CLIENT:

PROJECT: Social Housing at St. Olan's Place, Aghabullogue

DOCUMENT TITLE: Engineering Report including Drainage Impact Assessment & Flood Risk Screening Assessment

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Current Issue	Date	Issue Description	Approvals	
			By	Approved
A	17/11/23	Planning Issue	SH	FM
B	23/11/23	Planning Issue	SH	FM

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1.0 INTRODUCTION

1.1 Background

Cork County Council intend to construct eight new houses at St. Olan's Place, Aghabullogue, Co. Cork. This project has a Part VIII exemption under the Planning and Development and Foreshore (Amendment) Act 2022

Cork County Council have engaged DJF Engineering Services Ltd. to provide Engineering services in relation to the preparation of the information package for this development.

1.2 Scope

This Engineering Report sets out the Engineering approach taken for the proposed development in relation to Storm water, Wastewater, and Water supply.
This report also includes a Drainage Impact Assessment and Flood Risk Screening Assessment.

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2.0 SITE

2.1 Location

The proposed site is located on Cork County Council lands at St. Olan's Place, Aghabullogue, Co. Cork adjacent to an existing residential development.

2.2 Site Topography

This is an elevated site approximately 120m above sea level. There is a height difference of approximately 5m across the site falling in a Northerly direction towards a stream on the North West boundary of the site. The stream flows North East before entering the river Delaghinagh.

Groundwater flow is expected to follow the site topography and flow in a Northerly direction.

2.3 Adjacent Land Use

The proposed site is in the North East corner of the Cork County Council lands at St. Olan's Place. There are existing houses in the rest of the Cork County Council plot.

To the North and East there is arable farmland.

2.4 Existing Services

St. Olan's Place is served by existing water supply pipes, wastewater services, electrical services and telecom/data services.

3.0 DRAINAGE IMPACT ASSESSMENT

3.1 Drainage Impact Assessment Scope

This Drainage Impact Assessment (DIA) has been prepared to demonstrate how the development successfully uses Sustainable Urban Drainage Systems (SuDS) and nature based solutions to manage Storm Water within and adjacent to the site.

This DIA has been prepared as per the requirements of the Cork County Development Plan 2022 and the guidance given in Cork County Council Advice Note 1 Storm Water Management published in December 2022.

As the proposed development is for less than 10 residential units and/or less than 500 square meters of new or additional non-residential floorspace, the development is considered to be a “Small-Scale Development".

Table 1 *Nature Based Solutions and Small-Scale Development* of Advice Note 1 states that a DIA for development of less than 10 residential units and/or less than 500 square meters of new or additional non-residential floorspace should include, but is not limited to, the following:

- Full drainage details, drawings, and calculations.
- A SuDS statement incorporating Cork County Council SUDS Selection Hierarchy Sheet for Small Scale Development, showing how design of SuDS have been integrated successfully into the Storm Water management plan for the site.
- All new developments must allow for Climate Change as set out in Table 11.4 of Chapter 11. (For additional technical advice refer to the Cork County Council Strategic Flood Risk Assessment (SFRA) and the Greater Dublin Strategic Drainage Strategy Technical Documents, Volume 5, Climate Change).

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- Show how the 4 pillars of SuDS (Water Quantity, Water Quality, Amenity and Biodiversity) are achieved.

3.2 Storm Water Discharge Philosophy

In order to comply with Objective WM11-10 and paragraph 11.10.4 in the Cork County Development Plan 2022, a softer engineered or 'nature-based approach' shall be used to manage rainfall runoff on the site i.e., by managing and treating Storm Water above-ground rather than sending rainfall below-ground into drains, pipes, attenuation tanks and other 'hard engineering' solutions.

The approach aims to maximise the retention and/or infiltration of storm water runoff on-site and eliminate discharges to the public drainage system, thereby mitigating the drainage impact of the proposed development.

The table overleaf sets out the SuDS measured proposed for this development.

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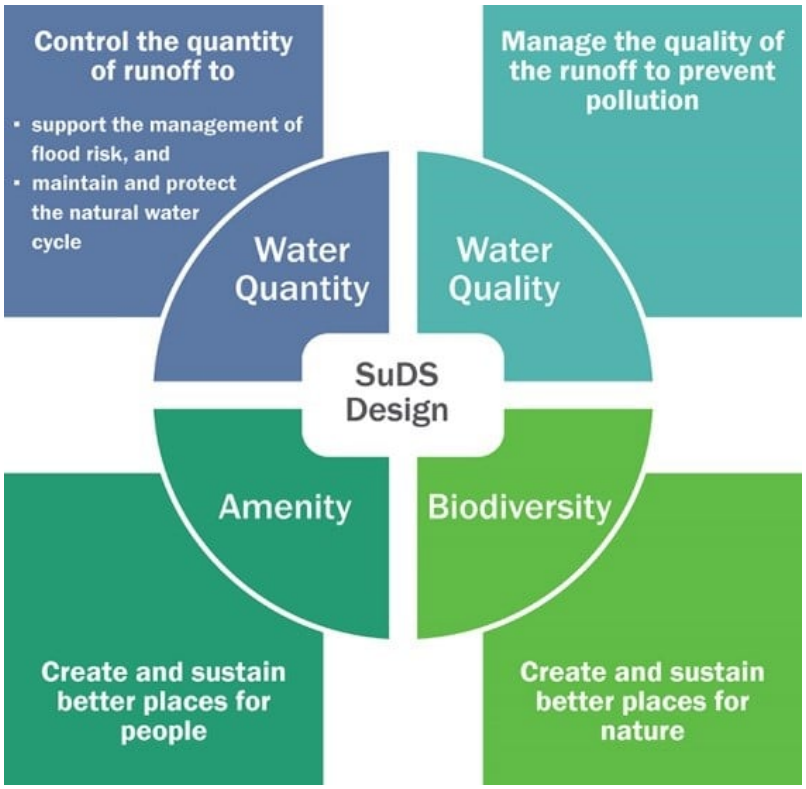
SuDS Selection Hierarchy for Small-Scale Development

SuDS Measure	Image	Measures to be used on site	Rationale for selecting/not selecting measure including discharge rate applied with supporting calculations
Water butt – 150L capacity or more (based water use demand) with means of overflow and tap for watering garden		Yes for rainwater pipes to rear	Cost effective measure, which can be securely positioned on the rear elevations
Permeable paving – consider for all hard paved areas without heavy traffic		No	Proposed parking area will be in the public realm and maybe subject to heavy traffic e.g. by refuse lorries when turning
Bio-retention planter – disconnect downpipe connection into drains and allow roof runoff into planter with means of overflow		No	Limited space available on rear footpaths Planters will require tenant maintenance
Green / Blue Roof – requires a minimum substrate depth (growth medium) of at least 80 mm excluding the vegetative map		No	No suitable roofs on the development
Rain garden - disconnect downpipe/RWP into the planted flower bed		No	Planted areas will require tenant maintenance. Paved areas at the front of houses are proposed to drain into adjacent private green areas.
Soakaways/Infiltration blankets discharging Storm Water collected from roofs and impermeable paving into the ground		Yes	Sites are suitable for discharging Storm Water to ground via infiltration blankets positioned in the rear gardens and in the public realm area – see the appendices for supporting calculations and refer to the proposed drawings

3.3 SuDS Pillars

The four pillars of SuDS are Water Quantity, Water Quality, Amenity and Biodiversity.



