Proposed Surface Water Pipe Network Design

The overall surface water drainage system is to consist of a gravity sewer network that will convey runoff from the roofs and paved areas to the outfall manhole. The new gravity network will discharge to an underground infiltration system with a controlled discharge to the existing public network as outlined in Section 3.3.2.

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 GDR COP 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.

Refer to drawing **G477-OCSC-XX-XX-DR-C-0500** for details of the proposed drainage infrastructure layout.

3.6 Proposed Surface Water Storage

The site investigation carried out on behalf of the client estimated infiltration on site between 0.021 and 0.034 m/hr. The infiltration rates were taken at depths ranging from 0.75 and 1.16 m below ground level. An infiltration rate of 0.025 m/hr was used in the design of the infiltration tank as the average of the three tests onsite. The infiltration rate at the location and depth of the proposed tank will be confirmed onsite prior to construction. As per BRE Digest 365, infiltration from the base was not included in the design with infiltration from the sides only.

Infiltration is to be provided in the form of an unlined infiltration system under the public open space.

As infiltration rates onsite are low, an outfall to the existing surface water network is to be provided at the greenfield equivalent run-off rate.

A minimum storage volume of 525 m³ of water storage is to be provided. The maximum infiltration during the 1 in 100-year storm is 1.2 l/s.

The infiltration system has been designed to provide for design rainfall events up to, and including, the 1% AEP with a 20% increase in rainfall intensity, along with the associated integrated surface water drainage network.

Please refer to Appendix D for Surface Water calculations and results.

Refer to Section 3.4.3 for further details of the proposed system.

3.7 Surface Water Outfall Location

The surface water is to discharge attenuated flows to the existing surface water network, at a location adjacent to the south-east corner of the site. The discharge rate is to be restricted to a maximum flow rate of 15.5 l/s (5.67 l/s/ha), as discussed in Section 0.

Infiltration rates onsite indicate that approximately 1.2 l/s can be achieved during a 1 in 100-year storm.

3.8 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 3.4.3:

- Pervious Paving in all car parking areas;
- Infiltration system;
- Trapped road gullies on all road carriageways, to trap silt and gross pollutants;
- Silt traps to be provided on the manhole immediately upstream of infiltration system, as a further preventative measure to trap silt and other gross pollutants;
- Class 1 Bypass fuel separator to be provided prior to discharging from site.

3.9 Maintenance

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

- Pervious paving;
- Infiltration system;
- Trapped road gullies;
- Silt trap manholes.

All devices, including road gullies, silt traps, flow control device and infiltration system should be inspected regularly and maintained, as appropriate and in accordance with manufacturer's recommendations and guidelines.

Items such as the flow controls and fuel separators have been located so as to provide easy vehicular access for inspection and maintenance.

3.10 Taking in Charge

It is proposed that all new surface water infrastructure associated with the proposed development **is** to be offered to be taken in charge by Galway City Council.

4 WASTEWATER DRAINAGE

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 existing wastewater discharge to the public wastewater infrastructure.

A new wastewater connection, serving the proposed residential development, is to be provided to the existing wastewater network to the south-east.

4.2 Existing Wastewater Drainage

Irish Water records indicate that there is an existing wastewater network located in the vicinity of the proposed development. There is an existing wastewater network located to the south-east of the proposed development.

Refer to **Appendix A** for details of Irish Water existing wastewater infrastructure records.

4.3 Consultation

A Pre-Connection Enquiry Form (***IW Ref Nr. CDS20004597***) was submitted to Irish Water for a total of 102 nr. domestic units and creche with confirmation of feasibility returned by letter. Refer to **Appendix F** for a copy of the Confirmation of Feasibility letter issued on 4th November 2020.

The Confirmation of Feasibility letter returned, confirmed that the existing wastewater drainage infrastructure has sufficient capacity to serve the proposed development, subject to upgrade works to the Merlin Park No. 1 pumping station to provide additional storage. These works are currently being delivered by Irish Water and a connection can be facilitated upon completion.

4.4 Proposed Wastewater Drainage Strategy

It is proposed to separate the wastewater and surface water drainage networks, which will serve the proposed development, and provide independent connections to the public wastewater and surface water infrastructure.

Refer to Section 3 for details of the proposed surface water drainage design strategy.

The wastewater from each dwelling is to connect via a private inspection chamber, to the new gravity pipe network within the development, which has been designed in accordance with the Irish Code of Practice for Wastewater Infrastructure. This pipe network discharges to the existing wastewater network adjacent to the south-eastern boundary of the development.

Refer to detailed design drawing **G477-OCSC-XX-XX-DR-C-0500** for the proposed drainage layout.

4.5 Wastewater Network Design Calculations

The **total peak design flow** from this proposed development has been calculated as **3.28 l/s**, see below.

Table 4-1: Proposed Wastewater flow

Wastewater				
	Domestic	Crèche - Child	Crèche - Staff	
Flow	150	50	90	l/person/day
Persons per Unit	2.7	20	9	
Infiltration	1.1	1.1	1.1	
DWF	446			l/unit
No. of Units	103	1	1	
DWF	0.53	0.013	0.007	l/s
Peaking factor	6	4.5	4.5	
Design Flow	3.19	0.06	0.03	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.

4.6 Taking In Charge

All new wastewater drainage infrastructure installed to serve the proposed development **is** to be offered to Irish Water for to be taken-in-charge.

5 POTABLE WATER SUPPLY

5.1 Overview

All proposed potable water design has been carried out in accordance with Irish Water's Code of Practice for Water Infrastructure.

A new 150 mm HDPE watermain connection is to be provided from the existing 200 mm uPVC watermain in the Coillte Mhuirlinne estate.

5.2 Existing Watermain Infrastructure

There is an existing Irish Water 200 mm diameter uPVC watermain servicing the existing Coillte Mhuirlinne Estate. Irish Water have confirmed that there is capacity in the Irish Water infrastructure to cater for the demand from the proposed development.

Refer to **Appendix A** for details of existing watermain infrastructure records.

5.3 Consultation

A Pre-Connection Enquiry Form (***IW Ref Nr. CDS20004597***) was submitted to Irish Water for a total of 102 nr. domestic units and 1 no. creche with confirmation of feasibility returned by letter. Refer to **Appendix F** for a copy of the Confirmation of Feasibility letter issued on 4th November 2020.

5.4 Connection to the Existing Network

It is proposed to provide a 150 mm high density polyethylene connection to the existing 200 mm main in Coillte Mhuirlinne. Refer to **Appendix A** for details of existing watermain infrastructure records.

Irish Water have confirmed that the proposed development can be facilitated to the 200 mm watermain in Coillte Mhuirlinne housing estate to the north without upgrades to the existing infrastructure.

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, with a bulk water meter to be provided at the development's entrance.

Refer to detailed design drawing **G477-OCSC-XX-XX-DR-C-0550** for the proposed watermain layout.

5.5 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.

5.6 Water Meters

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

5.7 Taking in Charge

All new watermain infrastructure installed to serve the proposed development is to be offered to Irish Water for to be taken-in-charge.

6 FLOOD RISK

This section assesses the potential flood risk associated with the proposed development, as per the Planning System and Flood Risk Management Guidelines. Refer to Section 1.4 for site topography details and further development context.

The proposed residential development is considered **Highly Vulnerable**, in accordance with the Planning System and Flood Risk Management Guidelines.

6.1 Historical Flooding

There are no reported incidents of flooding in the vicinity of the site, as outlined on the OPW's online National Flood Hazard Mapping website www.floodmaps.ie.

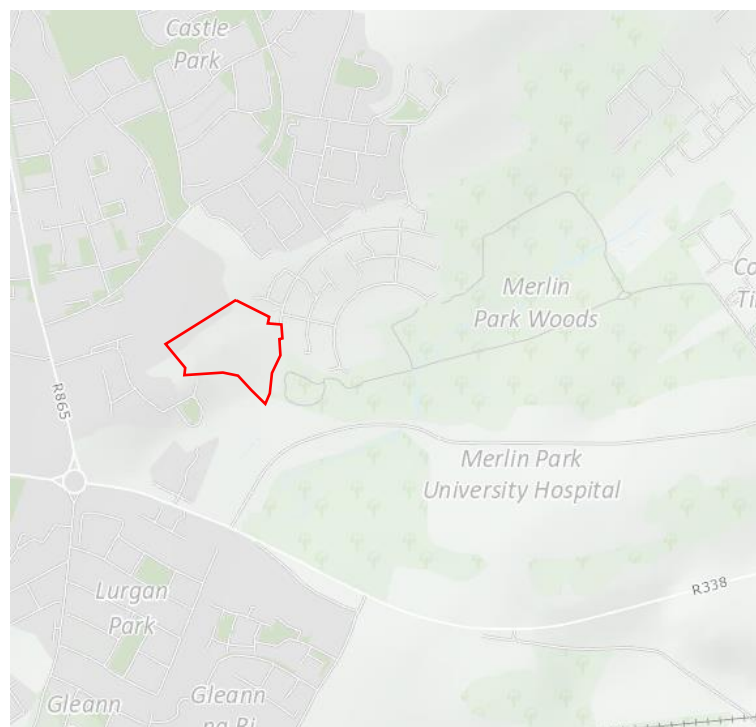


Figure 6-1: Review of historical flood event (source: Floodmaps.ie)

6.2 Fluvial Flooding

The proposed development is located approximately 1.2 km north of the Galway Bay and there is no watercourses adjacent to the site. A review of the OPW's Catchment Flood Risk Assessment Mapping (CFRAM) indicates that the

proposed development is located outside of Flood Zone A and Flood Zone B and is therefore considered to be located in Flood Zone C.

6.3 Tidal Flooding

The proposed development is located approximately 1.2 km north of the Galway Bay and existing site levels are in excess of 19 mAOD. A review of the OPWs Catchment Flood Risk Assessment Mapping (CFRAM) indicates that the proposed development is located outside of Flood Zone A and Flood Zone B and is therefore considered to be located in Flood Zone C.

6.4 Pluvial Flooding

There is no existing surface water drainage on the site. A new surface water network is proposed as part of this development, and as such, will manage any pluvial flood risk onsite.

6.5 Flood Zone

AS the site falls outside Flood Zone A and B as identified in the Planning System and Flood Risk Management Guidelines, the site is considered to be located within Flood Zone C and is considered appropriate for the proposed development.

7 ROAD DESIGN

7.1 Design Standards

The proposed development has incorporated a series of design measures, which will be detailed hereinafter, to promote more sustainable modes of transport and support vulnerable road users in line with the core principles of the Design Manual for Urban Roads and Streets (DMURS).

While DMURS is the principal design guideline for the roads elements of this project, the extended list of the main standard documents relied on is:

- DMURS;
- National Cycle Manual;
- Traffic Signs Manual 2019;
- DN-PAV-03021: Pavement & Foundation Design;
- GE-STY-01024: Road Safety Audit;
- DN-GEO-03060: Geometric Design of Junctions;
- NRA Design Manual for Roads and Bridges (NRA DMRB);
- NRA IAN 02/11 Interim Requirements for the Use of Eurocodes for the Design of Road Structures Amendment No. 1.

7.2 Site Accessibility

A Traffic and Transportation Assessment has been carried out by OCSC, which looks at the baseline road network, public transport accessibility and the impact of the development on the nearby road network.

7.3 Proposed Road Network

The development consists of a minimum 5.50 m wide internal access road.

7.4 Road Classification

The internal access roads will be used exclusively by the development and not for any local traffic. It is noted, however that lane widths in the development will cater for larger vehicles, all other design parameters have been chosen under DMURS.

Table 3.1 of DMURS illustrates how this road hierarchy relates to other relevant documents.

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 6.3 -DMURS Street Hierarchy

7.5 Road Design Speeds

The internal road has been designed to a 30 kph speed limit with geometric parameters chosen under DMURS.

		PEDESTRIAN PRIORITY		VEHICLE PRIORITY		
FUNCTION	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
		CENTRE	N'HOOD	SUBURBAN	BUSINESS/ INDUSTRIAL	RURAL FRINGE
CONTEXT						

Internal Road

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.

7.6 Horizontal and Vertical Geometry

The road alignments will be designed so that the geometric elements, including horizontal and vertical curvature, super elevation and sight distance will be in line with DMURS, having values consistent with the design speeds.

The relevant horizontal and vertical geometric design values are highlighted in DMURS *Table 4.3* below. A standard carriageway cross fall of 2.5% 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 also 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 6.5: DMURS Geometric Parameters

7.7 Road Cross Section

7.7.1 Carriageway

The carriageway widths have been selected as in accordance with Section 4.4.1 and Figure 4.55 of DMURS, excerpt below.

