Comhairle Contae Átha Cliath Theas
South Dublin County Council

DOCUMENT LEAD SHEET

ENGINEERING SERVICES REPORT

DOC. NO: P2005-C-001

PROJECT: U-STORE-IT, LIFFEY VALLEY

STATUS: PLANNING PERMISSION

CLIENT: OCEANGLADE LTD

ARCHITECT: CAREW KELLY ARCHITECTS

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Where this document has been revised it is recorded as indicated below. Please replace all superseded pages of this document with current version.

Rev	Date	Description	By	Checked	Approvals	
P1	14 Oct 2021	Planning Submission	SJ	GD/CP		

☑ Entire Document Issued this Revision	

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APPENDICES

1.0 INTRODUCTION

This Engineering Services Report (ESR) has been prepared by GDCL Consulting Engineers on behalf of U-Store-It which relates to the proposed residential development located at the Liffey Valley Complex, Fonthill Rd, Quarryvale, Co. Dublin. The site location is shown in Figure 1 below:

Figure 1 – Site Location Map

The site is approximately 0.73ha in area and is bordered to the west by a Giraffe Childcare facility and greenfield site, to the east by a multi-storey office complex, to the west by an An Post distribution facility, to the south by Liffey Valley Complex service road, and to the north by the N4 Motorway.

The proposed development will consist of the construction of a storage facility comprising two floors over a drive-in basement, comprising of:

- Reception/admin office/toilets on the ground floor
- Walk in storage units from the ground floor upwards
- A commercial unit on the ground floor

- Drive in storage units at basement level

The proposed development forms part of a larger site previously granted planning permission under Planning Register Reference S99A/0948 & S01A/0332, with much of the external drainage and watermain infrastructure already constructed.

The proposed development site is accessible at ground floor level via the existing has a single-entry point on the Liffey Valley Complex service road with the drive-in basement/under croft level accessible by an existing access road to the east of the proposed site, currently serving the adjacent office complex.

The site is located within the South Dublin County Council Development Plan 2016 - 2022 Map 2 boundary and zoned as Objective MRC - *'To protect, improve and provide for the future development of a Major Retail Centre'*. Please refer to the below Figure for details.

Use Zoning Objectives

Objective RES	To protect and/or improve residential amenity
Objective RES-N	To provide for new residential communities in accordance with approved area plans
Objective SDZ	To provide for strategic development in accordance with approved planning schemes
Objective REGEN	To facilitate enterprise and/or residential-led regeneration
Objective TC	To protect, improve and provide for the future development of Town Centres
Objective MRC	To protect, improve and provide for the future development of a Major Retail Centre

Figure 2 - South Dublin County Council Development Plan 2016 - 2022 Map 2 Excerpt

The aim of this report is to provide information on the calculations, estimates and assumptions used to design the foul drains, surface water drains, SuDS systems, surface water attenuation and water supply for the proposed development.

Foul and surface water systems for the site will be separate and are designed in accordance

with the requirements of South Dublin County Council, the recommendations of the Greater Dublin Strategic Drainage Study (GDSDS), the Building Regulations and the recommendations of the DOE Recommendations for Site development works for Housing areas. In addition, sewers have been designed with reference to the 'The Planning System and Flood Risk Management Guidelines', the Greater Dublin Regional Code of Practice for drainage works and Irish Water Standards Details for water and wastewater as applicable.

2.0 EXISTING SITE SERVICES

Murphy Matson O'Sullivan (MMOS) Consulting Engineers were requested by Barkhill Limited to undertake a study of the existing services within and in the immediate vicinity of the 3no. sites, Lots 1, 2 & 3 at Liffey Valley in Dublin 22. A report was produced on 9th of September 2019. The site which is the subject of this planning application forms part of Lot 2 of the original masterplan.

The Local Road to the east of the subject site has not been taken in charge by South Dublin County Council, and the detail of Foul and Surface water drainage in this road and within the surrounding area is therefore not indicated on the Irish Water/SDCC existing record drawings.

Figure 3 - Irish Water Drainage Records

The above-mentioned report compiled by MMOS Consulting Engineers indicates that there is existing drainage and watermain services adjacent to the proposed development. Please refer to Appendix C and the below Figure for details:

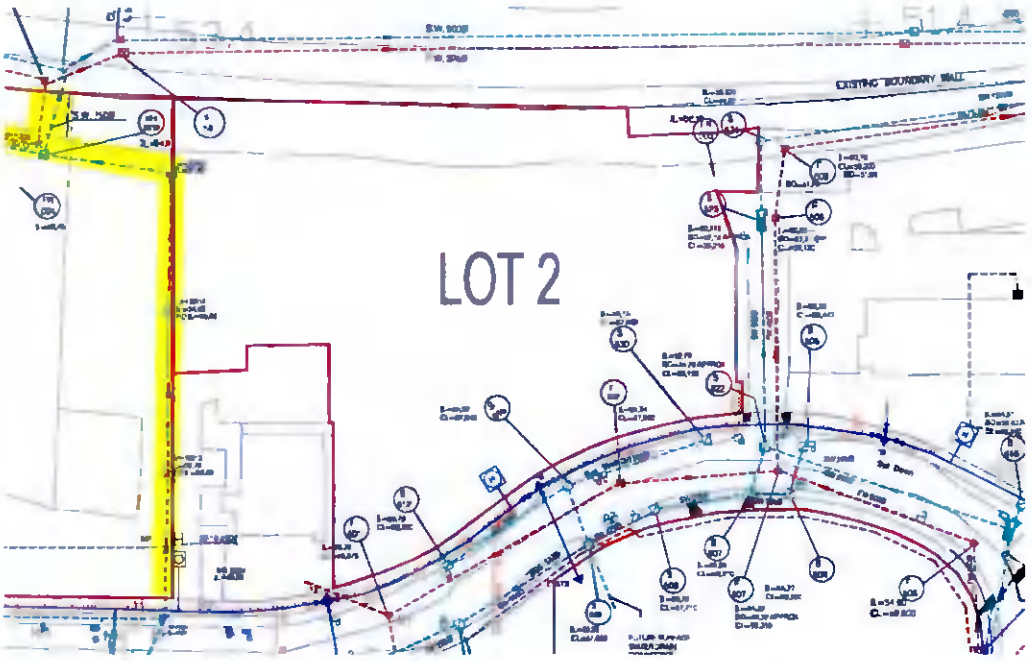


Figure 4 - Existing Site Services – Lot 2 MMOS Report

It is proposed that the surface water discharge into the existing 1050mm diameter surface water sewer located to the east of the subject site:

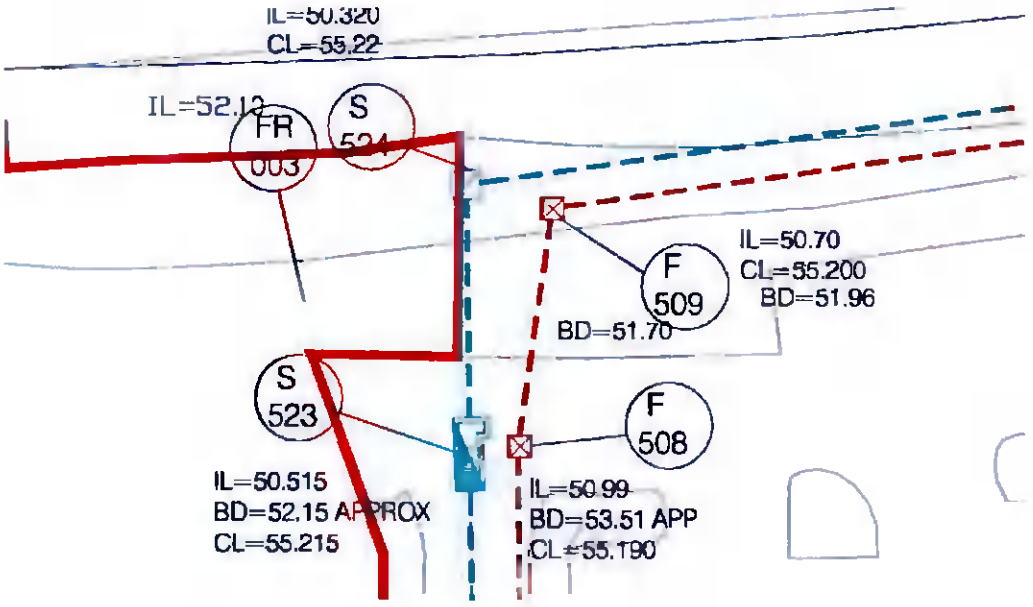


Figure 5 - Proposed Surface Water Connection Point

It is proposed that the foul water discharge into the existing 450mm diameter foul water sewer located to the south of the subject site. Additionally, it is proposed that the watermain be connected to the existing services in this location. Irish Water records indicate that the watermain is 100mm in diameter.

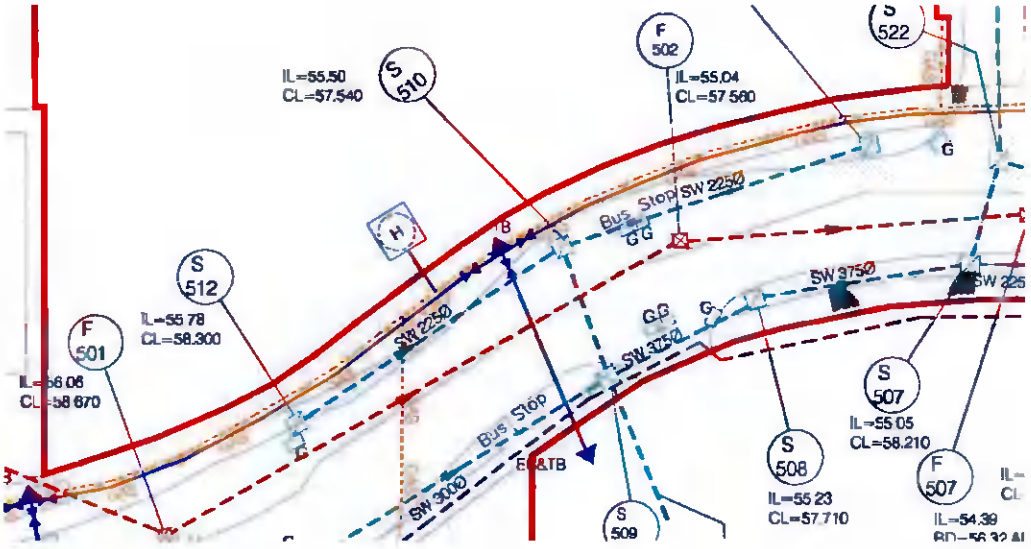


Figure 6 - Proposed Foul Water and Watermain Connection Point

Please refer to GDCL Drawing No. P2005-C-101 for details.