Water Quantity

This pillar is achieved by controlling the quantity of runoff from the site of the development through SuDS measures in particular the use of water butts and on site soakaways or infiltration blankets.

Water Quality

This pillar is achieved by having no runoff into a public Storm Water system or watercourse from the development. This mimics the natural catchment and groundwater recharge and manages the quality of runoff to prevent pollution.

Amenity

This pillar is achieved by creating and sustaining better places for people. The proposed development has well-proportioned green spaces to the rear and public open green spaces to the front of the houses.

Biodiversity

This pillar is achieved by creating and sustaining better places for nature. The proposed development has well-proportioned green spaces to the rear and public open green spaces to the front of the houses.

3.4 Storm Water Infiltration Design

It is proposed to construct an on-site storm water disposal system which id designed to discharge storm water to ground and not to overflow into existing watercourses or existing storm water sewers.

The on-site storm water disposal system proposed consists of infiltration blankets in each rear garden to take storm water from each dwelling's roofs and rear patios, and an infiltration blanket to the lower part of the public realm area to take storm water run off from the new public realm area.

Infiltration rates are taken from site investigations carried out by IGSL in September 2023 (refer to the appendices for further information). A 10% factor of safety has been applied to the infiltration rates, i.e. infiltration rates calculated form the average of site tests are reduced by 10%.

Detailed supporting calculations for the design of the infiltration blankets proposed carried out in accordance with CIRIA Report 156 and The SuDS Manual are included in the appendices. In general, 1000mm deep infiltration blankets constructed with single size clean stone are proposed.

The storm water system is designed for the 100-year storm event for critical duration with 20% increase in rainfall depth for climate change.

All storm water from roofs and patios at the rear of each unit are proposed to discharge into proposed infiltration blankets. Storm water from the proposed access road and footpath (proposed public realm areas) are proposed to discharge into proposed infiltration blanket located within public realm.

To reduce the risks of blockages to infiltration blankets, silt traps with mesh screens are proposed upstream of all infiltration blankets.

As an additional emergency safety measure against pluvial flooding, overflow pipes discharging into french drains, which in turn discharge into the stream to the North of the site are proposed.

4.0 FLOOD RISK SCREENING ASSESSMENT

The site is in Flood Risk Zone C and is not at risk of coastal or fluvial flooding. Neither is the elevated site at risk of flooding from nearby streams or drainage ditches or from pluvial flooding.

Therefore, it is considered that flood risk is not an issue for this development.

The proposed design considers the impact of Storm Water flood risks on drainage design. Flood risk from sources other than fluvial and tidal have been reviewed and the proposed floor level has been set to be above adjacent ground levels.

Storm Water discharge from the development is proposed to be drained to ground via suitably designed infiltration blankets (as noted above and as demonstrated in the appendices) with no discharge to the existing public drainage system.

There is no consequential increase in flood risk due to the proposed development.

Given that the site is not at risk of flooding and the proposed development does not increase flood risks, no further flood risk assessment is proposed.

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5.0 WASTE WATER

Uisce Eireann have confirmed that wastewater connections for the proposed development are feasible.

All proposed works are to be in accordance with Irish Water Code of Practice for Waste Water Infrastructure.

For further details, please refer to the drawings and the Irish Water Confirmation of Feasibility in the appendices.

6.0 WATER

Uisce Eireann have confirmed that water supply connections for the proposed development are feasible.

All proposed works are to be in accordance with Irish Water Code of Practice for Water Infrastructure.

For further details, please refer to the drawings and the Irish Water Confirmation of Feasibility in the appendices.

An existing watermain is proposed to be diverted to facilitate the works.

A new fire hydrant is proposed to be positioned adjacent to the public roadway where it can be accessed by fire tenders. This new hydrant will be within 46m of the proposed houses.

Appendix 1

Storm Water Infiltration Calculations

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5008 - STORM WATER HYDRAULIC CALCULATIONS FOR ACCESS ROAD AND FOOTPATH

Infiltration rate 1:	0.000009153	m / sec	=	0.03295	m / h
Infiltration rate 2:	0.000005104	m / sec	=	0.01837	m / h
Infiltration rate 3:	0.000007363	m / sec	=	0.02651	m / h
Infiltration rate 4:	0.000004649	m / sec	=	0.01674	m / h
Average infiltration rate:	0.000006567	m / sec	=	0.02364	m / h
Suggested factor of safety = 10%					
Final infiltration rate:	0.000005911	m / sec	=	0.02128	m / h
n - total porosity				0.50	
q - infiltration coefficient:				0.02128	m / h
A_D - area to be drained:				445	m^2
R - Run-off Co-efficient:				0.90	
A_b - base area of infiltration system:				54.0	m^2
R - drainage ratio = A_D/A_b				7.42	
H_{max} = (D x (R x I - q))/n					

D - storm duration	Rainfall: 100 year storm + 20% increase in depth (for climate change) Return Period Rainfall Depths for sliding Durations Irish Grid: Easting: 144546, Northing: 77414	i - rainfall intensity	H_{max} - maximum depth of water in sub-base with 50% air voids
[h]	[m]	[m/h]	[m]
0.083	0.0137	0.1642	0.199
0.2	0.0191	0.1145	0.276
0.3	0.0224	0.0898	0.322
0.5	0.0289	0.0578	0.408
1.0	0.0371	0.0371	0.508
2.0	0.0476	0.0238	0.622
3.0	0.0552	0.0184	0.692
4.0	0.0612	0.0153	0.738
6.0	0.0709	0.0118	0.797
9.0	0.0821	0.0091	0.835
12.0	0.0911	0.0076	0.841
18.0	0.1054	0.0059	0.798
24.0	0.1169	0.0049	0.713
48.0	0.1373	0.0029	- 0.005
72.0	0.1548	0.0022	- 0.767
96.0	0.1706	0.0018	- 1.553
144.0	0.1988	0.0014	- 3.177
192.0	0.2243	0.0012	- 4.842
240.0	0.2479	0.0010	- 6.534
288.0	0.2702	0.0009	- 8.246
384.0	0.3120	0.0008	- 11.711
480.0	0.3512	0.0007	- 15.214
600.0	0.3977	0.0007	- 19.632