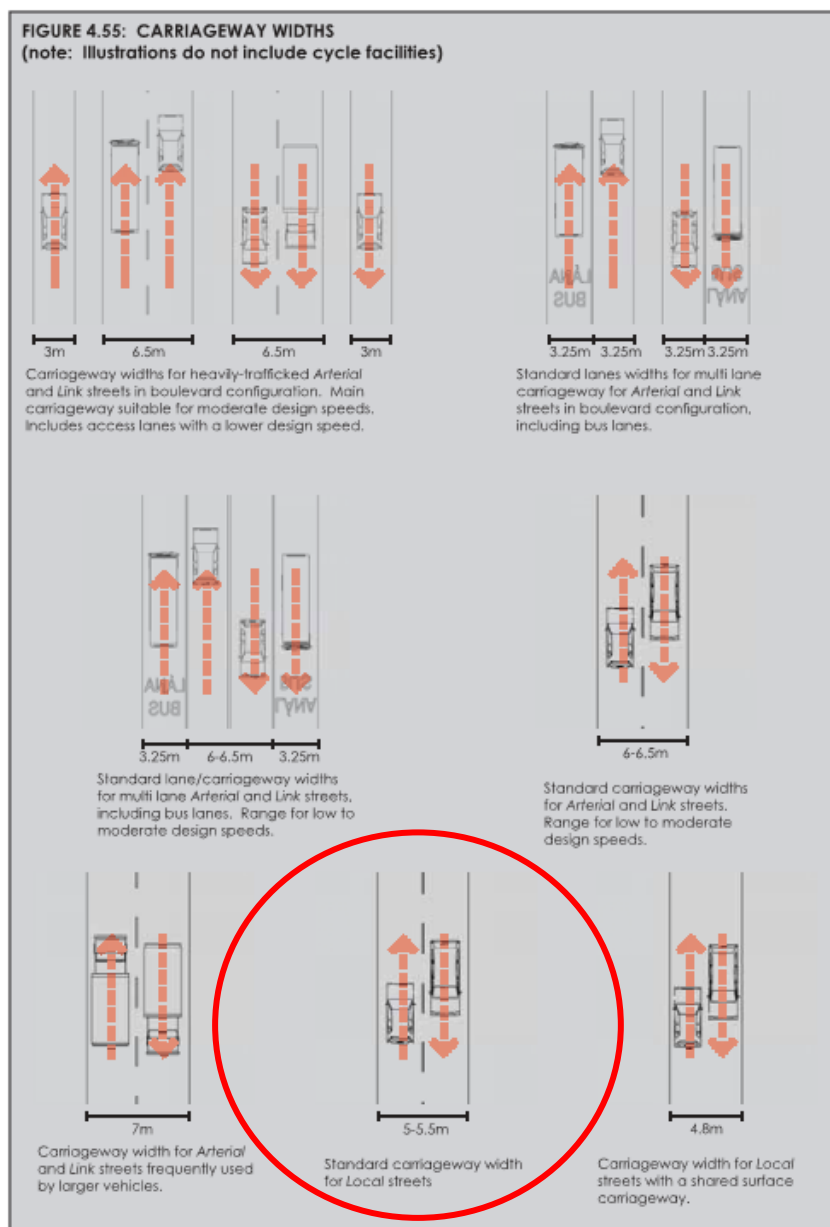


Figure 6.5 -DMURS Lane Widths

7.7.2 Footpaths

The width of the footpaths has been determined by reference to DMURS Section 4.3.1 with a minimum required width of 2.0 m based on the space needed for two wheelchairs to pass each other.

7.8 Road Junctions

The development's junctions have been designed with the primary principle of providing safe and consistent layouts in order to present a uniformity of approach to drivers and other road users. In addition, junctions will have sufficient capacity to accommodate design year peak traffic flows thus optimising network capacity. The primary junction strategy objectives has been:

- 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.

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

7.9 Consultation

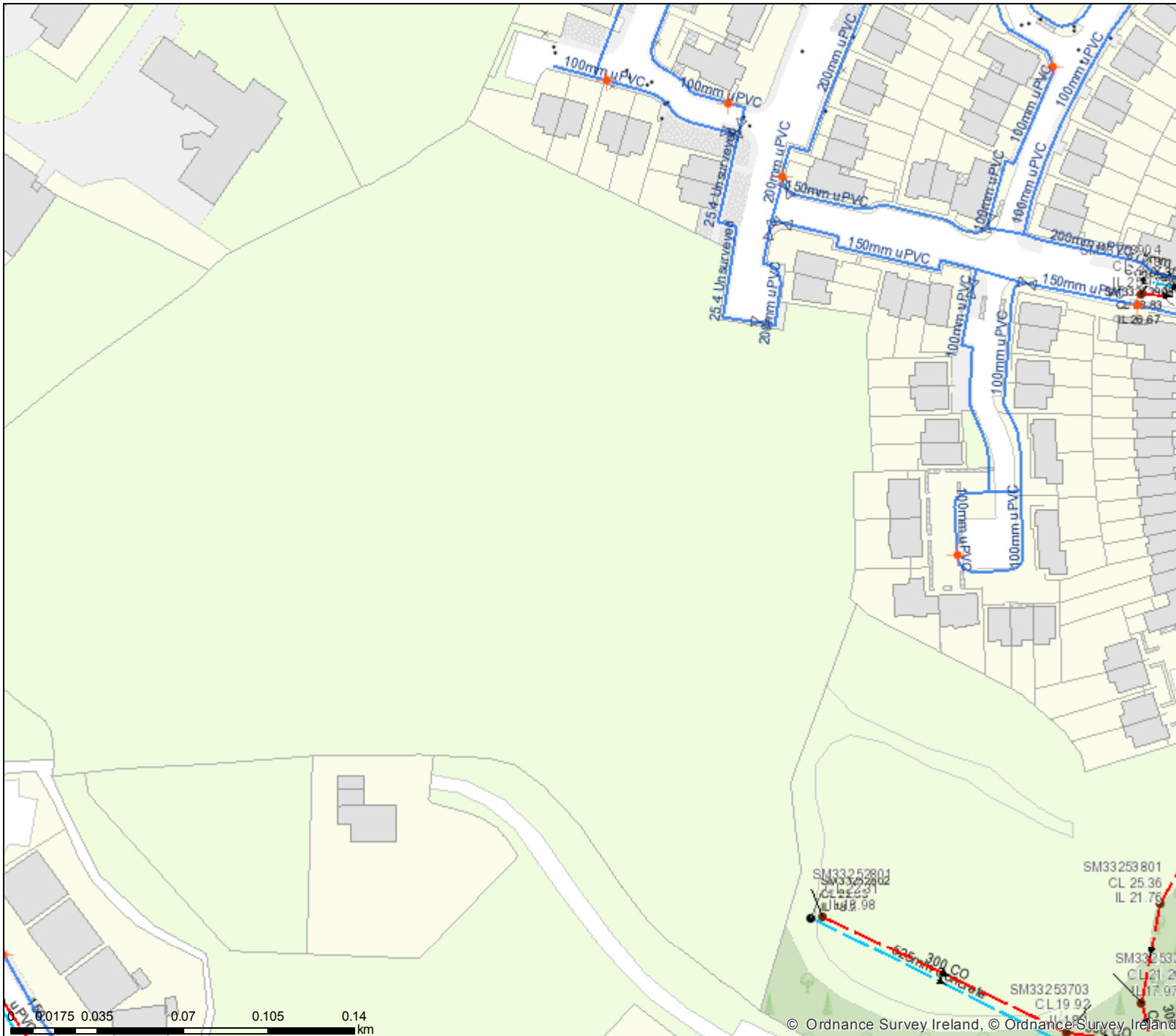
The Design Team met with Galway City Council to discuss the road layout and transportation strategy for the scheme.

APPENDIX A. IRISH WATER PUBLIC RECORDS

Appendix A

Irish Water Public Records

Housing Project Merlin Park



Print Date: 23/06/2020

Printed by: Irish Water

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NOTE: DIAL BEFORE YOU DIG Phone: 1850 427 747 or e-mail dig@gasnetworks.ie - The dual position of the gas/electricity distribution and transmission network must be verified on site before any mechanical excavating takes place. If any mechanical excavation is proposed, hard copy maps must be requested from GNI re gas. All work in the vicinity of gas distribution and transmission network must be completed in accordance with the current edition of the Health & Safety Authority publication, 'Code of Practice For Avoiding Danger From Underground Services' which is available from the Health and Safety Authority (1890 289 339) or can be downloaded free of charge at www.hsa.ie.

Water Distribution Network	Sewer Foul Combined Network	Storm Water Network
Water Treatment Plant	Waste Water Pump Station	Surface Water Pump Station
Storage Cell/Tower	Sewer Mains Irish Water	Surface Gravity Mains
Dosing Point	Gravity - Foul	Surface Water Pressurised Mains
Meter Station	Gravity - Unknown	Surface Water Pressurised Mains Private
Abstraction Point	Pumping - Combined	Inlet Type
Telemetry Kiosk	Pumping - Foul	Gully
Reservoir	Pumping - Unknown	Standard
Possible	Syphon - Combined	Other; Unknown
Raw Water	Syphon - Foul	Storm Manholes
Water Distribution Mains	Overflow	Standard
Irish Water	Sewer Mains Private	Backdrop
Private	Gravity - Foul	Cascade
Trunk Water Mains	Gravity - Unknown	Catchpit
Irish Water	Pumping - Combined	Bifurcation
Private	Pumping - Foul	Hatchbox
Water Lateral Lines	Pumping - Unknown	Lampole
Irish Water	Syphon - Combined	Hydrobrake
Non IW	Syphon - Foul	Other; Unknown
Water Casings	Overflow	Storm Culverts
Water Abandoned Lines	Sewer Lateral Lines	Stormwater Chambers
Boundary Meter	Sewer Casings	Discharge Type
Bulk/Check Meter	Outfall	Overflow
Group Scheme	Sewer Manholes	Soakaway
Source Meter	Standard	Other; Unknown
Waste Meter	Backdrop	Catchpit
Non-Return	Cascade	Transmission High Pressure Gasline
PRV	Catchpit	Distribution Medium Pressure Gasline
PSV	Bifurcation	Distribution Low Pressure Gasline
Sluice Line Valve Open/Closed	Hatchbox	ESB Networks
Butterfly Line Valve Open/Closed	Lampole	ESB HV Lines
Sluice Boundary Valve Open/Closed	Hydrobrake	HV Underground
Butterfly Boundary Valve Open/Closed	Other; Unknown	HV Overhead
Scour Valves	Discharge Type	HV Abandoned
Single Air Control Valve	Outfall	ESB MVLV Lines
Double Air Control Valve	Overflow	MV Overhead Three Phase
Water Stop Valves	Soakaway	MV Overhead Single Phase
Water Service Connections	Standard Outfall	LV Overhead Three Phase
Water Distribution Chambers	Other; Unknown	LV Overhead Single Phase
Water Network Junctions	Cleanout Type	MVLV Underground
Pressure Monitoring Point	Rodding Eye	Abandoned
Fire Hydrant	Flushing Structure	Non Service Categories
Fire Hydrant/Washout	Other; Unknown	Proposed
Water Fittings	Catchpit	Under Construction
Cap	Gully	Out of Service
Reducer	Standard	Decommissioned
Tap	Other; Unknown	Water Non Service Assets
Other Fittings	Sewer Inlets	Water Point Feature
	Vent/Cool	Water Pipe
	Other; Unknown	Water Structure
	Sewer Fittings	Waste Non Service Assets
	Vent/Cool	Waste Point Feature
	Other; Unknown	Sewer
		Waste Structure

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APPENDIX B. SITE INVESTIGATION