According to the Land Direct website (landdirect.ie), the proposed site and connection points to the existing sewers and watermain are all within one land holding:

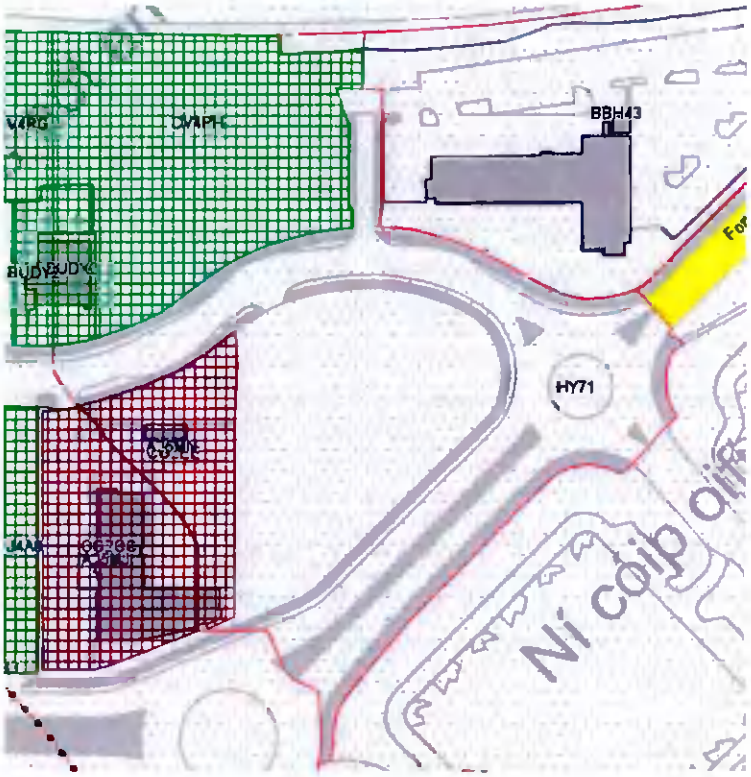


Figure 7 - Extract from Land Direct Website (landdirect.ie)

3.0 SURFACE WATER DRAINAGE

3.1 Attenuation Strategy

Surface water attenuation system will be provided using an off-line Stormtech SC740 attenuation system. The attenuation facility will be located within the covered carparking footprint, located at the basement level. Surface water discharge from the site will be controlled using a hydrobrake flow control device fitted at the outlet from the attenuation system. The total volume of the attenuation system is 340m^3.

The hydraulic modelling software system 'WinDes' was used to calculate the attenuation volumes required. Maximum rainfall data from Extreme Rainfall Return Period values produced by Met Eireann (Rainfall Return Periods Table website) was used to input into WinDes to determine maximum flood volume. For Cookstown (706800, 735100 ITM):

SAAR = 776mm

Ratio $M5_{60}/M5^{2d}$ = 0.28

$M5_{60}$ = 16.5mm

As per current practice a 10% increase to rainfall figures within 'WinDes' was applied to allow for climate change.

Runoff from roads and footpaths was assumed to be 80% impermeable. Runoff from traditional roofs areas was assumed to be 100% impermeable. Runoff from green areas/landscaping are assumed to be 5% as at least 95% of the rainfall during an extreme event would be percolate to ground, with the excess discharging to the site attenuation system.

The individual catchment characteristics are as follows: -

Catchment Characteristics			
Liffey Valley	Area (m^2)	Runoff Coeff.	Effective Area (m^2)
Roofs - Type 1 (Draining to gullies)	2 895	1 00	2895 0
Roofs - Type 2 (Draining to SUDS features)	-	0 70	0.0
Roofs - Type 3 (Draining to Back Gardens)	-	0 00	0.0
Green Roofs	-	0 70	0.0
Grass over Basements/Podiums	-	0 70	0.0
Roads and Footpaths - Type 1 (Draining to gullies)	3 381	0.80	2704 8
Roads and Footpaths - Type 2 (Draining to Suds features)	-	0 70	0.0
Permeable Paving	-	0 50	0.0
Gardens	-	0 30	0.0
Verges		0 15	0.0
Parks	-	0 15	0.0
Public Open Space	1,017	0 05	50 9
Effective Catchment Area (Impermeable)	0.565	Hectares	
Effective Catchment Runoff Coefficient	0.77		

Table 1 - Catchment Characteristics

The Greater Dublin Strategic Drainage Study (GDSDS) recommends that surface water runoff from new developments is limited to 2l/s/ha or Qbar (calculated using the UK IH124 equation). As the development catchment area is approximately 0.73ha, this results in a Qbar value of 1.5 l/s, see appendix for calculation.

It should be noted that the existing development is a brownfield site which currently does not provide any attenuation measures, therefore this reduction in flow would result in a significant benefit to the downstream system capacity.

A calculation sheet has been appended to this report which shows how the attenuation volume and discharge rate were calculated.

3.2 Interception Storage

It is current good practice in sustainable surface water drainage design that no run-off should directly pass to a receiving surface water system for rainfall depths of 5mm, therefore interception/infiltration storage should be provided at source where practicable. The volume of infiltration required is based on 5mm of rainfall depth from 80% of the runoff from impermeable areas and is calculated as follows:

Interception storage required $= 5650m^2 \times 0.8 \times 0.005 = 22\ m^3$

Interception storage will be provided within the 150mm deep stone layer at the base of the geocellular attenuation facility.

Interception storage provided **= 467m² x 0.15 x 0.4 = 28m³**

The benefit of providing interception storage is that it allows some form of storage for small rainfall events which results in water evaporation and adsorption in small quantities, therefore there will be less run-off from the system in small rainfall events thus mimicking the natural response for the catchment.

3.3 Treatment Volume

It is also current good practice in sustainable surface water drainage design that a "treatment volume" is provided in order to prevent any pollutants or sediments discharging into river systems, additionally a 'treatment train' stormwater runoff management system should be applied. According to CIRIA document C697 the following treatment train approach is necessary:

Roofs – 1 Treatment method
Paved Areas excluding Roads - 1 Treatment method
Roads - 2 Treatment Methods

The volume of treatment required is based on 15mm of rainfall depth from 80% of the runoff from impermeable areas and is calculated as follows:

Treatment storage required **= 5650m² x 0.8 x 0.015 = 68m³**

As all runoff is routed through the petrol interceptor and silt trap manhole as part of the offline attenuation system this will provide treatment storage in the system.

3.4 Surface Water Drainage System

Surface water throughout the site will collected by downpipes from the roof and road gullies within the tarmacadam areas, draining via the surface water pipe network before discharging into the attenuation facility.

Flows from the attenuation facility will be throttled to greenfield runoff rates as required by South Dublin County Council by means of a hydrobrake. The surface water will then discharge into the existing 1050mm diameter surface water sewer in running in an easterly direction, located at the northeast corner of the development site.

Surface water drains were designed using the Rational Method to size the pipes for a 1-year storm event. The following parameters applied:

Return period 1 year
Time of entry 4 minutes
Pipe Ks 0.6mm (concrete)
Minimum velocity 1.0 m/s
Maximum velocity 3.0 m/s
The peak surface flow from the proposed development is 1.5l/s. The surface water outfall pipe from the development would comprise an existing 1050mm diameter pipe at a gradient of not flatter than 1 in 150. This pipe at full capacity of the sewer is estimated at 2263l/s.

3.5 SuDS Measures

The SuDS strategy adopted by South Dublin County Council aims to provide an effective system to mitigate the adverse effects of urban stormwater runoff on the environment by reducing runoff rates, volumes, and frequency, reducing pollutant concentrations in stormwater, contributing to amenity, aesthetics and biodiversity enhancement where possible. In addition, SuDS features aim to replicate the natural characteristics of rainfall runoff for any site by providing control of run-off at source.

In terms of compliance with the principles outlined in the GDSDS (Greater Dublin Strategic Drainage Study) Regional Drainage Policies Volume 2 New Development and Sustainable Drainage Systems (SuDS), the introduction proposed extensive green roof system would provide ecological, aesthetic and amenity benefits and intercept and retain rainfall at source, reducing the volume of runoff and attenuating peak flows.

The proposed SuDS measures will not be taken in charge by South Dublin County Council.

A breakdown of the various sustainable drainage systems is provided below:

Petrol Interceptor: A proprietary oil/water separator which prevents hazardous chemical and petroleum products from entering watercourses and public sewers. This is proposed at the outfall from the site. For the subject site, it is proposed to use a NSBD3 bypass interceptor. The expected service life of a NSBD3 petrol interceptor is 50 years.

Cellular Attenuation System (Stormtech): A proprietary modular block or arch structure with a maintenance/inspection tunnel for providing underground surface water attenuation storage and can infiltrate runoff to the ground where the subgrade is suitable.

The expected service life of the Stormtech SC-740 attenuation tank proposed for this development is 50-75 years.

Figure 9 - Typical Cellular Storage (Stormtech) Installation

3.6 SuDS Maintenance

For the SUDS strategy to work as designed it is important that the entire drainage system is well maintained. It will be the responsibility of the site management team to ensure the drainage system is maintained. Maintenance and cleaning of the SUDS features will ensure adequate performance. The recommended program is outlined in the tables below:

Table 2 - Petrol Interceptor Maintenance Schedule

SUDS Element	Maintenance		
Petrol Interceptor	Maintenance period	Maintenance Task	Frequency
	Regular inspections	Inspect upstream and downstream manholes visually and assess silt build-up	Quarterly
		Measure the thickness of oil and aassess the level of sludge/silt	Biannually
		Level of sludge/silt to be assessed	Biannually
	Regular maintenance	Servicing of petrol interceptor by manufacturer	Biannually
		Integrity of interceptor to be assessed by manufacturer	Biannually
		Interceptor to be cleared of possible blockages by means if inspections	Quarterly
	Remedial work	Removal and replacing of interceptor to be carried out by manufacturer	As required
		Inspector to produce written interceptor inspection report	Post-inspection

Table 3 – Attenuation Tank Maintenance Schedule

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

4.0 FOUL DRAINAGE

There is an existing 225mm diameter foul sewer in running in an easterly direction on the Liffey Valley Complex service road, to the south of the site. Proposed foul drainage will discharge to this foul sewer.

Foul sewage within the site will be drained via gravity by a separate system via 225mm diameter pipes.

A Pre-Connection Enquiry Form was submitted to Irish Water and a response has been received on the 30th of May 2020, confirming that a foul connection to the public network can be facilitated. Please refer to Appendix A for details.

Drains generally will consist of thermoplastic structured wall pipes (IS EN 13476) pipes. Foul sewers have been designed in accordance with the Building Regulations and in accordance with the EPA Treatment Systems for Small Communities, Business, Leisure and Hotel. DOE 'Recommendations for Site Development Works' and the recommendations of the 'Greater Dublin Strategic Drainage Study' (GDSDS) and Irish Water requirements.

The following design criteria have been applied in the design of foul sewers:

(i) Pipe Ks 0.6 mm (uPVC)

(ii) Minimum velocity 0.75 m/s (self-cleansing velocity)

(iii) Maximum velocity 3 m/s

(v) Minimum gradients:

Table 4 – Foul Sewer Gradients

No. of Connections	Minimum Pipe Gradient
1	100mm dia. @ 1:60 or self-cleansing gradient
2-8	150mm dia. @ 1:80 or self-cleansing gradient
>8	Min 150mm dia.; 1: DN or self-cleansing gradient

The foul water drainage for the proposed development has been designed so that minimum cleansing velocities outlined in the "Irish Water Code of Practice for Wastewater

Infrastructure" are achieved for all foul sewers. The peak foul flow is based on Irish Water recommended peak demand/flow factors which are provided in the Irish Water 'Code of Practice for Wastewater Infrastructure', Wastewater Flow Rates for Design. Please refer to Appendix D for the foul sewer loading calculations.

The peak flow from the proposed development is estimated at 0.32l/s, please refer to Appendix F for details. The foul outfall pipe from the development would comprise a 225mm diameter pipe at a gradient of not flatter than 1 in 150. This pipe at full capacity of the sewer is estimated at 37.21l/s.

Sewers and drains shall be laid to comply with the requirements of the Building Regulations 1997 in accordance with the recommendations contained in the Technical Guidance Documents, Section H (revised 2005) and Irish Water.

5.0 WATER SUPPLY

The development will be serviced by a proposed 100mm diameter watermain which connects to the existing 100mm diameter watermain located on the Liffey Valley Complex service road, to the south of the site.

A Pre-Connection Enquiry Form was submitted to Irish Water and a response has been received on the 30th of May 2020, confirming that a foul connection to the public network can be facilitated. Please refer to Appendix A for details.

The external areas of the development will be served by existing fire hydrants together with additional hydrants to be located on the new 150mm diameter watermains.

A bulk water meter will be provided at the connection to the site from the existing watermain. This electromagnetic flow meter will include a remote telemetry unit and associated mini kiosk, to the requirements of SDCC Water Management Section and Irish Water.