From table above, H_{max} is: 0.841 m

Half - emptying time check T = (n x Hmax) / (2 x q) = 9.88 hour

5008 - STORM WATER HYDRAULIC CALCULATIONS FOR UNIT NO. 12

Infiltration rate 1:	0.000009153	m / sec	=	0.03295	m / h
Infiltration rate 2:	0.000005104	m / sec	=	0.01837	m / h
Infiltration rate 3:	0.000007363	m / sec	=	0.02651	m / h
Infiltration rate 4:	0.000004649	m / sec	=	0.01674	m / h
Average infiltration rate:	0.000006567	m / sec	=	0.02364	m / h
Suggested factor of safety = 10%					
Final infiltration rate:	0.000005911	m / sec	=	0.02128	m / h
n - total porosity				0.50	
q - infiltration coefficient:				0.02128	m / h
A_D - area to be drained:				109	m^2
R - Run-off Co-efficient:				0.90	
A_b - base area of infiltration system:				13.0	m^2
R - drainage ratio = A_D/A_b				7.58	
H_{max} = (D x (R x I - q))/n					

D - storm duration	Rainfall: 100 year storm + 20% increase in depth (for climate change) Return Period Rainfall Depths for sliding Durations Irish Grid: Easting: 144546, Northing: 77414	i - rainfall intensity	H_{max} - maximum depth of water in sub-base with 50% air voids
[h]	[m]	[m/h]	[m]
0.083	0.0137	0.1642	0.204
0.2	0.0191	0.1145	0.282
0.3	0.0224	0.0898	0.330
0.5	0.0289	0.0578	0.417
1.0	0.0371	0.0371	0.520
2.0	0.0476	0.0238	0.637
3.0	0.0552	0.0184	0.710
4.0	0.0612	0.0153	0.758
6.0	0.0709	0.0118	0.820
9.0	0.0821	0.0091	0.862
12.0	0.0911	0.0076	0.871
18.0	0.1054	0.0059	0.832
24.0	0.1169	0.0049	0.751
48.0	0.1373	0.0029	0.039
72.0	0.1548	0.0022	- 0.716
96.0	0.1706	0.0018	- 1.497
144.0	0.1988	0.0014	- 3.112
192.0	0.2243	0.0012	- 4.769
240.0	0.2479	0.0010	- 6.453
288.0	0.2702	0.0009	- 8.157
384.0	0.3120	0.0008	- 11.609
480.0	0.3512	0.0007	- 15.100
600.0	0.3977	0.0007	- 19.502

From table above, H_{max} is: 0.871 m

Half - emptying time check T = (n x Hmax) / (2 x q) = 10.23 hour

5008 - STORM WATER HYDRAULIC CALCULATIONS FOR UNIT NO. 13

Infiltration rate 1:	0.000009153	m / sec	=	0.03295	m / h
Infiltration rate 2:	0.000005104	m / sec	=	0.01837	m / h
Infiltration rate 3:	0.000007363	m / sec	=	0.02651	m / h
Infiltration rate 4:	0.000004649	m / sec	=	0.01674	m / h
Average infiltration rate:	0.000006567	m / sec	=	0.02364	m / h
Suggested factor of safety = 10%					
Final infiltration rate:	0.000005911	m / sec	=	0.02128	m / h
n - total porosity				0.50	
q - infiltration coefficient:				0.02128	m / h
A_D - area to be drained:				78	m^2
R - Run-off Co-efficient:				0.90	
A_b - base area of infiltration system:				8.6	m^2
R - drainage ratio = A_D/A_b				8.15	

H_{max} = (D x (R x I - q))/n

D - storm duration	Rainfall: 100 year storm + 20% increase in depth (for climate change) Return Period Rainfall Depths for sliding Durations Irish Grid: Easting: 144546, Northing: 77414	i - rainfall intensity	H_{max} - maximum depth of water in sub-base with 50% air voids
[h]	[m]	[m/h]	[m]
0.083	0.0137	0.1642	0.219
0.2	0.0191	0.1145	0.304
0.3	0.0224	0.0898	0.355
0.5	0.0289	0.0578	0.450
1.0	0.0371	0.0371	0.562
2.0	0.0476	0.0238	0.691
3.0	0.0552	0.0184	0.772
4.0	0.0612	0.0153	0.827
6.0	0.0709	0.0118	0.901
9.0	0.0821	0.0091	0.955
12.0	0.0911	0.0076	0.974
18.0	0.1054	0.0059	0.951
24.0	0.1169	0.0049	0.884
48.0	0.1373	0.0029	0.195
72.0	0.1548	0.0022	- 0.541
96.0	0.1706	0.0018	- 1.304
144.0	0.1988	0.0014	- 2.887
192.0	0.2243	0.0012	- 4.515
240.0	0.2479	0.0010	- 6.172
288.0	0.2702	0.0009	- 7.851
384.0	0.3120	0.0008	- 11.256
480.0	0.3512	0.0007	- 14.701
600.0	0.3977	0.0007	- 19.051

From table above, H_{max} is: 0.974 m

Half - emptying time check T = (n x Hmax) / (2 x q) = 11.44 hour

5008 - STORM WATER HYDRAULIC CALCULATIONS FOR UNIT NO. 14

Infiltration rate 1:	0.000009153	m / sec	=	0.03295	m / h
Infiltration rate 2:	0.000005104	m / sec	=	0.01837	m / h
Infiltration rate 3:	0.000007363	m / sec	=	0.02651	m / h
Infiltration rate 4:	0.000004649	m / sec	=	0.01674	m / h
Average infiltration rate:	0.000006567	m / sec	=	0.02364	m / h
Suggested factor of safety = 10%					
Final infiltration rate:	0.000005911	m / sec	=	0.02128	m / h
n - total porosity				0.50	
q - infiltration coefficient:				0.02128	m / h
A_D - area to be drained:				79	m^2
R - Run-off Co-efficient:				0.90	
A_b - base area of infiltration system:				8.8	m^2
R - drainage ratio = A_D/A_b				8.10	