Appendix B

Site Investigation

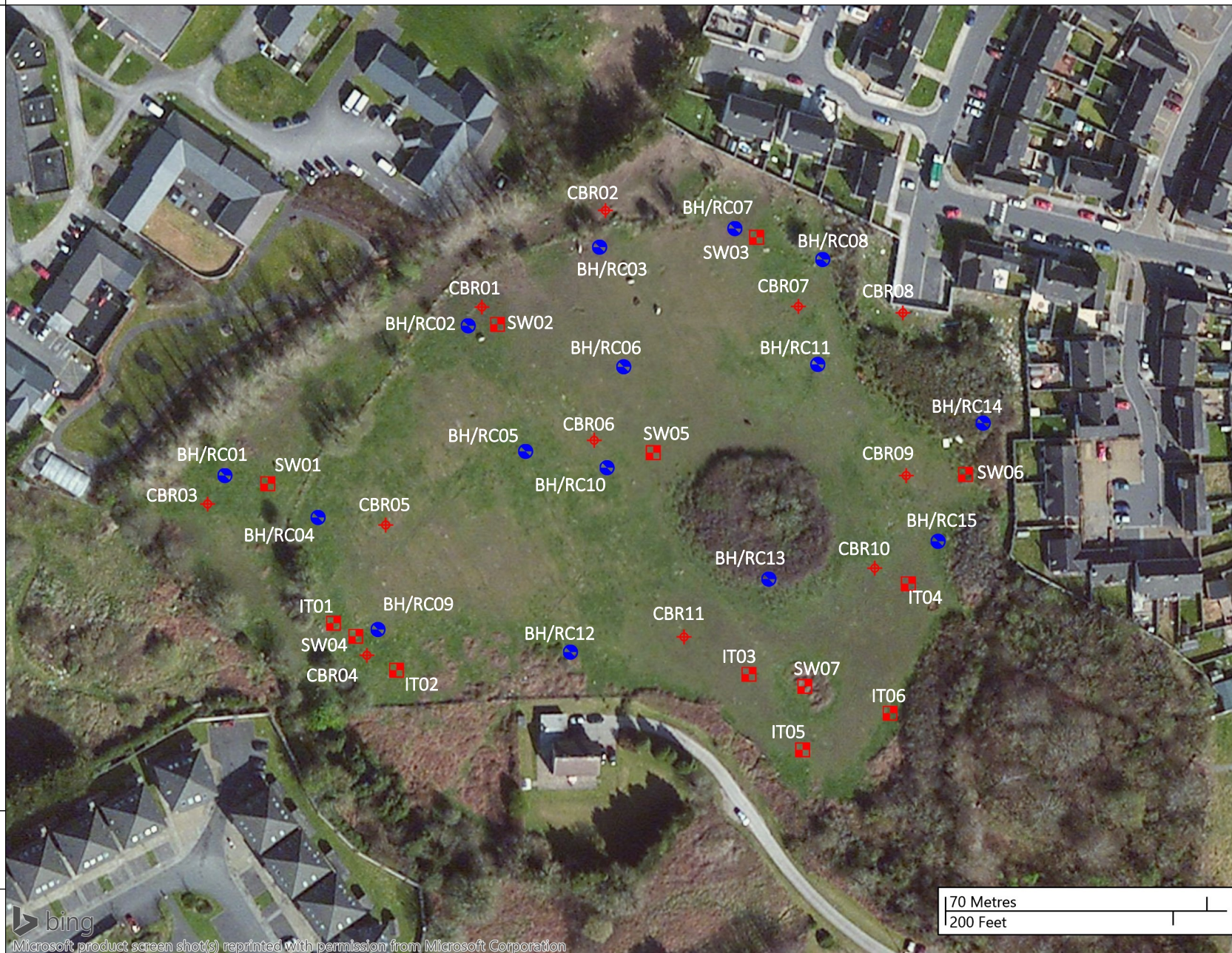


Project No.: 20-0718
Project Name: Merlin Park, Co. Galway

Client: Galway City Council
Client's Representative: OCSC Consulting Engineers

Legend Key

-  Locations By Type - CP
-  Locations By Type - DCP
-  Locations By Type - RO+RC
-  Locations By Type - TP



Title:
Exploratory Hole Location Plan

Last Revised:
08/10/2020

Scale:
1:1500



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

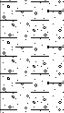


CAUSEWAY
— GEOTECH

APPENDIX F
SOAKAWAY TEST RESULTS



			Project No. 20-0718		Project Name: Merlin Park, Co. Galway			Trial Pit ID IT01	
			Coordinates 533047.67 E 725909.93 N		Client: Galway City Council Client's Representative: OCSC Consulting Engineers			Sheet 1 of 1 Scale: 1:25	
Method: Trial Pitting			Elevation 28.49 mOD		Date: 16/09/2020			Logger: RS	
Plant: 8T Tracked Excavator								FINAL	

Depth (m)	Sample / Tests	Field Records	Level (mOD)	Depth (m)	Legend	Description	Water
			28.04	0.45		Firm brown slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is subrounded fine to coarse of mixed lithologies predominantly limestone.	
			27.29	1.20		Stiff grey slightly gravelly sandy SILT with low cobble content. Sand is fine to coarse. Gravel is subangular fine to coarse of mixed lithologies predominately limestone. Cobbles are subrounded of limestone.	0.5
						End of trial pit at 1.20m	1.0
							1.5
							2.0
							2.5
							3.0
							3.5
							4.0
							4.5

Water Strikes		Depth: 1.20 Width: 0.40 Length: 1.70	Remarks: No groundwater encountered.	
Struck at (m)	Remarks			
Stability: Unstable		Termination Reason: Terminated at scheduled depth.		Last Updated 21/10/2020



Soakaway Infiltration Test

Project No.: 20-0718
Site: Merlin Park, Galway
Test Location: IT01
Test Date: 16 September 2020



*Analysis using method as described in BRE Digest 365
and CIRIA Report C697-The SUDS Manual*

width (m) length (m)
test pit top dimensions 0.40 1.70
test pit base dimensions 0.30 0.70
test pit depth (m) 1.20

depth to groundwater before adding water (m) = Dry

time (mins)	depth to water surface (m)	depth of water in pit (m)
0	0.49	0.71
1	0.51	0.69
2	0.53	0.67
4	0.55	0.65
6	0.57	0.63
8	0.59	0.61
10	0.61	0.60
15	0.64	0.56
20	0.66	0.54
25	0.68	0.52
30	0.70	0.50
90	0.82	0.38
130	0.88	0.33
230	1.05	0.15

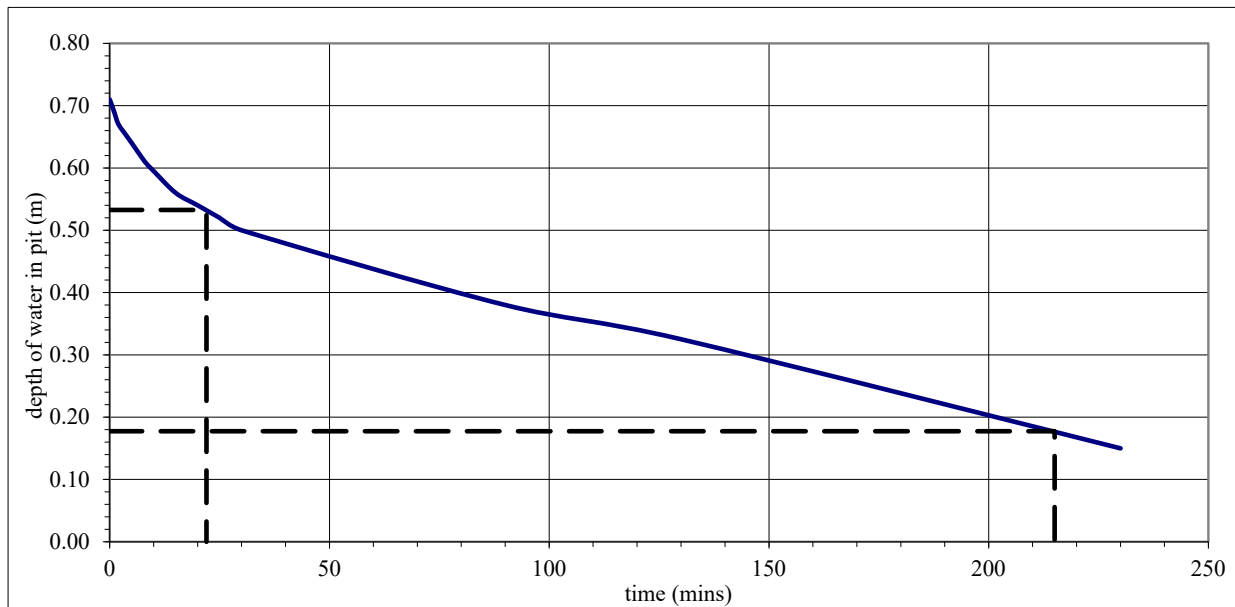
From graph below:

test start - 75% depth at
0.5325 m water depth
time is 22.0 minutes

test end - 25% depth at
0.1775 m water depth
time is 215.0 minutes

test infiltration rate (q) = 0.034 m/h

time (mins)	depth to water (m)	depth of water in pit (m)	time elapsed (mins)	volume of water lost (m ³)	Area of walls and base at 50% drop (m ²)	q (m/min)	q (m/h)
22	0.67	0.5325	193	0.12	1.06	5.7E-04	0.034
215	1.02	0.1775					



			Project No. 20-0718		Project Name: Merlin Park, Co. Galway			Trial Pit ID IT02	
			Coordinates 533064.38 E 725897.06 N		Client: Galway City Council Client's Representative: OCSC Consulting Engineers				
Method: Trial Pitting								Sheet 1 of 1 Scale: 1:25	
Plant: 8T Tracked Excavator			Elevation 25.92 mOD		Date: 16/09/2020			Logger: RS	
Depth (m)	Sample / Tests	Field Records	Level (mOD)	Depth (m)	Legend	Description			Water
			25.62	0.30		TOPSOIL			
						Stiff grey slightly sandy slightly gravelly SILT with low cobble content. Sand is fine to coarse. Gravel is subrounded fine to coarse of limestone. Cobbles are subrounded.			0.5
			24.62	1.30		End of trial pit at 1.30m			1.0
									1.5
									2.0
									2.5
									3.0
									3.5
									4.0
									4.5
Water Strikes			Depth: 1.30 Width: 0.50 Length: 1.65		Remarks: No groundwater encountered.				
Struck at (m) Remarks									
			Stability: Unstable		Termination Reason: Terminated at scheduled depth.			Last Updated 21/10/2020	
									

Soakaway Infiltration Test

Project No.: 20-0718
Site: Merlin Park, Galway
Test Location: IT02
Test Date: 16 September 2020



*Analysis using method as described in BRE Digest 365
and CIRIA Report C697-The SUDS Manual*

width (m) length (m)
test pit top dimensions 0.50 1.65
test pit base dimensions 0.30 1.10
test pit depth (m) 1.20

depth to groundwater before adding water (m) = Dry

time (mins)	depth to water surface (m)	depth of water in pit (m)
0	0.62	0.58
1	0.63	0.57
2	0.63	0.57
4	0.64	0.56
6	0.65	0.56
8	0.65	0.56
10	0.65	0.55
15	0.67	0.54
20	0.68	0.53
25	0.69	0.52
30	0.69	0.51
45	0.71	0.49
65	0.75	0.46
85	0.78	0.42
120	0.83	0.37
170	0.89	0.31
230	0.94	0.26
265	0.98	0.22
360	1.06	0.14

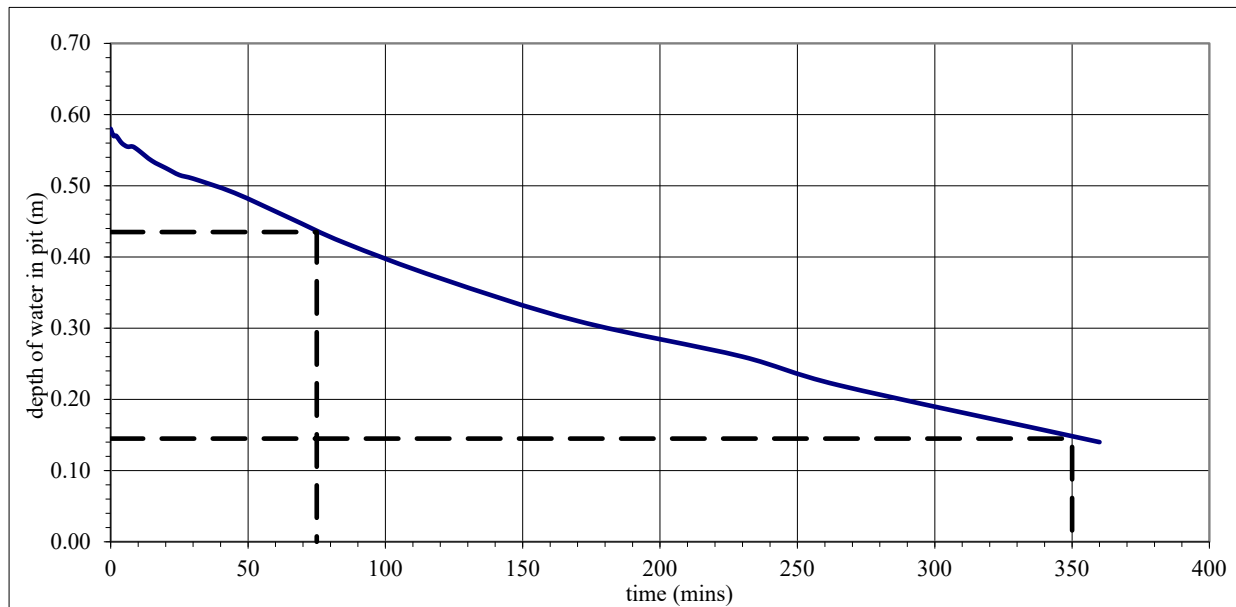
From graph below:

test start - 75% depth at
0.435 m water depth
time is 75.0 minutes

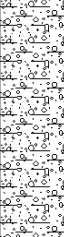
test end - 25% depth at
0.145 m water depth
time is 350.0 minutes

test infiltration rate (q) = 0.023 m/h

time (mins)	depth to water (m)	depth of water in pit (m)	time elapsed (mins)	volume of water lost (m ³)	Area of walls and base at 50% drop (m ²)	q (m/min)	q (m/h)
75	0.77	0.435	275	0.13	1.21	3.8E-04	0.023
350	1.06	0.145					



			Project No. 20-0718		Project Name: Merlin Park, Co. Galway			Trial Pit ID IT03	
			Coordinates 533159.37 E 725894.65 N		Client: Galway City Council Client's Representative: OCSC Consulting Engineers			Sheet 1 of 1 Scale: 1:25	
Method: Trial Pitting			Elevation 24.54 mOD		Date: 16/09/2020			Logger: RS	
Plant: 8T Tracked Excavator								FINAL	