The supply arrangements will be carried out to the requirements of Irish Water. The Peak Hour Water demand for the proposed development is estimated at 0.3l/s.

Please refer to Appendix G for the water supply calculations.

6.0 FLOOD RISK ASSESSMENT

The subject site is located more than 0.5km from the River Liffey, Additionally, the site is also located more than 12km from the coast and is therefore not prone to coastal flooding. The ECFRAMS Flood Study Mapping indicates outside of the 0.1% Fluvial AEP Event and the site is therefore deemed to be within **Flood Zone C**, i.e. outside the 1000-year flood events. It is therefore not necessary to carry out a Site-Specific Flood Risk Assessment.

The sequential approach recommended by *"The Planning System and Flood Risk Management Guidelines for Planning Authorities"* has been complied with for the subject site as it is within Flood Zone C.

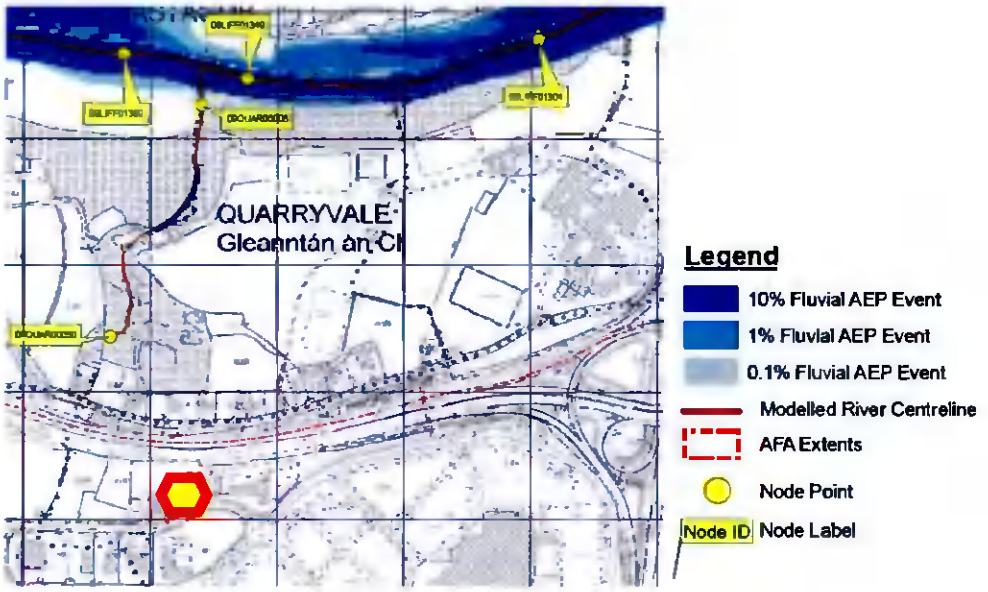


Figure 10 - Floodinfo.ie showing OPW Flood Mapping

The Strategic Flood Risk Assessment for South Dublin County Council Development Plan 2016-2022 Fluvial Flood Zone Mapping was consulted and indicated that there was no risk of Fluvial Flooding.

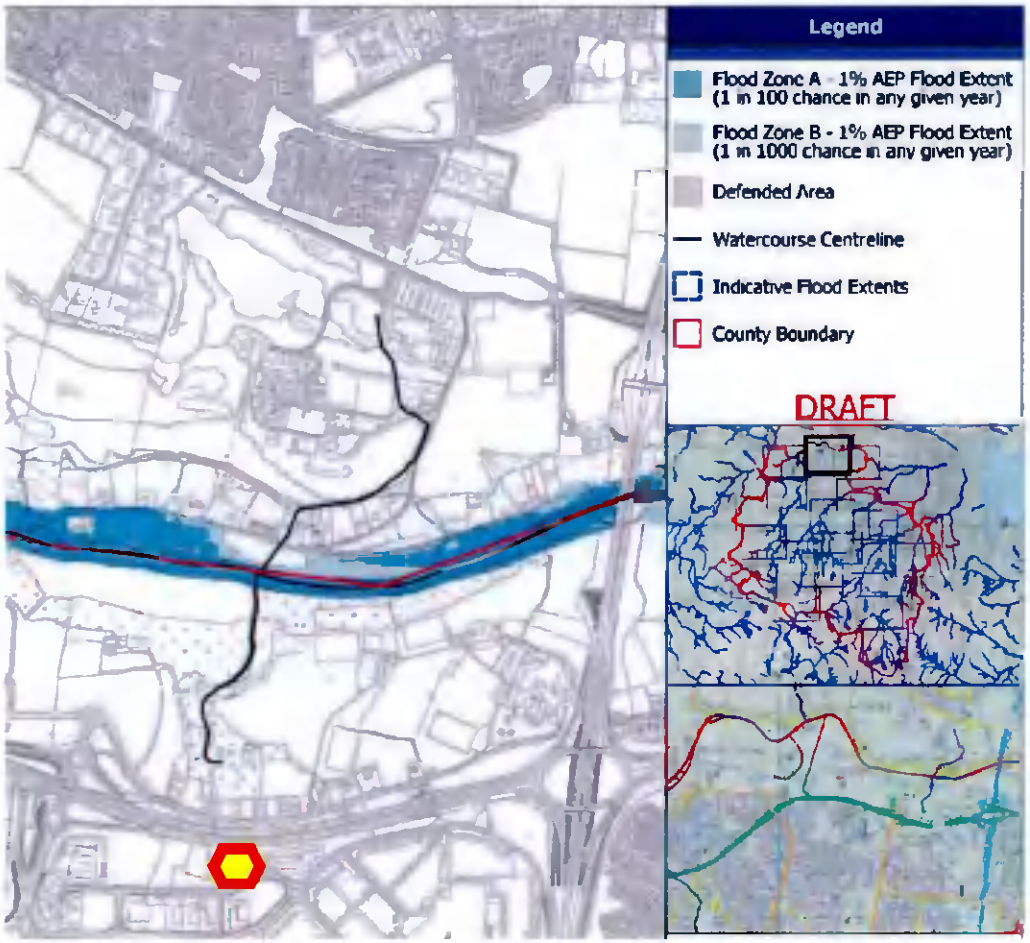


Figure 11 - South Dublin County Development Plan 2016-2022 Fluvial Flood Zone Map 2 Extract

The Office for Public Works (OPW) historical flood maps were consulted with regards to recorded flood events in the vicinity of the subject site. A map showing historical flood events within 2.5km of the subject site was generated. There were no recorded flood events within the immediate vicinity of the subject site, and it is therefore considered that there is a low likelihood of flooding from surrounding areas.

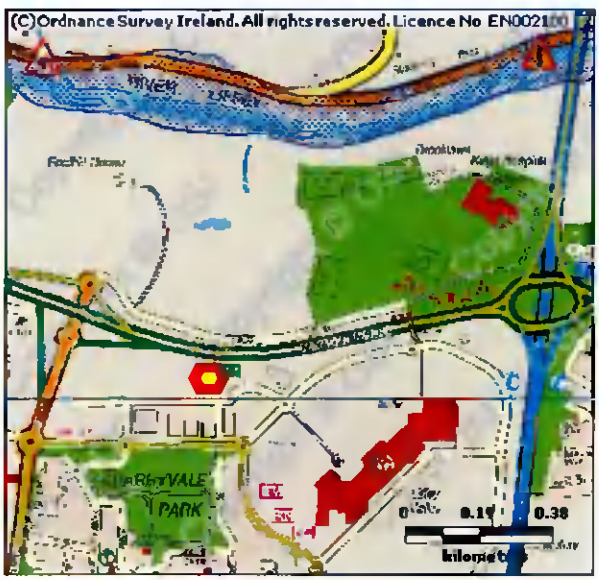


Figure 12 - Floodmaps.ie showing no historical flooding event with 0.5km of site

APPENDIX A

Confirmation of Feasibility Letter (Irish Water)

Alan Fitzsimons
GDCL Consulting Eng
Scope House
Whitehall Road West
Perrystown, Dublin 12
D12K8PP

13 May 2020

Dear Alan Fitzsimons,

Re: Connection Reference No CDS20002854 pre-connection enquiry -
Subject to contract | Contract denied

Connection for Business Connection of 1 unit at Unit A, Liffey Valley Office Campus, Dublin 22, Co. Dublin.

Irish Water has reviewed your pre-connection enquiry in relation to water and wastewater connections at Unit A, Liffey Valley Office Campus, Dublin 22, Co. Dublin. Based upon the details you have provided with your pre-connection enquiry and on the capacity currently available as assessed by Irish Water, we wish to advise you that, subject to a valid connection agreement being put in place, your proposed connection to the Irish Water network can be facilitated.

You are advised that this correspondence does not constitute an offer in whole or in part to provide a connection to any Irish Water infrastructure and is provided subject to a connection agreement being signed at a later date.

A connection agreement can be applied for by completing the connection application form available at www.water.ie/connections. Irish Water's current charges for water and wastewater connections are set out in the Water Charges Plan as approved by the Commission for Regulation of Utilities.

If you have any further questions, please contact us on 1850 278 278 or +353 1 707 2828, 8.00am-4.30pm, Mon-Fri or email newconnections@water.ie. For further information, visit www.water.ie/connections.