H_{max} = (D x (R x I - q))/n

D - storm duration	Rainfall: 100 year storm + 20% increase in depth (for climate change) Return Period Rainfall Depths for sliding Durations Irish Grid: Easting: 144546, Northing: 77414	i - rainfall intensity	H_{max} - maximum depth of water in sub-base with 50% air voids
[h]	[m]	[m/h]	[m]
0.083	0.0137	0.1642	0.218
0.2	0.0191	0.1145	0.302
0.3	0.0224	0.0898	0.353
0.5	0.0289	0.0578	0.447
1.0	0.0371	0.0371	0.558
2.0	0.0476	0.0238	0.687
3.0	0.0552	0.0184	0.767
4.0	0.0612	0.0153	0.821
6.0	0.0709	0.0118	0.894
9.0	0.0821	0.0091	0.947
12.0	0.0911	0.0076	0.965
18.0	0.1054	0.0059	0.941
24.0	0.1169	0.0049	0.872
48.0	0.1373	0.0029	0.181
72.0	0.1548	0.0022	- 0.556
96.0	0.1706	0.0018	- 1.321
144.0	0.1988	0.0014	- 2.907
192.0	0.2243	0.0012	- 4.537
240.0	0.2479	0.0010	- 6.197
288.0	0.2702	0.0009	- 7.878
384.0	0.3120	0.0008	- 11.287
480.0	0.3512	0.0007	- 14.737
600.0	0.3977	0.0007	- 19.091

From table above, H_{max} is: 0.965 m

Half - emptying time check T = (n x Hmax) / (2 x q) = 11.34 hour

5008 - STORM WATER HYDRAULIC CALCULATIONS FOR UNIT NO. 15

Infiltration rate 1:	0.000009153	m / sec	=	0.03295	m / h
Infiltration rate 2:	0.000005104	m / sec	=	0.01837	m / h
Infiltration rate 3:	0.000007363	m / sec	=	0.02651	m / h
Infiltration rate 4:	0.000004649	m / sec	=	0.01674	m / h
Average infiltration rate:	0.000006567	m / sec	=	0.02364	m / h
Suggested factor of safety = 10%					
Final infiltration rate:	0.000005911	m / sec	=	0.02128	m / h
n - total porosity				0.50	
q - infiltration coefficient:				0.02128	m / h
A_D - area to be drained:				79	m^2
R - Run-off Co-efficient:				0.90	
A_b - base area of infiltration system:				8.8	m^2
R - drainage ratio = A_D/A_b				8.10	

H_{max} = (D x (R x I - q))/n

D - storm duration	Rainfall: 100 year storm + 20% increase in depth (for climate change) Return Period Rainfall Depths for sliding Durations Irish Grid: Easting: 144546, Northing: 77414	i - rainfall intensity	H_{max} - maximum depth of water in sub-base with 50% air voids
[h]	[m]	[m/h]	[m]
0.083	0.0137	0.1642	0.218
0.2	0.0191	0.1145	0.302
0.3	0.0224	0.0898	0.353
0.5	0.0289	0.0578	0.447
1.0	0.0371	0.0371	0.558
2.0	0.0476	0.0238	0.687
3.0	0.0552	0.0184	0.767
4.0	0.0612	0.0153	0.821
6.0	0.0709	0.0118	0.894
9.0	0.0821	0.0091	0.947
12.0	0.0911	0.0076	0.965
18.0	0.1054	0.0059	0.941
24.0	0.1169	0.0049	0.872
48.0	0.1373	0.0029	0.181
72.0	0.1548	0.0022	- 0.556
96.0	0.1706	0.0018	- 1.321
144.0	0.1988	0.0014	- 2.907
192.0	0.2243	0.0012	- 4.537
240.0	0.2479	0.0010	- 6.197
288.0	0.2702	0.0009	- 7.878
384.0	0.3120	0.0008	- 11.287
480.0	0.3512	0.0007	- 14.737
600.0	0.3977	0.0007	- 19.091

From table above, H_{max} is: 0.965 m

Half - emptying time check T = (n x Hmax) / (2 x q) = 11.34 hour

5008 - STORM WATER HYDRAULIC CALCULATIONS FOR UNIT NO. 16

Infiltration rate 1:	0.000009153	m / sec	=	0.03295	m / h
Infiltration rate 2:	0.000005104	m / sec	=	0.01837	m / h
Infiltration rate 3:	0.000007363	m / sec	=	0.02651	m / h
Infiltration rate 4:	0.000004649	m / sec	=	0.01674	m / h
Average infiltration rate:	0.000006567	m / sec	=	0.02364	m / h
Suggested factor of safety = 10%					
Final infiltration rate:	0.000005911	m / sec	=	0.02128	m / h
n - total porosity				0.50	
q - infiltration coefficient:				0.02128	m / h
A_D - area to be drained:				79	m^2
R - Run-off Co-efficient:				0.90	
A_b - base area of infiltration system:				8.8	m^2
R - drainage ratio = A_D/A_b				8.10	
H_{max} = (D x (R x I - q))/n					

D - storm duration	Rainfall: 100 year storm + 20% increase in depth (for climate change) Return Period Rainfall Depths for sliding Durations Irish Grid: Easting: 144546, Northing: 77414	i - rainfall intensity	H_{max} - maximum depth of water in sub-base with 50% air voids
[h]	[m]	[m/h]	[m]
0.083	0.0137	0.1642	0.218
0.2	0.0191	0.1145	0.302
0.3	0.0224	0.0898	0.353
0.5	0.0289	0.0578	0.447
1.0	0.0371	0.0371	0.558
2.0	0.0476	0.0238	0.687
3.0	0.0552	0.0184	0.767
4.0	0.0612	0.0153	0.821
6.0	0.0709	0.0118	0.894
9.0	0.0821	0.0091	0.947
12.0	0.0911	0.0076	0.965
18.0	0.1054	0.0059	0.941
24.0	0.1169	0.0049	0.872
48.0	0.1373	0.0029	0.181
72.0	0.1548	0.0022	- 0.556
96.0	0.1706	0.0018	- 1.321
144.0	0.1988	0.0014	- 2.907
192.0	0.2243	0.0012	- 4.537
240.0	0.2479	0.0010	- 6.197
288.0	0.2702	0.0009	- 7.878
384.0	0.3120	0.0008	- 11.287
480.0	0.3512	0.0007	- 14.737
600.0	0.3977	0.0007	- 19.091

From table above, H_{max} is: 0.965 m

Half - emptying time check T = (n x Hmax) / (2 x q) = 11.34 hour

5008 - STORM WATER HYDRAULIC CALCULATIONS FOR UNIT NO. 17

Infiltration rate 1:	0.000009153	m / sec	=	0.03295	m / h
Infiltration rate 2:	0.000005104	m / sec	=	0.01837	m / h
Infiltration rate 3:	0.000007363	m / sec	=	0.02651	m / h
Infiltration rate 4:	0.000004649	m / sec	=	0.01674	m / h
Average infiltration rate:	0.000006567	m / sec	=	0.02364	m / h
Suggested factor of safety = 10%					
Final infiltration rate:	0.000005911	m / sec	=	0.02128	m / h
n - total porosity				0.50	
q - infiltration coefficient:				0.02128	m / h
A_D - area to be drained:				77	m^2
R - Run-off Co-efficient:				0.90	
A_b - base area of infiltration system:				8.8	m^2
R - drainage ratio = A_D/A_b				7.88	
H_{max} = (D x (R x I - q))/n					