Depth (m)	Sample / Tests	Field Records	Level (mOD)	Depth (m)	Legend	Description	Water
			23.74	0.80		Firm brown slightly gravelly sandy CLAY with medium cobble content. Sand is fine to coarse. Gravel is subrounded fine to coarse of mixed lithologies. Cobbles are subrounded.	
						End of trial pit at 0.80m	

Water Strikes		Depth: 0.80 Width: 0.60 Length: 1.70 Stability: Unstable	Remarks: No groundwater encountered.	
Struck at (m)	Remarks			
		Termination Reason: Terminated on possible bedrock.	Last Updated 21/10/2020	

			Project No. 20-0718		Project Name: Merlin Park, Co. Galway			Trial Pit ID IT04	
			Coordinates 533202.59 E 725918.38 N		Client: Galway City Council Client's Representative: OCSC Consulting Engineers			Sheet 1 of 1 Scale: 1:25	
Method: Trial Pitting			Elevation 26.09 mOD		Date: 15/09/2020			Logger: RS	
Plant: 8T Tracked Excavator								FINAL	

Depth (m)	Sample / Tests	Field Records	Level (mOD)	Depth (m)	Legend	Description	Water
			25.74	0.35		Firm brown slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is subrounded fine to coarse of mixed lithologies predominantly limestone.	
			25.49	0.60		Grey sandy silty subrounded fine to coarse GRAVEL of limestone with low cobble content. Sand is fine to coarse. Cobbles are of limestone.	0.5
			25.14	0.95		Soft grey slightly gravelly sandy SILT. Sand is fine to coarse. Gravel is subrounded fine to coarse of mixed lithologies predominantly limestone.	1.0
						End of trial pit at 0.95m	1.5
							2.0
							2.5
							3.0
							3.5
							4.0
							4.5

Water Strikes		Depth: 0.95 Width: 0.70 Length: 1.60 Stability: Unstable	Remarks: No groundwater encountered. Termination Reason: Terminated on possible bedrock.		Last Updated 21/10/2020	
Struck at (m)	Remarks					

Soakaway Infiltration Test

Project No.: 20-0718
Site: Merlin Park, Galway
Test Location: IT04
Test Date: 15 September 2020



*Analysis using method as described in BRE Digest 365
and CIRIA Report C697-The SUDS Manual*

width (m) length (m)

test pit top dimensions 0.70 1.60

test pit base dimensions 0.30 0.70

test pit depth (m) 0.95

depth to groundwater before adding water (m) = Dry

time (mins)	depth to water surface (m)	depth of water in pit (m)
0	0.51	0.44
1	0.53	0.43
2	0.53	0.42
4	0.55	0.40
6	0.56	0.39
8	0.57	0.39
10	0.58	0.38
15	0.59	0.36
20	0.60	0.35
25	0.61	0.35
30	0.61	0.34
45	0.63	0.32
60	0.65	0.31
90	0.67	0.29
130	0.69	0.26
190	0.72	0.24
350	0.75	0.20

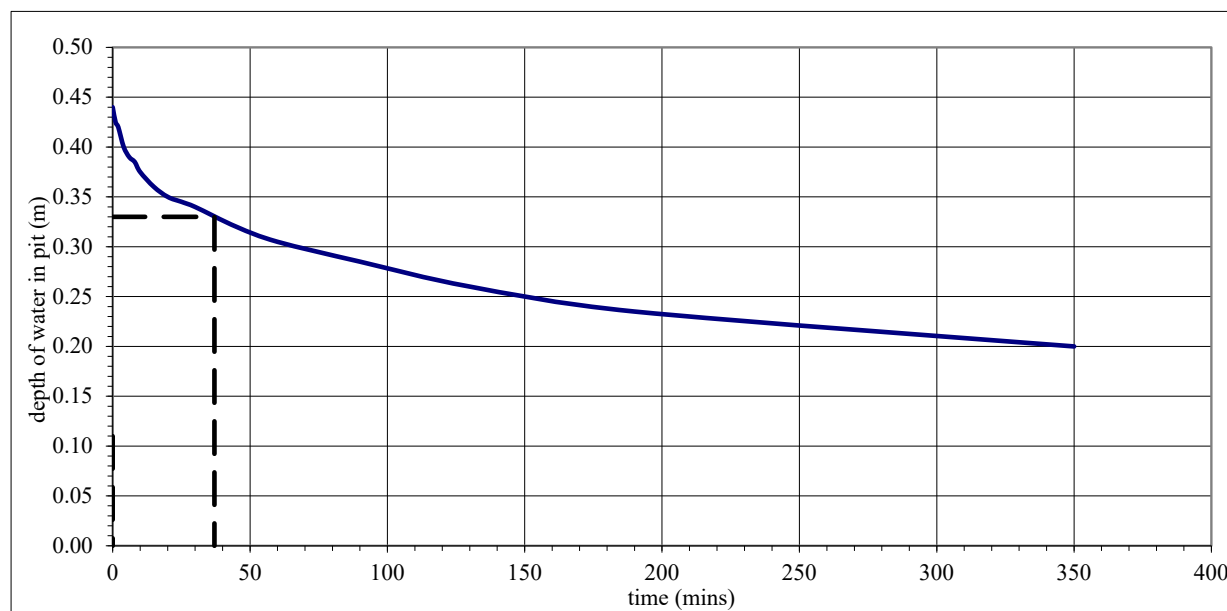
From graph below:

test start - 75% depth at
0.33 m water depth
time is 37.0 minutes

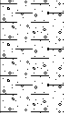
test end - 25% depth at
0.11 m water depth
time is not determined

infiltration rate (q) is very low

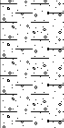
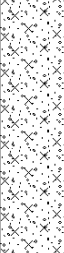
time (mins)	depth to water (m)	depth of water in pit (m)	time elapsed (mins)	volume of water lost (m ³)	Area of walls and base at 50% drop (m ²)	q (m/min)	q (m/h)
37	0.62	0.33		0.08	0.73		
	0.84	0.11					



 CAUSEWAY GEOTECH			Project No. 20-0718		Project Name: Merlin Park, Co. Galway			Trial Pit ID IT05	
			Coordinates 533173.48 E 725874.13 N		Client: Galway City Council Client's Representative: OCSC Consulting Engineers			Sheet 1 of 1 Scale: 1:25	
Method: Trial Pitting			Elevation 22.79 mOD		Date: 16/09/2020			Logger: RS	
Plant: 8T Tracked Excavator								FINAL	

Depth (m)	Sample / Tests	Field Records	Level (mOD)	Depth (m)	Legend	Description	Water
			22.39	0.40		Firm brown slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is subrounded fine to coarse of mixed lithologies predominantly limestone.	
			21.99	0.80		Grey gravelly silty fine to coarse SAND. Gravel is subangular fine to coarse of limestone.	0.5
						End of trial pit at 0.80m	1.0
							1.5
							2.0
							2.5
							3.0
							3.5
							4.0
							4.5

Water Strikes		Depth: 0.80 Width: 0.40 Length: 1.90 Stability: Stable	Remarks: No groundwater encountered. Termination Reason: Terminated on possible bedrock.		Last Updated 21/10/2020	
Struck at (m)	Remarks					

			Project No. 20-0718		Project Name: Merlin Park, Co. Galway			Trial Pit ID IT06	
			Coordinates 533197.35 E 725883.64 N		Client: Galway City Council Client's Representative: OCSC Consulting Engineers				
Method: Trial Pitting								Sheet 1 of 1 Scale: 1:25	
Plant: 8T Tracked Excavator			Elevation 24.21 mOD		Date: 15/09/2020			Logger: RS	
Depth (m)		Sample / Tests	Field Records	Level (mOD)	Depth (m)	Legend	Description	Water	
				23.76	0.45		Firm brown slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is subrounded fine to coarse of mixed lithologies.		
							Grey slightly gravelly silty fine to coarse SAND with low cobble content. Gravel is subrounded fine to coarse of mixed lithologies predominantly limestone. Cobbles are of limestone.		0.5
				22.91	1.30		End of trial pit at 1.30m		1.0
									1.5
									2.0
									2.5
									3.0
									3.5
									4.0
									4.5
Water Strikes			Remarks: No groundwater encountered.						
Struck at (m)		Remarks		Depth: 1.30 Width: 0.30 Length: 2.90		Termination Reason: Terminated at scheduled depth.		Last Updated 21/10/2020	
				Stability: Stable					

Soakaway Infiltration Test

Project No.: 20-0718
Site: Merlin Park
Test Location: IT06
Test Date: 15 September 2020



*Analysis using method as described in BRE Digest 365
and CIRIA Report C697-The SUDS Manual*

width (m) length (m)

test pit top dimensions 0.50 2.90

test pit base dimensions 0.30 0.90

test pit depth (m) 1.30

depth to groundwater before adding water (m) = Dry

time (mins)	depth to water surface (m)	depth of water in pit (m)
0	0.74	0.56
1	0.75	0.56
2	0.75	0.56
4	0.75	0.55
6	0.76	0.54
8	0.76	0.54
10	0.77	0.54
15	0.78	0.52
20	0.80	0.51
25	0.81	0.50
30	0.81	0.49
45	0.84	0.47
60	0.86	0.44
90	0.91	0.40
125	0.95	0.36
170	1.00	0.30
225	1.04	0.26
285	1.09	0.21
400	1.16	0.14

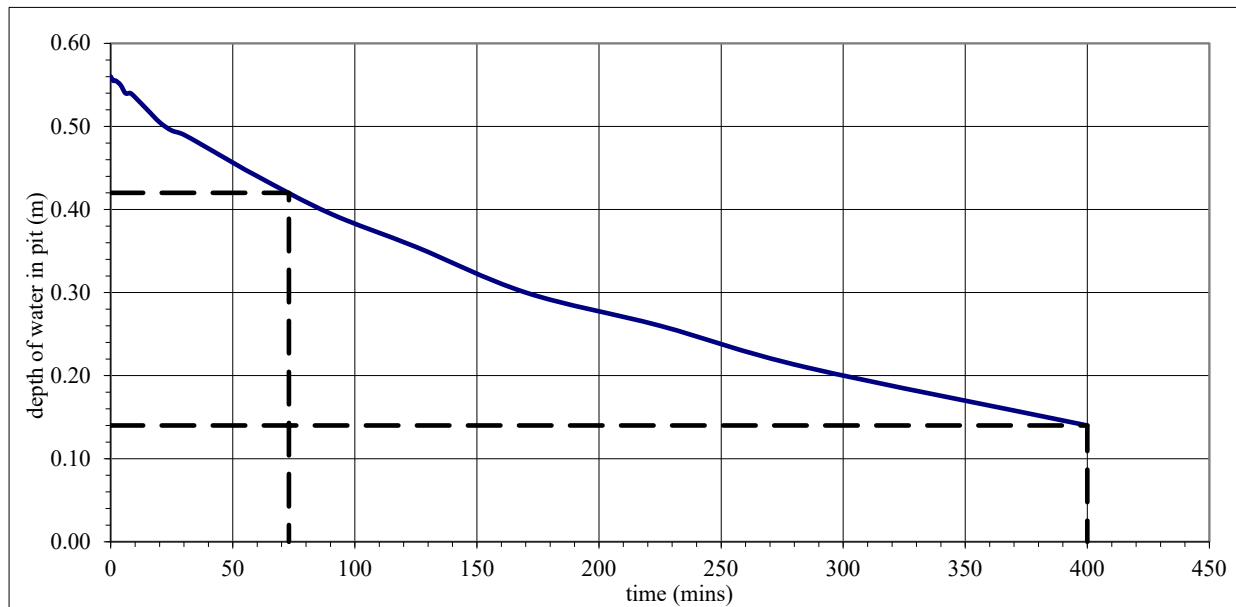
From graph below:

test start - 75% depth at
0.42 m water depth
time is 73.0 minutes

test end - 25% depth at
0.14 m water depth
time is 400.0 minutes

test infiltration rate (q) = 0.021 m/h

time (mins)	depth to water (m)	depth of water in pit (m)	time elapsed (mins)	volume of water lost (m ³)	Area of walls and base at 50% drop (m ²)	q (m/min)	q (m/h)
73	0.88	0.42	327	0.13	1.11	3.6E-04	0.021
400	1.16	0.14					



APPENDIX C. Q_{BAR} RUNOFF CALCULATIONS

- Met Éireann Rainfall Return Table;
- Q_{BAR} Runoff;

Met Eireann
Return Period Rainfall Depths for sliding Durations
Irish Grid: Easting: 133138, Northing: 225832,