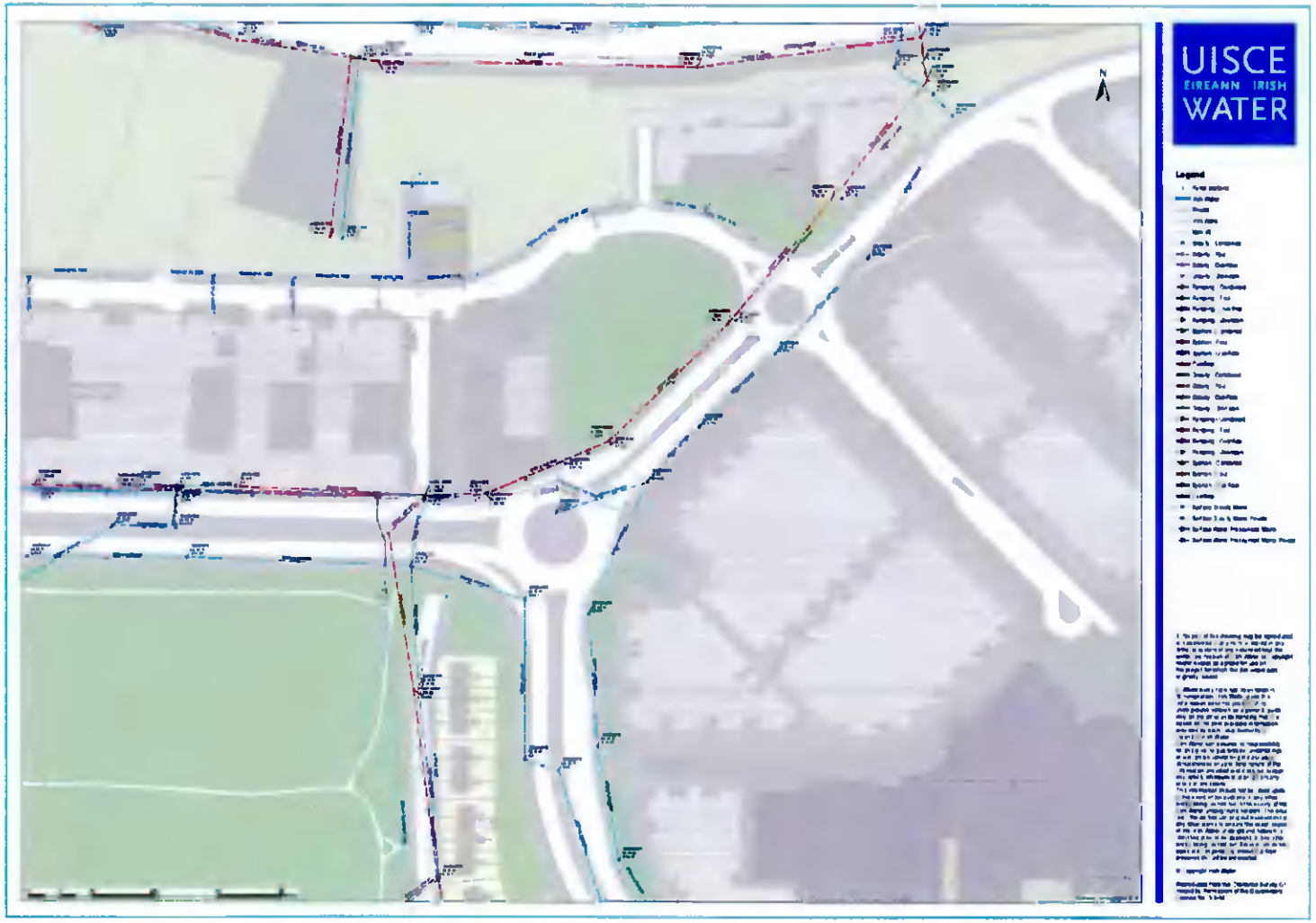
Yours sincerely,

Maria O'Dwyer

Connections and Developer Services

APPENDIX B

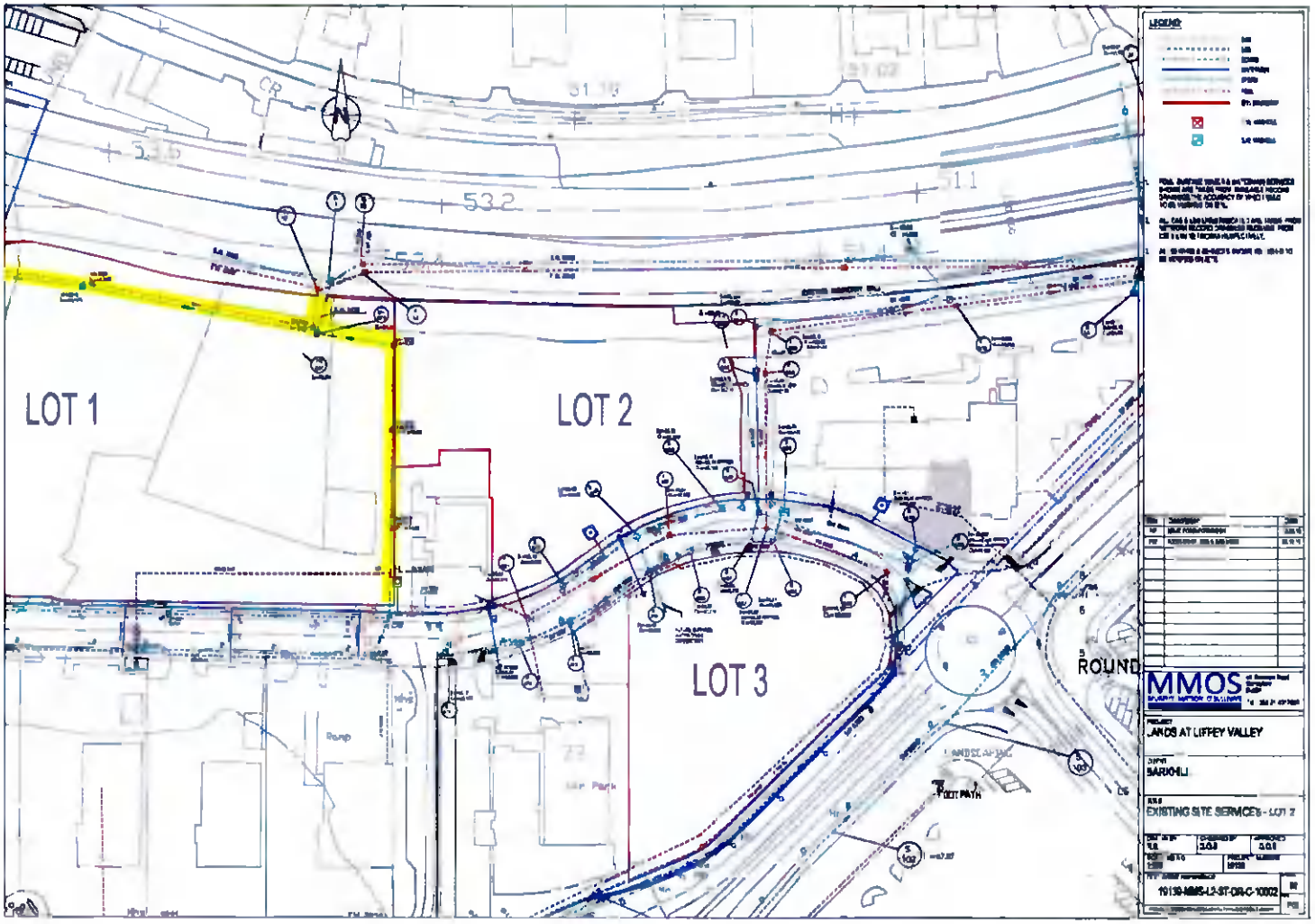
Irish Water Services Records


UISCE
EIREANN IRISH
WATER

APPENDIX C

Existing Site Services

by Murphy Matson O'Sullivan


LOT 1
LOT 2
LOT 3
ROUND
LEGEND
MMOS
LARCOS AT LIFFEY VALLEY
SARKHILL
EXISTING SITE SERVICES - LOT 2

APPENDIX D

Surface Water Attenuation Calculations

Met Eireann
Return Period Rainfall Depths for sliding Durations
Irish Grid: Easting: 306860, Northing: 235050,

	Interval		Years											
DURATION	6months,	1year,	2,	3,	4,	5,	10,	20,	30,	50,	75,	100,	150,	200,	250,	500,
5 mins	2.3,	3.4,	4.1,	5.0,	5.6,	6.2,	7.9,	9.8,	11.2,	13.1,	14.8,	16.1,	18.2,	19.9,	21.3,	N/A ,
10 mins	3.3,	4.8,	5.7,	7.0,	7.9,	8.6,	10.9,	13.7,	15.6,	18.2,	20.6,	22.5,	25.4,	27.7,	29.7,	N/A ,
15 mins	3.8,	5.7,	6.7,	8.2,	9.3,	10.1,	12.9,	16.1,	18.3,	21.4,	24.2,	26.5,	29.9,	32.6,	34.9,	N/A ,
30 mins	5.1,	7.4,	8.6,	10.6,	11.9,	12.9,	16.3,	20.3,	22.9,	26.7,	30.1,	32.7,	36.8,	40.0,	42.7,	N/A ,
1 hours	6.7,	9.6,	11.2,	13.6,	15.2,	16.5,	20.7,	25.5,	28.7,	33.2,	37.3,	40.4,	45.3,	49.1,	52.3,	N/A ,
2 hours	8.9,	12.5,	14.5,	17.5,	19.5,	21.1,	26.2,	32.1,	35.9,	41.4,	46.2,	50.0,	55.8,	60.3,	64.1,	N/A ,
3 hours	10.4,	14.7,	16.9,	20.3,	22.6,	24.3,	30.1,	36.7,	41.0,	47.0,	52.4,	56.6,	63.0,	68.0,	72.1,	N/A ,
4 hours	11.7,	16.4,	18.8,	22.5,	25.0,	27.0,	33.2,	40.3,	45.0,	51.5,	57.3,	61.8,	68.7,	74.0,	78.5,	N/A ,
6 hours	13.8,	19.1,	21.9,	26.1,	28.9,	31.1,	38.2,	46.1,	51.3,	58.6,	65.0,	70.0,	77.6,	83.5,	88.3,	N/A ,
9 hours	16.3,	22.3,	25.5,	30.3,	33.5,	35.9,	43.9,	52.7,	58.5,	66.6,	73.7,	79.2,	87.6,	94.1,	99.4,	N/A ,
12 hours	18.2,	24.9,	28.4,	33.6,	37.1,	39.8,	48.4,	58.0,	64.3,	73.0,	80.6,	86.5,	95.5,	102.4,	108.2,	N/A ,
18 hours	21.5,	29.1,	33.1,	39.0,	42.9,	45.9,	55.6,	66.3,	73.3,	83.0,	91.4,	97.9,	107.9,	115.5,	121.8,	N/A ,
24 hours	24.1,	32.5,	36.9,	43.3,	47.6,	50.8,	61.4,	73.0,	80.5,	90.9,	100.0,	107.0,	117.6,	125.7,	132.4,	155.6,
2 days	30.0,	39.5,	44.4,	51.4,	56.1,	59.6,	70.9,	83.1,	91.0,	101.8,	111.1,	118.2,	129.0,	137.2,	143.9,	166.9,
3 days	34.8,	45.1,	50.4,	58.0,	63.0,	66.8,	78.7,	91.5,	99.7,	110.9,	120.5,	127.8,	138.9,	147.3,	154.1,	177.4,
4 days	39.0,	50.1,	55.7,	63.7,	69.0,	73.0,	85.4,	98.8,	107.3,	118.9,	128.8,	136.3,	147.6,	156.2,	163.2,	186.8,
6 days	46.3,	58.7,	64.9,	73.7,	79.4,	83.7,	97.2,	111.5,	120.5,	132.8,	143.2,	151.1,	162.9,	171.8,	179.1,	203.5,
8 days	52.8,	66.2,	72.9,	82.4,	88.5,	93.1,	107.4,	122.6,	132.0,	144.8,	155.8,	164.0,	176.2,	185.5,	193.0,	218.1,
10 days	58.7,	73.1,	80.2,	90.3,	96.8,	101.6,	116.7,	132.5,	142.4,	155.8,	167.1,	175.6,	188.3,	197.8,	205.5,	231.4,
12 days	64.3,	79.5,	87.0,	97.6,	104.4,	109.5,	125.2,	141.7,	152.0,	165.8,	177.5,	186.3,	199.4,	209.1,	217.1,	243.5,
16 days	74.6,	91.4,	99.6,	111.1,	118.4,	124.0,	140.9,	158.5,	169.5,	184.1,	196.5,	205.8,	219.5,	229.8,	238.0,	265.7,
20 days	84.1,	102.3,	111.1,	123.4,	131.3,	137.1,	155.1,	173.8,	185.3,	200.7,	213.7,	223.4,	237.7,	248.4,	257.0,	285.6,
25 days	95.2,	115.0,	124.5,	137.7,	146.1,	152.4,	171.6,	191.4,	203.6,	219.8,	233.4,	243.5,	258.5,	269.7,	278.7,	308.5,

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

Qbar Calculation
Using IOH Report 124 for Sites < 25 km²

Catchment Name
[illegible]

[1] $Q_{bar} = 0.00108 * (AREA)^{0.89}(SAAR)^{1.17}(SOIL)^{2.17}$ — Estimation of QBAR from IOH Report 124 for catchments less than 25 km² using the 3 variable equation

AREA = 0.73 Ha — Overall Catchment Area (Hectares) For catchments < 50 hectares in area, flow rates are linearly interpolated for smaller areas.