D - storm duration	Rainfall: 100 year storm + 20% increase in depth (for climate change) Return Period Rainfall Depths for sliding Durations Irish Grid: Easting: 144546, Northing: 77414	i - rainfall intensity	H_{max} - maximum depth of water in sub-base with 50% air voids
[h]	[m]	[m/h]	[m]
0.083	0.0137	0.1642	0.212
0.2	0.0191	0.1145	0.294
0.3	0.0224	0.0898	0.343
0.5	0.0289	0.0578	0.435
1.0	0.0371	0.0371	0.542
2.0	0.0476	0.0238	0.666
3.0	0.0552	0.0184	0.743
4.0	0.0612	0.0153	0.795
6.0	0.0709	0.0118	0.863
9.0	0.0821	0.0091	0.911
12.0	0.0911	0.0076	0.925
18.0	0.1054	0.0059	0.895
24.0	0.1169	0.0049	0.822
48.0	0.1373	0.0029	0.122
72.0	0.1548	0.0022	- 0.623
96.0	0.1706	0.0018	- 1.395
144.0	0.1988	0.0014	- 2.993
192.0	0.2243	0.0012	- 4.634
240.0	0.2479	0.0010	- 6.304
288.0	0.2702	0.0009	- 7.995
384.0	0.3120	0.0008	- 11.422
480.0	0.3512	0.0007	- 14.888
600.0	0.3977	0.0007	- 19.263

From table above, H_{max} is: 0.925 m

Half - emptying time check T = (n x Hmax) / (2 x q) = 10.87 hour

5008 - STORM WATER HYDRAULIC CALCULATIONS FOR UNIT NO. 18

Infiltration rate 1:	0.000009153	m / sec	=	0.03295	m / h
Infiltration rate 2:	0.000005104	m / sec	=	0.01837	m / h
Infiltration rate 3:	0.000007363	m / sec	=	0.02651	m / h
Infiltration rate 4:	0.000004649	m / sec	=	0.01674	m / h
Average infiltration rate:	0.000006567	m / sec	=	0.02364	m / h
Suggested factor of safety = 10%					
Final infiltration rate:	0.000005911	m / sec	=	0.02128	m / h
n - total porosity				0.50	
q - infiltration coefficient:				0.02128	m / h
A_D - area to be drained:				77	m^2
R - Run-off Co-efficient:				0.90	
A_b - base area of infiltration system:				8.8	m^2
R - drainage ratio = A_D/A_b				7.88	
H_{max} = (D x (R x I - q))/n					

D - storm duration	Rainfall: 100 year storm + 20% increase in depth (for climate change) Return Period Rainfall Depths for sliding Durations Irish Grid: Easting: 144546, Northing: 77414	i - rainfall intensity	H_{max} - maximum depth of water in sub-base with 50% air voids
[h]	[m]	[m/h]	[m]
0.083	0.0137	0.1642	0.212
0.2	0.0191	0.1145	0.294
0.3	0.0224	0.0898	0.343
0.5	0.0289	0.0578	0.435
1.0	0.0371	0.0371	0.542
2.0	0.0476	0.0238	0.666
3.0	0.0552	0.0184	0.743
4.0	0.0612	0.0153	0.795
6.0	0.0709	0.0118	0.863
9.0	0.0821	0.0091	0.911
12.0	0.0911	0.0076	0.925
18.0	0.1054	0.0059	0.895
24.0	0.1169	0.0049	0.822
48.0	0.1373	0.0029	0.122
72.0	0.1548	0.0022	- 0.623
96.0	0.1706	0.0018	- 1.395
144.0	0.1988	0.0014	- 2.993
192.0	0.2243	0.0012	- 4.634
240.0	0.2479	0.0010	- 6.304
288.0	0.2702	0.0009	- 7.995
384.0	0.3120	0.0008	- 11.422
480.0	0.3512	0.0007	- 14.888
600.0	0.3977	0.0007	- 19.263

From table above, H_{max} is: 0.925 m

Half - emptying time check T = (n x Hmax) / (2 x q) = 10.87 hour

5008 - STORM WATER HYDRAULIC CALCULATIONS FOR UNIT NO. 19

Infiltration rate 1:	0.000009153	m / sec	=	0.03295	m / h
Infiltration rate 2:	0.000005104	m / sec	=	0.01837	m / h
Infiltration rate 3:	0.000007363	m / sec	=	0.02651	m / h
Infiltration rate 4:	0.000004649	m / sec	=	0.01674	m / h
Average infiltration rate:	0.000006567	m / sec	=	0.02364	m / h
Suggested factor of safety = 10%					
Final infiltration rate:	0.000005911	m / sec	=	0.02128	m / h
n - total porosity				0.50	
q - infiltration coefficient:				0.02128	m / h
A_D - area to be drained:				142	m^2
R - Run-off Co-efficient:				0.90	
A_b - base area of infiltration system:				15.5	m^2
R - drainage ratio = A_D/A_b				8.23	
H_{max} = (D x (R x I - q))/n					

D - storm duration	Rainfall: 100 year storm + 20% increase in depth (for climate change) Return Period Rainfall Depths for sliding Durations Irish Grid: Easting: 144546, Northing: 77414	i - rainfall intensity	H_{max} - maximum depth of water in sub-base with 50% air voids
[h]	[m]	[m/h]	[m]
0.083	0.0137	0.1642	0.222
0.2	0.0191	0.1145	0.307
0.3	0.0224	0.0898	0.359
0.5	0.0289	0.0578	0.455
1.0	0.0371	0.0371	0.568
2.0	0.0476	0.0238	0.699
3.0	0.0552	0.0184	0.781
4.0	0.0612	0.0153	0.837
6.0	0.0709	0.0118	0.912
9.0	0.0821	0.0091	0.968
12.0	0.0911	0.0076	0.989
18.0	0.1054	0.0059	0.968
24.0	0.1169	0.0049	0.903
48.0	0.1373	0.0029	0.217
72.0	0.1548	0.0022	- 0.516
96.0	0.1706	0.0018	- 1.276
144.0	0.1988	0.0014	- 2.855
192.0	0.2243	0.0012	- 4.479
240.0	0.2479	0.0010	- 6.132
288.0	0.2702	0.0009	- 7.808
384.0	0.3120	0.0008	- 11.205
480.0	0.3512	0.0007	- 14.645
600.0	0.3977	0.0007	- 18.987

From table above, H_{max} is: 0.989 m

Half - emptying time check T = (n x Hmax) / (2 x q) = 11.62 hour

Met Eireann
Return Period Rainfall Depths for sliding Durations
Irish Grid: Easting: 144546, Northing: 77414,