DURATION	Interval		Years													
	6months,	1year,	2,	3,	4,	5,	10,	20,	30,	50,	75,	100,	150,	200,	250,	500,
5 mins	3.4,	3.9,	4.2,	4.6,	4.8,	5.0,	5.6,	6.1,	6.4,	6.9,	7.2,	7.5,	7.9,	8.2,	8.4,	N/A ,
10 mins	4.7,	5.5,	5.9,	6.4,	6.8,	7.0,	7.7,	8.5,	9.0,	9.6,	10.1,	10.5,	11.0,	11.4,	11.7,	N/A ,
15 mins	5.5,	6.5,	6.9,	7.6,	7.9,	8.2,	9.1,	10.0,	10.6,	11.3,	11.9,	12.3,	13.0,	13.4,	13.8,	N/A ,
30 mins	7.1,	8.4,	9.0,	9.8,	10.3,	10.7,	11.8,	13.0,	13.7,	14.6,	15.4,	16.0,	16.8,	17.4,	17.9,	N/A ,
1 hours	9.3,	10.9,	11.6,	12.7,	13.4,	13.9,	15.3,	16.8,	17.7,	19.0,	20.0,	20.7,	21.8,	22.6,	23.2,	N/A ,
2 hours	12.0,	14.1,	15.1,	16.5,	17.3,	18.0,	19.9,	21.8,	23.0,	24.6,	25.9,	26.8,	28.2,	29.3,	30.1,	N/A ,
3 hours	14.0,	16.4,	17.6,	19.2,	20.2,	20.9,	23.1,	25.4,	26.8,	28.6,	30.1,	31.2,	32.9,	34.1,	35.1,	N/A ,
4 hours	15.6,	18.3,	19.6,	21.4,	22.5,	23.3,	25.8,	28.3,	29.9,	31.9,	33.6,	34.8,	36.6,	38.0,	39.1,	N/A ,
6 hours	18.1,	21.3,	22.8,	24.9,	26.2,	27.1,	30.0,	33.0,	34.8,	37.1,	39.1,	40.5,	42.7,	44.2,	45.5,	N/A ,
9 hours	21.1,	24.8,	26.5,	29.0,	30.5,	31.6,	34.9,	38.4,	40.5,	43.2,	45.5,	47.2,	49.7,	51.5,	53.0,	N/A ,
12 hours	23.5,	27.6,	29.6,	32.3,	33.9,	35.2,	38.9,	42.7,	45.1,	48.1,	50.7,	52.6,	55.3,	57.4,	59.0,	N/A ,
18 hours	27.4,	32.2,	34.4,	37.5,	39.5,	41.0,	45.3,	49.8,	52.5,	56.0,	59.0,	61.2,	64.4,	66.8,	68.7,	N/A ,
24 hours	30.5,	35.8,	38.4,	41.8,	44.0,	45.6,	50.5,	55.4,	58.4,	62.4,	65.7,	68.2,	71.7,	74.4,	76.5,	83.4,
2 days	38.7,	45.1,	48.1,	52.2,	54.8,	56.7,	62.4,	68.2,	71.7,	76.3,	80.1,	82.9,	87.0,	90.1,	92.5,	100.4,
3 days	45.8,	53.1,	56.5,	61.2,	64.1,	66.3,	72.7,	79.3,	83.2,	88.4,	92.6,	95.8,	100.4,	103.8,	106.5,	115.3,
4 days	52.3,	60.5,	64.3,	69.5,	72.7,	75.1,	82.2,	89.4,	93.7,	99.4,	104.1,	107.6,	112.6,	116.3,	119.3,	128.9,
6 days	64.4,	74.0,	78.5,	84.6,	88.4,	91.2,	99.6,	108.0,	113.0,	119.6,	125.1,	129.1,	134.9,	139.2,	142.6,	153.8,
8 days	75.6,	86.6,	91.7,	98.6,	103.0,	106.1,	115.6,	125.1,	130.8,	138.2,	144.4,	148.9,	155.5,	160.3,	164.1,	176.6,
10 days	86.2,	98.5,	104.2,	112.0,	116.8,	120.3,	130.8,	141.3,	147.6,	155.9,	162.6,	167.6,	174.9,	180.2,	184.4,	198.1,
12 days	96.5,	110.0,	116.3,	124.8,	130.0,	133.9,	145.4,	156.9,	163.8,	172.8,	180.2,	185.6,	193.4,	199.2,	203.8,	218.7,
16 days	116.4,	132.2,	139.5,	149.4,	155.6,	160.0,	173.4,	186.7,	194.7,	205.1,	213.6,	219.9,	229.0,	235.6,	240.9,	258.1,
20 days	135.6,	153.6,	161.9,	173.2,	180.1,	185.2,	200.3,	215.4,	224.4,	236.1,	245.7,	252.7,	262.9,	270.4,	276.4,	295.6,
25 days	159.0,	179.7,	189.2,	202.0,	210.0,	215.8,	233.0,	250.1,	260.3,	273.6,	284.5,	292.4,	304.0,	312.5,	319.2,	340.9,

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

O'Connor Sutton Cronin		Page 1
9 Prussia Street Dublin 7 Ireland	HOUSING AT MERLIN PARK MERLIN PARK, GALWAY	
Date 19/03/2021 File QBAR.SRCX	Designed by AB Checked by DR	
XP Solutions	Source Control 2019.1	

ICP SUDS Mean Annual Flood

Input

Return Period (years) 5 SAAR (mm) 1176 Urban 0.000
Area (ha) 2.939 Soil 0.370 Region Number User Defined

User Defined Growth Curve

Filename GDSDS Growth Curve.gcfx Description GDSDS

Return Period Growth Curve
(years) Factor

1	0.850
2	0.000
5	1.000
10	1.700
20	0.000
25	0.000
30	2.100
50	0.000
100	2.600
200	2.900
500	0.000
1000	0.000

Results 1/s

QBAR Rural 15.5
QBAR Urban 15.5

Q5 years 15.5

Q1 year 13.2
Q30 years 32.5
Q100 years 40.3

APPENDIX D. SURFACE WATER DESIGN CALCULATIONS

- Design Criteria;
- Area Summary;
- Network Design & Results Table;
- Simulation Criteria;
- Hydrobrake / Controls & Infiltration Design;
- Summary of Results.

Appendix D

Surface Water Design Calculations

O'Connor Sutton Cronin		Page 1
9 Prussia Street Dublin 7 Ireland	HOUSING AT MERLIN PARK MERLIN PARK, GALWAY	
Date 19/03/2021 File G477-MD-20210316.MDX	Designed by AB Checked by DR	
XP Solutions	Network 2019.1	

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - Scotland and Ireland

Return Period (years)	5	Foul Sewage (l/s/ha)	0.000	Maximum Backdrop Height (m)	2.000
M5-60 (mm)	13.900	Volumetric Runoff Coeff.	0.750	Min Design Depth for Optimisation (m)	1.200
Ratio R	0.245	PIMP (%)	100	Min Vel for Auto Design only (m/s)	1.00
Maximum Rainfall (mm/hr)	50	Add Flow / Climate Change (%)	20	Min Slope for Optimisation (1:X)	500
Maximum Time of Concentration (mins)	30	Minimum Backdrop Height (m)	0.000		

Designed with Level Soffits

Time Area Diagram for Storm

Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.662	4-8	0.834	8-12	0.007

Total Area Contributing (ha) = 1.503

Total Pipe Volume (m³) = 47.041

Network Design Table for Storm

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

Network Results Table

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

O'Connor Sutton Cronin		Page 2
9 Prussia Street	HOUSING AT MERLIN PARK	
Dublin 7	MERLIN PARK, GALWAY	
Ireland		
Date 19/03/2021	Designed by AB	
File G477-MD-20210316.MDX	Checked by DR	
XP Solutions	Network 2019.1	

Network Design Table for Storm

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	16.152	0.046	350.0	0.022	4.00	0.0	0.600	o	225	Pipe/Conduit	
S1.001	44.748	0.128	350.0	0.033	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.002	14.828	0.087	170.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.003	58.744	0.346	170.0	0.131	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.004	59.935	2.453	24.4	0.174	0.00	0.0	0.600	o	225	Pipe/Conduit	
S2.000	54.227	0.319	170.0	0.160	4.00	0.0	0.600	o	225	Pipe/Conduit	
S1.005	24.622	0.755	32.6	0.034	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.006	49.506	1.548	32.0	0.322	0.00	0.0	0.600	o	300	Pipe/Conduit	
S1.007	52.717	0.572	92.2	0.089	0.00	0.0	0.600	o	375	Pipe/Conduit	
S3.000	88.861	0.363	245.0	0.294	4.00	0.0	0.600	o	300	Pipe/Conduit	
S3.001	6.042	0.025	245.0	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)
S1.000	50.00	4.39	30.375	0.022	0.0	0.0	0.6	0.69	27.6	3.5
S1.001	47.51	5.46	30.329	0.055	0.0	0.0	1.4	0.69	27.6	8.5
S1.002	46.75	5.71	30.201	0.055	0.0	0.0	1.4	1.00	39.8	8.5
S1.003	44.01	6.69	30.114	0.186	0.0	0.0	4.4	1.00	39.8	26.6
S1.004	43.06	7.07	29.768	0.360	0.0	0.0	8.4	2.66	105.7	50.4
S2.000	49.37	4.90	27.634	0.160	0.0	0.0	4.3	1.00	39.8	25.7
S1.005	42.63	7.24	27.315	0.554	0.0	0.0	12.8	2.30	91.4	76.8
S1.006	41.94	7.54	26.485	0.876	0.0	0.0	19.9	2.79	197.2	119.4
S1.007	40.91	8.01	24.862	0.965	0.0	0.0	21.4	1.89	208.5	128.4
S3.000	47.46	5.48	27.471	0.294	0.0	0.0	7.6	1.00	70.7	45.3
S3.001	47.15	5.58	27.108	0.294	0.0	0.0	7.6	1.00	70.7	45.3

O'Connor Sutton Cronin		Page 3
9 Prussia Street Dublin 7 Ireland	HOUSING AT MERLIN PARK MERLIN PARK, GALWAY	
Date 19/03/2021 File G477-MD-20210316.MDX	Designed by AB Checked by DR	
XP Solutions	Network 2019.1	

Network Design Table for Storm

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
S4.000	23.381	1.169	20.0	0.054	4.00	0.0	0.600	o	225	Pipe/Conduit	🟢
S3.002	25.607	0.183	140.0	0.034	0.00	0.0	0.600	o	300	Pipe/Conduit	🟢
S3.003	18.157	0.672	27.0	0.028	0.00	0.0	0.600	o	300	Pipe/Conduit	🟢
S3.004	55.262	2.048	27.0	0.034	0.00	0.0	0.600	o	300	Pipe/Conduit	🟢
S3.005	36.732	0.800	45.9	0.095	0.00	0.0	0.600	o	300	Pipe/Conduit	🟢
S1.008	11.036	0.480	23.0	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit	🟢
S1.009	44.552	0.223	200.0	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	🔴
S1.010	18.824	0.941	20.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	🟢
S1.011	14.265	0.713	20.0	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)
S4.000	50.00	4.13	28.327	0.054	0.0	0.0	1.5	2.94	116.9	8.7
S3.002	46.18	5.90	27.083	0.381	0.0	0.0	9.5	1.33	93.8	57.2
S3.003	45.89	6.00	26.900	0.409	0.0	0.0	10.2	3.04	214.7	61.0
S3.004	45.03	6.31	26.228	0.443	0.0	0.0	10.8	3.04	214.8	64.8
S3.005	44.33	6.57	24.180	0.537	0.0	0.0	12.9	2.33	164.4	77.4
S1.008	40.81	8.05	23.305	1.503	0.0	0.0	33.2	3.79	418.9	199.3
S1.009	39.74	8.57	22.723	1.503	0.0	0.0	33.2	1.43	228.1	199.3
S1.010	50.00	4.11	22.500	0.000	15.5	0.0	2.6	2.94	116.9	15.5
S1.011	50.00	4.19	21.559	0.000	15.5	0.0	3.1	2.94	116.9	18.6

HOUSING AT MERLIN PARK MERLIN PARK, GALWAY



Designed by AB
Checked by DR

Network 2019.1

Area Summary for Storm

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	Classification	Hardstanding	100	0.014	0.014	0.014
	Classification	Hardstanding	100	0.005	0.005	0.019
	Classification	Grass	30	0.008	0.002	0.022
1.001	Classification	Hardstanding	100	0.026	0.026	0.026
	Classification	Grass	30	0.022	0.007	0.033
1.002	-	-	100	0.000	0.000	0.000
1.003	Classification	Hardstanding	100	0.044	0.044	0.044
	Classification	Hardstanding	100	0.047	0.047	0.090
	Classification	Pervious Paving	80	0.026	0.020	0.111
	Classification	Pervious Paving	80	0.026	0.020	0.131
1.004	Classification	Hardstanding	100	0.037	0.037	0.037
	Classification	Hardstanding	100	0.032	0.032	0.068
	Classification	Hardstanding	100	0.036	0.036	0.104
	Classification	Hardstanding	100	0.052	0.052	0.156
	Classification	Pervious Paving	80	0.009	0.007	0.164
	Classification	Hardstanding	100	0.009	0.009	0.173
	Classification	Grass	30	0.004	0.001	0.174
2.000	Classification	Hardstanding	100	0.049	0.049	0.049
	Classification	Hardstanding	100	0.058	0.058	0.107
	Classification	Hardstanding	100	0.030	0.030	0.137
	Classification	Pervious Paving	80	0.008	0.007	0.144
	Classification	Pervious Paving	80	0.008	0.006	0.150
	Classification	Grass	30	0.014	0.004	0.154
	Classification	Grass	30	0.019	0.006	0.160
1.005	Classification	Hardstanding	100	0.034	0.034	0.034
1.006	Classification	Hardstanding	100	0.097	0.097	0.097
	Classification	Hardstanding	100	0.068	0.068	0.165
	Classification	Pervious Paving	80	0.066	0.053	0.218
	Classification	Pervious Paving	80	0.043	0.034	0.252
	Classification	Hardstanding	100	0.068	0.068	0.319
	Classification	Grass	30	0.009	0.003	0.322
1.007	Classification	Hardstanding	100	0.032	0.032	0.032
	Classification	Pervious Paving	80	0.014	0.012	0.043
	Classification	Pervious Paving	80	0.014	0.012	0.055
	Classification	Hardstanding	100	0.034	0.034	0.089