AREA = 0.007 km² — Area of the Catchment (km²)

SAAR = 778 mm — Standard Annual Average Rainfall (mm)

SOIL = 0.30

Soil Type Expressed as a Percentage	Soil 1	Soil 2	Soil 3	Soil 4	Soil 5
	0	100	0	0	0
SOIL Value	0.15	0.30	0.40	0.45	0.50

$M5_{60}$ = 16.6 mm

$M5_{2day}$ = 59.6 mm

Ratio $M5_{60}/M5_{2d}$ = 0.277

Soil index value (SPR) calculated from Flood Studies Report Vol V Fig 4.16(1) - The Classification of Soils from Winter Rainfall Acceptance Rate

Flood Return Event	[4]Growth Factor	Permitted Flow (l/s)
1	0.85	1.3
QBAR	1	1.5
10	1.67	2.5
30	2.1	3.2
50	2.33	3.5
100	2.6	3.9
200	2.85	4.3
1000	3.5	5.3

[4]QBar from Site with Factorial Error Allowance

r² =	0.847
n =	71
fse =	1.651

Q'_{bar} = 2.48 l/s
(With Allowance for the standard factorial error)

Pro-rata based on 50 Ha Site area to calculate Qbar

Q_{bar} =	0.00004	cumecs/Ha
Q_{bar} =	2.1	l/s/Ha

$Q_{bar(rural)}$ = 1.5 l/s

Catchment Characteristics

Lilley Valley	Area (m²)	Runoff Coeff.	Effective Area (m²)
Roofs - Type 1 (Draining to gullies)	[illegible]	1.00	2815.0
Roofs - Type 2 (Draining to SUDS features)		0.70	0.0
Roofs - Type 3 (Draining to Back Gardens)		0.00	0.0
Green Roofs	-	0.70	0.0
Grass over Basements/Podiums		0.70	0.0
Roads and Footpaths - Type 1 (Draining to gullies)	3,391	0.90	2704.8
Roads and Footpaths - Type 2 (Draining to Suds features)	-	0.70	0.0
Permeable Paving	-	0.50	0.0
Gardens	-	0.30	0.0
Verges	-	0.15	0.0
Parks	-	0.15	0.0
Public Open Space	1,017	0.0[illegible]	80.9

Effective Catchment Area (Impermeable) 0.585 Hectares

Effective Catchment Runoff Coefficient 0.77

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Summary of Results for 100 year Return Period (+10%)

Half Drain Time : 2054 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	53.507	0.257	0.1	1.3	1.4	82.9	O K
30 min Summer	53.604	0.354	0.1	1.3	1.4	114.0	O K
60 min Summer	53.705	0.455	0.1	1.3	1.4	146.7	O K
120 min Summer	53.815	0.565	0.1	1.3	1.4	182.1	O K
180 min Summer	53.881	0.631	0.1	1.3	1.4	203.5	O K
240 min Summer	53.929	0.679	0.1	1.3	1.4	219.0	O K
360 min Summer	53.996	0.746	0.1	1.3	1.4	240.5	O K
480 min Summer	54.041	0.791	0.1	1.3	1.4	255.0	O K
600 min Summer	54.073	0.823	0.1	1.3	1.4	265.3	O K
720 min Summer	54.096	0.846	0.1	1.4	1.4	272.8	O K
960 min Summer	54.126	0.876	0.1	1.4	1.5	282.5	O K
1440 min Summer	54.148	0.898	0.1	1.4	1.5	289.7	O K
2160 min Summer	54.149	0.899	0.1	1.4	1.5	289.9	O K
2880 min Summer	54.141	0.891	0.1	1.4	1.5	287.3	O K
4320 min Summer	54.116	0.866	0.1	1.4	1.5	279.3	O K
5760 min Summer	54.087	0.837	0.1	1.4	1.4	269.8	O K
7200 min Summer	54.055	0.805	0.1	1.3	1.4	259.5	O K
8640 min Summer	54.022	0.772	0.1	1.3	1.4	248.9	O K
10080 min Summer	53.988	0.738	0.1	1.3	1.4	238.1	O K
15 min Winter	53.538	0.288	0.1	1.3	1.4	93.0	O K
30 min Winter	53.647	0.397	0.1	1.3	1.4	128.0	O K
60 min Winter	53.761	0.511	0.1	1.3	1.4	164.8	O K
120 min Winter	53.885	0.635	0.1	1.3	1.4	204.8	O K
180 min Winter	53.961	0.711	0.1	1.3	1.4	229.4	O K
240 min Winter	54.017	0.767	0.1	1.3	1.4	247.4	O K
360 min Winter	54.095	0.845	0.1	1.4	1.4	272.5	O K
480 min Winter	54.148	0.898	0.1	1.4	1.5	289.7	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	79.458	0.0	84.0	19
30 min Summer	54.933	0.0	111.6	34
60 min Summer	35.659	0.0	150.9	64
120 min Summer	22.503	0.0	190.6	124
180 min Summer	17.041	0.0	214.9	184
240 min Summer	13.968	0.0	219.8	242
360 min Summer	10.521	0.0	219.8	362
480 min Summer	8.593	0.0	219.8	482
600 min Summer	7.348	0.0	220.1	602
720 min Summer	6.452	0.0	220.6	722
960 min Summer	5.261	0.0	222.5	962
1440 min Summer	3.946	0.0	227.8	1440
2160 min Summer	2.957	0.0	444.9	1792
2880 min Summer	2.408	0.0	440.5	2164
4320 min Summer	1.799	0.0	417.8	2984
5760 min Summer	1.463	0.0	594.7	3856
7200 min Summer	1.245	0.0	632.8	4680
8640 min Summer	1.091	0.0	665.7	5528
10080 min Summer	0.976	0.0	694.8	6352
15 min Winter	79.458	0.0	94.1	19
30 min Winter	54.933	0.0	113.6	34
60 min Winter	35.659	0.0	169.1	64
120 min Winter	22.503	0.0	213.4	122
180 min Winter	17.041	0.0	219.9	180
240 min Winter	13.968	0.0	220.7	240
360 min Winter	10.521	0.0	221.6	358
480 min Winter	8.593	0.0	223.0	474

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Summary of Results for 100 year Return Period (+10%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Outflow (l/s)	Max Volume (m³)	Status
600 min Winter	54.188	0.938	0.1	1.4	1.5	302.3	O K
720 min Winter	54.217	0.967	0.1	1.4	1.5	311.9	O K
960 min Winter	54.258	1.008	0.1	1.5	1.6	325.0	O K
1440 min Winter	54.297	1.047	0.1	1.5	1.6	337.5	O K
2160 min Winter	54.303	1.053	0.1	1.5	1.6	339.5	O K
2880 min Winter	54.290	1.040	0.1	1.5	1.6	335.5	O K
4320 min Winter	54.253	1.003	0.1	1.5	1.6	323.4	O K
5760 min Winter	54.204	0.954	0.1	1.4	1.5	307.7	O K
7200 min Winter	54.151	0.901	0.1	1.4	1.5	290.6	O K
8640 min Winter	54.097	0.847	0.1	1.4	1.4	273.2	O K
10080 min Winter	54.043	0.793	0.1	1.3	1.4	255.8	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
600 min Winter	7.340	0.0	225.0	590
720 min Winter	6.452	0.0	227.7	706
960 min Winter	5.261	0.0	233.6	934
1440 min Winter	3.946	0.0	238.8	1384
2160 min Winter	2.957	0.0	459.8	2004
2880 min Winter	2.408	0.0	454.7	2276
4320 min Winter	1.799	0.0	443.5	3200
5760 min Winter	1.463	0.0	666.2	4152
7200 min Winter	1.245	0.0	708.7	5048
8640 min Winter	1.091	0.0	745.7	5960
10080 min Winter	0.976	0.0	760.5	6856

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Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	Scotland and Ireland	Cv (Winter)	0.840
M5-60 (mm)	16.500	Shortest Storm (mins)	15
Ratio R	0.277	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+10

Time Area Diagram

Total Area (ha) 0.565

Time (mins) From:	To:	Area (ha)
0	4	0.565

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Innovyze	Source Control 2018.1

Model Details

Storage is Offline Cover Level (m) 55.200 Dividing Weir Level (m) 53.250

Cellular Storage Structure

Invert Level (m) 53.250 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00100 Porosity 0.66
Infiltration Coefficient Side (m/hr) 0.00100

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	488.6	488.6	1.100	488.6	675.6	1.200	0.0	675.6

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0056-1500-1110-1500	Sump Available	Yes
Design Head (m)	1.110	Diameter (mm)	56
Design Flow (l/s)	1.5	Invert Level (m)	53.200
Flush-Flo™	Calculated	Minimum Outlet Pipe Diameter (mm)	75
Objective	Minimise upstream storage	Suggested Manhole Diameter (mm)	1200
Application	Surface		

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.110	1.5	Kick-Flo®	0.501	1.0
Flush-Flo™	0.247	1.3	Mean Flow over Head Range	-	1.2

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)
0.100	1.1	0.800	1.3	2.000	2.0	4.000	2.7	7.000	3.5
0.200	1.3	1.000	1.4	2.200	2.0	4.500	2.8	7.500	3.6
0.300	1.3	1.200	1.6	2.400	2.1	5.000	3.0	8.000	3.7
0.400	1.2	1.400	1.7	2.600	2.2	5.500	3.1	8.500	3.8
0.500	1.1	1.600	1.8	3.000	2.4	6.000	3.2	9.000	3.9
0.600	1.1	1.800	1.9	3.500	2.5	6.500	3.4	9.500	4.0

STORMTECH Stormwater Management System Design Tool

PROJECT REF:	U Store It
LOCATION:	Liffey Valley
DATE:	13/04/2020
CREATED BY:	PTC

Instructions:
- Fill in blue highlighted cells
- Set width to maximum allowance
- Adjust site parameters and system dimension until volume achieved
- For Rectangular systems only, for Irregular shape dig contact Microstrain

SYSTEM PARAMETERS

Required Total Storage	340	m^3
Stormtech chamber model	SC740	
Number of Isolator Rows for TSS Removal	1	

SITE PARAMETERS

Maximum Width at Excavation Base	6.23	m	
Stone Porosity	40%		
Excavation Batter Angle (degrees)	60	°	*Minimum Requirement*
Stone Below Chambers	0.15	m	*0.15*
Stone Above Chambers	0.15	m	*0.15*
Additional Storage. E.g. manholes, pipe	0	m^3	

CALCULATED CHAMBER SYSTEM DIMENSIONS

	Calculated	Adopted	
Number of Rows	4		ea
Number of units per Row	36		ea
Number of SC740 Chambers	144		ea
Number of SC740 Endcaps	8		ea
System Installed Storage Depth (effective storage depth)	1.060		m
Tank overall installed Width at base	6.23	6.23	m
Tank overall installed Length at Base	78.82	78.82	m
Total Effective System Storage	343.3	343.3	m^3

STORMTECH SYSTEM DETAIL

StormTech Chamber Model	SC740	
Unit Width	1.295	m
Unit Length	2.17	m
Unit Height	0.76	m
Min Cover Over System	0.3	m
Max Cover Over Chamber	2.4	m
Internal Storage Vol. (Chamber only)	1.3	m^3

STONE AND EXCAVATION DETAIL

Volume of Dig for System	576	
Area of Dig at Base of System	491	m^2
Area of Dig at Top of System	597	m^2
Void Ratio	60%	
Stone Requirement - tonne	637	tonne

StormTech
Subsurface Stormwater Management

APPENDIX E

Surface Water Network Calculations

Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	5	Maximum Rainfall (mm/hr)	50.0
Additional Flow (%)	0	Minimum Velocity (m/s)	1.00
FSR Region	Scotland and Ireland	Connection Type	Level Soffits
M5-60 (mm)	16.500	Minimum Backdrop Height (m)	0.200
Ratio-R	0.280	Preferred Cover Depth (m)	1.200
CV	1.000	Include Intermediate Ground	✓
Time of Entry (mins)	4.00	Enforce best practice design rules	✓

Nodes

Name	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
13	4.00	55.800	1200	59332.684	-64997.725	1.550
12		55.000	1200	59334.164	-64984.447	1.122
11		54.900	1200	59337.011	-64984.598	1.041
10		54.850	1200	59417.156	-64985.863	1.071
9	4.00	58.450	1200	59377.097	-65053.945	1.550
8		58.250	1200	59398.182	-65040.327	1.592
7		58.340	1200	59423.362	-65029.911	1.818
6		58.600	1200	59435.733	-65029.601	2.140
5		58.400	1200	59436.849	-65005.982	4.700
4		55.000	1200	59435.434	-64991.915	1.538
3		54.900	1200	59420.984	-64985.811	1.595
2		55.200	1200	59421.212	-64981.123	1.918
1		55.220	1200	59442.460	-64980.951	2.044