	Interval		Years												
DURATION	6months,	1year,	2,	3,	4,	5,	10,	20,	30,	50,	75,	100,	150,	200,	250,	500,
5 mins	3.0,	4.0,	4.4,	5.1,	5.6,	5.9,	7.0,	8.1,	8.9,	9.9,	10.8,	11.4,	12.4,	13.2,	13.8,	N/A ,
10 mins	4.2,	5.5,	6.2,	7.1,	7.7,	8.2,	9.7,	11.3,	12.4,	13.8,	15.0,	15.9,	17.3,	18.4,	19.3,	N/A ,
15 mins	5.0,	6.5,	7.3,	8.4,	9.1,	9.7,	11.4,	13.3,	14.5,	16.2,	17.7,	18.7,	20.4,	21.7,	22.7,	N/A ,
30 mins	6.8,	8.8,	9.8,	11.2,	12.1,	12.8,	15.0,	17.4,	18.9,	21.0,	22.7,	24.1,	26.1,	27.6,	28.9,	N/A ,
1 hours	9.4,	11.9,	13.2,	15.0,	16.1,	17.0,	19.8,	22.8,	24.6,	27.1,	29.3,	30.9,	33.4,	35.2,	36.7,	N/A ,
2 hours	12.9,	16.1,	17.7,	20.0,	21.5,	22.6,	26.1,	29.7,	32.0,	35.1,	37.7,	39.7,	42.7,	44.9,	46.7,	N/A ,
3 hours	15.5,	19.3,	21.1,	23.7,	25.4,	26.7,	30.6,	34.8,	37.3,	40.8,	43.8,	46.0,	49.3,	51.8,	53.8,	N/A ,
4 hours	17.7,	21.8,	23.9,	26.8,	28.6,	30.0,	34.3,	38.8,	41.7,	45.4,	48.6,	51.0,	54.6,	57.3,	59.4,	N/A ,
6 hours	21.3,	26.1,	28.4,	31.8,	33.9,	35.5,	40.3,	45.4,	48.6,	52.8,	56.4,	59.1,	63.0,	66.0,	68.4,	N/A ,
9 hours	25.6,	31.2,	33.9,	37.6,	40.1,	41.9,	47.4,	53.1,	56.7,	61.4,	65.4,	68.4,	72.8,	76.1,	78.7,	N/A ,
12 hours	29.2,	35.3,	38.3,	42.5,	45.1,	47.1,	53.1,	59.4,	63.2,	68.3,	72.6,	75.9,	80.6,	84.2,	87.0,	N/A ,
18 hours	35.1,	42.2,	45.6,	50.4,	53.4,	55.6,	62.4,	69.4,	73.7,	79.4,	84.3,	87.8,	93.1,	97.0,	100.2,	N/A ,
24 hours	40.1,	47.9,	51.6,	56.8,	60.1,	62.5,	69.9,	77.6,	82.2,	88.4,	93.6,	97.4,	103.1,	107.3,	110.7,	121.8,
2 days	50.2,	59.2,	63.5,	69.4,	73.1,	75.8,	84.1,	92.6,	97.8,	104.6,	110.2,	114.4,	120.6,	125.1,	128.8,	140.8,
3 days	58.8,	68.8,	73.6,	80.1,	84.1,	87.1,	96.2,	105.4,	111.0,	118.4,	124.5,	129.0,	135.6,	140.5,	144.4,	157.3,
4 days	66.5,	77.5,	82.6,	89.7,	94.1,	97.3,	107.1,	117.0,	123.0,	130.8,	137.4,	142.2,	149.2,	154.4,	158.5,	172.1,
6 days	80.5,	93.1,	98.9,	106.9,	111.9,	115.6,	126.6,	137.7,	144.4,	153.1,	160.4,	165.7,	173.5,	179.2,	183.8,	198.7,
8 days	93.3,	107.2,	113.7,	122.6,	128.1,	132.1,	144.2,	156.4,	163.7,	173.2,	181.1,	186.9,	195.4,	201.6,	206.5,	222.6,
10 days	105.3,	120.5,	127.6,	137.2,	143.2,	147.6,	160.7,	173.8,	181.6,	191.9,	200.4,	206.6,	215.6,	222.3,	227.6,	244.8,
12 days	116.7,	133.2,	140.8,	151.1,	157.5,	162.2,	176.2,	190.2,	198.6,	209.6,	218.6,	225.2,	234.8,	241.8,	247.4,	265.7,
16 days	138.4,	157.1,	165.7,	177.4,	184.5,	189.8,	205.5,	221.2,	230.5,	242.7,	252.7,	260.0,	270.7,	278.4,	284.6,	304.7,
20 days	159.1,	179.8,	189.3,	202.2,	210.1,	215.9,	233.1,	250.3,	260.5,	273.8,	284.7,	292.7,	304.2,	312.7,	319.4,	341.2,
25 days	183.9,	206.9,	217.5,	231.8,	240.5,	247.0,	266.0,	284.9,	296.1,	310.7,	322.6,	331.4,	344.0,	353.2,	360.6,	384.3,

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

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

Contract: Cork Housing Projects SITE C - Agabolluge Contract No. 24961
Test No. SK01 Stage 1
Client Cork Co Co
Date: 26/09/2023

Summary of ground conditions

from	to	Description	Ground water
0.00	0.15	Topsoil	None observed
0.15	0.60	Firm brown sandy gravelly CLAY	
0.60	1.60	Firm to stiff pruple sandy gravelly CLAY	

Notes:

Field Data

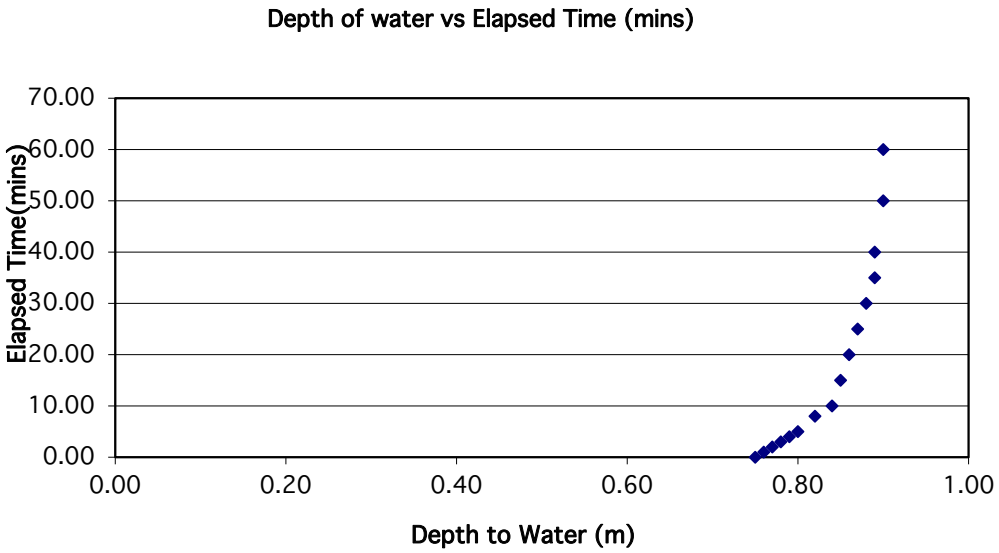
Depth to Water (m)	Elapsed Time (min)
0.75	0.00
0.76	1.00
0.77	2.00
0.78	3.00
0.79	4.00
0.80	5.00
0.82	8.00
0.84	10.00
0.85	15.00
0.86	20.00
0.87	25.00
0.88	30.00
0.89	35.00
0.89	40.00
0.90	50.00
0.90	60.00