HOUSING AT MERLIN PARK
MERLIN PARK, GALWAY



Designed by AB

Checked by DR

Network 2019.1

Area Summary for Storm

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
3.000	Classification	Hardstanding	100	0.093	0.093	0.093
	Classification	Hardstanding	100	0.080	0.080	0.174
	Classification	Pervious Paving	80	0.007	0.005	0.179
	Classification	Pervious Paving	80	0.005	0.004	0.183
	Classification	Pervious Paving	80	0.009	0.007	0.191
	Classification	Pervious Paving	80	0.011	0.009	0.199
	Classification	Hardstanding	100	0.082	0.082	0.281
	Classification	Grass	30	0.007	0.002	0.283
	Classification	Grass	30	0.008	0.002	0.286
	Classification	Grass	30	0.012	0.004	0.289
Classification	Grass	30	0.015	0.004	0.294	
3.001	-	-	100	0.000	0.000	0.000
4.000	Classification	Hardstanding	100	0.023	0.023	0.023
	Classification	Hardstanding	100	0.014	0.014	0.037
	Classification	Pervious Paving	80	0.008	0.007	0.044
	Classification	Pervious Paving	80	0.012	0.010	0.054
3.002	Classification	Pervious Paving	80	0.004	0.003	0.003
	Classification	Hardstanding	100	0.020	0.020	0.023
	Classification	Hardstanding	100	0.010	0.010	0.034
3.003	Classification	Pervious Paving	80	0.006	0.005	0.005
	Classification	Pervious Paving	80	0.006	0.005	0.010
	Classification	Hardstanding	100	0.007	0.007	0.017
	Classification	Hardstanding	100	0.007	0.007	0.024
3.004	Classification	Hardstanding	100	0.004	0.004	0.028
	Classification	Grass	30	0.030	0.009	0.009
	Classification	Hardstanding	100	0.008	0.008	0.017
3.005	Classification	Hardstanding	100	0.017	0.017	0.034
	Classification	Hardstanding	100	0.058	0.058	0.058
	Classification	Grass	30	0.004	0.001	0.060
	Classification	Pervious Paving	80	0.008	0.006	0.066
3.005	Classification	Pervious Paving	80	0.007	0.006	0.072
	Classification	Hardstanding	100	0.023	0.023	0.095
1.008	-	-	100	0.000	0.000	0.000
1.009	-	-	100	0.000	0.000	0.000
1.010	-	-	100	0.000	0.000	0.000

O'Connor Sutton Cronin		Page 6
9 Prussia Street Dublin 7 Ireland	HOUSING AT MERLIN PARK MERLIN PARK, GALWAY	
Date 19/03/2021 File G477-MD-20210316.MDX	Designed by AB Checked by DR	
XP Solutions	Network 2019.1	

Area Summary for Storm

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.011	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				1.669	1.503	1.503

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
S1.011	S-OUTFALL	22.250	20.846	18.900	525	0

O'Connor Sutton Cronin		Page 7
9 Prussia Street Dublin 7 Ireland	HOUSING AT MERLIN PARK MERLIN PARK, GALWAY	
Date 19/03/2021 File G477-MD-20210316.MDX	Designed by AB Checked by DR	
XP Solutions	Network 2019.1	

Online Controls for Storm

Hydro-Brake® Optimum Manhole: S19, DS/PN: S1.010, Volume (m³): 9.3

Unit Reference	MD-SHE-0172-1550-1400-1550	Sump Available	Yes
Design Head (m)	1.400	Diameter (mm)	172
Design Flow (l/s)	15.5	Invert Level (m)	22.500
Flush-Flo™	Calculated	Minimum Outlet Pipe Diameter (mm)	225
Objective	Minimise upstream storage	Suggested Manhole Diameter (mm)	1500
Application	Surface		

Control Points			Head (m)	Flow (l/s)	Control Points			Head (m)	Flow (l/s)
Design Point (Calculated)			1.400	15.5	Kick-Flo®			0.911	12.6
Flush-Flo™			0.419	15.5	Mean Flow over Head Range			-	13.4

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	6.1	0.600	15.2	1.600	16.5	2.600	20.8	5.000	28.5	7.500	34.6
0.200	14.2	0.800	14.1	1.800	17.5	3.000	22.3	5.500	29.8	8.000	35.7
0.300	15.2	1.000	13.2	2.000	18.4	3.500	24.0	6.000	31.1	8.500	36.8
0.400	15.5	1.200	14.4	2.200	19.2	4.000	25.6	6.500	32.3	9.000	37.8
0.500	15.4	1.400	15.5	2.400	20.0	4.500	27.1	7.000	33.5	9.500	38.8

O'Connor Sutton Cronin		Page 8
9 Prussia Street Dublin 7 Ireland	HOUSING AT MERLIN PARK MERLIN PARK, GALWAY	
Date 19/03/2021 File G477-MD-20210316.MDX	Designed by AB Checked by DR	
XP Solutions	Network 2019.1	
<u>Storage Structures for Storm</u>		
<u>Filter Drain Manhole: S2, DS/PN: S1.001</u>		
Infiltration Coefficient Base (m/hr)	0.02500	Trench Width (m) 0.6
Infiltration Coefficient Side (m/hr)	0.02500	Trench Length (m) 16.2
Safety Factor	2.0	Pipe Diameter (m) 0.225
Porosity	0.30	Pipe Depth above Invert (m) 0.075
Invert Level (m)	30.329	Number of Pipes 1
<u>Filter Drain Manhole: S3, DS/PN: S1.002</u>		
Infiltration Coefficient Base (m/hr)	0.02500	Trench Width (m) 0.6
Infiltration Coefficient Side (m/hr)	0.02500	Trench Length (m) 44.8
Safety Factor	2.0	Pipe Diameter (m) 0.225
Porosity	0.30	Pipe Depth above Invert (m) 0.075
Invert Level (m)	30.201	Number of Pipes 1
<u>Filter Drain Manhole: S15, DS/PN: S3.004</u>		
Infiltration Coefficient Base (m/hr)	0.02500	Trench Width (m) 0.8
Infiltration Coefficient Side (m/hr)	0.02500	Trench Length (m) 18.2
Safety Factor	2.0	Pipe Diameter (m) 0.300
Porosity	0.30	Pipe Depth above Invert (m) 0.075
Invert Level (m)	26.228	Number of Pipes 1
<u>Filter Drain Manhole: S16, DS/PN: S3.005</u>		
Infiltration Coefficient Base (m/hr)	0.02500	Trench Width (m) 0.8
Infiltration Coefficient Side (m/hr)	0.02500	Trench Length (m) 55.3
Safety Factor	2.0	Pipe Diameter (m) 0.300
Porosity	0.30	Pipe Depth above Invert (m) 0.075
Invert Level (m)	23.907	Number of Pipes 1
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O'Connor Sutton Cronin		Page 9
9 Prussia Street Dublin 7 Ireland	HOUSING AT MERLIN PARK MERLIN PARK, GALWAY	
Date 19/03/2021 File G477-MD-20210316.MDX	Designed by AB Checked by DR	
XP Solutions	Network 2019.1	

Cellular Storage Manhole: S19, DS/PN: S1.010

Invert Level (m) 22.500 Infiltration Coefficient Side (m/hr) 0.02500 Porosity 0.30
Infiltration Coefficient Base (m/hr) 0.00000 Safety Factor 1.0

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	1250.0	0.0	1.400	1250.0	175.0	1.401	0.0	175.0

O'Connor Sutton Cronin										Page 10																																																																																																																																																																																																					
9 Prussia Street Dublin 7 Ireland					HOUSING AT MERLIN PARK MERLIN PARK, GALWAY																																																																																																																																																																																																										
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5 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm <u>Simulation Criteria</u> Areal Reduction Factor 1.000 Manhole Headloss Coeff (Global) 0.500 MADD Factor * 10m³/ha Storage 2.000 Hot Start (mins) 0 Foul Sewage per hectare (l/s) 0.000 Inlet Coeffiecient 0.800 Hot Start Level (mm) 0 Additional Flow - % of Total Flow 0.000 Flow per Person per Day (l/per/day) 0.000 Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0 Number of Online Controls 1 Number of Storage Structures 5 Number of Real Time Controls 0 <u>Synthetic Rainfall Details</u> Rainfall Model FSR M5-60 (mm) 13.900 Cv (Summer) 0.750 Region Scotland and Ireland Ratio R 0.245 Cv (Winter) 0.840 Margin for Flood Risk Warning (mm) 150.0 DVD Status OFF Analysis Timestep 2.5 Second Increment (Extended) Inertia Status OFF DTS Status ON Profile(s) Summer and Winter Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080 Return Period(s) (years) 5, 30, 100 Climate Change (%) 20, 20, 20																																																																																																																																																																																																															
<table><thead><tr><th colspan="10"></th><th colspan="4">Water Surcharged Flooded</th><th colspan="2">Pipe</th><th colspan="2"></th></tr><tr><th>PN</th><th>US/MH Name</th><th>Storm</th><th>Return Period</th><th>Climate Change</th><th>First (X) Surcharge</th><th>First (Y) Flood</th><th>First (Z) Overflow</th><th>Overflow Act.</th><th>Level (m)</th><th>Depth (m)</th><th>Volume (m³)</th><th>Flow / Cap.</th><th>Overflow (l/s)</th><th>Pipe Flow (l/s)</th><th>Status</th><th>Level Exceeded</th></tr></thead><tbody><tr><td>S1.000</td><td>S1</td><td>15 Winter</td><td>5</td><td>+20%</td><td></td><td></td><td></td><td></td><td>30.443</td><td>-0.157</td><td>0.000</td><td>0.15</td><td></td><td>3.8</td><td>OK</td><td></td></tr><tr><td>S1.001</td><td>S2</td><td>15 Winter</td><td>5</td><td>+20%</td><td></td><td></td><td></td><td></td><td>30.415</td><td>-0.139</td><td>0.000</td><td>0.30</td><td></td><td>7.8</td><td>OK</td><td></td></tr><tr><td>S1.002</td><td>S3</td><td>15 Winter</td><td>5</td><td>+20%</td><td>100/15 Winter</td><td></td><td></td><td></td><td>30.278</td><td>-0.148</td><td>0.000</td><td>0.22</td><td></td><td>7.8</td><td>OK</td><td></td></tr><tr><td>S1.003</td><td>S4</td><td>15 Winter</td><td>5</td><td>+20%</td><td>100/15 Summer</td><td></td><td></td><td></td><td>30.245</td><td>-0.093</td><td>0.000</td><td>0.61</td><td></td><td>23.4</td><td>OK</td><td></td></tr><tr><td>S1.004</td><td>S5</td><td>15 Winter</td><td>5</td><td>+20%</td><td>100/15 Summer</td><td></td><td></td><td></td><td>29.875</td><td>-0.119</td><td>0.000</td><td>0.45</td><td></td><td>45.4</td><td>OK</td><td></td></tr><tr><td>S2.000</td><td>S6</td><td>15 Winter</td><td>5</td><td>+20%</td><td>30/15 Summer</td><td></td><td></td><td></td><td>27.779</td><td>-0.080</td><td>0.000</td><td>0.70</td><td></td><td>26.7</td><td>OK</td><td></td></tr><tr><td>S1.005</td><td>S7</td><td>15 Winter</td><td>5</td><td>+20%</td><td>30/15 Summer</td><td></td><td></td><td></td><td>27.482</td><td>-0.058</td><td>0.000</td><td>0.90</td><td></td><td>75.7</td><td>OK</td><td></td></tr><tr><td>S1.006</td><td>S8</td><td>15 Winter</td><td>5</td><td>+20%</td><td>100/15 Summer</td><td></td><td></td><td></td><td>26.661</td><td>-0.124</td><td>0.000</td><td>0.64</td><td></td><td>118.8</td><td>OK</td><td></td></tr><tr><td>S1.007</td><td>S9</td><td>15 Winter</td><td>5</td><td>+20%</td><td>100/15 Summer</td><td></td><td></td><td></td><td>25.090</td><td>-0.147</td><td>0.000</td><td>0.68</td><td></td><td>131.0</td><td>OK</td><td></td></tr></tbody></table>																														Water Surcharged Flooded				Pipe				PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Level (m)	Depth (m)	Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded	S1.000	S1	15 Winter	5	+20%					30.443	-0.157	0.000	0.15		3.8	OK		S1.001	S2	15 Winter	5	+20%					30.415	-0.139	0.000	0.30		7.8	OK		S1.002	S3	15 Winter	5	+20%	100/15 Winter				30.278	-0.148	0.000	0.22		7.8	OK		S1.003	S4	15 Winter	5	+20%	100/15 Summer				30.245	-0.093	0.000	0.61		23.4	OK		S1.004	S5	15 Winter	5	+20%	100/15 Summer				29.875	-0.119	0.000	0.45		45.4	OK		S2.000	S6	15 Winter	5	+20%	30/15 Summer				27.779	-0.080	0.000	0.70		26.7	OK		S1.005	S7	15 Winter	5	+20%	30/15 Summer				27.482	-0.058	0.000	0.90		75.7	OK		S1.006	S8	15 Winter	5	+20%	100/15 Summer				26.661	-0.124	0.000	0.64		118.8	OK		S1.007	S9	15 Winter	5	+20%	100/15 Summer				25.090	-0.147	0.000	0.68		131.0	OK	
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O'Connor Sutton Cronin		Page 11
9 Prussia Street Dublin 7 Ireland	HOUSING AT MERLIN PARK MERLIN PARK, GALWAY	
Date 19/03/2021 File G477-MD-20210316.MDX	Designed by AB Checked by DR	
XP Solutions	Network 2019.1	