Links (Input)

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.007	2	1	11.745	0.600	54.282	53.776	0.506	200.0	225	7.42	50.0
1.006	3	2	4.688	0.600	53.905	53.282	0.623	200.0	300	7.01	50.0
2.003	10	3	3.830	0.600	53.779	53.780	0.019	200.0	300	6.94	50.0
1.005	4	3	15.686	0.600	53.462	53.305	0.157	100.0	300	5.63	50.0
1.004	5	4	14.140	0.600	53.700	53.462	0.238	59.3	300	5.46	50.0
1.003	6	5	23.680	0.600	56.460	56.342	0.118	200.0	300	5.34	50.0
1.002	7	6	12.375	0.600	56.522	56.460	0.062	200.0	300	4.99	50.0
1.001	8	7	27.249	0.600	56.668	56.532	0.136	200.0	300	4.80	50.0
1.000	9	8	25.100	0.600	56.900	56.733	0.167	150.0	225	4.59	50.0
2.002	11	10	80.155	0.600	54.858	53.779	0.080	1000.0	300	6.88	50.0
2.001	12	11	2.851	0.600	58.878	53.859	0.019	150.0	300	4.15	50.0
2.000	13	12	13.383	0.600	54.250	53.953	0.297	45.0	225	4.11	50.0

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.007	[illegible]	200.0	225	Circular	55.200	[illegible]	1.693	55.220	[illegible]	1.819
1.006	[illegible]	200.0	300	Circular	54.900	[illegible]	1.295	55.200	[illegible]	1.618
2.003	[illegible]	200.0	[illegible]	Circular	54.850	[illegible]	[illegible]	54.900	[illegible]	[illegible]
1.005	[illegible]	100.0	[illegible]	Circular	55.000	[illegible]	1.238	54.900	[illegible]	1.295
1.004	[illegible]	59.3	[illegible]	Circular	58.400	53.700	[illegible]	55.000	[illegible]	1.238
1.003	[illegible]	200.0	[illegible]	Circular	58.600	[illegible]	1.840	58.400	56.342	1.758
1.002	[illegible]	200.0	[illegible]	Circular	58.340	56.522	1.518	58.600	56.460	1.840
1.001	[illegible]	200.0	300	Circular	58.250	[illegible]	1.292	58.340	56.522	1.518
1.000	[illegible]	150.0	225	Circular	58.450	56.900	1.325	58.250	[illegible]	1.292
2.002	[illegible]	1000.0	[illegible]	Circular	54.900	53.859	[illegible]	54.850	[illegible]	[illegible]
2.001	[illegible]	150.0	300	Circular	55.000	[illegible]	[illegible]	54.900	[illegible]	[illegible]
2.000	[illegible]	45.0	225	Circular	55.800	54.250	1.325	55.000	[illegible]	[illegible]

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.007	2	1200	[illegible]	Adoptable	1	1200	Manhole	Adoptable
1.006	3	1200	[illegible]	Adoptable	2	1200	[illegible]	Adoptable
2.003	10	1200	[illegible]	Adoptable	3	1200	Manhole	Adoptable
1.005	4	1200	[illegible]	Adoptable	3	1200	[illegible]	Adoptable
1.004	5	1200	[illegible]	Adoptable	4	1200	[illegible]	Adoptable
1.003	6	1200	[illegible]	Adoptable	5	1200	Manhole	Adoptable
1.002	7	1200	[illegible]	Adoptable	6	1200	[illegible]	Adoptable
1.001	8	1200	Manhole	Adoptable	7	1200	[illegible]	Adoptable
1.000	9	1200	[illegible]	Adoptable	8	1200	Manhole	Adoptable
2.002	11	1200	Manhole	Adoptable	10	1200	Manhole	Adoptable
2.001	12	1200	Manhole	Adoptable	11	1200	Manhole	Adoptable
2.000	13	1200	Manhole	Adoptable	12	1200	[illegible]	Adoptable

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
13	59332.684	-64997.725	55.800	1.550	[illegible]				
						0	2.000	[illegible]	225
12	59334.164	-64984.447	55.000	1.122	1200	1	2.000	[illegible]	225
						0	2.001	[illegible]	300
11	59337.011	-64984.598	54.900	1.041	1200	1	2.001	[illegible]	300
						0	2.002	[illegible]	[illegible]
10	59417.156	-64985.863	54.850	1.071	1200	1	2.002	[illegible]	300
						0	2.003	[illegible]	300
9	59377.097	65053.945	58.450	1.550	1200				
						0	1.000	[illegible]	225

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
8	59398.182	-65040.327	58.250	1.592	1200	1	1.000	56.750	225
						0	1.001	56.658	300
7	59423.362	-65029.911	58.340	1.818	1200	1	1.001	56.522	300
						0	1.002	56.522	300
6	59435.733	-65029.601	58.600	2.140	1200	1	1.002	56.460	300
						0	1.003	56.460	300
5	59436.849	-65005.982	58.400	4.700	1200	1	1.003	56.342	300
						0	1.004	53.700	300
4	59435.434	-64991.915	55.000	1.538	1200	1	1.004	53.462	300
						0	1.005	53.462	300
3	59420.984	-64985.811	54.900	1.595	1200	1	2.003	53.760	300
						2	1.005	53.305	300
						0	1.006	53.305	300
2	59421.212	-64981.123	55.200	1.918	1200	1	1.006	53.282	300
						0	1.007	53.282	225
1	59442.460	-64980.951	55.220	2.044	1200	1	1.007	53.176	225

Simulation Settings

Rainfall Methodology	FSR	Analysis Speed	Normal
FSR Region	Scotland and Ireland	Skip Steady State	x
MS-60 (mm)	16.500	Drain Down Time (mins)	240
Ratio-R	0.280	Additional Storage (m³/ha)	20.0
Summer CV	1.000	Check Discharge Rate(s)	x
Winter CV	1.000	Check Discharge Volume	x

Storm Durations

15	60	180	360	600	960	2160
30	120	240	480	720	1440	2880

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
5	10	0	0

APPENDIX F

Foul Water Network Calculations

Design Settings

Frequency of use (kDU)	1.00	Minimum Velocity (m/s)	1.00
Flow per dwelling per day (l/day)	2700	Connection Type	Level Soffits
Domestic Flow (l/s/ha)	0.0	Minimum Backdrop Height (m)	0.200
Industrial Flow (l/s/ha)	0.0	Preferred Cover Depth (m)	0.800
Additional Flow (%)	0	Include Intermediate Ground	✓

Nodes

Name	Cover Level (m)	Manhole Type	Easting (m)	Northing (m)	Depth (m)
5	58.250	Adoptable	59397.918	-65028.215	1.250
1	57.560	Adoptable	59414.982	-65046.340	1.569
3	58.450	Adoptable	59381.327	-65048.848	1.250
4	58.250	Adoptable	59405.469	-65034.071	2.000

Links (Input)

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)
1.001	4	1	[illegible]	[illegible]	56.250	[illegible]	[illegible]	60.0	[illegible]
2.000	5	4	[illegible]	[illegible]	57.000	[illegible]	[illegible]	60.0	225
1.000	3	4	[illegible]	[illegible]	57.200	[illegible]	0.47[illegible]	60.0	225

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.001	[illegible]	60.0	[illegible]	Circular	58.250	56.250	[illegible]	57.560	[illegible]	1.344
2.000	9.558	60.0	225	Circular	58.250	57.000	1.025	58.250	56.841	1.184
1.000	28.307	60.0	225	Circular	58.450	57.200	1.025	58.250	56.728	1.297

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.001	4	[illegible]	[illegible]	Adoptable	1	[illegible]	[illegible]	Adoptable
2.000	5	[illegible]	[illegible]	Adoptable	4	[illegible]	[illegible]	Adoptable
1.000	3	[illegible]	[illegible]	Adoptable	4	[illegible]	[illegible]	Adoptable

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
5	59397.918	-65028.215	58.250	1.250	[illegible]				
						0	2.000	57.000	225
1	59414.982	-65046.340	57.560	1.569	[illegible]	1	1.001	[illegible]	[illegible]
3	59381.327	-65048.848	58.450	1.250	[illegible]				
						0	1.000	[illegible]	225

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
4	59405.469	-65034.071	58.250	2.000	1200	1	2.000	56.841	225
						2	1.000	56.728	225
						0	1.001	56.250	225

APPENDIX G

Foul Sewer Loading Calculations

PROJECT TITLE: U Store It. Liffey Valley **JOB REFERENCE:** U Store It

SUBJECT
Wastewater Load for Irish Water

gdcl CONSULTING ENGINEERS

DRAWING NO. **CALCULATIONS BY** **CHECKED BY** **DATE**

POST DEVELOPMENT DEMAND

Wastewater flow per head[1]	150	litres	Unit Consumption Allowance[3]	10	%
Average Occupancy Ratio[2]	2.7	person/3 bed unit	DWF Peak Factor[4]	6	

Residential Unit Type	5 Bed Unit	4 Bed Unit	2 Bed Unit A	2 Bed Unit B	1 Bed Unit
Average Occupancy(persons)	5	4	4	3	1.5
Number of Units	0	0	0	0	0
Average Occupancy[2] (PE)	0	0	0	0	0

Residential Dry Weather Flow(DWF) Volume[5] 0 litres

Commercial Unit Type	Shopping	Office/ Factory	Pub/ Restaurant	Leisure/ Gym	Medical/ Care Home	Creche
Average Occupancy (per m2)	18	25	5	5	20	20
Area(m2)	0	2100	0	0	0	0
Average Occupancy[2] (PE)	0	84	0	0	0	0
Average Usage(litres per person/day)[3]	25	50	60	50	350	60
Daily Usage(/)	0	4200	0	0	0	0

Commercial Dry Weather Flow(DWF) Volume[5] 4,620 litres

WASTEWATER LOADING SUMMARY

	Residential	Commercial	Total
Average Daily Discharge	0.00 l/s	0.05 l/s	0.05 l/s
Peak Discharge[6]	0.00 l/s	0.32 l/s	0.32 l/s

ORGANIC LOADING

EPA Wastewater Parameters Loading Concentrations		Residential Organic Loading		Commercial Organic Loading		Total Organic Loading	
Average Concentration[7]	Max Concentration[8]	Average Conc[7]	Max Conc[8]	Average Conc[7]	Max Conc[8]	Average Conc[7]	Max Conc[8]
BOD(mg/l)		BOD(kg/day)		BOD(kg/day)		BOD(kg/day)	
163.0	422.0	0.00	0.00	0.76	1.95	0.76	1.95
SS (mg/l)		SS (kg/day)		SS (kg/day)		SS (kg/day)	
163.0	435.0	0.00	0.00	0.75	2.01	0.75	2.01
N (mg/l)		N (kg/day)		N (kg/day)		N (kg/day)	
40.6	78.6	0.00	0.00	0.19	0.36	0.19	0.36
P (mg/l)		P (kg/day)		P (kg/day)		P (kg/day)	
7.1	15.5	0.00	0.00	0.03	0.07	0.03	0.07

Notes:

1. Waste Water flow - 150 l/head as per Irish Water Code of Practice - (3.6)
2. Average Occupancy ratio of 2.7 persons per dwelling from Irish Water Code of Practice - (3.6)
3. 10% Unit Consumption Allowance as per Irish Water Code of Practice - (3.6.3)
4. DWF Peak Factor is 6 as per Irish Water Code of Practice - (3.6)
5. Dry Weather Flow = No. of Residential Units X Average Occupancy Ratio X Waste Water Flow X UCA[3]
6. Peak Discharge = Average Daily Discharge X DWF Peak Factor
7. The average concentrations of wastewater parameters taken from EPA "Wastewater Treatment Manuals, Treatment Systems for Small Communities, Business, Leisure Centres and Hotels"
8. Assumed Maximum concentration is equal to the average concentration plus 2 times the standard deviation (for the 95%ile) taken from EPA "Wastewater Treatment Manuals Treatment Systems for Small Communities, Business, Leisure Centres and Hotels"