Field Test

Depth of Pit (D)	1.60	m
Width of Pit (B)	0.60	m
Length of Pit (L)	1.60	m
Initial depth to Water =	0.75	m
Final depth to water =	0.90	m
Elapsed time (mins)=	60.00	
Top of permeable soil		m
Base of permeable soil		m
Base area=	0.96	m2
*Av. side area of permeable stratum over test period	3.41	m2
Total Exposed area =	4.37	m2

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

f= 0.00055 m/min or 9.153E-06 m/sec



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

Contract: Cork Housing Projects SITE C - Agabolluge Contract No. 24961
Test No. SK01 Stage 2
Client Cork Co Co
Date: 26/09/2023

Summary of ground conditions

from	to	Description	Ground water
0.00	0.15	Topsoil	None observed
0.15	0.60	Firm brown sandy gravelly CLAY	
0.60	1.60	Firm to stiff pruple sandy gravelly CLAY	

Notes:

Field Data

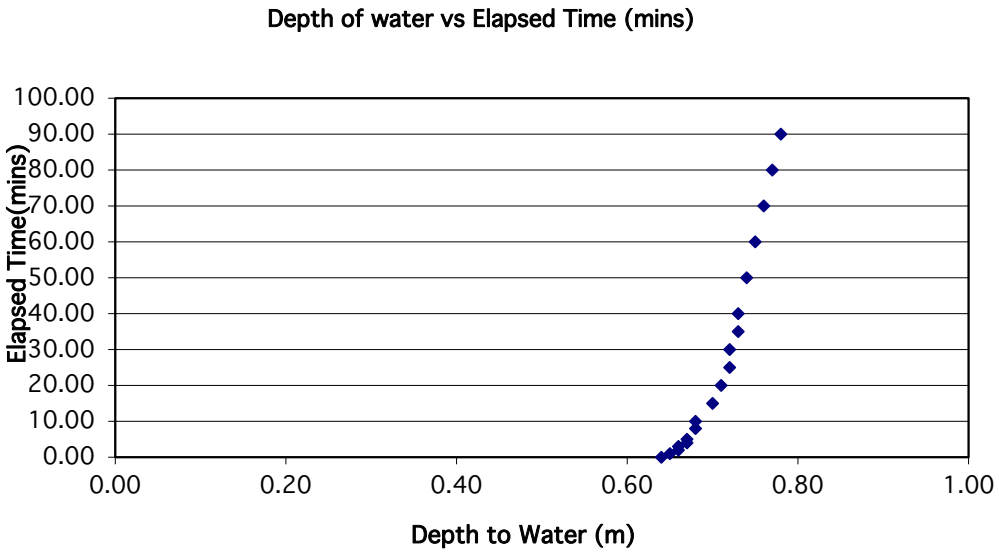
Depth to Water (m)	Elapsed Time (min)
0.64	0.00
0.65	1.00
0.66	2.00
0.66	3.00
0.67	4.00
0.67	5.00
0.68	8.00
0.68	10.00
0.70	15.00
0.71	20.00
0.72	25.00
0.72	30.00
0.73	35.00
0.73	40.00
0.74	50.00
0.75	60.00
0.76	70.00
0.77	80.00
0.78	90.00

Field Test

Depth of Pit (D)	1.60	m
Width of Pit (B)	0.60	m
Length of Pit (L)	1.60	m
Initial depth to Water =	0.64	m
Final depth to water =	0.78	m
Elapsed time (mins)=	90.00	
Top of permeable soil		m
Base of permeable soil		m
Base area=	0.96	m2
*Av. side area of permeable stratum over test period	3.916	m2
Total Exposed area =	4.876	m2

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

f= 0.00031 m/min or 5.104E-06 m/sec



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

Contract: Cork Housing Projects SITE C - Agabolluge Contract No. 24961
Test No. SK02 Stage 1
Client Cork Co Co
Date: 26/09/2023

Summary of ground conditions

from	to	Description	Ground water
0.00	0.15	Topsoil	None observed
0.15	0.70	Firm brown sandy gravelly CLAY	
0.70	1.60	Firm to stiff pruple sandy gravelly CLAY	

Notes:

Field Data

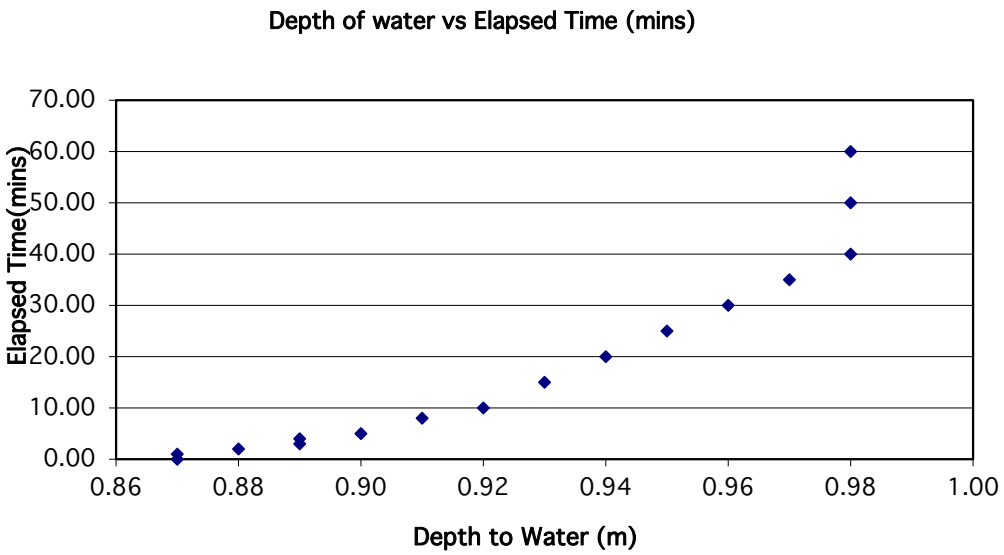
Depth to Water (m)	Elapsed Time (min)
0.87	0.00
0.87	1.00
0.88	2.00
0.89	3.00
0.89	4.00
0.90	5.00
0.91	8.00
0.92	10.00
0.93	15.00
0.94	20.00
0.95	25.00
0.96	30.00
0.97	35.00
0.98	40.00
0.98	50.00
0.98	60.00