5 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

									Water	Surcharged	Flooded	Pipe				
PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Level (m)	Depth (m)	Volume (m³)	Flow / Cap.	Overflow (l/s)	Flow (l/s)	Status	Level Exceeded
S3.000	S10	15 Winter	5	+20%	30/15 Summer				27.668	-0.103	0.000	0.68		46.6	OK	
S3.001	S11	15 Winter	5	+20%	30/15 Summer				27.333	-0.075	0.000	0.92		45.1	OK	
S4.000	S12	15 Winter	5	+20%					28.372	-0.180	0.000	0.09		9.5	OK	
S3.002	S13	15 Winter	5	+20%	100/15 Summer				27.265	-0.118	0.000	0.67		56.3	OK	
S3.003	S14	15 Winter	5	+20%					27.017	-0.183	0.000	0.32		60.0	OK	
S3.004	S15	15 Winter	5	+20%					26.343	-0.185	0.000	0.31		64.0	OK	
S3.005	S16	15 Winter	5	+20%	100/15 Summer				24.330	-0.150	0.000	0.49		75.1	OK	
S1.008	S17	15 Winter	5	+20%	30/15 Summer				23.549	-0.130	0.000	0.76		205.9	OK	
S1.009	S18	15 Winter	5	+20%	30/15 Summer				23.106	-0.067	0.000	0.99		203.9	OK	
S1.010	S19	360 Winter	5	+20%	5/15 Summer				23.087	0.362	0.000	0.15		15.4	SURCHARGED	
S1.011	S20	480 Summer	5	+20%					21.617	-0.167	0.000	0.15		15.4	OK	

HOUSING AT MERLIN PARK MERLIN PARK, GALWAY



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30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

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

Number of Input Hydrographs	0	Number of Offline Controls	0	Number of Time/Area Diagrams	0
Number of Online Controls	1	Number of Storage Structures	5	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR M5-60 (mm)	13.900	Cv (Summer)	0.750
Region Scotland and Ireland	Ratio R	0.245	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	150.0	DVD Status	OFF
Analysis Timestep 2.5 Second Increment (Extended)		Inertia Status	OFF
DTS Status	ON		

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years)	5, 30, 100
Climate Change (%)	20, 20, 20

PN	US/MH		Return Period	Climate Change	First (X)		First (Y)		First (Z) Overflow	Overflow Act.	Water	Surcharged	Flooded	Pipe		Level Exceeded
	Name	Storm			Surcharge	Flood	Overflow	Level (m)			Depth (m)	Volume (m³)	Flow / Cap.	Overflow (1/s)	Flow (1/s)	
S1.000	S1	15 Winter	30	+20%							30.465	-0.135	0.000	0.23	5.5	OK
S1.001	S2	15 Winter	30	+20%							30.444	-0.110	0.000	0.49	12.8	OK
S1.002	S3	15 Winter	30	+20%	100/15	Winter					30.331	-0.095	0.000	0.45	15.6	OK
S1.003	S4	15 Winter	30	+20%	100/15	Summer					30.313	-0.025	0.000	0.98	37.8	OK
S1.004	S5	15 Winter	30	+20%	100/15	Summer					29.920	-0.074	0.000	0.76	77.5	OK
S2.000	S6	15 Winter	30	+20%	30/15	Summer					28.233	0.374	0.000	0.85	32.4	SURCHARGED
S1.005	S7	15 Winter	30	+20%	30/15	Summer					28.061	0.521	0.000	1.29	108.7	SURCHARGED
S1.006	S8	15 Winter	30	+20%	100/15	Summer					26.721	-0.064	0.000	0.95	177.3	OK
S1.007	S9	15 Winter	30	+20%	100/15	Summer					25.236	-0.001	0.000	1.00	193.6	OK

O'Connor Sutton Cronin		Page 13
9 Prussia Street Dublin 7 Ireland	HOUSING AT MERLIN PARK MERLIN PARK, GALWAY	
Date 19/03/2021 File G477-MD-20210316.MDX	Designed by AB Checked by DR	
XP Solutions	Network 2019.1	

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH		Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level	Surcharged Depth	Flooded Volume	Flow / Overflow	Pipe Flow	Status	Level Exceeded
	Name									(m)	(m)	(m³)	Cap.	(l/s)		
S3.000	S10	15	Winter	30	+20%	30/15	Summer			27.813	0.042	0.000	0.97	66.0	SURCHARGED	
S3.001	S11	15	Winter	30	+20%	30/15	Summer			27.434	0.025	0.000	1.27	62.6	SURCHARGED	
S4.000	S12	15	Winter	30	+20%					28.380	-0.172	0.000	0.13	13.8	OK	
S3.002	S13	15	Winter	30	+20%	100/15	Summer			27.313	-0.070	0.000	0.91	76.8	OK	
S3.003	S14	30	Summer	30	+20%					27.039	-0.161	0.000	0.43	79.5	OK	
S3.004	S15	15	Winter	30	+20%					26.364	-0.164	0.000	0.42	85.7	OK	
S3.005	S16	15	Winter	30	+20%	100/15	Summer			24.366	-0.114	0.000	0.70	105.7	OK	
S1.008	S17	15	Winter	30	+20%	30/15	Summer			23.966	0.287	0.000	1.09	296.7	SURCHARGED	
S1.009	S18	360	Winter	30	+20%	30/15	Summer			23.505	0.332	0.000	0.35	71.6	SURCHARGED	
S1.010	S19	360	Winter	30	+20%	5/15	Summer			23.498	0.773	0.000	0.15	15.4	SURCHARGED	
S1.011	S20	180	Summer	30	+20%					21.617	-0.167	0.000	0.15	15.4	OK	

HOUSING AT MERLIN PARK
MERLIN PARK, GALWAY



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Network 2019.1

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

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

Number of Input Hydrographs	0	Number of Offline Controls	0	Number of Time/Area Diagrams	0
Number of Online Controls	1	Number of Storage Structures	5	Number of Real Time Controls	0

Rainfall Model	FSR M5-60 (mm)	13.900	Cv (Summer)	0.750
Region Scotland and Ireland	Ratio R	0.245	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	150.0	DVD Status	OFF
Analysis Timestep 2.5 Second Increment (Extended)		Inertia Status	OFF
DTS Status	ON		

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years)	5, 30, 100
Climate Change (%)	20, 20, 20

									Water	Surcharged	Flooded	Pipe				
PN	US/MH		Return	Climate	First (X)	First (Y)	First (Z)	Overflow	Level	Depth	Volume	Flow /	Overflow	Flow		Level
	Name	Storm	Period	Change	Surcharge	Flood	Overflow	Act.	(m)	(m)	(m³)	Cap.	(l/s)	(l/s)	Status	Exceeded
S1.000	S1	15 Winter	100	+20%					30.482	-0.118	0.000	0.29		7.1	OK	
S1.001	S2	15 Winter	100	+20%					30.463	-0.091	0.000	0.62		16.3	OK	
S1.002	S3	15 Winter	100	+20%	100/15 Winter				30.429	0.003	0.000	0.69		24.2	SURCHARGED	
S1.003	S4	15 Winter	100	+20%	100/15 Summer				30.419	0.080	0.000	1.03		39.4	SURCHARGED	
S1.004	S5	15 Winter	100	+20%	100/15 Summer				30.074	0.081	0.000	0.84		86.0	SURCHARGED	
S2.000	S6	15 Winter	100	+20%	30/15 Summer				28.864	1.005	0.000	0.90		34.6	SURCHARGED	
S1.005	S7	15 Winter	100	+20%	30/15 Summer				28.605	1.065	0.000	1.45		122.0	SURCHARGED	
S1.006	S8	15 Winter	100	+20%	100/15 Summer				27.176	0.391	0.000	1.06		197.4	SURCHARGED	
S1.007	S9	15 Winter	100	+20%	100/15 Summer				25.397	0.160	0.000	1.14		220.5	SURCHARGED	

O'Connor Sutton Cronin		Page 15
9 Prussia Street Dublin 7 Ireland	HOUSING AT MERLIN PARK MERLIN PARK, GALWAY	
Date 19/03/2021 File G477-MD-20210316.MDX	Designed by AB Checked by DR	
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100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water	Surcharged	Flooded	Pipe		Status	Level Exceeded
									Level (m)	Depth (m)	Volume (m ³)	Flow / Cap.	Overflow (l/s)	Flow (l/s)	
S3.000	S10	15 Winter	100	+20%	30/15 Summer				28.071	0.300	0.000	1.19		81.4	SURCHARGED
S3.001	S11	15 Winter	100	+20%	30/15 Summer				27.510	0.102	0.000	1.60		78.8	SURCHARGED
S4.000	S12	15 Winter	100	+20%					28.388	-0.164	0.000	0.17		17.8	OK
S3.002	S13	15 Winter	100	+20%	100/15 Summer				27.417	0.034	0.000	1.11		92.9	SURCHARGED
S3.003	S14	15 Winter	100	+20%					27.057	-0.143	0.000	0.53		97.8	OK
S3.004	S15	15 Winter	100	+20%					26.381	-0.146	0.000	0.51		104.6	OK
S3.005	S16	15 Winter	100	+20%	100/15 Summer				24.684	0.205	0.000	0.78		118.1	SURCHARGED
S1.008	S17	15 Winter	100	+20%	30/15 Summer				24.222	0.543	0.000	1.22		330.9	SURCHARGED
S1.009	S18	480 Winter	100	+20%	30/15 Summer				23.875	0.702	0.000	0.37		75.1	SURCHARGED
S1.010	S19	480 Winter	100	+20%	5/15 Summer				23.866	1.141	0.000	0.15		15.4	SURCHARGED
S1.011	S20	2880 Winter	100	+20%					21.617	-0.167	0.000	0.15		15.4	OK

APPENDIX E. IRISH WATER CONFIRMATION OF FEASIBILITY

Appendix E

Irish Water Confirmation of Feasibility

David Goaley
OSCS,
Second Floor, Technology House,
Galway Technology Park, Parkmore
Galway

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

4 November 2020

Re: CDS20004597 pre-connection enquiry - Subject to contract | Contract denied

Connection for development of 102 Housing Units & 1. No. Creche at Merlin Park, Co. Galway

Dear Sir/Madam,

Irish Water has reviewed your pre-connection enquiry in relation to a Water & Wastewater connection at Housing Development of 102 Units, 1. No. Creche at Merlin Park, Co. Galway (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 subject to the conditions noted below in the site specific comments section of this feasibility letter.

SERVICE	OUTCOME OF PRE-CONNECTION ENQUIRY <u>THIS IS NOT A CONNECTION OFFER. YOU MUST APPLY FOR A CONNECTION(S) TO THE IRISH WATER NETWORK(S) IF YOU WISH TO PROCEED.</u>
Water Connection	Feasible without infrastructure upgrade by Irish Water. Please see the site specific comments below for further detail.
Wastewater Connection	Feasible Subject to upgrades. Please see the site specific comments below for further information on connection options.
SITE SPECIFIC COMMENTS	
Water Connection	A connection can be facilitated to the 200mm diameter watermain network of the Coillte Mhuirlinne housing estate to the north of your development site. From a preliminary desktop study undertaken it appears that the water infrastructure serving this existing housing estate has been taken in charge..
Wastewater Connection	Option 1 - Connect to 300mm sewer to east of development that conveys flows to the Merlin Park No. 1 Pumping Station. In order to accommodate the proposed connection of this housing development at this connection location upgrade works require to be delivered at Merlin Park No. 1 Pumping Station to provide additional storage. Irish Water is currently delivering a capital project to provide this additional storage. A connection could be facilitated to the 300mm sewer to the east of your development site upon completion of this Irish Water project. The location of this point of

connection is highlighted yellow on the map below.