APPENDIX H

Water Demand Calculations

PROJECT TITLE: U Store It, Liffey Valley **JOB REFERENCE:** U Store It

SUBJECT
Water Demand for Irish Water

gdcl CONSULTING ENGINEERS

DRAWING NO. **CALCULATIONS BY** **CHECKED BY** **DATE**

POST DEVELOPMENT DEMAND

Per-Capita Consumption[1] 150 litres/person/day

Average Occupancy Ratio[2] 2.7 person/3 bed unit

Residential Unit Type	5 Bed Unit	4 Bed Unit	2 Bed Unit A	2 Bed Unit B	1 Bed Unit
Average Occupancy(persons)	5	4	4	3	1.5
Number of Units	0	0	0	0	0
Average Occupancy[5] (PE)	0	0	0	0	0

Average Residential Demand[6] 0 l/day

Commercial Unit Type	Shopping	Office/ Factory	Pub/ Restaurant	Leisure/ Gym	Medical/ Care Home	Creche
Average Occupancy (per m2)	18	21	5	5	20	20
Area(m2)	0	2100	0	0	0	0
Average Occupancy[5] (PE)	0	84	0	0	0	0
Average Usage[litres per person/day)	25	50	60	60	350	60
Daily Usage(l)	0	4200	0	0	0	0

Average Commercial Demand[6] 4,200 l/day

Average Day/Week Demand Factor[3] 1.25

Peak Demand Factor[4] 5

WATER DEMAND SUMMARY

	Residential	Commercial	Total
Average Daily Demand	0.00 l/s	0.05 l/s	0.05 l/s
Average Day/Peak Week Demand[7]	0.00 l/s	0.06 l/s	0.06 l/s
Peak Hour Water Demand[8]	0.000 l/s	0.304 l/s	0.304 l/s

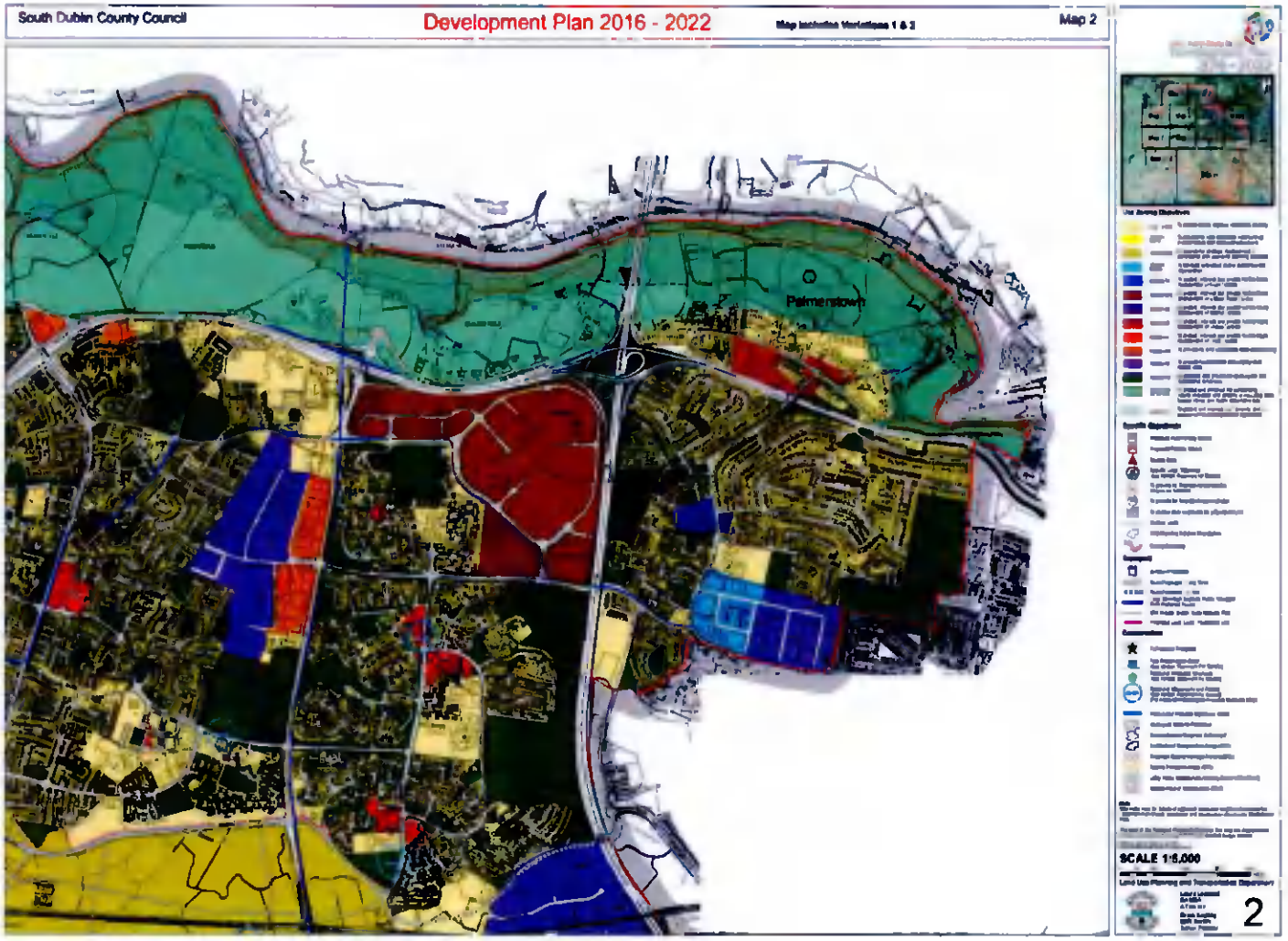
Notes:

1. Per-Capita Consumption 150l/person/day as per Irish Water Code of Practice - (3.7.2)
2. Average Occupancy ratio of 2.7 persons per dwelling from Irish Water Code of Practice - (3.7.2)
3. Average Day/Week Demand Factor is 1.25 as per Irish Water Code of Practice - (3.7.2)
4. Peak Demand Factor is 5 as per Irish Water Code of Practice - (3.7.2)
5. Average Occupancy(or PE-Population Equivalent) = No. of Residential Units X Average Occupancy Ratio
6. Average Domestic Demand = Average Occupancy X Per-Capita Consumption
7. Average Day/Peak Week Demand = Average Daily Domestic Demand X Average Day/Week Demand Factor
8. Peak Hour Water Demand = Average Occupancy X Per-Capita Consumption X Average Day/Week Demand Factor X Peak Demand Factor

APPENDIX I

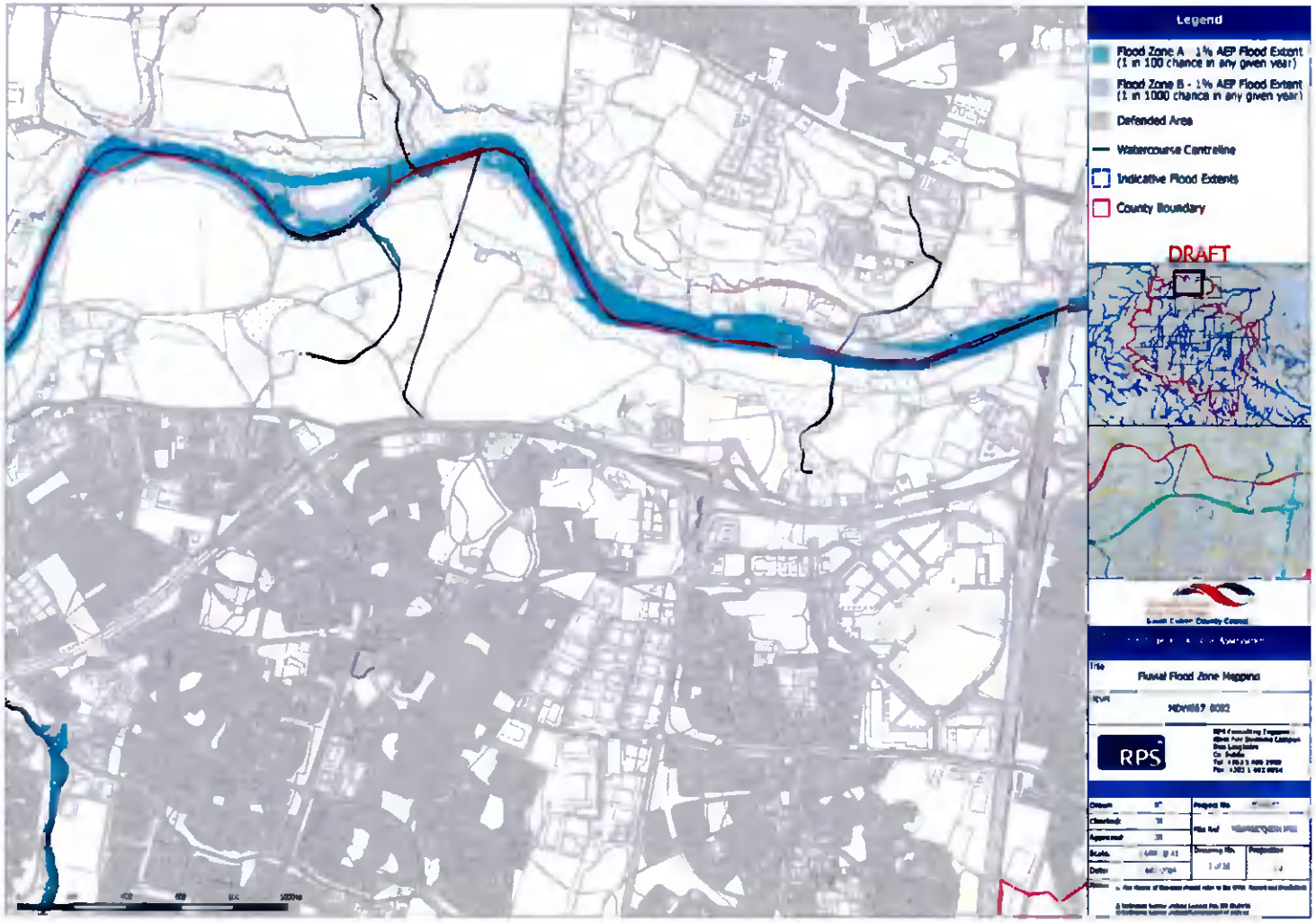
South Dublin County Council Development Plan

2016 - 2022 Zoning Objectives - Map 2


South Dublin County Council
Development Plan 2016 - 2022
Map 2
Palmerstown
SCALE 1:5,000
2