Field Test

Depth of Pit (D)	1.60	m
Width of Pit (B)	0.60	m
Length of Pit (L)	1.50	m
Initial depth to Water =	0.87	m
Final depth to water =	0.98	m
Elapsed time (mins)=	60.00	
Top of permeable soil		m
Base of permeable soil		m
Base area=	0.9	m2
*Av. side area of permeable stratum over test perio	2.835	m2
Total Exposed area =	3.735	m2

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

f= 0.00044 m/min or 7.363E-06 m/sec



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

Contract: Cork Housing Projects SITE C - Agabolluge Contract No. 24961
Test No. SK02 Stage 2
Client Cork Co Co
Date: 26/09/2023

Summary of ground conditions

from	to	Description	Ground water
0.00	0.15	Topsoil	None observed
0.15	0.70	Firm brown sandy gravelly CLAY	
0.70	1.60	Firm to stiff pruple sandy gravelly CLAY	

Notes:

Field Data

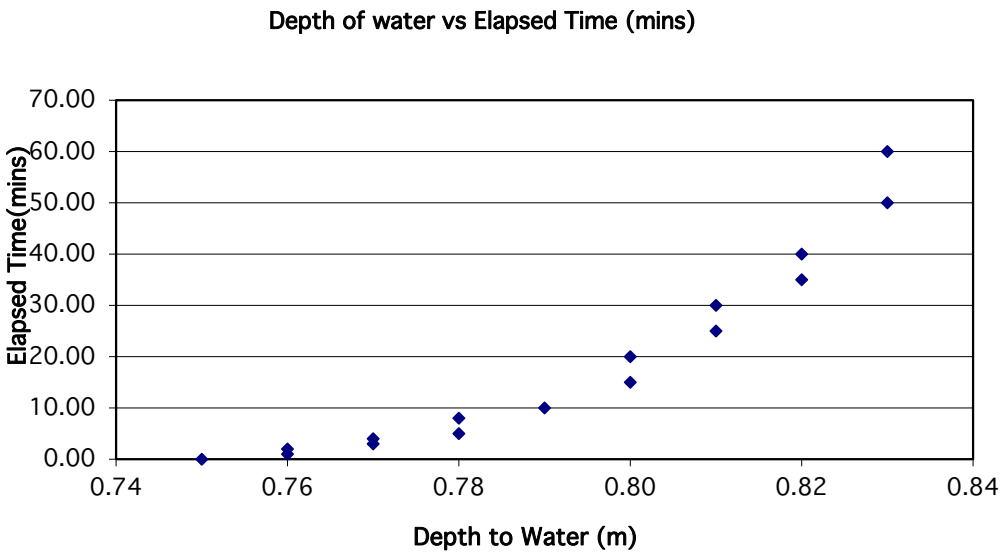
Depth to Water (m)	Elapsed Time (min)
0.75	0.00
0.76	1.00
0.76	2.00
0.77	3.00
0.77	4.00
0.78	5.00
0.78	8.00
0.79	10.00
0.80	15.00
0.80	20.00
0.81	25.00
0.81	30.00
0.82	35.00
0.82	40.00
0.83	50.00
0.83	60.00

Field Test

Depth of Pit (D)	1.60	m
Width of Pit (B)	0.60	m
Length of Pit (L)	1.50	m
Initial depth to Water =	0.75	m
Final depth to water =	0.83	m
Elapsed time (mins)=	60.00	
Top of permeable soil		m
Base of permeable soil		m
Base area=	0.9	m2
*Av. side area of permeable stratum over test period	3.402	m2
Total Exposed area =	4.302	m2

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

f= 0.00028 m/min or 4.649E-06 m/sec



DETERMINATION OF LOOSE/COMPACTED BULK DENSITY EN 1097-3: 1998

Sample Ref.	:	Cl. 505 Type B Filter material
Supplier	:	Roadstone - Ryans Quarry Ennis
Mass of sample tested	:	20160.0g
Artificially heated before test	:	Unknown
Method of Test	:	EN 1097-3: 1998

Results:

Loose Bulk Density	;	1.36 Mg/m^3
Voids content	;	50 %

Appendix 2

Irish Water Confirmation of Feasibility

QUALITY
ISO 9001:2015
NSAI Certified

CONFIRMATION OF FEASIBILITY

Uisce Éireann
Bosca OP448
Oifig Sheachadta na
Cathrach Theas
Cathair Chorcaí

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

www.water.ie

Sinead Kelleher

Cork County Council
County Hall
Carrigrohane Road
Cork
Co. Cork
T12 R2NC

11 April 2023

Our Ref: CDS23001855 Pre-Connection Enquiry
St. Olan's Place, Aghabullogue, Co. Cork

Dear Applicant/Agent,

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

Irish Water has reviewed the pre-connection enquiry in relation to a Water & Wastewater connection for a Housing Development of 6 unit(s) at St. Olan's Place, Aghabullogue, Co. Cork **(the Development)**.

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

- **Water Connection** - Feasible without infrastructure upgrade by Irish Water
- **Wastewater Connection** - Feasible without infrastructure upgrade by Irish Water

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

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

Stiúrthóirí / Directors: Tony Keohane (Chairman), Niall Gleeson (CEO), Christopher Banks, Fred Barry, Gerard Britchfield, Liz Joyce, Patricia King, Eileen Maher, Cathy Mannion, Michael Walsh
Oifig Chláraithe / Registered Office: Teach Colvill, 24-26 Sráid Thalbóid, Baile Átha Cliath 1, D01 NP86 / Colvill House, 24-26 Talbot Street, Dublin 1 D01 NP86
Is cuideachta ghníomhaíochta ainmnithe atá faoi theorainn scaireanna é Uisce Éireann / Irish Water is a designated activity company, limited by shares.
Uimhir Chláraithe in Éirinn / Registered in Ireland No.: 530363

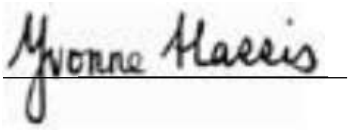
Where can you find more information?

- **Section A -** What is important to know?

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

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

Yours sincerely,



Yvonne Harris
Head of Customer Operations

Section A - What is important to know?

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

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