Option 2 - connect to the existing 225mm sewer to the west of your proposed development lands. This would require agreement to cross third party lands which would be your responsibility to investigate. From a preliminary desktop study undertaken this 225m sewer has a constraint downstream in the Woodhaven estate where the sewer gradient is relatively flat. There is a 300mm sewer which crosses this 225mm sewer at the location highlighted red on the map below. It may be possible to divert a portion of the flows from the 225mm diameter sewer into the 300mm sewer at this location upstream of the constraint. The existing sewers appear to be in third party lands at this location. As a result there may be third party permissions required with the landowners, you would responsible to organise any third party permissions that may be required to facilitate the works associated with the diversion of flows. This work should then eliminate any concern with the existing 225mm sewer having capacity downstream to accommodate the loadings from your proposed development. The 300mm diameter sewer at this location does not discharge to the Merlin Park Pumping Station No. 1, it follows another route towards the city. Therefore, this route of connection would not be dependent on the Merlin Park PS upgrade project being delivered.

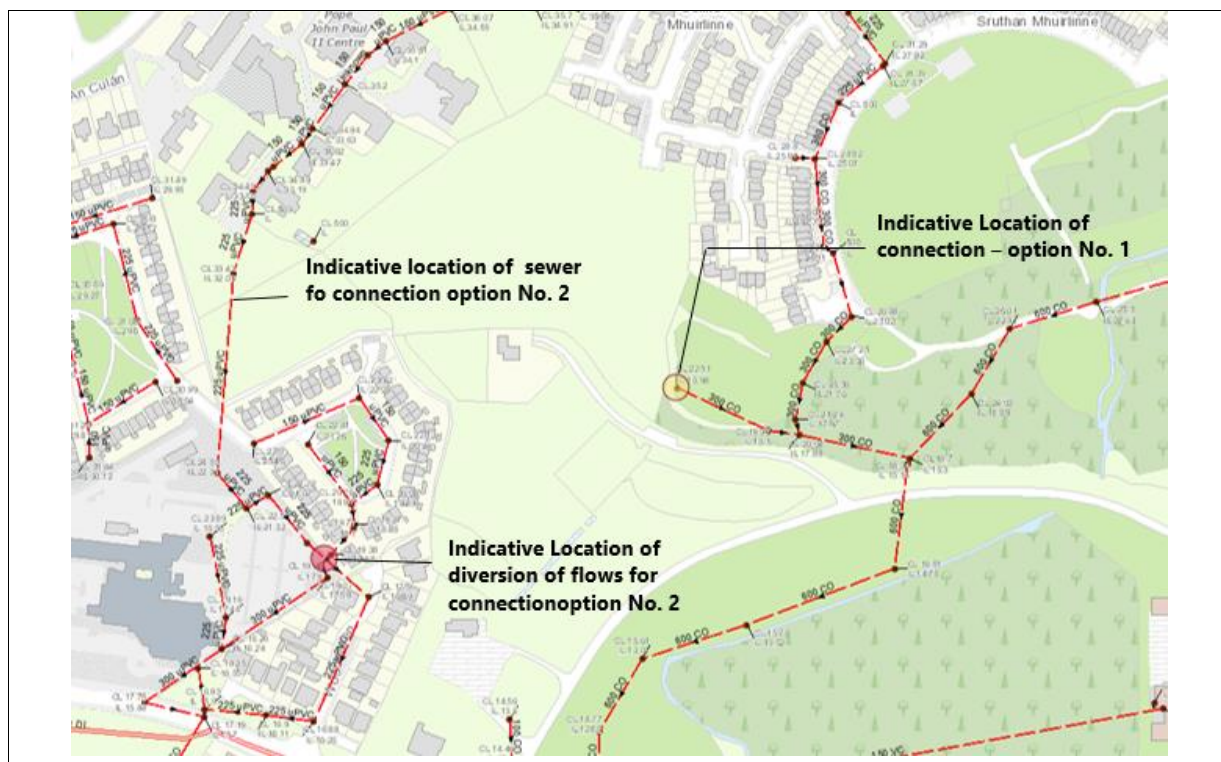
The design and construction of the Water & Wastewater pipes and related infrastructure to be installed in this development shall comply with the Irish Water Connections and Developer Services Standard Details and Codes of Practice that are available on the Irish Water website. Irish Water reserves the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

Strategic Housing Development

Irish Water notes that the scale of this development may dictate that it is subject to the Strategic Housing Development planning process. Therefore in advance of submitting your full application to An Bord Pleanála for assessment, you must have reviewed this development with Irish Water and received a Statement of Design Acceptance in relation to the layout of water and wastewater services. A design proposal for the water and/or wastewater infrastructure can be submitted to cdsdesignqa@water.ie for assessment. All infrastructure should be designed and installed in accordance with the Irish Water Codes of Practice and Standard Details.

The development will be subject to Irish Water's Quality Assurance Requirements for Design and Field Inspections. A design proposal for the water and/or wastewater infrastructure should be submitted to Irish Water for assessment. The overall Quality Assurance requirements will be incorporated into a Connection Agreement at connection application stage as part of a Connection Offer from Irish Water. Please note there is a requirement for wayleaves to be provided along the routes of watermain and wastewater pipes in favour of Irish Water as part of the Connection Agreement. This is to facilitate the vesting of the watermain and wastewater infrastructure. This wayleave requirement extends to the arterial route of connection to the Irish Water network should a connection be proposed via third party/private infrastructure. Further guidance in relation to IW design requirements is available at <https://www.water.ie/connections/developer-services/QA-Design-Req-Manual.pdf>.

The map included below outlines the options for the wastewater connection to the current Irish Water infrastructure:



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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 James O'Malley from the design team at jjomalley@water.ie For further information, visit **www.water.ie/connections**.

Yours sincerely,



Maria O'Dwyer

Connections and Developer Services

APPENDIX F. WASTEWATER DESIGN NETWORK TABLES

- As per Irish Water Code of Practice for Wastewater Infrastructure, IW-CDS-5030-03
- Network Design Tables

Appendix F

Wastewater Design Network Tables

Water and Wastewater Design Calculations

Job Name:	Merlin Woods	Calcs By:	DR
Job No.:	G477	Checked:	DR
Title:	Water & Wastewater Design Calculations	Date:	19-03-2021
Development Type	Standard residential		

Wastewater	
Flow	150 l/person/day
Persons per Unit	2.7
Infiltration	1.1
DWF	446 l/unit
No. of Units	103
No. of People	278.1
DWF	45.938 m3/day
Operating Hours	24
DWF	0.53 l/s
Peaking factor	6
Design Flow (6DWF)	3.19 l/s
Design Flow (6DWF)	275.63 m3/day

Water	
Flow	150 l/person/day
Persons per Unit	2.7
No. of Units	103
Average Daily	41.72 m3/day
Operating Hours	24
Average Daily	0.48 l/s
Average day/Peak Week Factor	1.25
Average day/Peak Week	0.60 l/s
Peaking Factor	5
Peak Demand	3.02 l/s
Peak Demand	260.72 m3/day

Residential Occupancy rates from Appendix C of IW Code of Practice for Wastewater Infrastructure
Flow rates from Appendix D of IW Code of Practice for Wastewater Infrastructure
Infiltration rates from Appendix C of IW Code of Practice for Wastewater Infrastructure
Peaking Factor from Appendix C of IW Code of Practice for Wastewater Infrastructure

Water and Wastewater Design Calculations

Job Name:	Merlin Woods	Calcs By:	DR
Job No.:	G477	Checked:	DR
Title:	Water & Wastewater Design Calculations	Date:	19-03-2021
Development Type	Creche Staff		

Wastewater	
Flow	90 l/person/day
Persons per Unit	6
Infiltration	1.1
DWF	594 l/unit
No. of Units	1
No. of People	6
DWF	0.594 m3/day
Operating Hours	24
DWF	0.01 l/s
Peaking factor	4.5
Design Flow (6DWF)	0.03 l/s
Design Flow (6DWF)	2.67 m3/day

Water	
Flow	90 l/person/day
Persons per Unit	6
No. of Units	1
Average Daily	0.54 m3/day
Operating Hours	24
Average Daily	0.01 l/s
Average day/Peak Week Factor	1.25
Average day/Peak Week	0.01 l/s
Peaking Factor	5
Peak Demand	0.04 l/s
Peak Demand	3.38 m3/day

Residential Occupancy rates from Appendix C of IW Code of Practice for Wastewater Infrastructure
Flow rates from Appendix D of IW Code of Practice for Wastewater Infrastructure
Infiltration rates from Appendix C of IW Code of Practice for Wastewater Infrastructure
Peaking Factor from Appendix C of IW Code of Practice for Wastewater Infrastructure

Water and Wastewater Design Calculations

Job Name:	Merlin Woods	Calcs By:	DR
Job No.:	G477	Checked:	DR
Title:	Water & Wastewater Design Calculations	Date:	19-03-2021
Development Type	Creche Children		

Wastewater	
Flow	50 l/person/day
Persons per Unit	20
Infiltration	1.1
DWF	1100 l/unit
No. of Units	1
No. of People	20
DWF	1.1 m3/day
Operating Hours	24
DWF	0.01 l/s
Peaking factor	4.5
Design Flow (6DWF)	0.06 l/s
Design Flow (6DWF)	4.95 m3/day

Water	
Flow	50 l/person/day
Persons per Unit	20
No. of Units	1
Average Daily	1.00 m3/day
Operating Hours	24
Average Daily	0.01 l/s
Average day/Peak Week Factor	1.25
Average day/Peak Week	0.01 l/s
Peaking Factor	5
Peak Demand	0.07 l/s
Peak Demand	6.25 m3/day

Residential Occupancy rates from Appendix C of IW Code of Practice for Wastewater Infrastructure
Flow rates from Appendix D of IW Code of Practice for Wastewater Infrastructure
Infiltration rates from Appendix C of IW Code of Practice for Wastewater Infrastructure
Peaking Factor from Appendix C of IW Code of Practice for Wastewater Infrastructure

O'Connor Sutton Cronin		Page 2
9 Prussia Street Dublin 7 Ireland	HOUSING AT MERLIN PARK MERLIN PARK, GALWAY	
Date 19/03/2021 File	Designed by AB Checked by DR	
XP Solutions	Network 2019.1	

Network Design Table for Foul - Main

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	Houses	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
WW2.001	66.687	0.333	200.0	0.000	16	0.0	1.500	o	225	Pipe/Conduit	
WW1.005	23.436	0.444	52.8	0.000	2	0.0	1.500	o	225	Pipe/Conduit	
WW3.000	27.793	0.731	38.0	0.000	3	0.0	1.500	o	150	Pipe/Conduit	
WW1.006	47.096	1.590	29.6	0.000	16	0.0	1.500	o	225	Pipe/Conduit	
WW1.007	22.936	0.765	30.0	0.000	0	0.0	1.500	o	225	Pipe/Conduit	
WW4.000	69.285	3.465	20.0	0.000	7	0.0	1.500	o	150	Pipe/Conduit	
WW4.001	52.399	1.300	40.3	0.000	3	0.0	1.500	o	225	Pipe/Conduit	
WW4.002	66.170	0.427	155.0	0.000	12	0.0	1.500	o	225	Pipe/Conduit	
WW1.008	49.682	1.662	29.9	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 (l/s)	Add Flow (l/s)	P.Dep (mm)	P.Vel (m/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
WW2.001	27.771	0.000	0.0	41	0.0	31	0.39	0.81	32.2	1.3
WW1.005	27.437	0.000	0.0	62	0.0	27	0.70	1.58	62.9	1.9
WW3.000	27.800	0.000	0.0	3	0.0	7	0.31	1.42	25.2	0.1
WW1.006	26.993	0.000	0.0	81	0.0	27	0.94	2.11	84.0	2.5
WW1.007	25.403	0.000	0.0	81	0.0	27	0.93	2.10	83.5	2.5
WW4.000	29.384	0.000	0.0	7	0.0	9	0.52	1.97	34.7	0.2
WW4.001	25.844	0.000	0.0	10	0.0	11	0.43	1.81	72.0	0.3
WW4.002	24.544	0.000	0.0	22	0.0	22	0.35	0.92	36.6	0.7
WW1.008	24.117	0.000	0.0	103	0.0	30	1.00	2.10	83.7	3.2

O'Connor Sutton Cronin		Page 3
9 Prussia Street Dublin 7 Ireland	HOUSING AT MERLIN PARK MERLIN PARK, GALWAY	
Date 19/03/2021 File	Designed by AB Checked by DR	
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Network Design Table for Foul - Main

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	Houses	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
WW1.009	19.364	0.968	20.0	0.000	0	0.0	1.500	o	225	Pipe/Conduit	
WW1.010	13.436	0.672	20.0	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)
WW1.009	22.455	0.000	0.0	103	0.0	27	1.15	2.57	102.3
WW1.010	21.487	0.000	0.0	103	0.0	27	1.15	2.57	102.3

Free Flowing Outfall Details for Foul - Main

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
WW1.010	WW-OUTFALL	22.240	20.815	18.980	300	0



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