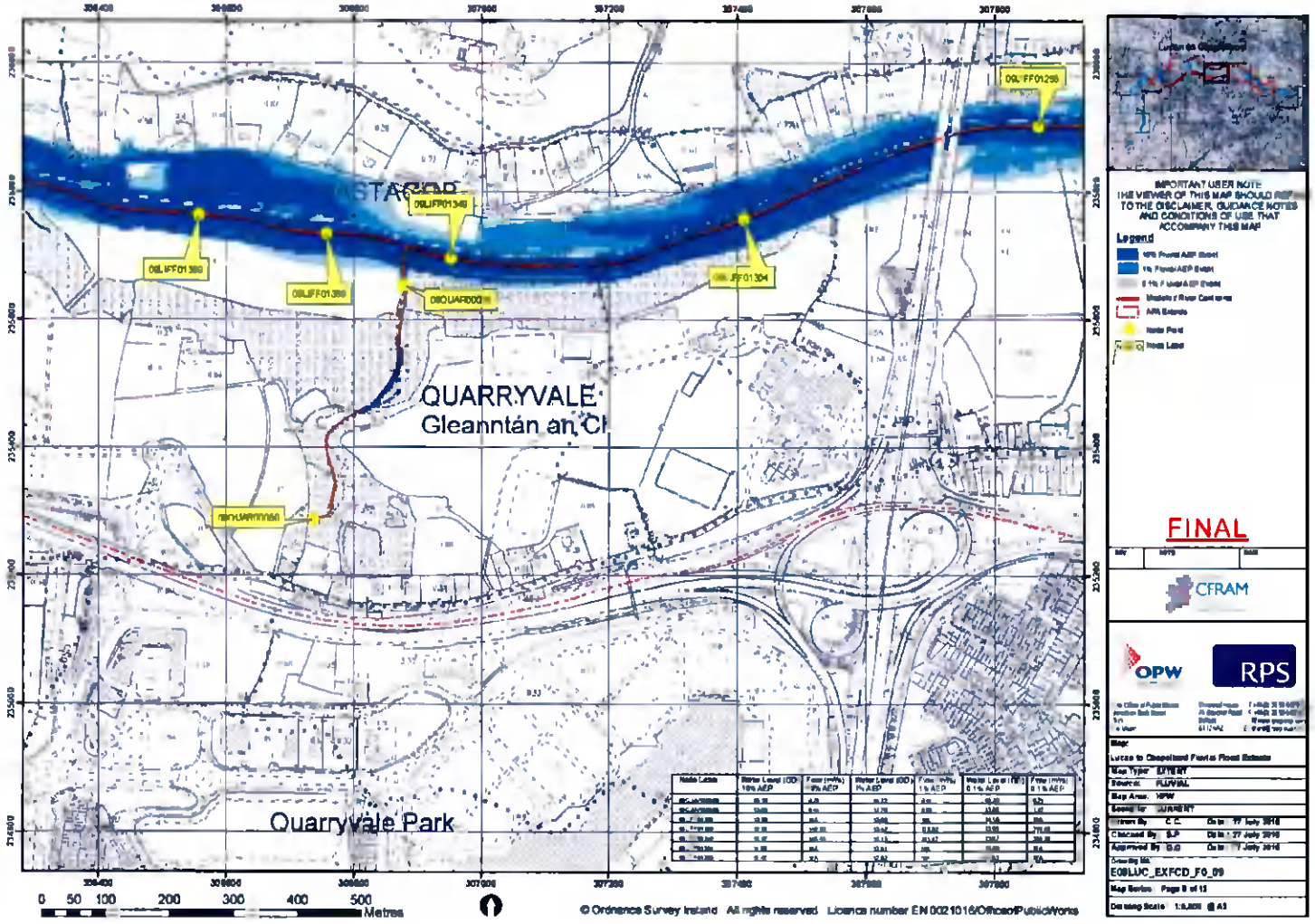
APPENDIX J

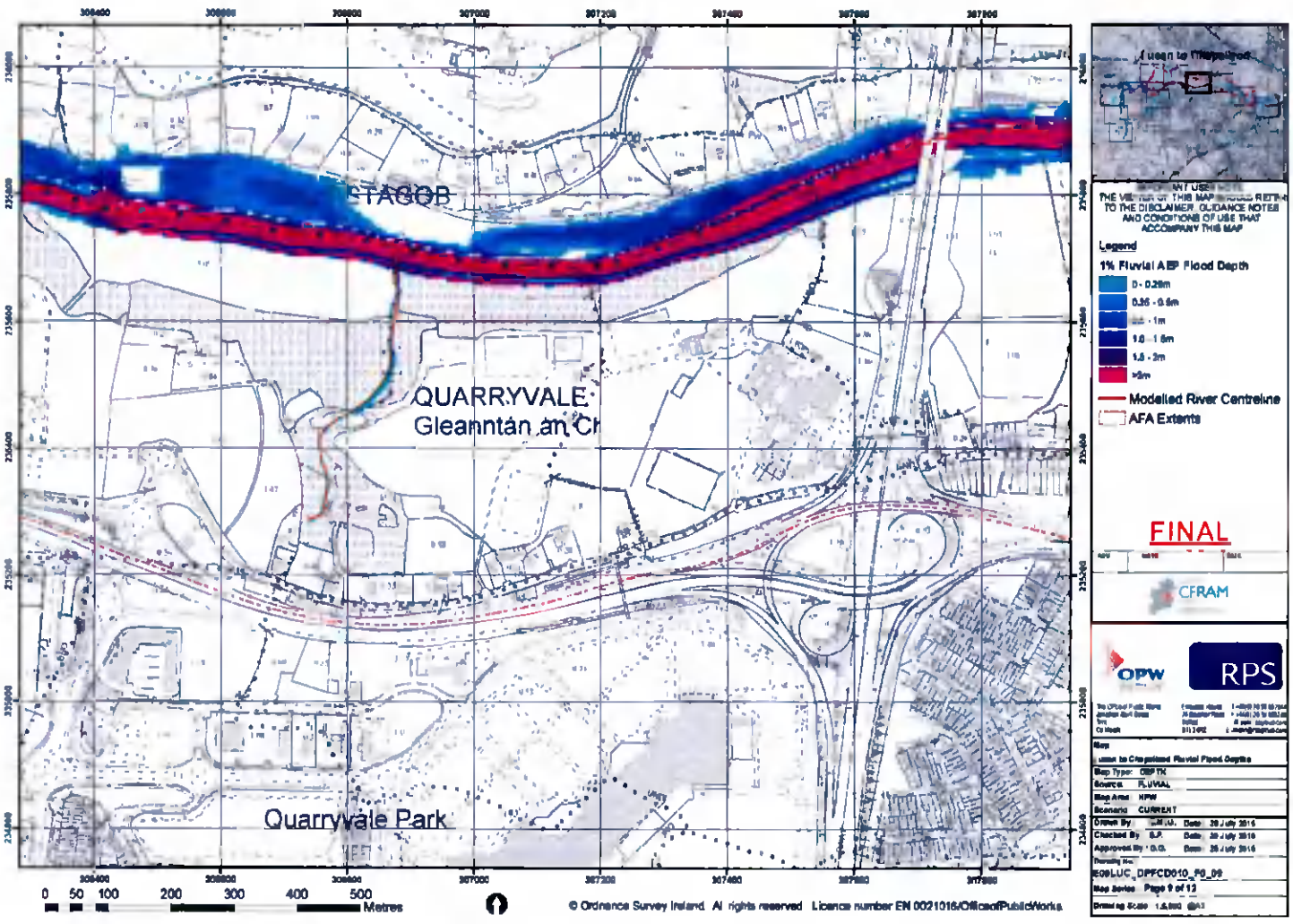
South Dublin County Development Plan 2016 - 2022 Strategic Flood Risk Assessment Fluvial Flood Zone Mapping - Map 2


Legend
Flood Zone A - 1% AEP Flood Extent (1 in 100 chance in any given year)
Flood Zone B - 1% AEP Flood Extent (1 in 1000 chance in any given year)
Defended Area
Watercourse Centreline
Indicative Flood Extents
County Boundary
DRAFT
Fluvial Flood Zone Mapping
RPS

APPENDIX K

CFRAMS Flood Mapping


QUARRYVALE
Gleanntán an Ch
Quarryvale Park
0 50 100 200 300 400 500
Metres
© Ordnance Survey Ireland All rights reserved Licence number EN 0021016/OfficeofPublicWorks
IMPORTANT USER NOTE
THE VIEWER OF THIS MAP SHOULD REF
TO THE DISCLAIMER, GUIDANCE NOTES
AND CONDITIONS OF USE THAT
ACCOMPANY THIS MAP
Legend
FINAL
CFRAM
OPW
RPS
Map:
Lucan to Chapelland Fluvial Flood Extents
Map Type: EXTENT
Source: FLUVIAL
Map Area: NPW
Layout for: JURNEY
Drawn By: C.C. Date: 17 July 2018
Checked By: S.P Date: 27 July 2018
Approved By: G.O Date: 1 July 2018
Drawing No:
EOBLUC_EXFCD_F0_09
Map Series: Page 9 of 13
Drawing Scale: 1:5,000 @ A3


QUARRYVALE
Gleanntán an Ch
Quarryvale Park
0 50 100 200 300 400 500
Metres
© Ordnance Survey Ireland. All rights reserved. Licence number EN 0021016/OfficialPublicWorks.
Legend
1% Fluvial AEP Flood Depth
0 - 0.25m
0.25 - 0.5m
0.5 - 1m
1.0 - 1.5m
1.5 - 2m
>2m
Modelled River Centreline
AFA Extents
FINAL
CFRAM
OPW
RPS
Map Type: DEPTH
Source: FLUVIAL
Map Area: NPW
Scenario: CURRENT
Drawn By: S.M.U. Date: 20 July 2015
Checked By: S.P. Date: 20 July 2015
Approved By: D.O. Date: 20 July 2015
Drawing No.
EGBLUC_DPFCD010_P0_09
Map Series Page 9 of 12
Drawing Scale 1:5,000 @A3

APPENDIX L

OPW National Flood Hazard Mapping

Summary Report

OPW *National Flood Hazard Mapping*

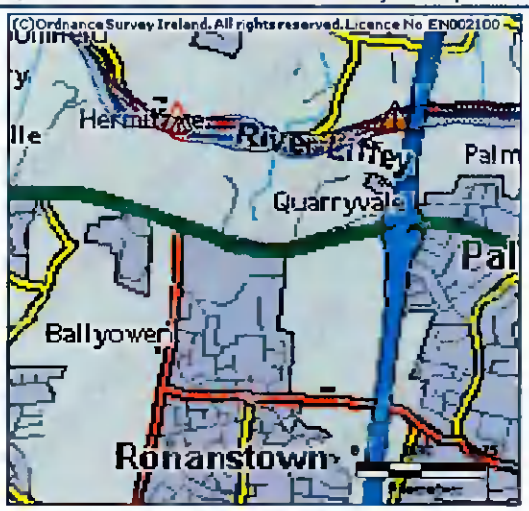
Summary Local Area Report

This Flood Report summarises all flood events within 2 5 kilometres of the map centre.

The map centre is in:

County: Dublin

NGR: O 068 350



Map Scale 1:30,979

Map Legend

- Flood Points
- Multiple / Recurring Flood Points
- Areas Flooded
- Hydrometric Stations
- Rivers
- Lakes
- River Catchment Areas
- Land Commission *
- Drainage Districts *
- Benefiting Lands *

* Important These maps do not indicate flood hazard or flood extent. Thier purpose and scope is explained in the Glossary.

7 Results

1. Liffey Lower - Dec 1954
County: Kildare, Dublin
Start Date 08/Dec/1954
Flood Quality Code 2
Additional Information: Reports (4) Press Archive (2) More Mapped Information

2. Liffey Sommerton Rd Lutrellstown Golf C Oct 2004
County: Dublin
Start Date 28/Oct/2004
Flood Quality Code:4
Additional Information: Reports (1) More Mapped Information

3. Liffey R109 at the Strawberry Beds Nov 2002
County: Dublin
Start Date 13/Nov/2002
Flood Quality Code:3
Additional Information: Reports (2) More Mapped Information

4. Liffey Strawberry Beds June 1993
County: Dublin
Start Date: 10/Jun/1993
Flood Quality Code.2
Additional Information: Photos (1) Reports (1) Press Archive (1) More Mapped Information

5. Beech Row Ronanstown Recurring
County: Dublin
Start Date:
Flood Quality Code:3

Report Produced 22-Apr-2020 21:45

Additional Information: Reports (2) More Mapped Information

6. Palmerston Mill Lane Recurring — Start Date:

County:Dublin — Flood Quality Code:4

Additional Information: Reports (1) More Mapped Information

7. Lucan St Edmonsbury Road Recurring — Start Date:

County:Dublin — Flood Quality Code:4

Additional Information: Reports (1) More Mapped Information
